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POSTDOCTORAL STUDIES

Nabil Naas

AUTEUR DE LA THÈSE / AUTHOR OF THESIS

Ph.D. (Electrical Engineering)

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TITRE DE LA THÈSE / TITLE OF THESIS

Hussein T. Mouftah

DIRECTEUR (DIRECTRICE) DE LA THÈSE / THESIS SUPERVISOR

CO-DIRECTEUR (CO-DIRECTRICE) DE LA THÈSE / THESIS CO-SUPERVISOR

EXAMINATEURS (EXAMINATRICES) DE LA THÈSE / THESIS EXAMINERS

Abdelhakim Hafid

Amiya Nayak

Ashrah Matrawy

Shervin Shirmohammadi

Gary W. Slater

Le Doyen de la Faculté des études supérieures et postdoctorales / Dean of the Faculty of Graduate and Postdoctoral Studies

TOWARDS THE REALISTIC PLANNING OF THE GMPLS-BASED OPTICAL TRANSPORT NETWORKS

by

Nabil A. Naas

A thesis submitted to the
Faculty of Graduate and Postdoctoral Studies
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Abstract

The explosive growth of traffic in Wavelength Division Multiplexing (WDM)-based transport networks has necessitated an increase in the number of wavelengths per fiber. However, the continuation of this trend will definitely lead to both an explosion in the size of Optical Crossconnect (OXC)s/Reconfigurable Optical Add/Drop Multiplexers (ROADMs) and an increased difficulty in routing and managing wavelengths. With the introduction of Generalized Multiprotocol Label Switching (GMPLS), the multi-granular switching concept becomes essential to alleviating these serious scalability problems. However, in spite of the fact that this new switching concept brings many benefits, it also results in new network design and planning challenges.

In this thesis, a new problem in planning the GMPLS-based (or multi-granular) transport network, called the Routing and Multi-Granular Paths Assignment (RMGPA) problem, is addressed. The objective of the RMGPA problem is to minimize the total weighted port count in the transport network. The novelty of this problem lies in the incorporation of the following for the first time: (1) considering the whole traffic hierarchy defined in GMPLS; (2) optimizing multi-granularity traffic demands; (3) allowing the bifurcation of multi-granularity demands; (4) (de)grouping traffic flows at all granularity levels; (5) allowing wavelength, waveband, and fiber conversions; (6) imposing the optical-reach constraint on the length of all-optical paths; and (7) customizing the optical reach of all-optical paths. In addition, in order to realize the functionalities required by these newly addressed issues, a new GMPLS-based node architecture is proposed.

Different versions of the RMGPA problem are formulated as Mixed Integer Linear Programming (MILP) and Non-linear Programming (NLP) models. Due to the computational complexity of the planning problem, only the MILP models of small-sized problems are solved. To satisfy the planning speed requirement, various efficient heuristics that are capable of solving large-sized problems in a reasonable amount of time are also proposed. In addition, the solutions to the MILP models are used to validate the proposed heuristics. Moreover, in order to achieve the best possible planning solution to different versions of the RMGPA problem in both fiber-scarce and plentiful situations, a comprehensive evaluation of different heuristic variations through illustrative examples and simulations is conducted. Furthermore, the results provide valuable insights into many issues that can contribute to further research and development in this area.

“Success is peace of mind which is a direct result of self-satisfaction in knowing you did your best to become the best you are capable of becoming” –

John R. Wooden

To my FAMILY with love

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Abbreviations

3R	Re-amplification, Reshaping, and Re-timing
BLP	Binary Linear Programming
BPHT	Balanced Path Routing with Heavy-Traffic first waveband assignment
BSC	Band Switch Capable
BTMH	Balanced Traffic routing with Maximum-Hop first waveband assignment
BXC	Band Crossconnect
CBS	Clear Band-Switched
CD	Chromatic Dispersion
CFS	Clear Fiber-Switched
CI	Confidence Interval
CWS	Clear Wavelength-Switched
EDFA	Erbium-Doped Fiber Amplifier
EON	European Optical Network
EXC	Electronic Crossconnect
FEM	Full OEO-based Merging
FF	First-Fit
F-LSP	Fiber-Switched Path
FSC	Fiber Switch Capable
FXC	Fiber Crossconnect
GMPLS	Generalized Multiprotocol Label Switching
HXC	Hierarchical Crossconnect
IETF	Internet Engineering Task Force
ILP	Integer Linear Programming
LCBF	Least Cost Branch First
LP	Linear Programming
LRH	Lagrangean Relaxation with Heuristics
LSC	Lambda Switch Capable
λ -LSP	Wavelength-Switched Path

MEMS	Micro-Electro-Mechanical Systems
MG-OXC	Multi-Granular Optical Crossconnect
MG-XC	Multi-Granular Crossconnect
MILP	Mixed Integer Linear Programming
MOR	Maximum Overlap Ratio
MPLS	Multiprotocol Label Switching
NLP	Non-Linear Programming
NP	Nondeterministic Polynomial
NSF	National Science Foundation
OEO	Optical-Electrical-Optical
OOO	All-Optical
OXC	Optical crossconnect
PEM	Partial OEO-based Merging
PMD	Polarization Mode Dispersion
RMGPA	Routing Multi-Granular Paths Allocation
RNG	Random Number Generator
ROADM	Reconfigurable Optical Add/Drop Multiplexers
RWA	Routing and Wavelength Assignment
RWA ⁺	RWA in the multi-granular network
RWAT	Routing and Wavelength Assignment with Tunnel allocation
TDM	Time-Division-Multiplexing
UBS	Unclear Band-Switched
UFS	Unclear Fiber-Switched
UWS	Unclear Wavelength-Switched
WB-LSP	Waveband-Switched Path
WBO	Waveband Oblivious Optimal
WBS	Waveband Switching
WCP	Wavelength Convergence Point
WDM	Wavelength Division Multiplexing
WDP	Wavelength Divergence Point
WXC	Wavelength Crossconnect

Chapter 1

Introduction

1.1 Background and Motivations

In order to satisfy the continuous growth in Internet traffic along with the dramatic increase in both broadband and wireless applications, more efficient and cost-effective transport network technologies are required. Optical networking using Wavelength Division Multiplexing (WDM) has become a key technology for accommodating these rapidly expanding demands [Gree93][VGIz03]. WDM divides the enormous fiber bandwidth into a large number of wavelengths (or λ s), each now operating at a rate of 40 Gb/s [FULL06]. With advances in the WDM technology, WDM networks using wavelength-routing by Optical Crossconnects (OXC)s/Reconfigurable Optical Add/Drop Multiplexers (ROADMs) have been widely recognized as the most feasible architectural solutions for transport networks [Lee+02][LYTi04]. In addition, OXC)s/ROADMs allow transport networks to be reconfigurable to adapt to changes in traffic patterns as well as restore these networks after failures [HSKO99][Ciar00].

To meet the demands of ever-increasing traffic, a large number of wavelengths will ultimately be required. However, increasing the number of wavelengths per fiber will result in (1) an increased number of OXC ports, (2) increased footprint, (3) increased power consumption, (4) increased complexity of OXC)s, (5) increased difficulty in implementing and maintaining OXC)s, (6) increased complexity associated with the control and management of the network, and (7) more severe cross-talk requirements for WDM demultiplexers in OXC)s [Acam94][HSKO99][Ciar00][Lee+02][CAXQ03][VaJu04][ZZFZ04]. In order to overcome these drawbacks while maintaining high

scalability, as well as to keep network complexity at a reasonable level and flexibility at a low cost, the number of ports in the switching fabric can be reduced by routing a group of wavelengths, called a waveband, together through a single port. Further port reduction is possible if these wavebands are grouped again into one fiber and routed through a single port. Reducing the port count is one of the main factors contributing to the cost reduction of OXC [NVD01]. An OXC that uses this multi-granular switching concept is referred to as a Multi-Granular OXC (MG-OXC) [HSKO99][Ciar00][NVD00][NVD01][CAXQ03][LYTi04][VaJu04].

On the other hand, the idea of multi-granularity traffic flows, as shown in Fig. 1.1, has led to Generalized Multiprotocol Label Switching (GMPLS) since the early 2000s [Man+01]. GMPLS was extended from Multiprotocol Label Switching (MPLS) by the Internet Engineering Task Force (IETF) to support not only sub-wavelength switching but also wavelength, waveband, and fiber switching. This means that, with GMPLS, the same control plane can be used by both IP routers and other equipment such as OXCs [AwRe01]. GMPLS-based routers that use the multi-granular switching concept have already been developed [Sat+02]. Moreover, for existing MPLS networks, the IETF is working on developing an appropriate strategy for the migration from MPLS to GMPLS. The strategy can be based on a service provider's network deployment plan, customer demand, available network equipment, etc [SPL+06].

Although a Label-Switched Path (LSP) in MPLS and a Wavelength-Switched Path (λ -LSP) in wavelength-routing networks are fundamentally different, GMPLS is equipped with the ability to provision multi-granularity flows and adds a suite of mechanisms that assigns a generalized label to these flows as follows and as illustrated in Fig. 1.1. First, a sub- λ -LSP is labeled with its frame/cell/packet header or the serial number of the TDM time slot. Second, a λ -LSP is labeled

and switched according to its wavelength number. Next, with the MG-OXC, the switching types and traffic granularities are no longer limited to sub- λ - and λ -LSPs, but consecutive wavelengths can be grouped as a waveband LSP (WB-LSP) that is labeled and switched as a whole according to its waveband number. Moreover, consecutive wavebands can be grouped as a fiber LSP (F-LSP) that is labeled and switched as an entity based on its fiber code (or fiber label/ID) on the unidirectional physical link [Ban+01][HoMo02a][MoHo03].

Fig. 1.1: Traffic flow hierarchy defined in GMPLS.

One major challenge in WDM networks has been to develop efficient methods for solving the Routing and Wavelength Assignment (RWA) problem. The RWA problem deals with (1) finding routes for traffic demands between source nodes to their respective destinations; and (2) assigning wavelengths to these routes, which is subject to the wavelength-continuity constraint if wavelength converters are absent. It has been shown that the RWA problem is an NP-complete problem [CGKa92]. Numerous approximation methods and heuristics have been extensively studied and proposed in [CGKa92][ZhAc95][RaSi96][LeLi96][MBRM96][GSMa97][Mukh97][RaSi98][NaMo99a][NaMo99b][StBa99][DuRo00][LMMa00][ZJMu00][MoHo03][JMTh04][NaMo05] and their references with the aim of balancing the trade-off between accuracy and computational time complexity. However, once the multi-granular switching concept is taken into consideration, most

of the existing RWA methods become functionally or economically infeasible [CAXQ03][LYTi04][VaJu04][CAQi06][VaJu06]. Therefore, the efficient implementation of the GMPLS flow hierarchy has to be delivered by the appropriate routing, grouping, and label (or color) assignment of all flows [IGKV03]. Although a significant amount of open research has been carried out in this area, many unexplored issues still need to be addressed and investigated.

1.2 Objectives

The aim of our research is to contribute to the ongoing research and development in the area of GMPLS-based (or multi-granular) transport networks. Our focus is on developing new efficient methods for planning¹ GMPLS-based transport mesh networks with and without the color conversion and optical signal regeneration capabilities. The broad objective of this thesis is to address many unexplored issues in this domain. Our objectives can be summarized as follows:

1. Consider the whole traffic hierarchy defined in GMPLS, namely sub-wavelength, wavelength, waveband, and fiber demands.
2. Create/adjust multi-granularity traffic demands in a way that maximizes the end-to-end grouping of demands of the same source and destination.
3. Perform (de)grouping of traffic flows at all granularity levels.
4. Incorporate the demand-bifurcation² feature into the planning process and study its impact on resource utilization and port count.
5. Consider wavelength, waveband, and fiber conversion capability in the planning process and study its effect on resource utilization and port count. This means that the color-continuity constraint is not necessarily satisfied along the wavelength/waveband/fiber-switched path.

¹ For the rest of this thesis, the terms planning, dimensioning, and designing refer to the same concept and will be used interchangeably.

² Bifurcation is the act of allowing the units of a node pair traffic demand of the same granularity to use different routes.

6. Incorporate the optical signal regeneration capability into the planning process and study its impact on resource utilization and port count. This means that the optical-reach³ constraint needs to be used to ensure that the length of the all-optical path stays within the maximum optical reach value.
7. Consider the optical-reach customization in the planning process and study its significance on resource utilization and port count. Without the optical-reach customization, all network transceivers must have the same maximum optical reach, whereas customizing the reach means that the reach of the transceiver is decided based on the length of the all-optical path launched/terminated at the transceiver.
8. Develop a new GMPLS-based transport node architecture that is capable of (i) (de)grouping and switching the whole traffic flow hierarchy defined in GMPLS; and (ii) performing color conversion and optical signal regeneration functionalities on wavelength-, waveband-, and fiber-switched paths.
9. Develop Mixed Integer Linear Programming (MILP)/Non-Linear Programming (NLP) models, which address the afore-mentioned issues, to solve small-sized planning problems optimally and use their solutions as benchmarks for other optimization methods.
10. Develop fast and efficient planning heuristics, which also incorporate the afore-mentioned issues, to solve large-sized planning problems sub-optimally.

1.3 Thesis Contributions

The contributions of this thesis lie in the development of mathematical programming models and heuristics in conjunction with a newly developed GMPLS-based node architecture to address

³ Optical reach is the distance an optical signal can travel without the need for regeneration [Simm05].

effectively the problem of planning a GMPLS-based transport network with and without the color conversion and signal regeneration capabilities. The contributions can be summarized as follows:

1. A new GMPLS-based node architecture that consists of a scalable MG-OXC segment and an Electronic Crossconnect (EXC) segment has been proposed. The hybrid architecture handles the entire traffic hierarchy defined in GMPLS. The MG-OXC segment provides both the optical-switching of wavelength-, waveband-, and fiber-switched paths and the grouping/degrouping of wavelengths into/from wavebands and wavebands into/from fibers. The EXC segment provides the electronic-switching of sub-wavelength flows, grouping/degrouping of sub-wavelength flows into/from wavelengths, and color conversion and regeneration of wavelength-, waveband-, and fiber-switched paths.
2. A method of generating optimized multi-granularity traffic demands has been devised to maximize the end-to-end grouping.
3. An MILP model has been developed to plan exactly a GMPLS-based transport network without color conversion and regeneration capabilities. This MILP model has been successfully solved for small-sized planning problems.
4. An MILP model has been developed to plan exactly a GMPLS-based transport network with color conversion and regeneration capabilities and without customizing the optical reach. This MILP model has been solved successfully for small-sized planning problems.
5. An NLP model has also been formulated to plan exactly a GMPLS-based transport network with color conversion and regeneration capabilities and with the customization of the optical reach. Although the model has not been solved due to its extreme complexity, it provides a foundation for finding the optimal solution for this problem in the future.
6. Various efficient heuristics have been proposed for solving large-sized planning problems (the afore-mentioned versions) in a reasonable amount of time. The proposed heuristics have been

validated with the solutions to the MILP models and have been proven to be good approximations of the exact solutions.

7. The results, through many illustrative examples, have provided valuable insights into the effects of many parameters and the benefits of many heuristic enhancements on the planning solutions.
8. To obtain the best solutions to the planning problems in both fiber-scarce and plentiful situations, extensive simulations have been conducted. The results have allowed us to understand how different heuristic variations perform as the traffic pattern, physical topology, fiber capacity, and maximum optical reach value change as well as whether the color-continuity and optical-reach constraints are imposed and whether the optical reach is customized. Thus, instead of trying all possible heuristic variations, the planning time can be significantly reduced if we use only the promising heuristic variations, which have been identified in simulations. Moreover, through simulations, many important questions that can contribute to further research and development in this area have been answered. Among them are the following: (i) the value of bifurcating demands and at what level of granularity bifurcation makes sense, (ii) the significance of performing color conversion, (iii) the significance of customizing the optical reach, and (iv) what maximum optical reach the system vendors need to target.

1.4 Thesis Outline

The rest of this thesis is organized as follows. Chapter 2 presents the background and state-of-the-art material on the planning of multi-granular optical transport networks. First, a brief overview is given of the network planning process and common optimization techniques used to solve the planning problem. Then, a survey of related work in the area of planning multi-granular transport networks as reported in the current literature is provided. Chapter 3 presents the proposed system

of the GMPLS-based transport network to be considered in our work. First, it describes in detail the domain of the planning problem in terms of the proposed node architecture, path types, and (de)grouping strategies. Then, the new proposed planning problem that needs to be solved is defined. Afterword, the chapter presents our simplifying assumptions and the approach to be taken to solve the problem optimally and sub-optimally. Chapter 4 focuses on solving the planning problem without the color conversion and signal regeneration capabilities. It first presents the MILP formulation of the problem and then presents the heuristic approach. After that, it presents and discusses the numerical results obtained from the verification of the heuristic approach against the MILP formulation, many demonstration examples to elaborate on various issues, and the evaluation of different heuristic variations via simulation. Chapter 5 focuses on solving the planning problem with the color conversion and signal regeneration capabilities. First, it presents the MILP and NLP formulations of the problem without and with the optical-reach customization respectively. Then, it presents the heuristic approaches. Afterword, it presents and discusses the numerical results obtained from the verification of the heuristic approach against the MILP formulation. After that, for different versions of the planning problem, it presents and discusses the results obtained from both many demonstration examples to elaborate on a variety of issues and the evaluation of different heuristic variations via simulation. Finally, Chapter 6 presents our concluding remarks and proposes topics for future work.

Chapter 2

Background and State-of-the-Art

2.1 Introduction

The multi-granular switching concept is expected to be the “future-proof” solution for mitigating the OXC/ROADM scalability problems associated with the continuing growth of traffic in optical transport networks. The new paradigm also brings new challenges, however, since the use of RWA methods with the MG-OXC may lead to more port requirements than the use of ordinary OXC/ROADM. The major challenges in multi-granular transport networks stem from the need to perform the following tasks efficiently: (1) determining the route and assigning colors to wavelength-, waveband-, and fiber-switched paths; and (2) grouping/degrouping sub-wavelength-switched paths into/from wavelengths, wavelength-switched paths into/from wavebands, and waveband-switched paths into/from fibers. Since we will be dealing with the GMPLS-based transport network from the planning perspective throughout this thesis, our focus will be on solving the static (or off-line) case of this challenging problem. Accordingly, in the first part of this chapter, we present an overview of the most commonly used optimization techniques for planning transport networks. In the second part, we describe the relevant state-of-the art papers in the area of planning multi-granular optical transport networks.

2.2 What is Network Planning?

In transport network planning [Ari+00], forecasted traffic demands are given. The aim of the planning process is to come up with the best plan to fulfil these demands under a given physical topology, a set of parameters, and specified constraints and bounds. Fig. 2.1 depicts the general

task of network planning. The planning process usually optimizes the network cost or port count; however, it may be quite normal to take into account other performance metrics such as the availability, capacity requirement, delay, number of hops, link utilization, etc. The optimum/sub-optimum network plan can include many details, such as the working and protection/restoration routes and the location and size of equipment.

Fig. 2.1: The network planning process.

2.3 Formulating Optimization Problems

Generally, the optimization problem consists of four components [PTVF92][WiVe03][Chin04][Gro04][Chino7]: the decision variables, objective function, constraints, and bounds. A decision variable is the amount of each resource to be determined. Decision variables can be binary, integer, real, or mixed variables. The objective function is a function of the decision variables and can be either minimized or maximized. Also, it can be a linear or non-linear function. The constraints and bounds are sets of inequalities and/or equalities that restrict the decision

variables to certain predetermined values. A constraint can be a linear or non-linear inequality/equality. Any solution (a set of decision variable values) that satisfies all of the constraints and bounds is said to be a feasible solution.

Most of the transport network planning problems can be formulated mathematically using the Linear Programming (LP) and Non-Linear Programming (NLP) models. The optimum solutions to these models are manageable for small-sized problems; however, as the problem size increases, the solve time increases exponentially and sometimes the solution cannot be reached. This issue necessitates the use of other optimization techniques that achieve sub-optimum solutions in a reasonable amount of time. The factors that determine the problem complexity are as follows: (1) the type and number of variables, (2) the type of the objective function, (3) the type and number of constraints, and (4) the number of bounds. Based on these factors, the optimization problems can be classified into the following categories:

- *Linear Programming (LP) problem:* variables are real and both the objective function and constraints are linear.
- *Integer Linear Programming (ILP) problem:* variables are integer and both the objective function and constraints are linear.
- *Binary Linear Programming (BLP) problem:* a special class of the ILP problem in which variables are binary.
- *Mixed Integer Linear Programming (MILP) problem:* variables are mixed and both the objective function and constraints are linear.
- *Non-Linear Programming (NLP) problem:* the objective function or/and at least one of the constraints is non-linear.

In general, the NLP problem is much more difficult to solve than the ILP/LP problem. On the other hand, the ILP problem is much more difficult to solve than the LP problem. Moreover, solving the ILP problem using an LP-based optimization technique by rounding any non-integer variable value to the closest integer value has proven to be wrong [Chin04][Chin07]. However, if the solution of the LP-based optimization technique yields a solution in which all required integer variables are integer, then this solution is considered an optimum solution to the ILP problem [WiVe03].

There are two formulation approaches that have been widely used in network optimization and they are explained as follows [SwSi02]:

- *Link formulation:* In this approach, the main variables of the optimization problem are the flows on each link relative to each source-destination pair demand. For each demand, a flow-conservation constraint has to be created at every network node. Therefore, the number of constraints grows polynomially with the number of nodes.
- *Path formulation:* In this approach, a number of predefined possible paths is given for each demand. The main variables are the flows to be routed along each path. The number of paths between a node pair increases exponentially with the number of nodes. To reduce the problem complexity, the path formulation will have to restrict itself to a few paths per node pair.

2.4 Optimization Techniques

In this section, the focus will be on the optimization techniques used to solve linear programming models. The non-linear models will not be covered here because none of the previous related work has used these models. In addition, we will be solving only linear

programming models in our approaches. The optimization techniques can be classified into two main categories: exact techniques and approximation techniques.

2.4.1 Exact Techniques

With exact techniques, the optimum solution is always guaranteed. The following are the most commonly used exact methods:

- *Simplex method:* This method [PTVF92][WiVe03][Chin04][Chin07] is a simple algorithmic engine for solving LP problems. It converts the objective function and the constraints into a tableau where the number of rows represents the number of constraints and the number of columns represents the number of variables. The new tableau is created from the old one through some manipulations until the optimum tableau is reached from which the optimum solution can be extracted. The speed of this method depends mainly on the number of constraints and not the number of variables.
- *Dual Simplex method:* This method [WiVe03][Gro04] is a modified version of the Simplex method in which the LP tableau is turned sideways; therefore, its speed depends on the number of variables. Accordingly, this method is quite useful when the number of constraints is more than the number of variables.
- *Enumeration method:* This method [Chin04][Chin07] involves simply enumerating all possible solutions, evaluating them, and then choosing the best one. Given that there could be a huge number of permitted solutions for a particular network planning problem, enumeration is only possible for very-small-sized ILP/BLP problems.
- *Branch-and-Bound method:* This method [WiVe03][Chin04][Chin07] is a powerful technique for accelerating enumeration. Its main idea is to avoid growing the whole enumeration tree as much as possible. Instead, it grows the tree in stages and only the most promising tree nodes

at any stage. Essential for this technique is the estimation of a bound on the best value of the objective function that can be obtained by growing a bud node further. This method is commonly used to solve small- and medium-sized ILP/BLP problems.

- *Balas' method*: This method [WiVe03] is a special type of the branch-and-bound method and is used to solve small- and medium-sized BLP problems.
- *Dakin's method*: This method [WiVe03] is also a special class of the branch-and-bound method that relies heavily on the Simplex method or other LP methods. Dakin's method is an important method for solving small and medium-sized MILP problems. In this method, the MILP model is treated as an LP model, which means that all non-real variables are treated as real variables, and branching occurs only on variables that are required to be integers. Every time branching occurs, a new constraint is added to the LP model.
- *Dynamic Programming method*: This method [WiVe03] is a recursive technique that can be used to solve small- and medium-sized ILP problems. Some resource-allocation problems can be best solved using this technique. This method obtains solutions by breaking up the problem into a series of smaller, more manageable problems. By working backward, the optimum solution to the smaller part of the problem is found first, then the problem is enlarged slightly and the optimum solution is found for the enlarged problem by using the previously found optimum solution.

2.4.2 Approximation Techniques

With approximation techniques⁴, a faster solve time is guaranteed for the optimization problems but at the expense of having sub-optimal solutions. The following are the most well-known approximation methods:

⁴ Some of the approximation techniques can also be used to solve NLP problems.

- *Heuristic method:* This method [WiVe03][Gro04] is based on practical rules that require a deep knowledge of the problem. Although these rules may not have a mathematical proof, they are based on good results obtained in practice. Due to their relative simplicity, heuristic approaches are widely used in the optimization world. The heuristics may be combined with other exact optimization techniques for reducing both the complexity of the problem and solve time.
- *Relaxation method:* In addition to its ability to provide faster solve time, relaxation [Bert99][Guig03][WiVe03] plays a role in providing bounds for the optimum solution of large-sized problems and can be used as a starting point for other optimization techniques. There are two types of relaxations that are used most frequently: LP relaxation and Lagrangean relaxation. LP relaxation relaxes the integer variables of the ILP model, which can provide a lower bound for the minimization ILP problem and an upper bound for the maximization ILP problem. On the other hand, Lagrangean relaxation removes some difficult constraints or substitutes them with other looser constraints. This requires the introduction of new variables called Lagrangean multipliers as additional terms in the objective function.
- *Simulated Annealing method:* This method [PTVF92][WiVe03][Gro04] is a meta-heuristic⁵ technique that attempts to simulate the phenomenon of cooling metals to achieve certain crystal properties. Simulated annealing is an attractive method for solving large-sized optimization problems. The implementation of this method is relatively simple, but requires mastering the fundamental physics of the process or following a trial-error method.

⁵ "Meta-heuristic is a general master strategy to solve problems, and they are based on intelligent search techniques. These techniques are based on natural adaptive systems. They can be based on evolutionary principles such as the method of natural selection, physical systems such as annealing process, and human learning as in the brain's adaptive neural strategy and memory".[WiVe03]

Simulated annealing employs a random search that accepts changes that not only decrease the objective function, but also that increase it in order to escape the local optimality. The method parameters, which are fewer than the parameters used in other meta-heuristics, can be controlled to converge in a given time with a “good” solution.

- *Genetic Programming method:* This method [WiVe03][Gro04] is a meta-heuristic technique that attempts to simulate the phenomenon of the natural evolution of species. Genetic programming is a popular method for solving large-sized optimization problems and has a faster convergence. Candidate solutions must be encoded by strings (or chromosomes). Then, an initial population of chromosomes is selected randomly. Within the genetic algorithm, the population selection in each generation is based on the principle of survival of the fittest through a formula that represents the nature of the problem. The genetic programming method handles the problem constraints via a penalty approach, and searches are usually terminated when the best/worst solution has not changed for several generations.
- *Tabu Search method:* This method [WiVe03][Gro04] is a meta-heuristic technique that makes an extensive use of memory to emulate the heuristic rules that people use to incorporate previous experiences into today’s decision-making process. The tabu search method is also used in large-sized optimization problems. Similar to simulated annealing, the aim of the tabu search method is to escape the local optimality; however, it is much greedier than simulated annealing. This characteristic is why the tabu search is more complicated to implement than simulated annealing. Still, in spite of this difficulty, tabu search has a faster convergence and can achieve better sub-optimum solutions. The main idea of the tabu search method is to explore the search space of all possible solutions through a sequence of movements. Thus, the selection of one solution or another will be the best of those possible.

A tabu list disallows certain moves from taking place. The list specifies restrictions on the direction of moves. After each move is made, the tabu list will be updated. Different tabu searches may use different strategies to manipulate the tabu list. The choice of which moves are forbidden is based on the short-term history (to avoid cycling around a local neighbourhood in the solution space) and long-term history (to conduct searches in the most promising neighbourhoods) of the sequence of moves.

2.5 Prior Related Work

Because of its importance and difficulty, the multi-granular switching concept has drawn a lot of attention in recent years. In this section, we take a close look at the related work that has been done from the planning perspective. The review of each study covers various aspects. Among them are the node architecture used, main assumptions, approach and optimization methods used in solving the planning problem, and key findings of the study. The goal of this section is to provide a better background and perspective on our work; however, the studies covered might not represent a complete survey of all of the work done in this area.

2.5.1 Traffic Grouping Strategies

In [NVD01], Noirie et al demonstrated the impact of using different grouping policies for wavelengths and wavebands on the port count of the different switching stages of the MG-OXC. This study is a continuation of the work done in [NVD00] by the same group, in which wavelengths and wavebands are grouped only if they share the same source and destination. This is what the authors defined as end-to-end grouping. The suggested MG-OXC architecture, Type A as shown in Fig. 2.2, consists of three switching stages: Fiber Crossconnect (FXC), Band Crossconnect (BXC), and Wavelength Crossconnect (WXC). Adding, dropping, and bypassing traffic can be done at any of these stages. The WXC and BXC stages are interconnected through

wavelength-to-band multiplexers and band-to-wavelength demultiplexers. Similarly, the BXC and FXC stages are interconnected through band-to-fiber multiplexers and fiber-to-band demultiplexers. The authors assumed that all wavebands/fibers have the same number of wavelengths/wavebands. They also assumed that wavelength/waveband converters might be required at the outputs of the WXC/BXC stage.

Fig. 2.2: "Type A" MG-OXC architecture [NVD01].

The authors proposed a heuristic approach (although they did not present detailed steps) that is based on first achieving the end-to-end grouping of wavelengths into wavebands and fibers and then performing intermediate grouping on the remaining wavelengths and wavebands. The intermediate waveband/fiber grouping is based on the grouping of wavelengths/wavebands with different sources or different destinations along the longest common sub-path. The intermediate grouping does not include the grouping of traffic from different source nodes to different destination nodes. The shortest path is selected for each traffic demand.

The key simulation findings of this work are as follows. (1) OXCs that use the multi-granular switching concept can achieve a huge reduction (up to 97%) in the port count with respect to the

ordinary OXCs (see Fig. 2.6), particularly as the traffic volume increases. (2) Combining the intermediate grouping with the end-to-end grouping significantly reduces the size of the switching stages, especially WXC and BXC, compared to the case in which only the end-to-end grouping is used; also, the amount of reduction depends on the physical topology and traffic. The authors suggested that a further reduction could be achieved if intermediate grouping is also considered between traffic with different sources and destinations.

2.5.2 Two-Stage Multiplexing Scheme

Lee et al in [Lee+02] proposed a design scheme for multi-granular networks in which the waveband is formed by grouping wavelength paths that share the same destination. The authors used the term Hierarchical Crossconnect (HXC) as an alternative name for MG-OXC. The proposed MG-OXC architecture, Type B as shown in Fig. 2.3, consists of two switching stages only: WXC and BXC. Wavelength conversions are only allowed at the inputs of the WXC stage, and conversions cannot be performed at the BXC stage due to the technical difficulties of implementing waveband conversion. Wavelength demands are added only at the WXC stage and can be dropped at both the WXC and BXC stages.

Fig. 2.3: “Type B” MG-OXC architecture [Lee+02].

The authors suggested three policies for waveband grouping: (1) grouping wavelength paths that share the same source and destination, (2) grouping wavelength paths that share the same destination but not the same source, and (3) grouping wavelength paths that share intermediate common physical links. The authors argued that the second policy could achieve a significant reduction in the WXC size in the sense that once wavelength paths are grouped into a waveband they do not need to be degrouped until they arrive at their destination. Moreover, a further reduction can be achieved if the whole waveband is dropped at the destination without entering the WXC stage, as illustrated in Fig. 2.3. The authors referred to the waveband path that uses the second policy as a packed-waveband path, and to the other waveband paths as unpacked-waveband paths.

The authors formulated the design problem (without solving it) as an ILP model based on the packed and unpacked path approach and using the path-formulation approach with the objective of minimizing the port count of MG-OXCs under the minimum number of wavelengths per link. To cope with the complexity of the problem, the authors developed a heuristic approach. The heuristic consists of three parts: routing, wavelength path grouping, and wavelength assignment. In the first part, the goal is to maximize the number of packed waveband paths. The number of physical hops is used as a cost metric for the shortest path calculation. The second part decides into which waveband each wavelength path will be grouped. Upon finishing this part, the size of the WXC and BXC in each network node can be calculated. In the third part, each wavelength path in packed waveband paths should have the same color for every link on its path since wavelength conversion is not allowed in the BXC. This leads to an increased wavelength requirement in the network. On the other hand, the wavelength assignment for a wavelength path in unpacked waveband paths is straightforward since wavelength conversion is possible in the

WXC. The authors formulated the assignment problem for packed wavebands as a BLP problem, and pointed out that such a problem can be quite manageable since the number of constraints and number of variables are $2 \times \text{band size}$ and band size^2 respectively.

As a benchmark, the MG-OXC-based network using the proposed heuristic is compared with the WXC-based network, which uses the ordinary OXC (Fig. 2.6) with wavelength converters placed at the inputs of the WXC. The key simulation findings of this work are as follows. (1) As the traffic volume increases, the use of MG-OXCs leads to significant reductions in both the size of crossconnects (up to 22%) and number of 2x2 cross-points, which constitute the crossconnects, (up to 36%). This agrees with the finding in [NVD01]. (2) The optimum waveband size that yields a maximum reduction in both the port and cross-point count may exist, and its optimum value depends on the physical topology and traffic. (3) The reductions in the size of crossconnects at the optimum waveband come at the price of an increased wavelength requirement compared to the wavelength requirement in WXC-based networks, and this ratio tends to decrease as the traffic volume increases.

2.5.3 Comprehensive Study on Waveband Switching

In [CXAQ02][CAXQ03], Cao et al conducted a comprehensive study on waveband switching in multi-granular networks. The MG-OXC architecture considered in this study, Type C as shown in Fig. 2.4, is similar to the one used in [NVD01] without employing wavelength and waveband converters since this technology is still immature and expensive. The authors developed a Waveband Switching (WBS) classification scheme, in which the number of wavebands/wavelengths per fiber/waveband can be either fixed or variable and the set of wavelengths in the waveband can be further classified as either pre-determined or adaptive. Accordingly, many variations of the WBS schemes are possible. However, the authors focused

only on the simplest scheme, in which each fiber has a fixed number of wavebands and each waveband has both a fixed number and set of wavelengths, although they also mentioned that their ILP model and heuristics are applicable to other WBS schemes.

Fig. 2.4: “Type C” MG-OXC architecture [CXAQ02].

The ILP modeling of the WBS problem is quite different from the modeling that is done in [Lee+02]. The modeling in the latter is based mainly on grouping wavelength paths having the same destinations, whereas in this work a general policy is adopted in which wavelength paths of different sources and different destinations can be grouped. In addition, the new ILP model considers the case of multi-fiber networks, in which any link between two nodes can contain more than one fiber. Moreover, the new ILP model uses the link-formulation approach instead of the path-formulation approach. The objectives of the ILP model are the following: (1) to minimize the total cost associated with the MG-OXC ports in the network, where all ports are weighted by a factor depending on the type of the switching stage, and, for simplification, are assumed to have the same cost; and (2) to minimize the maximum size of the MG-OXC over all nodes. The

authors argued that the solution to the ILP model is NP-complete since many constraints used in the problem are similar to the one used in the RWA problem, which is itself NP-complete.

To cope with the complexity of the problem, the authors proposed various heuristics. Many of these heuristics have been developed specifically for comparison purposes. The Waveband Oblivious Optimal RWA (WBO-RWA) heuristic is proposed to study the relationship between the WBS and traditional RWA. The heuristic first solves the ILP model used for the RWA in [MBRM96], in which the objective is to minimize the number of hops. Then, it groups the assigned wavelength paths into wavebands and fibers and calculates the port count accordingly.

The Balanced Path Routing with Heavy-Traffic first waveband assignment (BPHT) heuristic consists of three parts: balanced path routing, wavelength assignment, and waveband switching. The objective of the first part is to decide on the best physical route to be used by all wavelength paths of the source-destination (s - d) pair that minimizes the maximum link load in the network. In the second part, the objective is to assign wavelengths to the pass-through wavelength paths first since they constitute 60-80% of the transport traffic. To maximize the benefit of wavebanding, these wavelength paths can also be grouped with other shorter overlapping wavelength paths. The wavelength paths with the smallest hop count are assigned wavelengths first. In the third part, the sizes of all switching stages in all network nodes are decided after switching fully formed fibers/wavebands using FXCs/BXCs and switching the remaining wavelength paths at WXC's separately.

The Balanced Traffic routing with Maximum-Hop first waveband assignment (BTMH) heuristic is a variation of the BPHT heuristic. In the BTMH heuristic, the first part of the BPHT heuristic is modified such that the physical routes for all s - d pairs are decided by balancing the load in each link

in terms of the actual number of wavelength paths. Moreover, the second part is also modified such that the wavelength paths with the largest hop count are assigned wavelengths first. To test the performance of the BPHT heuristic, the authors proposed many analytical models in order to obtain the total number of ports in an MG-OXC-based network. One model is developed for the case in which the traffic demand per node pair is not a multiple of the waveband size. The other model is developed for the case in which the demand is a multiple of the waveband size. Moreover, models for generalized upper and lower bounds are also developed.

The main findings of this work are as follows. (1) For small-sized problems, the proposed BPHT heuristic can achieve good sub-optimum results in terms of the number of ports compared to the ILP model solution. (2) BPHT achieves a significant port count saving when compared with WBO-RWA. (3) In single/multi-fiber networks, the port count saving using the MG-OXC is around 50/70% compared to the case in which the ordinary OXC is used, which is consistent with the results obtained in [NVD01][Lee+02]. (4) On the other hand, the port count saving achieved with the ILP model and BPHT comes at the expense of an increased wavelength requirement in comparison with WBO-RWA, which agrees with the findings in [Lee+02], and the authors came to the conclusion that this is a problem of trade-off. (5) The performance evaluation shows that BPHT is even more beneficial in terms of reducing the port count and wavelength requirement in multi-fiber networks due to the natural wavelength conversion capability of these networks. (6) Comparing the developed analytical models with BPHT, the results show that heuristic results are within the limits and that the performance analysis is accurate. (7) The waveband size has an optimum value and has a large impact on the performance of multi-granular networks, which is again consistent with the finding in [Lee+02]. (8) BPHT has a better port count saving than

BTMH; however, it has a slightly higher wavelength requirement than BTMH, which in turn has a higher requirement than WBO-RW.

2.5.4 RWA with Tunnel Allocation

In [HMWu03], Ho et al proposed another approach for dimensioning multi-granular networks, which they called the problem of Routing and Wavelength Assignment with Tunnel allocation (RWAT). The authors used the same MG-OXC architecture, Type D as shown in Fig. 2.5, that they had proposed earlier in [HoMo02a], in which the architecture is used for developing algorithms for multi-granular networks under on-line traffic. There are many important observations to mention about this architecture. First, regardless of the volume of traffic, adding and dropping wavelength demands have to be done through the WXC stage and this definitely has a major impact on increasing the number of MG-OXC ports. Second, the architecture consists of two BXC/FXC stages, which also leads to the duplication of ports for pass-through wavebands and fibers. Third, the architecture has a fixed WXC size in all network nodes regardless of whether some nodes need a greater or smaller size.

Fig. 2.5: "Type D" MG-OXC architecture [HoMo02a].

This work is motivated by the following. First, the ILP model in [CXAQ02] suffers from very high computational complexity since all of the input/output ports of all switching stages need to be numbered. Moreover, the weighting port parameters in the objective function of the ILP model have not been addressed. The proposed heuristic also does not consider increasing the chance of grouping wavelength paths, although in our opinion the main motive of [CXAQ02] is to improve grouping in comparison to the previous work in [NVD01][Lee+02]. The authors' approach is based on the so-called tunneling principle, in which virtual connectivity is developed in the fiber- and waveband-switching tiers to accommodate more traffic demands. A wavelength path is grouped with other wavelength paths having different wavelengths at the entry node and then separated at the exit node. Many assumptions are made about the tunnels. First, all tunnels have lengths in hops greater than or equal to the average distance in a network in order to reduce the resource fragmentation in the tunnel tiers. Second, a tunnel path is the shortest path between the entry and exit nodes. Third, all wavebands/fibers have the same number of wavelengths/wavebands.

The dimensioning problem is formulated as an ILP model using the path-formulation approach with the objective of minimizing the total number of ports in waveband- and fiber-switching tiers. Upon solving the ILP model, the total number of switching points in the network can be decided based on the resultant port count of each switching stage. Here, it is assumed that the two-dimensional Micro-Electromechanical-System (MEMS) technology is used in the FXC, BXC, and WXC. To reduce the computational complexity of the ILP model, a heuristic is developed. The heuristic consists of three parts: the selection of entry-exit pairs, RWA, and tunnel allocation. The objective of the first part is to determine the entries and exits of all fiber and waveband tunnels. This can be achieved using a certain mathematical formulation that depends on a random

manipulation of traffic demands and the likelihood of a node pair taking a tunnel. The second part performs the RWA process in order to route wavelength demands over the additional fiber and waveband tunnels, the endpoints of which are decided during the first part. The RWA problem is solved by formulating the problem as an ILP model with the objective of minimizing the number of wavelength demands that cannot be satisfied. Upon solving the ILP model, if some demands cannot be satisfied, then this means that more tunnels are required. Accordingly, the first part of the heuristic has to be repeated to create additional tunnels until all demands are satisfied by the RWA process. In the third part, physical routes are selected for all tunnels by formulating the problem as an ILP model. The objective function of the ILP model is to minimize the total cost of laying fibers for the fiber and waveband switching in each link. After finishing the third part, the number of ports for each switching tier should be easily determined; consequently, the total number of switching points, or mirrors, can be calculated.

The main findings of this study are as follows. (1) For a small-sized problem, the performance evaluation of the proposed RWAT heuristic, in terms of the port count of both FXCs and BXCs, is within 10% of the ILP model solution and can be accepted as a good sub-optimum solution. (2) The use of the suggested MG-OXC requires additional port count compared to the case in which a pure wavelength-switching (or ordinary) OXC, Type E as shown in Fig. 2.6, is used, which is contrary to the findings reported in previous work. However, this difference is expected because of the points we have mentioned earlier about this architecture. (3) The proposed MG-OXC achieves a lower port count than using the fiber- and wavelength-switching MG-OXCs, Type F as shown in Fig. 2.7. (4) The increase in the number of mirrors as the traffic demand grows can be significantly slowed with the proposed MG-OXC but at the expense of a moderate increase (5-15%) in the port count with respect to the ordinary OXC. This means that in terms of the number

of mirrors, the proposed MG-OXC has the best scalability and the ordinary OXC has the worst scalability. This is consistent with the finding in [Lee+02].

Fig. 2.6: “Type E” Wavelength-switching OXC architecture.

Fig. 2.7: “Type F” Fiber- & wavelength-switching MG-OXC architecture [HMWu03].

2.5.5 Non-Uniform versus Uniform Waveband Switching

In [Izm+02][IGKV03], Izmailov et al investigated the performance of both the MG-OXC that uses uniform wavebands, in which the size of wavebands is fixed, and that using non-uniform wavebands, in which wavebands vary in size. The MG-OXC architecture used in this study is also called a hybrid hierarchical architecture. The hybrid architecture, Type G as shown in Fig. 2.8, consists of an all-optical (OOO) crossconnect (or BXC) that switches wavebands as well as an Optical-Electrical-Optical (OEO)-based crossconnect (or EXC) that switches wavelengths and performs wavelength conversions.

Fig. 2.8: “Type G” MG-OXC architecture [Izm+02].

The authors suggested three solutions for grouping pass-through wavelength paths. The first is the all-optical solution in which wavelength paths are grouped into uniform wavebands and switched optically by the BXC. These uniform wavebands can be partially filled. The second is the hybrid uniform wavebands solution in which the EXC is used to switch some of the coming wavelength paths to output fibers with either the same or a different color, and the remaining wavelength paths are grouped into fully filled uniform wavebands and switched optically by the BXC. The third is the non-uniform wavebands solution in which wavelength paths are grouped into fully filled non-uniform wavebands. The switching here can be either optical or hybrid if individual wavelength paths are left over. Determining the size of the non-uniform wavebands and the set of wavelengths to be used by each waveband requires solving the so-called waveband selection and waveband assignment problem. The authors formulated the problem as a dynamic programming problem with the objective of minimizing the weighted port count.

With the assumption that the cost of an EXC port is five times the cost of a BXC port, the authors showed through simulation that: (1) compared with the uniform wavebands solution, the

use of the non-uniform wavebands solution can achieve a significant weighted port count reduction; and (2) the uniform waveband has an optimum size that leads to the highest weighted port count reduction, as has been shown by the previously reviewed work.

2.5.6 Waveband Routing and Merging

Ganguly et al in [GTIM04] extended the work done in [Izm+02][IGKV03]. The authors pointed out two essential problems associated with the hybrid hierarchical architecture. The first problem is how to route wavelengths and wavebands in the lowest cost manner (routing cost), while the second is how and where to merge wavelengths into wavebands in the lowest cost manner (merging cost). Decoupling both problems as in [Izm+02][IGKV03] limits the full benefits of waveband merging. Accordingly, the goal of this work is to combine both problems.

The authors considered the uniform waveband case and proposed two waveband merging architectures that are modified versions of the hybrid architecture proposed in [Izm+02] (Fig. 2.8): Full OEO-based Merging (FEM) architecture and Partial OEO-based Merging (PEM) architecture. In FEM architecture, two partially filled pass-through waveband paths arriving at two fiber ports are redirected to the EXC, where the two wavebands are merged into a new waveband path that is forwarded directly to the output port without the involvement of the BXC. The new waveband path can use a different color if there is a contention for the same color at the output fiber. This waveband conversion capability leads to better resource utilization. In PEM architecture, on the other hand, only one of the two partially filled pass-through waveband paths is redirected to the EXC and the other is switched optically by the BXC. The wavelengths of the OEO-switched waveband undergo wavelength conversions in such a way that the new wavelengths should be different from the wavelengths of the OEO-switched waveband. The OEO-switched wavelengths are merged with the OEO-switched waveband path through a

coupler at the output port. The authors proposed two routing-and-merging heuristics to minimize the cost of routing and merging wavelengths and wavebands for both architectures.

In the FEM-based heuristic, the source-to-destination routing process of wavelength demands consists of three stages. In the first stage, wavelength demands in groups of the waveband size are routed along the shortest available routes from their source nodes to a node referred to as the Wavelength Convergence Point (WCP) that is designated for this set of demands. In the second stage, the WCP node merges these wavelength paths into wavebands and routes the resulting wavebands to a node called the Wavelength Divergence Point (WDP) via the available route with the smallest hop count (to reduce the number of OOOs or BXC ports). In the third stage, the grouped wavelengths are routed from the WDP to their destinations using the shortest available routes. The proper selections of WCP and WDP are essential to reducing the network cost since the merging and diverging cost (in terms of the number of OEOs or EXC ports) dominates the overall network cost. The WCP/WDP selection process is done through matrix manipulations to find the right node pair, namely one that serves a certain set of wavelength demands and at the same time minimizes the total merging and diverging cost.

The PEM-based heuristic, which the authors called Least Cost Branch First (LCBF), is based on the waveband-merging tree concept in which an unfilled waveband path can originate from multiple different sources and terminate at a filled waveband at a single node (the tree root). The authors resorted to the heuristic approach due to the fact that the optimal solution to the tree construction problem is known to be NP-complete. The LCBF heuristic constructs a merging tree for a set of single wavelength demands with the same destination by extending a branch each time a wavelength demand is served. The tree grows until all demands are served. While constructing waveband-merging trees, the heuristic tries to minimize the cost associated with each tree. The

total cost for a given tree is the summation of the following: the total cost of OEOs, total cost of OOOs, and merging cost (coupler cost) at nodes where two or more wavebands are merged.

The key simulation findings are as follows. (1) The proposed heuristics outperform the heuristic used in [Izm+02][IGKV03] in terms of the network cost. (2) As has been shown by the previously reviewed work, the waveband size has an optimum value, and this value varies depending on the physical topology and traffic. (3) The PEM architecture and its corresponding merging heuristic provide the best cost reduction for medium traffic volumes; however, the topology and traffic conditions should decide which merging architecture should be chosen. It is worth mentioning here that the FEM and PEM comparison is similar to the comparison between the earlier mentioned waveband grouping policies, namely the shared intermediate sub-path policy and shared destination policy.

2.5.7 Lagrangean Relaxation Approach

In [LYTi04], Lee et al proposed an approximation approach to solve the ILP model of the RWA problem in the multi-granular network, which the authors named RWA^+ . Unlike in previously reported work, the authors assumed here that the network consists of different types of nodes (with no optical conversion capability in any type). The node can be Fiber Switch Capable (FSC), Lambda Switch Capable (LSC), or both. Due to the existence of these different types of nodes, the authors used a graph transformation method to replace each node by a bipartite subgraph that consists of phantom nodes. The number of these phantom nodes and how they are interconnected are functions of the number of wavelengths per fiber and physical nodal degree.

The RWA^+ problem is formulated as an ILP model using the path-formulation approach with the objective of minimizing the highest link utilization. The exact ILP problem is approximated using

Lagrangian Relaxation with Heuristics (LRH), in which the inequality constraints are relaxed and the objective function is translated into a new objective function to reflect the constraints relaxation using Lagrangian multipliers. This type of relaxation, as we have mentioned in Subsection 2.4.2, is unlike the traditional LP approach that relaxes integers into non-integers. The LR approach here leaves integer constraints in the constraints sets while relaxing complex constraints such that the relaxed problem can be decomposed into independent manageable sub-problems. Each sub-problem deals with part of the objective function of the relaxed problem, and the sub-problem is solved heuristically.

The authors did not solve the exact ILP problem. However, they showed through simulation, with the assumption that the network consists of only LSC nodes, that the LR approach provides tighter upper bounds and shorter solve time on the optimal solutions to the RWA⁺ problem than those obtained by using the LP approximation approach in [BaMu96].

2.5.8 Single-Layer MG-OXC

Cao et al in [CAQi04][CAQi06] extended their previous work done in [CXAQ02][CAXQ03]. They compared their earlier proposed MG-OXC architecture (Type C as shown in Fig. 2.4), which they called the multi-layer MG-OXC, with a new proposed architecture that they called the single-layer MG-OXC, Type H as shown in Fig. 2.9. In the single-layer MG-OXC architecture, ‘wavelength-to-band’/‘band-to-fiber’ multiplexers and ‘band-to-wavelength’/‘fiber-to-band’ demultiplexers that are used to interconnect the ‘WXC and BXC’/‘BXC and FXC’ stages in the multi-layer architecture are removed. As a result, some input fibers are switched at the FXC. Other fibers are demultiplexed to wavebands. Some of these wavebands are switched at the BXC and others are demultiplexed to wavelengths and switched at the WXC. Because of these differences, the single-layer architecture is expected to have a lower port requirement. Moreover, the optical signal quality

is better than that of the multi-layer architecture, because all optical flows go through only one switching stage.

Fig. 2.9: "Type H" MG-OXC architecture [CAQi04].

The authors compared the performance of both architectures under off-line and on-line traffic. For the off-line case, they used the BPHT heuristic proposed in [CXAQ02][CAXQ03]. For the on-line case, they proposed and used an algorithm called Maximum Overlap Ratio (MOR), the objective of which is to minimize the request blocking probability.

The comparison via simulation shows that in the off-line case, the single-layer architecture can use up to 15% fewer ports than the multi-layer one. However, in the on-line case, the multi-layer architecture is better than the single-layer one since it achieves a lower blocking probability.

2.5.9 Disjoint Shared Waveband Path Protection

In [VGIz03], Varsou et al is the first group to our knowledge to address the protection problem in multi-granular networks. The authors adopted the MG-OXC architecture proposed in [Izm+02] (Fig. 2.8). They assumed that the waveband paths (the working capacity) have already been decided for all s - d pair wavelength demands, and the problem is how to protect a waveband path that carries wavelengths between an s - d pair. This is what we call disjoint protection, as opposed to joint protection in which both the working and protection capacity are decided simultaneously. The authors suggested that this can be done by finding either a protection waveband path or several protection wavelength paths. These protection wavebands and wavelengths (the spare capacity) can be shared by many s - d pairs. Therefore, the objective of the problem is to decide on which method to use for any s - d pair such that it minimizes the total spare capacity. If both methods yield the same spare capacity requirement, then the one with the minimum number of ports will be chosen.

The proposed problem is formulated as an ILP model with two objective functions: the first is to minimize the spare capacity and the second is to minimize the number of ports. The authors used the link-formulation approach to develop the ILP model. However, they did not solve the ILP model and alternatively suggested software packages that can solve dual-objective ILP problems. To ease the complexity of the ILP model, the authors developed a heuristic that they referred to as the waveband/wavelength protection tree algorithm. The heuristic relies on the working capacity, which is obtained using the waveband routing and aggregation algorithm presented in [Ara+02]. In this waveband routing and aggregation algorithm, all wavelength demands are routed first along the shortest available route. Then, wavelength paths sharing the longest common links are grouped together into one waveband along the common sub-route. These steps are repeated until no

further grouping is possible. In the waveband/wavelength protection tree algorithms, trees are constructed in a way that takes into account the number of waveband paths that can be protected as well as the number of available wavebands. A link (or branch) in the tree is weighted by how many waveband paths it can protect either completely or partially and how many wavebands are available in its link. If a path is completely protected by the tree, it is removed from the list of paths that a link can protect. Trees continue to be constructed as long as there are still unprotected paths.

The key simulation finding of this work is that the proposed waveband/wavelength protection tree scheme (the mixed approach) outperforms the wavelength approach, in which waveband paths are protected by only shared wavelength paths.

2.5.10 Dedicated and Shared Waveband Path Protection

Varma and Jue in [VaJu04][VaJu06] considered the problem of establishing working and dedicated/shared protection waveband paths for wavelength demands in multi-granular networks. The authors adopted the single-layer MG-OXC architecture proposed in [CAXQ03] (Fig. 2.9) and assumed that all wavebands/fibers have the same number of wavelengths/wavebands.

The proposed problem is formulated as an ILP model using the link-formulation approach with the objective of minimizing the port count in the network. In the formulation, the joint dedicated/shared waveband path protection approach is used to allocate the protection capacity for each working waveband path. In the dedicated protection approach, to avoid non-linear constraints, the authors assumed that the shared protection wavelengths on a link cannot be grouped into wavebands.

To cope with the complexity of the problem, the authors proposed a graph-based heuristic. The heuristic is based on creating auxiliary graphs from the given network topology. The number of these graphs is equal to the number of wavebands per fiber. The single node in the original network topology is transformed into many nodes if there is add/drop traffic at that node. The weights of the external links, which interconnect the node with other nodes, are the same as those in the original topology. The weights of the internal links between the generated nodes are updated by the heuristic every time an s - d pair is served. Finding a path in the auxiliary graph is equivalent to finding the physical route and waveband color. The minimum cost working waveband path is chosen among paths obtained from all graphs. The coloring of wavelengths in the chosen waveband is done using the First-Fit (FF) color assignment in a way that satisfies the wavelength-continuity constraint. If one waveband path is not enough to serve the s - d pair demands, then the second minimum cost path is selected and so on until all demands are served. The protection disjoint path is assigned sequentially to each working waveband path. In the dedicated protection problem, the protection path is found in the auxiliary graphs in the same way as the working path by modifying the internal links in a way that ensures that the working and protection paths are disjoint. In the shared protection problem, the auxiliary graphs are modified in such a way that the working paths having a protection path that shares wavelengths on the same link are link disjoint themselves since the problem is dealing with a single point of failure.

To benchmark the proposed heuristic, the authors used a heuristic based on the traditional RWA heuristic. In this heuristic, the working and protection paths are decided jointly by using the least combined cost path pair. In the dedicated protection approach, the coloring of wavelengths is done by the FF color assignment. In the shared protection approach, on the other hand, coloring is done in a way that increases the sharing among the protection paths.

The authors were unable to solve the ILP problem even for small-sized problems. Alternatively, they relaxed the integer variables of the ILP model and solved the resultant LP problem to provide lower bounds on the solutions to small-sized ILP problems. The key findings of this work are the following. (1) Graph-based heuristics achieve significant savings in the port count (up to 25%) with respect to traditional RWA heuristics, which agrees with the findings in [CXAQ02] [CAXQ03]. (2) Although dedicated protection consumes more wavelengths, it outperforms shared protection in terms of the port count for both heuristics and as well as the lower bound of the ILP problem. (3) Choosing the right waveband size is an important factor in maximizing the savings in the port count, which again agrees with the findings of the previously reviewed work.

2.5.11 Grouping Strategies with Joint Dedicated Path Protection

In [STPa07], Secci et al compared various grouping strategies in multi-granular networks with dedicated path protection. The authors adopted the single-layer MG-OXC architecture proposed in [CAQi04] (Fig. 2.9). They assumed that all wavebands/fibers have the same number of wavelengths/wavebands. Also, in the traffic model, they assumed that the bit-rate (or raw) traffic demand between any s - d pair can be mapped over one or more of the following types of demand granularities: wavelength, waveband, and multi-waveband (or fiber) demands. The authors used the best rounding-up method to reduce the gap between the volume of the required raw demand and the capacity (in bit/sec) of the allocated multi-granularity demand.

The authors classified grouping strategies into three levels: the wavelength, waveband, and fiber levels. The wavelength grouping level consists of only an end-to-end wavelength, which carries the wavelength demand between an s - d pair. The waveband grouping level consists of (1) an end-to-end waveband, which carries the waveband demand between an s - d pair; and (2) a local waveband, which is the sub-path/intermediate grouping of end-to-end wavelength paths. The fiber grouping

level consists of (1) an end-to-end fiber, which carries the fiber demand between an s - d pair; (2) a local fiber, which is the sub-path grouping of end-to-end waveband paths; and (3) a heterogeneous fiber, which is the sub-path grouping of end-to-end waveband and wavelength paths. Based on this grouping hierarchy, the authors proposed four network architecture cases: (1) the ordinary OXC (Fig. 2.6) without grouping, (2) MG-OXC with end-to-end wavebands and fibers, (3) MG-OXC with end-to-end wavebands and fibers as well as local wavebands and fibers, and (4) MG-OXC with all grouping strategies (Case 3 with heterogeneous fibers).

The authors formulated the network architecture cases mentioned above as ILP models using the link-formulation approach with the objective of minimizing the network cost. The network cost is expressed in terms of the port cost, fiber cost, and propagation delay cost. In the ILP formulation, they also used the joint dedicated link-disjoint path protection approach to allocate the spare capacity for each working wavelength/waveband/fiber path.

The ILP models are solved for different network topologies and traffic volumes. The authors were able to get the optimum solutions for these models for low traffic volumes, especially in network architecture cases that do not use sub-path grouping. Otherwise, they fixed a time limit for the ILP solver and considered the most feasible solutions available. The main findings of this study are as follows. (1) Adding grouping capabilities to network nodes through the use of the MG-OXC leads to a significant reduction in the network cost (up to 22%) and port count (up to 88%) with respect to the use of the ordinary OXC. In addition, greater reductions are expected as the traffic volume increases. These results are consistent with most of the findings in the previously reviewed work. (2) Incorporating sub-path grouping capabilities leads to additional slight savings in the network cost and port count with respect to the case in which only end-to-end groupings are used, which agrees with the finding in [NVDo01]. Moreover, the highest savings are more likely to occur for

low traffic volumes and networks with high network physical connectivity. Nevertheless, these savings come at the expense of a significantly increased complexity of the ILP model and, accordingly, the solve time. (3) Although combining the sub-path grouping with heterogeneous grouping leads to the best results, it does not achieve considerable savings compared to the case without heterogeneous grouping given the fact the ILP model of this network architecture case becomes extremely difficult to solve.

2.5.12 Dedicated Waveband Sub-path Protection

In [YHSa07], Yamada et al considered the problem of jointly establishing working waveband paths and dedicated protection waveband sub-paths for wavelength demands in multi-granular networks. The authors used an MG-OXC architecture similar to the one proposed in [Lee+02] (Fig. 2.3), but without either the use of wavelength converters or dropping wavelength demands from the BXC stage. They assumed that all wavebands have the same number of wavelengths.

The authors proposed a heuristic approach to tackle this problem with the objective of minimizing the network cost, which is expressed in terms of port and fiber requirements. The approach is based on the idea that each working waveband path can be divided into many sub-paths, and protection link-and-node disjoint waveband paths are obtained for these working sub-paths. Accordingly, a pair of working and protection waveband sub-paths forms a loop. The working/protection waveband path for any s - d pair consists of at least three loops: the source, intermediate, and destination loops. The source/destination loop includes the sources/destinations of other s - d pairs, which can use the spare capacity of the existing intermediate waveband loops. The heuristic consists of two parts. In the first part, source-destination loop pairs and intermediate loops are developed iteratively to accommodate as many demands as possible. The disjoint path pair is obtained using Suurballe's algorithm [Bhan97] using the distance as a cost metric. In the

second part, the original physical topology, established working/protection wavebands, and available wavelengths in wavebands are converted into the so-called multi-layered modified dual graph. The remaining demands are accommodated by this graph using Dijkstra's Algorithm [Dijk59].

The authors compared the dedicated waveband sub-path protection with the dedicated waveband path protection. The key simulation finding is that the former can achieve a 10-50% network cost savings over the latter.

2.5.13 Summary

Table 2.1 summarizes the related work by comparing the studies based on various issues considered in the design problem. The objectives of this summary are (1) to demonstrate the novelty of these studies, and (2) to identify potential opportunities for further research and development in this area.

Table 2.1: Comparison of previous work based on various issues.

Attribute Work	Demand granularity	Grouping level	WBS scheme	Node architecture	Demand bifurcation	Color conversion	Optical reach	Protection technique
[NVD01]	λ , band, fiber	band, fiber	uniform bands & fibers	Type A	No	λ , band	No	No
[Lee+02]	λ	band	uniform bands	Type B	No	λ	No	No
[CXAQ02] [CAXQ03]	λ	band, fiber	uniform bands & fibers	Type C	No	No	No	No
[HMWu03]	λ	band, fiber	uniform bands & fibers	Types D & F	No	No	No	No
[Izm+02] [IGKV03]	λ	band	non-uniform bands	Type G	No	λ	No	No
[GTIM04]	λ	band	uniform bands	Type G with some modifications	No	λ	No	No
[LYT04]	λ	fiber	uniform fibers	WXC and/or FXC	No	No	No	No
[CAQ04] [CAQ06]	λ	band, fiber	uniform bands & fibers	Type H	No	No	No	No
[VGIz03]	λ	band	uniform bands	Type G	No	No	No	shared band path protection
[VaJu04] [VaJu06]	λ	band, fiber	uniform bands & fibers	Type H	No	No	No	shared/dedicated band path protection
[STPa07]	λ , band, fiber	band, fiber	uniform bands & fibers	Type H	No	No	No	dedicated λ /band/fiber path protection
[YHSo07]	λ	band	uniform bands	Type B with some modifications	No	No	No	dedicated band sub-path protection

Chapter 3

Network Architecture and Framework

3.1 Introduction

Although extensive research work has been done in the area of multi-granular transport network planning, there are still some open issues that need to be considered and investigated. To the best of our knowledge, the following issues have not been mentioned or addressed in the literature: (1) considering the whole traffic hierarchy defined in GMPLS, (2) bifurcating multi-granularity traffic demands among distinct physical routes, (3) performing color conversions of the optical signal at all granularity levels, (4) imposing a constraint on the length of the all-optical path in order to cope with the optical-reach limitation, and (5) protecting the working multi-granularity traffic flows using the link and p-cycle protection techniques. Addressing these issues will certainly pave the road to an efficient implementation of the GMPLS-based transport network. The focus of this thesis will be on the consideration of the first four points, and the last point will be left as a further extension to our work.

In this chapter, we explain in detail the domain of the new planning problem we are going to address. First, we proceed with a full description of the proposed GMPLS-based node architecture as well as the path types involved in the system. Then, the new planning problem is stated and the assumptions are explained. After that, the optimization approaches to be taken in order to solve the problem optimally and sub-optimally are described.

3.2 The System

3.2.1 Node Architecture

A GMPLS-based transport mesh network consists of a group of nodes interconnected by fiber links. The proposed GMPLS-based node⁶ architecture [NaMo06a] consists of an MG-OXC segment and an EXC segment, as shown in Fig. 3.1. The MG-OXC segment is responsible for the grouping/degrouping and switching of optical flows (or lightpaths)⁷. In this thesis, we adopt the multi-layer MG-OXC architecture. Although it has been shown in [CAQi04][CAQi06] (Subsection 2.5.8) that the single-layer MG-OXC architecture can lead to a greater reduction in the port count under unprotected static traffic demands, it lacks the flexibility to (1) implement proper network provisioning, (2) cope with node/link failure, or (3) adapt to changes in the traffic pattern. Type C architecture [CXAQ02] (Fig. 2.4) or Type A architecture [NVDo01] (Fig. 2.2) without optical converters is chosen for the MG-OXC segment. Type C architecture is the best choice for the optical segment for the following reasons. First, adding/dropping different optical traffic granularities directly at the designated crossconnect leads to a significant reduction in the port requirement in comparison to other MG-OXC architectures. This fact is demonstrated through the example shown in Table 3.1, where it is clear that Type C architecture has the best scalability as traffic demands increase. Second, Type C also requires the lowest port requirement for pass-through traffic and scales better than other architectures as the volume of pass-through traffic flows increases, as is clearly demonstrated in Table 3.2. The FXC can be implemented using a space switch. Both the BXC and WXC can be implemented by various technologies such as liquid crystal and MEMS.

⁶ For the rest of this thesis, the terms GMPLS-based node and Multi-Granular Crossconnect (MG-XC) refer to the same concept and will be used interchangeably.

⁷ The terms lightpath, virtual link, clear path, and all-optical path have the same meaning and will be used interchangeably.

To perform the switching of sub-wavelength flows and grouping/degrouping of sub-wavelength flows into/from wavelengths, it is necessary to combine the EXC with the MG-OXC segment. The EXC consists of three parts: the switching matrix, line-side interfaces, and tributary-side interfaces. The switching matrix can be a GMPLS core router. A line-side interface consists of an optical transceiver with a certain optical reach capability. Line-side interfaces are interconnected with the MG-OXC segment through different types of GMPLS interfaces [Ban+01]. A Fiber-Switch-Capable (FSC) interface is used to launch/terminate a fiber-switched path, while a Band-Switch-Capable (BSC) interface is used to launch/terminate a waveband-switched path and a Lambda-Switch-Capable (LSC) interface is used to launch/terminate a wavelength-switched path. On the other hand, tributary-side interfaces are used to interconnect the EXC with metro core (or regional), metro edge, or excess networks, which are the sources and sinks of the transport network traffic. Tributary-side interfaces can be any of the interfaces mentioned previously as well as any of the following sub-wavelength type interfaces [Ban+01]: TDM-capable interfaces, Packet-Switch-Capable (PSC) interfaces, or Layer 2-Switch-Capable (L2SC) interfaces. However, tributary-side interfaces will not be included in our cost model.

Since the EXC allows for OEO domain conversion with the use of back-to-back transceivers, there are two added-value benefits associated with its deployment: the 3R (Re-amplification, Reshaping, and Re-timing) regeneration and color conversion of optical signals at all granularities. The regeneration functionality of the EXC is needed to reduce impairments that accumulate along the all-optical path. With the EXC, the use of expensive dispersion compensators along network spans can be avoided. The color conversion functionality removes the color-continuity constraint, improves the resource utilization of the network, and ultimately decreases the fiber requirements, which consequently reduces the computational complexity of the GMPLS control plane. It is

worth mentioning here that when the signal regeneration is needed it is also an opportunity to perform color conversion and vice versa. The cost-effective selection of OEO locations for performing the afore-mentioned functionalities will no doubt be part of the optimization process.

Fig. 3.1: The proposed GMPLS-based node architecture.

Table 3.1: A demonstrative example to compare different MG-OXC architectures in terms of the weighted port count in a single node for different volumes of add traffic, given that all optical port types have the same weight, the EXC port weight is twice the optical port weight, and the number of wavelengths/wavebands per waveband/fiber is 8/4.

<i>MG-OXC Architecture</i> <i>Add Traffic</i>	Type A/C	Type B	Type D	Type E	Type F	Type G
1 λ	WXC: 2 ports BXC: 2 ports FXC: 2 ports Σ Weighted ports= 6	WXC: 2 ports BXC: 2 ports Σ Weighted ports= 4	WXC: 2 ports BXC: 2 ports FXC: 2 ports Σ Weighted ports= 6	WXC: 2 ports Σ Weighted ports= 2	WXC: 2 ports FXC: 2 ports Σ Weighted ports= 4	EXC: 2 ports BXC: 2 ports Σ Weighted ports= 6
8 λs	BXC: 2 ports FXC: 2 ports Σ Weighted ports= 4	WXC: 16 ports BXC: 2 ports Σ Weighted ports= 18	WXC: 16 ports BXC: 2 ports FXC: 2 ports Σ Weighted ports= 20	WXC: 16 ports Σ Weighted ports= 16	WXC: 16 ports FXC: 2 ports Σ Weighted ports= 18	EXC: 16 ports BXC: 2 ports Σ Weighted ports= 34
32 λs	FXC: 2 ports Σ Weighted ports = 2	WXC: 64 ports BXC: 8 ports Σ Weighted ports= 72	WXC: 64 ports BXC: 8 ports FXC: 2 ports Σ Weighted ports= 74	WXC: 64 ports Σ Weighted ports= 64	WXC: 64 ports FXC: 2 ports Σ Weighted ports= 66	EXC: 64 ports BXC: 8 ports Σ Weighted ports= 136
64 λs	FXC: 4 ports Σ Weighted ports = 4	WXC: 128 ports BXC: 16 ports Σ Weighted ports= 144	WXC: 128 ports BXC: 16 ports FXC: 4 ports Σ Weighted ports= 148	WXC: 128 ports Σ Weighted ports=128	WXC: 128 ports FXC: 4 ports Σ Weighted ports= 132	EXC: 128 ports BXC: 16 ports Σ Weighted ports=272

Table 3.2: A demonstrative example to compare different MG-OXC architectures in terms of the weighted port count in a single node for different volumes of pass-through traffic, given that all optical port types have the same weight, the EXC port weight is twice the optical port weight, and the number of wavelengths/wavebands per waveband/fiber is 8/4.

<i>MG-OXC Architecture</i> <i>Pass-Through Traffic</i>	Type A/C	Type B	Type D	Type E	Type F	Type G
1 Fiber	FXC: 2 ports Σ Weighted ports= 2	BXC: 8 ports Σ Weighted ports= 8	FXC: 4 ports Σ Weighted ports= 4	WXC: 64 ports Σ Weighted ports= 64	FXC: 4 ports Σ Weighted ports= 4	BXC: 8 ports Σ Weighted ports= 8
2 Fibers	FXC: 4 ports Σ Weighted ports= 4	BXC: 16 ports Σ Weighted ports= 16	FXC: 8 ports Σ Weighted ports= 8	WXC: 128 ports Σ Weighted ports= 128	FXC: 8 ports Σ Weighted ports=8	BXC: 16 ports Σ Weighted ports= 16

3.2.2 Path Types

In this work, we consider the following path types between any source-destination ($s-d$) pair in the GMPLS-based transport network [NaMo06a][NaMo07a]:

- *Clear Wavelength-Switched (CWS) Path*: This path can carry either a wavelength demand or sub-wavelength demand(s) that share the same source and destination. The CWS path must have enough optical reach to use the same wavelength on the same waveband within the same fiber along the entire path without undergoing OEO domain conversion, as shown in Fig. 3.2. The launch/termination of this path is at the LSC interface. The CWS path can enter the intermediate WXC or BXC stages for grouping/degrouping the path segment with/from other lightpaths that share the same waveband or fiber, as illustrated in Fig. 3.2.

Fig. 3.2: Clear wavelength-switched path.

- *Unclear Wavelength-Switched (UWS) Path*: This path is used to carry either a wavelength demand or sub-wavelength demand(s). The UWS path is a concatenation of CWS paths. This path undergoes OEO conversion at least once for the purpose of (1) sharing the capacities of its CWS paths with other sub-wavelength demands (note that CWS paths here are to be used only by sub-wavelength demands), as depicted in Fig. 3.3, and we call this level of grouping the wavelength-level; (2) optical signal regeneration, if the length of all-optical path segments exceeds the optical reach, as

shown in Fig. 3.4; and/or (3) wavelength color conversion to another wavelength color on the same waveband, a different waveband, or a different fiber, as shown in Fig. 3.5.

Fig. 3.3: Unclear wavelength-switched path, sub-wavelength flow (de)grouping scenario.

Fig. 3.4: Unclear wavelength-switched path, optical signal regeneration scenario.

Fig. 3.5: Unclear wavelength-switched path, wavelength conversion scenario.

- *Clear Band-Switched (CBS) Path*: The CBS path is used to carry a waveband demand. This type must have a sufficient optical reach to use the same waveband on the same fiber along the entire path without undergoing OEO conversion, as shown in Fig. 3.6. The launch/termination of this path is at the BSC interface. The CBS path can enter the intermediate BXC stages for grouping/degrouping the path segment with/from other lightpaths that share the same fiber, as illustrated in Fig. 3.6.

Fig. 3.6: Clear waveband-switched path.

- *Unclear Band-Switched (UBS) Path*: This path is used to carry a waveband demand. The UBS path is a concatenation of CBS paths. This path undergoes OEO conversion at least once for the purpose of optical signal regeneration, as shown in Fig. 3.7, and/or waveband color conversion to another waveband color on either the same or a different fiber, as shown in Fig. 3.8.

Fig. 3.7: Unclear waveband-switched path, optical signal regeneration scenario.

Fig. 3.8: Unclear waveband-switched path, waveband conversion scenario.

- *Clear Fiber-Switched (CFS) Path*: This path is used to carry a fiber demand. The path must have enough optical reach to use the same fiber along the entire path without undergoing OEO conversion. The launch/termination of this path is at the FSC interface, as shown in Fig. 3.9.

Fig. 3.9: Clear fiber-switched path.

- *Unclear Fiber-Switched (UFS) Path*: The UFS path is used to carry a fiber demand. It is a concatenation of CFS paths and undergoes OEO conversion at least once for the purpose of optical signal regeneration and/or fiber-code conversion, as shown in Figs. 3.10 and 3.11 respectively.

Fig. 3.10: Unclear fiber-switched path, optical signal regeneration scenario.

Fig. 3.11: Unclear fiber-switched path, fiber conversion scenario.

The CWS, CBS, and CFS paths whether they are used between s - d pairs or as a result of using UWS, UBS, and UFS paths are the virtual links of the multi-granular virtual topology, which decides on the port requirements of all MG-XCs in the transport network.

3.2.3 Grouping and Degrouping of Paths

One of the main factors that play a major role in minimizing the port count in multi-granular transport networks is how the different types of paths are grouped and degrouped. There are three levels of grouping, and they are explained as follows. First, the fiber-level grouping (studied in the literature) groups waveband flows at a certain fiber. Second, the waveband-level grouping (studied extensively in the literature) groups wavelength flows at a certain waveband. Third, the wavelength-level grouping (a new contribution in the context of multi-granular networks) groups sub-wavelength flows at a certain wavelength. The consideration of all these levels and the interactions between them are part of the novelty of this thesis.

In each grouping level, paths can be grouped in many different ways, such as the following. (1) First is the grouping of paths that have the same source and destination (or the end-to-end grouping). The fiber/waveband/wavelength-switched path is a typical scenario of an end-to-end

grouping of waveband/wavelength/sub-wavelength demands at the fiber/waveband/wavelength-level. Other forms of grouping include (2) the grouping of paths that have same source but different destinations, (3) the grouping of paths that have the same destination but different sources, and (4) the grouping of paths that have different sources and destinations (i.e. intermediate grouping). Table 3.3 summarizes how each path type can be involved in the grouping process at all levels.

Table 3.3: Comparison of different *s-d* path types in terms of their involvement in the grouping process at all levels.

<div>Grouping involvement & opportunity</div> <div>Path type</div>	Wavelength-Level				Waveband-Level				Fiber-Level			
	End-to-End	Same Source	Same Destination	Intermediate	End-to-End	Same Source	Same Destination	Intermediate	End-to-End	Same Source	Same Destination	Intermediate
CWS	✓					✓	✓	✓		✓	✓	✓
UWS	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓
CBS					✓					✓	✓	✓
UBS					✓					✓	✓	✓
CFS									✓			
UFS									✓			

On the other hand, the degrouping of a sub-wavelength/wavelength/waveband-switched path from other path(s) at any transport node requires that all path types using the same incoming fiber enter finer switching stages. Although this process is necessary, it results in extra ports for pass-through paths that do not have to be degrouped at this node. Therefore, the questions of how and where paths should be degrouped are essential parts of the optimization process. Degrouping is needed for many reasons, and these are explained as follows: (1) to perform color conversion,

because it is not possible for a particular path to continue grouping in the next route segment by using the same color utilized in the previous route segment; (2) to perform signal regeneration; (3) to drop a demand; and (4) to switch a path to a different route segment.

3.3 Solution of the Planning Problem

3.3.1 Problem Statement

The problem of planning the GMPLS-based transport network involves creating/adjusting multi-granularity demands, selecting their path types and the corresponding physical routes and color assignments, and (de)grouping paths. All of these elements have to be combined in ways that minimize the total weighted port count of the transport nodes and satisfy all demands at the same time. The problem is solved given the following: the network fiber layout, the raw/‘multi-granularity’ traffic demands between all node pairs, the wavelength capacity (C), the waveband size or the number of wavelengths per waveband (W), the number of wavebands per fiber (B), the number of fibers per unidirectional physical link (F), the maximum optical reach (R_{max}), and the cost weights of all port types. We call this problem Routing and Multi-Granular Paths Assignment (RMGPA) [NaMo06a]. The RMGPA problem is NP-complete since it contains instances of the RWA problem, which is known to be an NP-complete. In this thesis, we will solve different versions of the RMGPA problem that depend on whether the color conversion and signal regeneration capabilities are considered.

3.3.2 Assumptions

To facilitate solving the RMGPA problem and make the problem more focused and tractable, our assumptions are explained as follows:

- *Network Model:* The network fiber-conduit layout already exists in which each conduit between a node pair consists of two unidirectional physical links (or spans) working at opposite directions. Each unidirectional physical link, as shown in Fig. 1.1, is composed of a number of low-dispersion dark fibers that can be lighted up as required. Each fiber is coded by its ID on a link and consists of uniform or fixed size wavebands, which in turn consist of a number of wavelengths and all wavelengths have the same capacity (i.e. they operate at the same bit rate). In this thesis, we assume that the network model is homogenous in the sense that F , B , W , and C are the same throughout the network. Moreover, all transport nodes have the same architecture shown in Fig. 3.1.
- *Traffic Model:* The traffic demand between any node pair represents the long-term average traffic demand. The s - d pair demand is asymmetric. The demand can be of either a raw traffic or multi-granularity traffic type that can be expressed as a multi-dimensional demand in which each dimension represents a different traffic granularity. The sub-wavelength demand is always expressed in bit/s regardless of its origin (i.e. whether it is L2, TDM, or ATM traffic, etc.). The traffic demand of the same granularity can also be bifurcated among distinct physical routes. The significance of bifurcating demands is one of the issues that will be investigated in this thesis.
- *Coping with power losses and impairments:* An optical signal may have to pass through a number of MG-OXCs and fiber segments. Therefore, while propagating through the network, the signal degrades in quality as it loses power due to such primary causes as fiber attenuations and insertion losses at the MG-OXC. To compensate for these losses, we assume that each transport node is already equipped with automatic-gain-control postamplifiers and preamplifiers. Moreover, each unidirectional physical link is already equipped with automatic-gain-control Erbium-Doped Fiber Amplifiers (EDFAs). In addition to these losses, the optical

signal is also affected by various serious physical impairments, such as Polarization Mode Dispersion (PMD) and Chromatic Dispersion (CD). These impairments accumulate over links within an all-optical path (or clear path). How far an all-optical path can be routed optically without the need for signal regeneration using the EXC depends on how the impairments accumulate without exceeding predefined thresholds. This is the definition of the so-called optical reach. The use of optical duobinary modulation techniques [HARD06] in the EXC line-side interfaces promises improved optical reach with the elimination of dispersion compensators along network spans [MASO07]. Moreover, the proper choice of the duobinary technique and the fiber type is key to extending the optical reach to thousands of kms [Tan+07]. Throughout this thesis, we assume that all EXC interfaces use the duobinary technique. Also, we assume that the maximum optical reach is given as an input parameter to the problem, and all-optical paths are chosen in such a way that the length of all-optical paths must not exceed the given optical reach value.

- *Cost Model:* The MG-OXC ports and EXC line-side interfaces (or ports) are included in our cost model. We assume that the input port and output port of the MG-OXC/EXC have the same cost weight. The cost of the EXC port depends on the type of interface used and the reach it can provide. Long-reach interfaces are more expensive than short-reach ones [Simm05]. In addition, EXC ports are more expensive than MG-OXC ports [Grub01] [Izm+02]. The cost ratio of an EXC port to an MG-OXC port (E/O ratio) as a function of the optical reach is decided using the following equation [Simm05]:

$$\frac{\text{EXC port weight}}{\text{MG - OXC port weight}} = \text{RATIO}_{1000} \times (1.25)^{\log_2(R/1000)} \quad (3.1)$$

where R is the optical reach in km and RATIO_{1000} is the E/O ratio at $R=1000$ km. These differences in cost will be reflected in the weighting factors of all port types when the port

count of MG-XCs is minimized. Throughout this thesis, we assume that the 40G-based EXC port costs two-and-a-half times what a 10G-based EXC port would cost [FULL06].

- *Label conversion:* A wavelength/waveband/fiber-switched path can be assigned different labels (or colors) along the entire path. The label in a wavelength-switched path corresponds to the wavelength used at a certain waveband of a certain fiber ID. The label in a waveband-switched path corresponds to the waveband used at a certain fiber ID. The label in a fiber-switched path corresponds to the fiber ID used. Changing labels along the path is done electronically by switching the whole signal (data+label) into the EXC, where the label conversion is performed.
- *Protection:* Protection techniques regarding the possible failure of fiber links or nodes are not considered. In other words, our focus is only on the efficient allocation of the working traffic.

3.3.3 Solution Approach

In Chapters 4 and 5, different versions of the RMGPA problem will be tackled. A high-level description of the methodology to be used to solve the RMGPA problem is shown in Fig. 3.12. Regardless of the problem version and the optimization method to be used, the first subtask of the problem solution is to create optimized multi-granularity traffic demands from the given raw demands or adjust the given multi-granularity demands. The goal of this subtask is to increase the end-to-end grouping at the wavelength-, waveband-, and fiber-levels. In the sense that the volume of sub-wavelength demands that is equal to C is treated as one unit of the wavelength demand and has to follow the same physical route. Similarly, the number of wavelength demands that is equal to W is considered to be one unit of the waveband demand. Moreover, the number of waveband demands that is equal to B is considered to be one unit of the fiber demand. Although there are some similarities between our approach [NaMo06a] and the approach presented in [STPa07]

(Subsection 2.5.11), our approach (1) ensures that there is no gap between the volume of the required raw demand and the capacity of the allocated multi-granularity demand, (2) considers all of the traffic granularities defined in GMPLS, and (3) not only creates optimized multi-granularity demands from raw demands but also adjusts the given multi-granularity demands. The Demand Adjustment algorithm works as follows [NaMo06a]:

Demand Adjustment Algorithm;

Input: Raw/'multi-granularity' traffic demands, C , W , B

Output: Optimized/adjusted multi-granularity demands

Begin

1. Initialization:

If the given demands are raw demands

- {
- Set sub-wavelength demands = raw demands
- Set wavelength/waveband/fiber demands = zero
- }

2. For all sub-wavelength demands, do the following:

If sub-wavelength demand $\geq C$

- {
- Set wavelength demand (of the same $s-d$ pair) = wavelength demand + $\lfloor \text{sub-wavelength demand}/C \rfloor$
- Set sub-wavelength demand = sub-wavelength demand - $(\lfloor \text{sub-wavelength demand}/C \rfloor) \times C$
- }

Else sub-wavelength demand remains unchanged

3. For all wavelength demands, do the following:

If wavelength demand $\geq W$

- {
- Set waveband demand = waveband demand + $\lfloor \text{wavelength demand}/W \rfloor$
- Set wavelength demand = wavelength demand - $(\lfloor \text{wavelength demand}/W \rfloor) \times W$
- }

Else wavelength demand remains unchanged

4. For all waveband demands, do the following:

If fiber demand $\geq B$

{

- Set fiber demand = fiber demand + $\lfloor \text{waveband demand}/B \rfloor$
- Set waveband demand = waveband demand - $(\lfloor \text{waveband demand}/B \rfloor) \times B$

}

Else waveband demand remains unchanged

End.

Fig. 3.12: Flowchart for the approach to be taken to solve the RMGPA problem optimally and sub-optimally.

After this point, the methodology proceeds in two directions. The aim of the first direction is to obtain an exact solution to the RMGPA problem. This can be achieved by formulating the problem as an MILP/NLP model using the path-formulation approach. The optimization variables consist of binary, integer, and real variables. Sub-wavelength flows are the main reason behind the existence of real variables. However, due to the extreme complexity of the problem, only MILP models will be solved for small-sized planning problems. The solutions of the MILP

models will serve as valuable quality references for the sub-optimum methods developed [Gro04]. MILP models are solved using AMPL CPLEX version 7.0 software [CPLEX] [FGKe03], which uses Dakin's method (refer to Subsection 2.4.1).

The aim of the second direction is to solve large-sized planning problems and satisfy the planning speed requirement, which should be completed in a matter of minutes [Simm06]. However, this will be at the expense of a trade-off in the accuracy of the solution for a decrease in the complexity of the computation. This can be achieved by using heuristic methods. To determine the best sub-optimum solution, many heuristics are proposed in this thesis. Heuristic algorithms will be implemented using the C/C++ language. The implementation platforms of MILP models and heuristics run on an Intel Pentium 4, 2.4G CPU, with 1GB of physical memory.

Chapter 4

Planning of GMPLS-Based Transport Networks without Conversion and Regeneration Capabilities

4.1 Introduction

In this chapter, we focus on planning the GMPLS-based transport network without considering the color conversion and optical signal regeneration capabilities. This means that the RMGPA problem here has to include the color-continuity constraints and exclude the optical-reach constraints. Accordingly, for fiber, waveband, and wavelength demands, only clear paths are to be used. However, for sub-wavelength demands, both clear and unclear paths can be involved. Unclear paths are needed in this case for the purpose of sharing the capacities of clear paths between many sub-wavelength demands. Thus, an unclear path can consist of clear paths with different colors. This version of the RMGPA problem is the right fit for the planning problem in metro core⁸ (or regional) transport networks in which the control plane requires that the color-continuity constraints be kept in order to reduce the resource fragmentation⁹ [HoMo02b].

This chapter proceeds with the MILP formulation of the RMGPA problem. Then, algorithms of the proposed heuristic approach are explained. Afterword, numerical results are presented by including the following: (1) the verification of the heuristic approach, (2) demonstrations of the

⁸ In metro core networks, fiber links are generally short enough that optical signal regeneration is not generally required.

⁹ Resource fragmentation means that unclear paths are used for the purpose of color conversions, and each clear path in the unclear path is represented as a link in the link-state database of the control plane. As a result, the computational complexity of the path selection in the control plane will be increased and more computational resources will be needed.

impact of input parameters and some solution enhancements, and (3) a comparison of heuristics via simulation.

4.2 MILP Formulation

To achieve the optimum solution to the RMGPA problem, the problem is formulated as an MILP model. The formulation proceeds as follows [NaMo06a][NaMo06b][NaMo08c].

Parameters:

- N is the number of network nodes.
- C , W , B , and F .
- P is the number of physical routes allowable between a node pair.
- $cf / cb / cw$ is the relative cost of the FXC/BXC/WXC port.
- $cgf / cgb / cgw$ is the relative cost of the FSC/BSC/LSC-based EXC port.
- Λ_{sd}^g is the s - d pair “adjusted” demand of the g^{th} granularity obtained using the Demand Adjustment algorithm (refer to Subsection 3.3.3); $g = 0/1/2/3$ for sub-wavelength/wavelength/waveband/fiber demand.
- $\delta_{ij} = 1$ if there is a fiber connectivity between node pair i - j ; otherwise it is zero.
- Q^{sd} is the set of P distinct routes between the s - d pair computed using the All Distinct Routes algorithm [Gro04].
- $\zeta_{ij}^{g, sd, p} = 1$ if the s - d demand of the g^{th} granularity (note that $g \neq 0$ here) using the p^{th} distinct route crosses physical link i - j ; otherwise it is zero. This parameter is derived from Q^{sd} , Λ_{sd}^g and δ_{ij} .
- $\gamma_{ij}^{sd, p} = 1$ if the node pair s - d using the p^{th} distinct route crosses physical link i - j ; otherwise it is zero. This parameter is derived from Q^{sd} and δ_{ij} .

Sets:

- Node indices: s, d, i, j, m , and $n \in \{0, 1, \dots, N - 1\}$.
- Route index: $p \in \{0, 1, \dots, P - 1\}$.
- Wavelength index: $k \in \{0, 1, \dots, W - 1\}$.
- Waveband index: $b \in \{0, 1, \dots, B - 1\}$.
- Fiber index: $f \in \{0, 1, \dots, F - 1\}$.

Optimization Variables:

- $FXC_i / BXC_i / WXC_i$ is an integer variable that represents the number of FXC/BXC/WXC ports at node i .
- $FSCO_i / BSCO_i / WSCO_i$ is an integer variable that represents the number of FSC/BSC/LSC-based GMPLS transmitters at node i .
- $FSCI_i / BSCI_i / WSCI_i$ is an integer variable that represents the number of FSC/BSC/LSC-based GMPLS receivers at node i .
- $FA_i / BA_i / WA_i$ is an integer variable that represents the number of FXC/BXC/WXC add ports at node i .
- $FD_i / BD_i / WD_i$ is an integer variable that represents the number of FXC/BXC/WXC drop ports at node i .
- $FI_i / BI_i / WI_i$ is an integer variable that represents the number of FXC/BXC/WXC input ports at node i .
- $FO_i / BO_i / WO_i$ is an integer variable that represents the number of FXC/BXC/WXC output ports at node i .

- $fi_i^{j,f} / fo_i^{j,f} = 1$ if the FXC input/output port of node i that is operating at fiber f is used by the traffic ‘arriving from’/‘going to’ the fiber-connected node j ; otherwise it is zero.
- $bi_i^{j,f,b} / bo_i^{j,f,b} = 1$ if the BXC input/output port of node i that is operating at waveband b of fiber f is used by the traffic ‘arriving from’/‘going to’ the fiber-connected node j ; otherwise it is zero.
- $wi_i^{j,f,b,k} / wo_i^{j,f,b,k} = 1$ if the WXC input/output port of node i that is operating at wavelength k of waveband b and fiber f is used by the traffic ‘arriving from’/‘going to’ the fiber-connected node j ; otherwise it is zero.
- FB_i / BF_i is an integer variable that represents the number of FXC output/input ports that are connected to the BXC stage at node i .
- BW_i / WB_i is an integer variable that represents the number of BXC output/input ports that are connected to the WXC stage at node i .
- $fb_i^{j,f} / bf_i^{j,f} = 1$ if the FXC output/input port of node i that is connected to the BXC stage and operating at fiber f is used by the traffic ‘arriving from’/‘going to’ the fiber-connected node j ; otherwise it is zero.
- $bw_i^{j,f,b} / wb_i^{j,f,b} = 1$ if the BXC output/input port of node i that is connected to the WXC stage and operating at waveband b of fiber f is used by the traffic ‘arriving from’/‘going to’ the fiber-connected node j ; otherwise it is zero.
- $VF_f^{sd,p} = 1$ if there is a CFS path between an s - d pair that has a fiber demand, uses the p^{th} distinct route, and utilizes fiber f along the entire path; otherwise it is zero.
- $VB_{f,b}^{sd,p} = 1$ if there is a CBS path between an s - d pair that has a waveband demand, uses the p^{th} distinct route, and utilizes waveband b of fiber f along the entire path; otherwise it is zero.

- $VW_{f,b,k}^{sd,p} = 1$ if there is a CWS path between an s - d pair that has a wavelength demand, uses the p^{th} distinct route, and is carried on wavelength k of waveband b and fiber f along the entire path; otherwise it is zero.
- $VS_{f,b,k}^{sd,p} = 1$ if there is a CWS path between an s - d pair that uses the p^{th} distinct route and is carried on wavelength k of waveband b and fiber f along the entire path; otherwise it is zero. This CWS path is used solely by sub-wavelength demands.
- $BFPT_{f,b}^{sd,p,i,mn} = 1 / WFPT_{f,b,k}^{sd,p,i,mn} = 1 / SFPT_{f,b,k}^{sd,p,i,mn} = 1$ if the portion of the virtual link $VB_{f,b}^{sd,p} / VW_{f,b,k}^{sd,p} / VS_{f,b,k}^{sd,p}$ that passes through node i , arrives from node m , and goes to node n is only fiber-switched; otherwise it is zero.
- $BPT_{f,b}^{sd,p,i,mn} = 1 / WBPT_{f,b,k}^{sd,p,i,mn} = 1 / SBPT_{f,b,k}^{sd,p,i,mn} = 1$ if the portion of the virtual link $VB_{f,b}^{sd,p} / VW_{f,b,k}^{sd,p} / VS_{f,b,k}^{sd,p}$ that passes through node i , arrives from node m , and goes to node n is waveband-switched; otherwise it is zero.
- $WPT_{f,b,k}^{sd,p,i,mn} = 1 / SPT_{f,b,k}^{sd,p,i,mn} = 1$ if the portion of the virtual link $VW_{f,b,k}^{sd,p} / VS_{f,b,k}^{sd,p}$ that passes through node i , arrives from node m , and goes to node n is wavelength-switched; otherwise it is zero.
- $\varphi_{p,k,b,f}^{sd,ij}$ is a real variable that represents the amount of the sub-wavelength flow of the s - d demand that is carried on the virtual link $VS_{f,b,k}^{ij,p}$.

Objective:

Minimize the total weighted port count in the GMPLS-based transport network:

$$\min \left(\begin{aligned} & cf \cdot \sum_i FXC_i + cb \cdot \sum_i BXC_i + cw \cdot \sum_i WXC_i + \\ & cgf \cdot \sum_i (FSCO_i + FSCI_i) + cgb \cdot \sum_i (BSCO_i + BSCI_i) + cgw \cdot \sum_i (WSCO_i + WSCI_i) \end{aligned} \right) \quad (4.1)$$

Constraints:

Minimizing the weighted port count is subject to the following constraints:

1) Port configurations at all switching stages of the GMPLS-based transport node, as illustrated in Fig. 4.1:

$$WXC_i = WD_i + WA_i + WO_i + WI_i \quad \forall i \quad (4.2)$$

$$BXC_i = BD_i + BA_i + WB_i + BW_i + BO_i + BI_i \quad \forall i \quad (4.3)$$

$$FXC_i = FD_i + FA_i + FB_i + BF_i + FO_i + FI_i \quad \forall i \quad (4.4)$$

$$WSCO_i = WA_i \quad \forall i \quad (4.5)$$

$$WSCI_i = WD_i \quad \forall i \quad (4.6)$$

$$BSCI_i = BD_i \quad \forall i \quad (4.7)$$

$$BSCO_i = BA_i \quad \forall i \quad (4.8)$$

$$FSCI_i = FD_i \quad \forall i \quad (4.9)$$

$$FSCO_i = FA_i \quad \forall i \quad (4.10)$$

Fig. 4.1: Port configurations at all switching stages of the GMPLS-based transport node.

2) WXC add and drop ports (refer to Fig. 4.1) are decided by the endpoints of the CWS-based virtual links that are needed to handle both wavelength and sub-wavelength demands; BXC/FXC add and drop ports are decided by the endpoints of the CBS/CFS-based virtual links as well as waveband/fiber demands:

$$WA_s = \sum_{j \neq s} \sum_{m \neq s} \sum_p \sum_f \sum_b \sum_k \left(\gamma_{sm}^{sj,p} \cdot VS_{f,b,k}^{sj,p} + \zeta_{sm}^{1,sj,p} \cdot VW_{f,b,k}^{sj,p} \right) \quad \forall s \quad (4.11)$$

$$WA_s = \sum_{j \neq s} \sum_p \sum_f \sum_b \sum_k \left(VS_{f,b,k}^{sj,p} + VW_{f,b,k}^{sj,p} \right) \quad \forall s \quad (4.12)$$

$$WD_d = \sum_{i \neq d} \sum_{n \neq d} \sum_p \sum_f \sum_b \sum_k \left(\gamma_{nd}^{id,p} \cdot VS_{f,b,k}^{id,p} + \zeta_{nd}^{1,id,p} \cdot VW_{f,b,k}^{id,p} \right) \quad \forall d \quad (4.13)$$

$$WD_d = \sum_{i \neq d} \sum_p \sum_f \sum_b \sum_k \left(VS_{f,b,k}^{id,p} + VW_{f,b,k}^{id,p} \right) \quad \forall d \quad (4.14)$$

$$BA_s = \sum_{j \neq s} \sum_{m \neq s} \sum_p \sum_f \sum_b \left(\zeta_{sm}^{2,sj,p} \cdot VB_{f,b}^{sj,p} \right) \quad \forall s \quad (4.15)$$

$$BA_s = \sum_d \Lambda_{sd}^2 \quad \forall s \quad (4.16)$$

$$BD_d = \sum_{i \neq d} \sum_{n \neq d} \sum_p \sum_f \sum_b \left(\zeta_{nd}^{2,id,p} \cdot VB_{f,b}^{id,p} \right) \quad \forall d \quad (4.17)$$

$$BD_d = \sum_s \Lambda_{sd}^2 \quad \forall d \quad (4.18)$$

$$FA_s = \sum_{j \neq s} \sum_{m \neq s} \sum_p \sum_f \left(\zeta_{sm}^{3,sj,p} \cdot VF_f^{sj,p} \right) \quad \forall s \quad (4.19)$$

$$FA_s = \sum_d \Lambda_{sd}^3 \quad \forall s \quad (4.20)$$

$$FD_d = \sum_{i \neq d} \sum_{n \neq d} \sum_p \sum_f \left(\zeta_{nd}^{3,id,p} \cdot VF_f^{id,p} \right) \quad \forall d \quad (4.21)$$

$$FD_d = \sum_s^{s \neq d} \Lambda_{sd}^3 \quad \forall d \quad (4.22)$$

3) The multi-granular virtual topology must accommodate all multi-granularity traffic demands:

$$\sum_j^{j \neq s} \sum_p \sum_f \sum_b \sum_k \varphi_{p,k,b,f}^{sd,sj} = \Lambda_{sd}^0 \quad \forall s, d \mid s \neq d \quad (4.23)$$

$$\sum_i^{i \neq d} \sum_p \sum_f \sum_b \sum_k \varphi_{p,k,b,f}^{sd,id} = \Lambda_{sd}^0 \quad \forall s, d \mid s \neq d \quad (4.24)$$

$$\sum_p \sum_f \sum_b \sum_k VW_{f,b,k}^{sd,p} = \Lambda_{sd}^1 \quad \forall s, d \mid s \neq d \quad (4.25)$$

$$\sum_p \sum_f \sum_b VB_{f,b}^{sd,p} = \Lambda_{sd}^2 \quad \forall s, d \mid s \neq d \quad (4.26)$$

$$\sum_p \sum_f VF_f^{sd,p} = \Lambda_{sd}^3 \quad \forall s, d \mid s \neq d \quad (4.27)$$

4) Sub-wavelength flows must satisfy the wavelength capacity constraint:

$$\sum_s \sum_d^{d \neq s} \varphi_{p,k,b,f}^{sd,ij} \leq VS_{f,b,k}^{ij,p} \cdot C \quad \forall p, f, b, k, i, j \mid i \neq j \quad (4.28)$$

5) A pass-through CWS/CBS-based virtual link at each intermediate node can be switched at the 'BXC or WXC'/BXC, as depicted in Fig. 4.2, for degrouping and grouping purposes; otherwise, it is switched at the FXC:

$$SPT_{f,b,k}^{sd,p,i,mn} + SBPT_{f,b,k}^{sd,p,i,mn} + SFPT_{f,b,k}^{sd,p,i,mn} = VS_{f,b,k}^{sd,p} \quad (4.29)$$

$$\forall k, b, f, p, i, j, m, n, s, d \mid s \neq d \neq i, m \neq d, n \neq s, m \neq n, \gamma_{in}^{sd,p} = 1, \gamma_{mi}^{sd,p} = 1$$

$$WPT_{f,b,k}^{sd,p,i,mn} + WBPT_{f,b,k}^{sd,p,i,mn} + WFPT_{f,b,k}^{sd,p,i,mn} = VW_{f,b,k}^{sd,p} \quad (4.30)$$

$$\forall k, b, f, p, i, j, m, n, s, d \mid \Lambda_{sd}^1 > 0, s \neq d \neq i, m \neq d, n \neq s, m \neq n, \zeta_{in}^{1,sd,p} = 1, \zeta_{mi}^{1,sd,p} = 1$$

$$BPT_{f,b}^{sd,p,i,mn} + BFPT_{f,b}^{sd,p,i,mn} = VB_{f,b}^{sd,p} \quad (4.31)$$

$$\forall b, f, p, i, j, m, n, s, d \mid \Lambda_{sd}^2 > 0, s \neq d \neq i, m \neq d, n \neq s, m \neq n, \zeta_{in}^{2,sd,p} = 1, \zeta_{mi}^{2,sd,p} = 1$$

Fig. 4.2: Switching options for the pass-through CWS/CBS-based virtual link.

6) Pass-through sub-wavelength flow conservation must be ensured at each node in the CWS-based virtual topology:

$$\sum_{i \neq m} \sum_{j \neq n} \sum_{p \neq f} \sum_{b \neq k} (\varphi_{p,k,b,f}^{sd,im} - \varphi_{p,k,b,f}^{sd,mj}) = 0 \quad \forall m, s, d \mid \Lambda_{sd}^0 > 0, m \neq s \neq d \quad (4.32)$$

7) WXC/BXC/FXC non-add and non-drop ports (refer to Fig. 4.1) are decided based on add, drop, and pass-through virtual links in a way that ensures a non-blocking architecture at all optical switching stages:

$$wo_i^{n,f,b,k} = \sum_{d \neq i} \sum_p (\zeta_{in}^{1,id,p} \cdot VW_{f,b,k}^{id,p} + \gamma_{in}^{id,p} \cdot VS_{f,b,k}^{id,p}) + \sum_{s \neq n} \sum_{d \neq s \neq i} \sum_{m \neq n \neq d \neq i} \sum_p (\zeta_{mi}^{1,sd,p} \cdot \zeta_{in}^{1,sd,p} \cdot WPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SPT_{f,b,k}^{sd,p,i,mn}) \quad (4.33)$$

$$\forall i, n, f, b, k \mid i \neq n, \delta_{in} > 0$$

$$WO_i = \sum_n \sum_f \sum_b \sum_k (\delta_{in} \cdot wo_i^{n,f,b,k}) \quad \forall i \quad (4.34)$$

$$wb_i^{n,f,b} \geq \sum_k \left(\frac{wo_i^{n,f,b,k}}{W} \right) \forall i, n, f, b \mid i \neq n, \delta_{in} > 0 \quad (4.35)$$

$$WB_i = \sum_n \sum_f \sum_b^{n \neq i} (\delta_{in} \cdot wb_i^{n,f,b}) \forall i \quad (4.36)$$

$$\begin{aligned} wi_i^{m,f,b,k} = & \sum_s \sum_p^{s \neq i} (\zeta_{mi}^{1,si,p} \cdot VW_{f,b,k}^{si,p} + \gamma_{mi}^{si,p} \cdot VS_{f,b,k}^{si,p}) + \\ & \sum_s \sum_d \sum_n \sum_p^{s \neq d \neq i \neq m \neq i \neq n \neq m \neq s} (\zeta_{mi}^{1,sd,p} \cdot \zeta_{in}^{1,sd,p} \cdot WPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SPT_{f,b,k}^{sd,p,i,mn}) \end{aligned} \quad (4.37)$$

$$\forall i, m, f, b, k \mid i \neq m, \delta_{mi} > 0$$

$$WI_i = \sum_m \sum_f \sum_b \sum_k^{m \neq i} (\delta_{mi} \cdot wi_i^{m,f,b,k}) \forall i \quad (4.38)$$

$$bw_i^{m,f,b} \geq \sum_k \left(\frac{wi_i^{m,f,b,k}}{W} \right) \forall i, m, f, b \mid i \neq m, \delta_{mi} > 0 \quad (4.39)$$

$$BW_i = \sum_m \sum_f \sum_b^{m \neq i} (\delta_{mi} \cdot bw_i^{m,f,b}) \forall i \quad (4.40)$$

$$\begin{aligned} bo_i^{n,f,b} \geq & \sum_d \sum_p^{d \neq i} (\zeta_{in}^{2,id,p} \cdot VB_{f,b}^{id,p}) + wb_i^{n,f,b} + \sum_s \sum_d \sum_m \sum_p^{s \neq n \neq d \neq s \neq i \neq m \neq n \neq d \neq i} (\zeta_{mi}^{2,sd,p} \cdot \zeta_{in}^{2,sd,p} \cdot BPT_{f,b}^{sd,p,i,mn}) + \\ & \frac{\sum_s \sum_d \sum_m \sum_p^{s \neq n \neq d \neq s \neq i \neq m \neq n \neq d \neq i} (\zeta_{mi}^{1,sd,p} \cdot \zeta_{in}^{1,sd,p} \cdot WBPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SBPT_{f,b,k}^{sd,p,i,mn})}{W} \end{aligned} \quad (4.41)$$

$$\forall i, n, f, b \mid i \neq n, \delta_{in} > 0$$

$$BO_i = \sum_n \sum_f \sum_b^{n \neq i} (\delta_{in} \cdot bo_i^{n,f,b}) \forall i \quad (4.42)$$

$$bf_i^{n,f} \geq \sum_b \left(\frac{bo_i^{n,f,b}}{B} \right) \forall i, n, f \mid i \neq n, \delta_{in} > 0 \quad (4.43)$$

$$BF_i = \sum_n \sum_f^{n \neq i} (\delta_{in} \cdot bf_i^{n,f}) \forall i \quad (4.44)$$

$$\begin{aligned}
bl_i^{m,f,b} = & \sum_{s \neq i} \sum_{p \neq s} \left(\zeta_{mi}^{2,si,p} \cdot VB_{f,b}^{si,p} \right) + bw_i^{m,f,b} + \sum_{s \neq d \neq i \neq m \neq n \neq m \neq s} \sum_{d \neq s} \sum_{n \neq d} \sum_{p \neq n} \left(\zeta_{mi}^{2,sd,p} \cdot \zeta_{in}^{2,sd,p} \cdot BPT_{f,b}^{sd,p,i,mn} \right) + \\
& \sum_{s \neq d \neq i \neq m \neq n \neq m \neq s} \sum_{s \neq d} \sum_{n \neq d} \sum_{p \neq n} \frac{\left(\zeta_{mi}^{1,sd,p} \cdot \zeta_{in}^{1,sd,p} \cdot WBPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SBPT_{f,b,k}^{sd,p,i,mn} \right)}{W}
\end{aligned} \quad (4.45)$$

$$\forall i, m, f, b \mid i \neq m, \delta_{mi} > 0$$

$$BI_i = \sum_{m \neq i} \sum_f \sum_b \left(\delta_{mi} \cdot bl_i^{m,f,b} \right) \forall i \quad (4.46)$$

$$fb_i^{m,f} \geq \sum_b \left(\frac{bl_i^{m,f,b}}{B} \right) \forall i, m, f \mid i \neq m, \delta_{mi} > 0 \quad (4.47)$$

$$FB_i = \sum_{m \neq i} \sum_f \left(\delta_{mi} \cdot fb_i^{m,f} \right) \forall i \quad (4.48)$$

$$\begin{aligned}
fo_i^{n,f} \geq & \sum_{d \neq i} \sum_{p \neq d} \left(\zeta_{in}^{3,id,p} \cdot VF_f^{id,p} \right) + bf_i^{n,f} + \sum_{s \neq n \neq d \neq i \neq m \neq n \neq d \neq i} \sum_{s \neq d} \sum_{m \neq s} \sum_{p \neq m} \left(\zeta_{mi}^{3,sd,p} \cdot \zeta_{in}^{3,sd,p} \cdot VF_f^{sd,p} \right) + \\
& \sum_{s \neq n \neq d \neq i \neq m \neq n \neq d \neq i} \sum_{s \neq d} \sum_{m \neq s} \sum_{p \neq m} \frac{\left(\zeta_{mi}^{2,sd,p} \cdot \zeta_{in}^{2,sd,p} \cdot BFPT_{f,b}^{sd,p,i,mn} \right)}{B} + \\
& \sum_{s \neq n \neq d \neq i \neq m \neq n \neq d \neq i} \sum_{s \neq d} \sum_{m \neq s} \sum_{p \neq m} \frac{\left(\zeta_{mi}^{1,sd,p} \cdot \zeta_{in}^{1,sd,p} \cdot WFPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SFPT_{f,b,k}^{sd,p,i,mn} \right)}{W \cdot B}
\end{aligned} \quad (4.49)$$

$$\forall i, n, f \mid i \neq n, \delta_{in} > 0$$

$$FO_i = \sum_n \sum_f \left(\delta_{in} \cdot fo_i^{n,f} \right) \forall i \quad (4.50)$$

$$\begin{aligned}
fi_i^{m,f} \geq & \sum_{s \neq i} \sum_{p \neq s} \left(\zeta_{mi}^{3,si,p} \cdot VF_f^{si,p} \right) + fb_i^{m,f} + \sum_{s \neq d \neq i \neq m \neq n \neq m \neq s} \sum_{s \neq d} \sum_{n \neq d} \sum_{p \neq n} \left(\zeta_{mi}^{3,sd,p} \cdot \zeta_{in}^{3,sd,p} \cdot VF_f^{sd,p} \right) + \\
& \sum_{s \neq d \neq i \neq m \neq n \neq m \neq s} \sum_{s \neq d} \sum_{n \neq d} \sum_{p \neq n} \frac{\left(\zeta_{mi}^{2,sd,p} \cdot \zeta_{in}^{2,sd,p} \cdot BFPT_{f,b}^{sd,p,i,mn} \right)}{B} + \\
& \sum_{s \neq d \neq i \neq m \neq n \neq m \neq s} \sum_{s \neq d} \sum_{n \neq d} \sum_{p \neq n} \frac{\left(\zeta_{mi}^{1,sd,p} \cdot \zeta_{in}^{1,sd,p} \cdot WFPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SFPT_{f,b,k}^{sd,p,i,mn} \right)}{W \cdot B}
\end{aligned} \quad (4.51)$$

$$\forall i, m, f \mid i \neq m, \delta_{mi} > 0$$

$$FI_i = \sum_{m \neq i} \sum_f \left(\delta_{mi} \cdot fi_i^{m,f} \right) \forall i \quad (4.52)$$

8) Port count conservation must be ensured at all optical switching stages:

$$WO_i + WD_i = WI_i + WA_i \quad \forall i \quad (4.53)$$

$$BO_i + BW_i + BD_i = BI_i + WB_i + BA_i \quad \forall i \quad (4.54)$$

$$FO_i + FB_i + FD_i = FI_i + BF_i + FA_i \quad \forall i \quad (4.55)$$

4.3 Heuristic Approach

The computational complexity of the MILP model calls for the use of heuristics to solve the problem sub-optimally in a reasonable amount of time. A high-level view of the approach to be taken to solve the RMGPA problem heuristically is shown in Fig. 4.3. The heuristic approach consists of two phases. The task of the first phase is to build the multi-granular virtual topology. The task of the second phase is to decrease the port requirement of the pass-through segments of the built virtual links. Both phases are explained individually as follows.

Fig. 4.3: A high-level view of the heuristic approach proposed to solve the RMGPA problem with the color-continuity constraints and without the optical-reach constraints.

The objective of the first phase is to build a multi-granular virtual topology that can accommodate all traffic demands with the lowest weighted port count. In this phase, clear paths will be assigned to fiber, waveband, and wavelength demands, while both clear and unclear paths will be assigned to sub-wavelength demands. The idea of the heuristic is to perform in an integrated manner the routing and color assignment for the largest granularity traffic (fiber demands) first, and then to

work on those having smaller granularity traffic by using as much of the remaining resources as possible and so on until all demands are served. The sequence in which $s-d$ pairs are served needs to follow a certain policy. Four sorting policies are considered in this version of the RMGPA problem, and they are explained as follows. In Policy 1/2, $s-d$ pairs are sorted in the decreasing/increasing order of their traffic demands. In Policy 3/4, $s-d$ pairs are sorted in the decreasing/increasing order of their lowest physical hop requirement, which is obtained via Dijkstra's algorithm [Dijk59][Stal00] using the number of physical hops as a cost metric. The multi-granular virtual topology is constructed using the following algorithm [NaMo07a] [NaMo07d]:

Multi-Granular Virtual Topology Algorithm;

Input: Network physical topology, adjusted multi-granularity traffic demands, C, W, B, F , MG-OXC/EXC port weights

Output: Sub-optimum multi-granular virtual topology

Begin

1. Initialization:

- For all nodes, mark all WXC/BXC/FXC add, drop, input, and output ports as unused; a WXC add/output port is designated as <wavelength k , waveband b , fiber f , next destination node>; a WXC drop/input port is designated as <wavelength k , waveband b , fiber f , arriving from node>; a BXC add/output port is designated as <waveband b , fiber f , next destination node>; a BXC drop/input port is designated as <waveband b , fiber f , arriving from node>; a FXC add/output port is designated as <fiber f , next destination node>; a FXC drop/input port is designated as <fiber f , arriving from node>
- For all nodes, mark all EXC output and input ports as unused; a LSC output/input port is designated as <wavelength k , waveband b , fiber f , 'next destination'/'arriving from' node>; a BSC output/input port is designated as <waveband b , fiber f , 'next destination'/'arriving from' node>; a FSC output/input port is designated as <fiber f , 'next destination'/'arriving from' node>

2. Fiber-Switched Path Assignment:

- Let $M=\{m_0, m_1, \dots\}$ be a set of unserved fiber demands whose traffic $\neq 0$
- While ($M \neq \emptyset$)

```

{
  ▪ Order unserved fiber demands in  $M$  according to the sorting policy used
  ▪ Set served demand = fiber demand,  $\Lambda_{sd}^3$ , at the top of the sorted list, which is the element  $m_0$  of  $M$ 
  ▪ Set  $D=1$ , if fiber demand bifurcation is allowed; otherwise, set  $D = \text{served demand}$ 
  ▪ While (served demand  $\neq 0$ )
  {
    • Evaluate the cost of all physical links according to the availability of fibers along the physical link; link cost = 1 if the remaining (or residual) unused fibers  $\geq D$ , otherwise link cost =  $\infty$ 
    • Find all possible physical routes for the served demand using the All Distinct Routes algorithm [Gro04] and choose the routes that satisfy the color (fiber index)-continuity constraint using the First-Fit color assignment scheme [ZJMu00], in which a lower index color is considered before a higher index color
    • If there is no feasible route, then end the algorithm
    • Evaluate the incremental port count requirement for all feasible routes; the incremental port count for a feasible eligible route is the summation of all unused FXC and EXC ports needed along the route, but these ports will not be marked as used at this step
    • Choose the candidate route that incurs the lowest incremental port count
    • Along the best route, update residual fiber resources and mark required FXC and EXC ports as used
    • Create CFS-based virtual link(s) between the  $s$ - $d$  pair served; the virtual link attributes are the best route and the color used along the path
    • Set served demand = served demand -  $D$ 
  }
  ▪ Remove  $m_0$  from  $M$ 
}

```

3. Waveband-Switched Path Assignment:

- Let $M=\{m_0, m_1, \dots\}$ be a set of unserved waveband demands whose traffic $\neq 0$
- While ($M \neq \emptyset$)


```

      {
        ▪ Order unserved waveband demands in  $M$  according to the sorting policy used
        ▪ Set served demand = waveband demand,  $\Lambda_{sd}^2$ , at the top of the sorted list
        ▪ Set  $D=1$ , if waveband demand bifurcation is allowed; otherwise, set  $D = \text{served demand}$ 

```

- While (served demand $\neq 0$)
 - {
 - Evaluate the cost of all physical links according to the availability of wavebands along the physical link; *link cost* = 1 if the remaining unused wavebands $\geq D$, otherwise *link cost* = ∞
 - Find all possible physical routes for the served demand using the All Distinct Routes algorithm and choose the routes that satisfy the color (waveband index of the same fiber index)- continuity constraint using the First-Fit color assignment scheme
 - If there is no feasible route, then end the algorithm
 - Evaluate the worst incremental port count requirement for all feasible routes; the incremental port count for a feasible eligible route is the summation of all unused FXC, BXC, and EXC ports needed along the route. The worst scenario for deciding the unused ports is based on the fact that a waveband-switched path at an intermediate node can be (1) switched at the FXC if the fiber utilization at both the incoming and outgoing links is zero and there are no further add/drop waveband/wavelength/sub-wavelength demands at this intermediate node, or (2) switched at the BXC otherwise (refer to the right part of Fig. 4.2)
 - Choose the candidate route that incurs the lowest incremental port count
 - Along the best route, update the residual waveband resources and mark the required FXC, BXC, and EXC ports as used
 - Create CBS-based virtual link(s) between the s-d pair served
 - Set *served demand* = *served demand* - *D*
 - }
- Remove m_0 from M
- }

4. Wavelength-Switched Path Assignment:

- Let $M = \{m_0, m_1, \dots\}$ be a set of unserved wavelength demands whose traffic $\neq 0$
- While ($M \neq \emptyset$)
 - {
 - Order unserved wavelength demands in M according to the sorting policy used
 - Set served demand = wavelength demand, λ_{sd}^1 , at the top of the sorted list
 - Set $D=1$, if wavelength demand bifurcation is allowed; otherwise, set D = served demand
 - While (served demand $\neq 0$)
 - {

- Evaluate the cost of all physical links according to the availability of wavelengths along the physical link; $link\ cost = 1$ if the remaining unused wavelengths $\geq D$, otherwise $link\ cost = \infty$
 - Find all possible physical routes for the served demand using the All Distinct Routes algorithm and choose the routes that satisfy the color (wavelength index of the same waveband index at the same fiber index)-continuity constraint using the First-Fit color assignment scheme
 - If there is no feasible route, then end the algorithm
 - Evaluate the worst incremental port count requirement for all feasible routes; the incremental port count for a feasible eligible route is the summation of all unused FXC, BXC, WXC, and EXC ports needed along the route. The worst scenario for deciding the unused ports is based on the fact that a wavelength-switched path at an intermediate node can be (1) switched at the FXC if the fiber and waveband utilization at both the incoming and outgoing links is zero and there are no further add/drop wavelength/sub-wavelength demands at this intermediate node, (2) switched at the BXC if the waveband utilization at both the incoming and outgoing links is zero and there are no further add/drop wavelength/sub-wavelength demands at this intermediate node, or (3) switched at the WXC otherwise (refer to the left part of Fig. 4.2)
 - Choose the candidate route that incurs the lowest incremental port count
 - Along the best route, update the residual wavelength resources and mark the required FXC, BXC, WXC, and EXC ports as used
 - Create CWS-based virtual link(s) between the s - d pair served
 - Set $served\ demand = served\ demand - D$
- }
- Remove m_0 from M
- }

5. Sub-Wavelength-Switched Path Assignment:

- Let $M = \{m_0, m_1, \dots\}$ be a set of unserved sub-wavelength demands whose traffic $\neq 0$
- While ($M \neq \emptyset$)
 - {
 - Order unserved sub-wavelength demands in M according to the sorting policy used
 - Set $served\ demand = \text{sub-wavelength demand}, \lambda_{sd}^0$, on the top of the sorted list
 - Set $D=1$, if sub-wavelength demand bifurcation is allowed; otherwise, set $D = served\ demand$

- While (served demand $\neq 0$)
 - {
 - Evaluate the cost of all CWS-based virtual links according to the availability of wavelength capacities along the physical link; *link cost* = 1 if the remaining wavelength capacity $\geq D$, otherwise *link cost* = ∞
 - Find the shortest virtual route over the existing CWS-based virtual topology using Dijkstra's algorithm, which uses the number of virtual hops (a virtual hop represents an already-built virtual link) as a cost metric. The reason behind using this cost metric is to reduce the duplication of the traffic demand among virtual links as much as possible in order to save the existing capacity resources for the remaining demands
 - If a virtual route exists (which means that there is an UWS path and no new ports are required)
 - {
 - Update the residual wavelength-capacity resources along the best path
 - Set *served demand* = *served demand* - D
 - Else (which means that there is a need to build a CWS path and new ports are required)
 - {
 - Evaluate the cost of all physical links according to the availability of wavelengths along the physical link; *link cost* = 1 if the remaining unused wavelengths ≥ 1 , otherwise *link cost* = ∞
 - Find all possible physical routes for the served demand using the All Distinct Routes algorithm and choose the routes that satisfy the color (wavelength index of a certain waveband index at a certain fiber index)-continuity constraint using the First-Fit color assignment scheme
 - If there is no feasible route, then end the algorithm
 - Evaluate the worst incremental port count requirement for all feasible routes; the incremental port count for a feasible eligible route is the summation of all unused FXC, BXC, WXC, and EXC ports needed along the route. The worst scenario for deciding the unused ports is based on the fact that a wavelength-switched path at an intermediate node can be (1) switched at the FXC if the fiber and waveband utilization at both the incoming and outgoing links is zero and there are no further add/drop sub-wavelength demands at this intermediate node, (2) switched at the BXC if the waveband utilization at both

the incoming and outgoing links is zero and there are no further add/drop sub-wavelength demands at this intermediate node, or (3) switched at the WXC otherwise

- Choose the candidate route that incurs the lowest incremental port count
- Along the best route, update the residual wavelength and wavelength-capacity resources (new residual wavelengths/'wavelength capacity' = old residual wavelengths/'wavelength capacity' - 1/D) and mark the required FXC, BXC, WXC, and EXC ports as used
- Create a CWS-based virtual link between the s - d pair served
- Set $\text{served demand} = \text{served demand} - D$

}

}

- Remove m_0 from M

}

6. If the resultant multi-granular virtual topology can handle all demands, then this virtual topology is both feasible and sub-optimum

End.

Running the previous heuristic phase alone can result in situations where, at some nodes, many waveband-switched paths would have to be switched at the BXC stage instead of the FXC stage. Similarly, wavelength-switched paths would have to be switched either at the BXC stage instead of the FXC stage or at the WXC stage rather than the BXC or FXC stage. These can occur because the worst (de)grouping scenarios are assumed when these paths are originally allocated. Therefore, an adjustment phase is needed to minimize the port count of pass-through segments at all nodes and, accordingly, to decide on the final weighted port count. The adjustment phase works as follows [NaMo07a][NaMo07d]:

Pass-Through Adjustment Algorithm;

Input: Feasible multi-granular virtual topology, W, B, F , MG-OXC/EXC port weights

Output: Sub-optimum weighted port count

Begin

1. Initialization:

- For all nodes, create separate FXC, BXC and WXC-based planes
- For all nodes, assume that FXC/BXC/WXC ports are integer variables and mark them as unused; XC port types with their attributes are denoted as follows: INPUT $\langle \text{current node } (i), \text{ arriving from node } (m), \text{ color} \rangle$; OUTPUT $\langle i, \text{ next destination node } (n), \text{ color} \rangle$; ADD $\langle i, n, \text{ color} \rangle$; DROP $\langle i, m, \text{ color} \rangle$
- For all nodes, assign all FXC/BXC/WXC ports with the value of their next destination node based on their involvement with the CFS/CBS/CWS-based virtual links

2. For all assigned WXC output ports at all nodes, do the following:

If the WXC output port has a CWS-based pass-through segment (i.e. INPUT $\langle i, m, \{\text{wavelength } k, \text{ waveband } b, \text{ fiber } f\} \rangle = \text{OUTPUT } \langle i, n, \{\text{wavelength } k, \text{ waveband } b, \text{ fiber } f\} \rangle = n$)

{

If 'other CWS/CBS-based pass-through segments arriving from different nodes', 'WXC/BXC add ports', or 'WXC/BXC drop ports' are sharing the same waveband b and/or fiber f that are used by the WXC output port

{

If sharing exists only at fiber f (i.e. the CWS path needs to be switched at the BXC stage)

{

- Set BXC OUTPUT $\langle i, n, \{b, f\} \rangle = \text{WXC OUTPUT } \langle i, n, \{k, b, f\} \rangle$
- Set BXC INPUT $\langle i, m, \{b, f\} \rangle = \text{WXC INPUT } \langle i, m, \{k, b, f\} \rangle$
- Mark WXC OUTPUT $\langle i, n, \{k, b, f\} \rangle$ as unused
- Mark WXC INPUT $\langle i, m, \{k, b, f\} \rangle$ as unused

}

Else (i.e. the sharing exists at waveband b ; therefore, the CWS path needs to be switched at the WXC stage)

{

Port assignment remains unchanged

}

}

Else (i.e. there is no sharing; therefore, the CWS path needs to be switched only at the FXC stage)

{

- Set FXC OUTPUT $\langle i, n, f \rangle = \text{WXC OUTPUT } \langle i, n, \{k, b, f\} \rangle$

- Set FXC INPUT $\langle i, m, f \rangle = \text{WXC INPUT } \langle i, m, \{k, b, f\} \rangle$
 - Mark WXC OUTPUT $\langle i, n, \{k, b, f\} \rangle$ as unused
 - Mark WXC INPUT $\langle i, m, \{k, b, f\} \rangle$ as unused
- }
- }

3. For all assigned BXC output ports at all nodes, do the following:

If the BXC output port has a CBS-based pass-through segment (i.e. INPUT $\langle i, m, \{\text{waveband } b, \text{ fiber } f\} \rangle = \text{OUTPUT } \langle i, n, \{\text{waveband } b, \text{ fiber } f\} \rangle = n$)

- {
- If 'other CWS/CBS-based pass-through segments arriving from different nodes', 'WXC/BXC add ports', or 'WXC/BXC drop ports' are sharing the same fiber f that is used by the BXC output port, then the port assignment remains unchanged
- Else (i.e. there is no sharing; therefore, the CBS path needs to be switched only at the FXC stage)
- {
- Set FXC OUTPUT $\langle i, n, f \rangle = \text{BXC OUTPUT } \langle i, n, \{b, f\} \rangle$
 - Set FXC INPUT $\langle i, m, f \rangle = \text{BXC INPUT } \langle i, m, \{b, f\} \rangle$
 - Mark BXC OUTPUT $\langle i, n, \{b, f\} \rangle$ as unused
 - Mark BXC INPUT $\langle i, m, \{b, f\} \rangle$ as unused
- }
- }
- }

4. For all nodes, calculate the WB, BW, FB and BF ports:

The ports needed to interconnect the three XC planes at node i (refer to Fig. 4.1) are calculated as follows

- $$WB_i = \sum_{n=0}^{N-1} \sum_{f=0}^{F-1} \sum_{b=0}^{B-1} \left[\frac{\sum_{k=0}^{W-1} \text{count assigned WXC OUTPUT } \langle i, n, \{k, b, f\} \rangle}{W} \right]$$
- $$BW_i = \sum_{m=0}^{N-1} \sum_{f=0}^{F-1} \sum_{b=0}^{B-1} \left[\frac{\sum_{k=0}^{W-1} \text{count assigned WXC INPUT } \langle i, m, \{k, b, f\} \rangle}{W} \right]$$

$$\begin{aligned}
\blacksquare \quad BF_i &= \sum_{n=0}^{N-1} \sum_{f=0}^{F-1} \left[\frac{\sum_{b=0}^{B-1} \text{count assigned BXC OUTPUT } \langle i, n, \{b, f\} \rangle}{B} \right] \\
\blacksquare \quad FB_i &= \sum_{m=0}^{N-1} \sum_{f=0}^{F-1} \left[\frac{\sum_{b=0}^{B-1} \text{count assigned BXC INPUT } \langle i, m, \{b, f\} \rangle}{B} \right]
\end{aligned}$$

5. The total port count is the weighted summation of all assigned ports in addition to the ports calculated in Step 4.

End.

4.4 Numerical Results and Analysis¹⁰

4.4.1 Verification of the Heuristic Approach

To verify the heuristic approach, we compare the heuristic results with the results obtained from the MILP formulation. Due to the computational complexity of the MILP model, which would involve a large amount of computational time and high computational intensity in order to obtain an optimal solution, the optimization is conducted on a small-sized planning problem. In this subsection, we consider a 5-node sample network as a physical topology¹¹, as shown in Fig. 4.4. Since some of the s - d pairs can have up to four distinct eligible routes, the parameter P is set to 4. To keep the problem computationally manageable, we use a set of a few adjusted traffic demands, as illustrated in Table 4.1. The rest of the input parameters used in this subsection are as follows: $C=10$ Gb/s, $W=3$, $B=3$, $F \geq 1$, all MG-OXC/EXC ports have the same weight (i.e. $cf=cb=cw/cgf=cgb=cgw$), and the EXC port weight is twice the MG-OXC port weight (i.e. $\frac{cgf}{cf} = \frac{cgb}{cb} = \frac{cgw}{cw} = 2$).

¹⁰ For the sake of simplicity, for the rest of the thesis, the term “optimum” always refers to the term “sub-optimum” when applied to the results obtained using heuristics.

¹¹ The distance information shown in all topologies in this chapter will be used only in Chapter 5 when the signal regeneration capability is considered.

Fig. 4.4: 5-node sample network fiber layout with span distances in km.

Table 4.1 illustrates the solution to the RMGPA problem using both optimization methods for various traffic demand instances in terms of the weighted port count, the solve time, and the minimum parameter F needed to obtain a feasible solution, which is denoted as F_{min} . Throughout this thesis, the RMGPA problem will be solved for different values of the parameter F , and F_{min} will be the measure of the most efficient utilization of network resources. Heuristic variations are based on the sorting policy and demand-bifurcation scenario used. Three demand-bifurcation scenarios will be considered throughout this thesis: (1) bifurcation is not allowed at any traffic granularity, (2) bifurcation is allowed only at the fiber-traffic granularity, and (3) bifurcation is allowed at all traffic granularities. It is important to note here that in a certain bifurcation scenario, the suggested four policies have led to the same solution since few demands per granularity-level have been considered. The best bifurcation scenario, and accordingly the best heuristic variation, is defined as the one that achieves the lowest F_{min} with the lowest weighted port count.

From Table 4.1, it is obvious that increasing the problem size in terms of the number of constraints and variables by imposing more traffic on the network increases exponentially the solve time needed by CPLEX until it becomes hard to obtain an optimum solution in a reasonable amount of time with the given computing capability. This increase in the problem size stems mainly from the increase in F_{min} required to build a multi-granular virtual topology that can handle all demands. This increase is expected since the number of optimization variables and constraints

of the MILP formulation, as explained in Section 4.2, depend heavily on the parameter F . For instance, Table 4.1 clearly shows the considerable difference between the problem size at $F_{min}=1$ and $F_{min}=2$.

On the other hand, solving the RMGPA problem with the heuristic approach takes less than one second, which can be considered a significant saving in the solve time. This finding also indicates that the heuristic approach scales well with respect to the increase in the problem size. Most importantly, the solutions produced by the heuristic approach are within ≈ 0 -11% of the MILP formulation solutions and can be accepted as good approximations of the optimum solutions. It is worth mentioning here that allowing the bifurcation of fiber demands in the heuristic approach yields better solutions for some traffic instances. This result can occur when the fiber demands are greater than one; otherwise, there is no point in performing the bifurcation.

Now, we verify the feasibility of the MILP formulation and heuristic approach solutions and, at the same time, demonstrate how the resultant multi-granular virtual topology decides the network port count. Fig. 4.5 illustrates the multi-granular virtual topology solution of both the MILP formulation and heuristic approach for the traffic demand instance that leads to the 11% difference in weighted port count (the underlined port counts in Table 4.1). From Fig. 4.5, it is clear that both virtual topologies are feasible due to the following: (1) all CFS/CBS/CWS-based virtual links sharing a common unidirectional physical link are assigned distinct colors; (2) all flows along a common unidirectional physical link are within the span, fiber, waveband, and wavelength capacity; (3) all virtual links satisfy the color-continuity constraint; and (4) all demands are handled by the virtual topology.

Figs. 4.6-4.10 depict in detail how the different types of clear paths, which constitute the virtual topology shown in Fig. 4.5, are ‘grouped with’/‘degroupped from’ other clear paths within all network nodes. From Figs. 4.6-4.10, it is apparent that the realization of the multi-granular virtual topology dictates the port requirements at all nodes. Moreover, both realizations are feasible. Furthermore, in comparing the port requirement breakdown of the MILP formulation solution with that of the heuristic approach solution at all nodes (by comparing the left part with the right part of Figs. 4.6-4.10), it is quite clear that choosing the right virtual topology has an impact on reducing the total weighted port count.

Table 4.1: Comparison between the results obtained using the MILP formulation and heuristic approach for the 5-node network example of solving the RMGPA problem with the color-continuity constraints and without the optical-reach constraints.

# of traffic elements per granularity matrix	Adjusted traffic demands	F_{min}	MILP				Heuristic		
			# of constraints	# of variables	Total solve time [sec]	Weighted Port count	Total solve time [sec]	Weighted port count	Best bifurcation scenario
1	$\Lambda_{20}^0 = 1$ $\Lambda_{02}^1 = 1$ $\Lambda_{10}^2 = 2$ $\Lambda_{03}^3 = 1$	1	2234	13817	651.703	66	0.03	66	No bifurcation
1	$\Lambda_{20}^0 = 2$ $\Lambda_{34}^1 = 2$ $\Lambda_{01}^2 = 2$ $\Lambda_{43}^3 = 2$	1	2207	13736	56.8438	82	0.03	82	Bifurcating fiber demands
1	$\Lambda_{32}^0 = 1$ $\Lambda_{42}^1 = 2$ $\Lambda_{20}^2 = 1$ $\Lambda_{30}^3 = 2$ $\Lambda_{14}^4 = 2$	1	2210	13733	1007.94	74	0.04	74	No bifurcation
1	$\Lambda_{31}^0 = 2$ $\Lambda_{24}^1 = 2$ $\Lambda_{20}^2 = 2$ $\Lambda_{30}^3 = 2$ $\Lambda_{02}^4 = 2$	1	2210	13733	193.984	<u>90</u>	0.03	<u>100</u>	Bifurcating fiber demands
2	$\Lambda_{20}^0 = \Lambda_{34}^0 = 2$ $\Lambda_{01}^1 = \Lambda_{13}^1 = 2$ $\Lambda_{20}^2 = \Lambda_{33}^2 = 1$ $\Lambda_{30}^3 = \Lambda_{13}^3 = 1$ $\Lambda_{01}^4 = \Lambda_{13}^4 = 1$	1	2282	14202	25131.7	124	0.01	124	No bifurcation
2	$\Lambda_{31}^0 = \Lambda_{24}^0 = 2$ $\Lambda_{10}^1 = \Lambda_{02}^1 = 2$ $\Lambda_{24}^2 = \Lambda_{40}^2 = 1$ $\Lambda_{04}^3 = \Lambda_{42}^3 = 1$ $\Lambda_{41}^4 = \Lambda_{42}^4 = 1$	1	2329	14361	70249.2	130	0.03	130	No bifurcation
3	$\Lambda_{30}^0 = \Lambda_{31}^0 = \Lambda_{24}^0 = 1$ $\Lambda_{02}^1 = \Lambda_{40}^1 = \Lambda_{42}^1 = 1$ $\Lambda_{01}^2 = \Lambda_{14}^2 = \Lambda_{41}^2 = 1$ $\Lambda_{24}^3 = \Lambda_{31}^3 = \Lambda_{34}^3 = 1$	2	4553	29281	>766545 (9 days)	N/A (PC ran out of memory)	0.05	178	No bifurcation
3	$\Lambda_{24}^0 = \Lambda_{30}^0 = \Lambda_{31}^0 = 2$ $\Lambda_{04}^1 = \Lambda_{40}^1 = 1, \Lambda_{02}^1 = 2$ $\Lambda_{20}^2 = 2, \Lambda_{41}^2 = 1, \Lambda_{42}^2 = 1$ $\Lambda_{01}^3 = \Lambda_{14}^3 = 2, \Lambda_{31}^3 = 1$ $\Lambda_{14}^4 = \Lambda_{24}^4 = 2, \Lambda_{31}^4 = 1$	2	4547	29269	>1385120 (16 days)	N/A (PC ran out of memory)	0.04	212	No bifurcation

Fig. 4.5: The multi-granular virtual topology solution for the 5-node network example using the MILP formulation (left) and heuristic approach (right), given that $C=10$ Gb/s, $W=3$, $B=3$, and $F=F_{min}=1$.

Fig. 4.6: Port requirements at Node 0 of the 5-node sample network for the realization of the multi-granular virtual topology solution using the MILP formulation (left) and heuristic approach (right).

Fig. 4.7: Port requirements at Node 1 of the 5-node sample network for the implementation of the multi-granular virtual topology solution using the MILP formulation (left) and heuristic approach (right).

Fig. 4.8: Port requirements at Node 2 of the 5-node sample network for the implementation of the multi-granular virtual topology solution using the MILP formulation (left) and heuristic approach (right).

Fig. 4.9: Port requirements at Node 3 of the 5-node sample network for the implementation of the multi-granular virtual topology solution using the MILP formulation (left) and heuristic approach (right).

Fig. 4.10: Port requirements at Node 4 of the 5-node sample network for the implementation of the multi-granular virtual topology solution using the MILP formulation (left) and heuristic approach (right).

4.4.2 Significance of Adjustment Phase

In this subsection, we demonstrate a proof-of-concept of performing the adjustment phase upon designing the multi-granular virtual topology. An 8-node sample network shown in Fig. 4.11 is used in this demonstration. In this topology, the number of distinct routes between a node pair can be as high as 29 routes. The used raw traffic demands are randomly chosen from the range (0,1000) Gb/s, as shown in Table 4.2. The rest of the input parameters are as follows: $C=10$ Gb/s, $W=4$, $B=4$, $F=F_{min}$, all MG-OXC/EXC ports have the same weight, and the EXC port weight is twice the MG-OXC port weight. The optimized multi-granularity traffic demands are shown in Table 4.3, which is the result of running the Demand Adjustment algorithm (refer to Subsection 3.3.3). The solutions to the planning problem using different heuristic variations with and without the adjustment phase are shown in Figs. 4.12 and 4.13.

Fig. 4.11: 8-node sample network fiber layout with span distances in km.

Table 4.2: The 8-node network raw traffic demands, which are chosen randomly from the range (0,1000) Gb/s.

Source	Destination								
	0	1	2	3	4	5	6	7	
	0	0	416	92	757	530	931	383	654
	1	66	0	723	671	383	632	885	519
	2	652	238	0	262	762	754	910	72
	3	272	898	275	0	516	359	247	487
	4	847	831	34	992	0	679	767	60
	5	384	478	948	935	905	0	319	701
	6	7	365	266	987	277	630	0	166
7	736	436	983	736	233	90	505	0	

Table 4.3: The 8-node network multi-granularity demands, which are generated from the (0,1000) Gb/s range raw demands along with the use of the $C=10$ Gb/s, $W=4$, & $B=4$ combination.

		Destination							
		0	1	2	3	4	5	6	7
Source	0	0	6	2	7	0	1	3	4
	1	6	0	3	1	3	2	5	9
	2	2	8	0	2	2	4	0	2
	3	2	8	5	0	6	9	7	7
	4	7	1	4	2	0	9	7	0
	5	4	8	8	5	5	0	9	1
	6	7	5	6	7	7	0	0	6
	7	6	6	3	6	3	0	5	0
		Sub- λ [Gb/s]							
		0	1	2	3	4	5	6	7
	0	0	1	1	3	1	1	2	1
	1	2	0	0	3	2	3	0	3
	2	1	3	0	2	0	3	3	3
	3	3	1	3	0	3	3	0	0
	4	0	3	3	3	0	3	0	2
	5	2	3	2	1	2	0	3	2
	6	0	0	2	2	3	3	0	0
	7	1	3	2	1	3	1	2	0
		λ							
		0	1	2	3	4	5	6	7
	0	0	2	2	2	1	3	1	0
	1	1	0	2	0	1	3	2	0
	2	0	1	0	2	3	2	2	1
	3	2	2	2	0	0	0	2	0
	4	1	0	0	0	0	0	3	1
	5	1	3	3	3	2	0	3	1
	6	0	1	2	0	2	3	0	0
	7	2	2	0	2	1	2	0	0
		Waveband							
		0	1	2	3	4	5	6	7
	0	0	2	0	4	3	5	2	4
	1	0	0	4	4	2	3	5	3
	2	4	1	0	1	4	4	5	0
	3	1	5	1	0	3	2	1	3
	4	5	5	0	6	0	4	4	0
	5	2	2	5	5	5	0	1	4
	6	0	2	1	6	1	3	0	1
	7	4	2	6	4	1	0	3	0
		Fiber							

Figure 4.12 shows that adding the adjustment phase does not affect the fiber requirement since the multi-granular virtual topology remains the same. However, Fig. 4.13 clearly illustrates that there is a consistent port saving when the adjustment phase is added to all heuristic variations. This saving is due to the decrease in the number of MG-OXC ports needed by pass-through segments by avoiding going into unnecessarily finer granular switching stages.

Fig. 4.12: Minimum fiber requirements for all heuristics with/without the adjustment phase.

Fig. 4.13: Weighted port count at F_{min} for all heuristics with/without the adjustment phase.

4.4.3 Impact of Increasing Fiber Resources

If fiber resources are plentiful, increasing the parameter F beyond F_{min} can bring a further reduction in the port count. In this subsection, we demonstrate the impact of increasing fiber resources on the planning problem solution. Using the same input data and parameters considered in Subsection 4.4.2, the results of heuristic variations for $F \geq F_{min}$ are shown in Figs. 4.14-4.16.

From the figures, it is quite clear that regardless of the bifurcation scenario and sorting policy employed, the weighted port count changes after F_{min} and remains unchanged or becomes saturated beyond a certain F , which we call F_{sat} . Within the $[F_{min}, F_{sat}]$ range, the weighted port count can reach the minimal point. The corresponding F to the minimal weighted port count is denoted as F_{opt} , where $F_{min} \leq F_{opt} \leq F_{sat}$. The weighted port count tends to decrease as the parameter F increases, since selecting shorter physical routes for (un)clear paths will be more likely. However, sometimes using short routes for some (un)clear paths will lead to an increase in the weighted port count instead, as shown in Figs. 4.14-4.16. In the optimum situation, these (un)clear paths would have used longer routes in order to increase grouping, which can lead to more savings than the savings achieved by using short routes. Because of the way the heuristics work while serving demand, it is hard to foresee the grouping opportunity with other unserved demands. In addition, the results indicate that the best heuristic variation at F_{min} is not necessarily also the best one at F_{opt} . Furthermore, this case study shows that the use of Policy 1 without demand bifurcation, as illustrated in Fig. 4.14, can achieve the lowest fiber requirement ($F_{min}=16$) and will be beneficial if fiber resources are scarce. In contrast, if fiber resources are plentiful, then using Policy 4 with the fiber-bifurcation scenario, as depicted in Fig. 4.15, will lead to the lowest weighted port count (at $F_{opt}=22$). It is worth mentioning here that the savings in the port count at F_{opt} will come at the expense of an increased total solve time of the planning problem. This result is expected since in

the fiber-plentiful situation the RMGPA problem will be solved several times from $F=1$ to $F=F_{sup}$ whereas in the fiber-scarce situation the RMGPA problem will be solved from $F=1$ to $F=F_{min}$.

Fig. 4.14: Weighted port count vs. F , where $F \geq F_{min}$ for all sorting policies without bifurcating demands.

Fig. 4.15: Weighted port count vs. F , where $F \geq F_{min}$ for all sorting policies by allowing the bifurcation of fiber demands.

Fig. 4.16: Weighted port count vs. F , where $F \geq F_{min}$ for all sorting policies by allowing the bifurcation of all demands.

4.4.4 Impact of E/O Cost Ratio

This subsection captures the impact of changing the E/O cost ratio on the solution of the planning problem. Using the same input data and parameters considered in Subsection 4.4.2, except that the E/O cost ratio=2 and 3, the results of heuristic variations at $F=F_{min}$ and F_{opt} are shown in Figs. 4.17-4.20.

From the figures, it is obvious that in spite of the fact that increasing the E/O ratio increases the weighted port count, this increase does not change the fiber requirements, the best sorting policy, or the best bifurcation scenario. This result stems from the fact that the resultant multi-granular virtual topology remains unchanged as the E/O ratio changes. This can be implied from the unchanged “unweighted” port count breakdown shown in Fig. 4.21 as the E/O ratio changes. The multi-granular virtual topology is insensitive to the change in the E/O ratio because of the following. (1) ‘Some sub-wavelength and wavelength’/waveband/fiber demands use CWS/CBS/CFS paths (or CWS/CBS/CFS-based virtual links), which means that no OEO

domain conversions are performed at intermediate nodes. As a result, the number of virtual links will remain the same, and changing the E/O ratio will not affect the selection of the physical route and the color to be assigned to the clear path. (2) Although sub-wavelength demands can use UWS paths, which involve the use of intermediate EXCs to perform the grouping/degrouping of sub-wavelength flows into/from existing CWS-based virtual links, minimizing the number of CWS-based virtual hops is the selection criteria for physical routes in order to utilize efficiently the remaining capacities of CWS paths regardless of the E/O ratio used.

Fig. 4.17: The minimum fiber requirements for all heuristic variations for E/O ratio=2 and 3.

Fig. 4.18: The weighted port count at F_{min} for all heuristic variations for E/O ratio=2 and 3.

Fig. 4.19: The optimum fiber requirement for all heuristic variations for E/O ratio=2 and 3.

Fig. 4.20: The weighted port count at F_{opt} for all heuristic variations for E/O ratio=2 and 3.

Fig. 4.21: The resultant “unweighted” port count breakdown at all nodes of the 8-node network at $F_{opt}=22$ using Policy 4 with the fiber-bifurcation scenario for E/O ratio=2 and 3.

4.4.5 Why Bifurcating All Demands is an Expensive Choice

In this subsection, we illustrate why allowing demand bifurcation at all traffic granularities achieves the highest weighted port count. We use the input data and parameters used in Subsection 4.4.2. For the purpose of comparing bifurcation scenarios, only one sorting policy is considered in

heuristic variations. With Policy 1, all bifurcation scenarios achieve the same $F_{opt}=22$, as shown in Figs. 4.14-4.16. The port and (de)multiplexer count breakdown at all nodes at F_{opt} using all bifurcation scenarios is shown in Figs. 4.22 and 4.23 and Figs. 4.24 and 4.25 respectively.

By comparing Fig. 4.22 with Fig. 4.23, it is clear that allowing demand bifurcation at all traffic granularities will lead to an increase in the port count at all switching stages. This surge in port count is due to the following. (1) The first cause is the increase in the number of CWS paths needed to handle sub-wavelength demands, since every bifurcated unit of the sub-wavelength demand will be treated separately (this increase can be inferred from the increase in the number of EXC ports in the sense that bifurcating other traffic granularities will not affect the number of EXC ports). (2) The second factor is the increase in the WB/BW and BF/FB ports (refer to Fig. 4.1) needed to interconnect the WXC stage with the BXC stage and the BXC stage with the FXC stage, since treating each bifurcated unit of the sub-wavelength, wavelength, and waveband demand separately increases the chance that these units will use separate wavelength and waveband (de)multiplexers (this port increase can be implied from the significant increase in the number of (de)multiplexers, as can be observed clearly by comparing Fig. 4.24 with Fig. 4.25). (3) Lastly, the increase in the number of both EXC ports and (de)multiplexers has a ripple effect that leads to a further duplication of ports in the next coarse granular switching stages. Because of the ripple effect, it is expected that more wavelength, waveband, and fiber resources will be consumed in order to achieve the minimum fiber requirement, as we shall see in the heuristics evaluation subsection. It is also interesting to note from Fig. 4.22 that allowing the bifurcation of fiber demands can be a promising bifurcation scenario, since the finer granular switching stages are not involved when fiber demands are bifurcated.

Fig. 4.22: The resultant “unweighted” port count breakdown at all nodes of the 8-node network at $F_{opt}=22$ using Policy 1 with the no-/fiber-bifurcation scenario.

Fig. 4.23: The resultant “unweighted” port count breakdown at all nodes of the 8-node network at $F_{opt}=22$ using Policy 1 with the all-demand bifurcation scenario.

Fig. 4.24: The required number of (de)multiplexers at all nodes of the 8-node network at $F_{opt}=22$ using Policy 1 with the no-/fiber-bifurcation scenario.

Fig. 4.25: The required number of (de)multiplexers at all nodes of the 8-node network at $F_{opt}=22$ using Policy 1 with the all-demand bifurcation scenario.

4.4.6 Effects of the C - W - B Combination Selection

This subsection examines the impact of having different combinations of parameters C , W , and B that lead to the same fiber capacity, where the fiber capacity = $C \times W \times B$, or to different fiber capacities. The input data and parameters used in this subsection are as follows: the physical topology of the 8-node network shown in Fig. 4.11; the raw traffic demands shown in Table 4.2;

$C=10$ and 40 Gb/s; $W=2, 4$, and 8 ; $B=2, 4$, and 8 ; $F \geq F_{min}$; all MG-OXC/EXC ports have the same weight; and the $10/40$ G-based EXC port weight is $2/5$ times the MG-OXC port weight.

In the first part of this subsection, we look at the C - W - B combinations that lead to the same fiber capacity. Table 4.4 shows the optimized multi-granularity demands for several combinations.

Table 4.4: The 8-node network optimized multi-granularity demands (which are generated from the raw traffic shown in Table 4.2) for different C [Gb/s]- W - B combinations, provided that all combinations give the same fiber capacity.

		$C=10, W=4, B=4$	$C=10, W=2, B=8$	$C=10, W=8, B=2$	$C=40, W=2, B=2$				
		Destination							
		0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7				
Sub- λ [Gb/s]	0	0 6 2 7 0 1 3 4	0 6 2 7 0 1 3 4	0 6 2 7 0 1 3 4	0 16 12 37 10 11 23 14				
	1	6 0 3 1 3 2 5 9	6 0 3 1 3 2 5 9	6 0 3 1 3 2 5 9	26 0 3 31 23 32 5 39				
	2	2 8 0 2 2 4 0 2	2 8 0 2 2 4 0 2	2 8 0 2 2 4 0 2	12 38 0 22 2 34 30 32				
	3	2 8 5 0 6 9 7 7	2 8 5 0 6 9 7 7	2 8 5 0 6 9 7 7	32 18 35 0 36 39 7 7				
	4	7 1 4 2 0 9 7 0	7 1 4 2 0 9 7 0	7 1 4 2 0 9 7 0	7 31 34 32 0 39 7 20				
	5	4 8 8 5 5 0 9 1	4 8 8 5 5 0 9 1	4 8 8 5 5 0 9 1	24 38 28 15 25 0 39 21				
	6	7 5 6 7 7 0 0 6	7 5 6 7 7 0 0 6	7 5 6 7 7 0 0 6	7 5 26 27 37 30 0 6				
	7	6 6 3 6 3 0 5 0	6 6 3 6 3 0 5 0	6 6 3 6 3 0 5 0	16 36 23 16 33 10 25 0				
λ	0	0 1 1 3 1 1 2 1	0 1 1 1 1 1 0 1	0 1 1 3 5 5 6 1	0 0 0 0 1 1 1 0				
	1	2 0 0 3 2 3 0 3	0 0 0 1 0 1 0 1	6 0 0 3 6 7 0 3	1 0 0 0 1 1 0 0				
	2	1 3 0 2 0 3 3 3	1 1 0 0 0 1 1 1	1 7 0 2 4 3 3 7	0 1 0 0 1 0 0 1				
	3	3 1 3 0 3 3 0 0	1 1 1 0 1 1 0 0	3 1 3 0 3 3 0 0	0 0 0 0 0 0 0 0				
	4	0 3 3 3 0 3 0 2	0 1 1 1 0 1 0 0	4 3 3 3 0 3 4 6	1 0 0 0 0 0 1 1				
	5	2 3 2 1 2 0 3 2	0 1 0 1 0 0 1 0	6 7 6 5 2 0 7 6	1 1 1 1 0 0 1 1				
	6	0 0 2 2 3 3 0 0	0 0 0 0 1 1 0 0	0 4 2 2 3 7 0 0	0 1 0 0 0 1 0 0				
	7	1 3 2 1 3 1 2 0	1 1 0 1 1 1 0 0	1 3 2 1 7 1 2 0	0 0 0 0 1 0 0 0				
Waveband	0	0 2 2 2 1 3 1 0	0 4 4 5 2 6 3 0	0 1 1 1 0 1 0 0	0 1 1 1 0 1 0 0				
	1	1 0 2 0 1 3 2 0	3 0 4 1 3 7 4 1	0 0 1 0 0 1 1 0	0 0 1 0 0 1 1 0				
	2	0 1 0 2 3 2 2 1	0 3 0 5 6 5 5 3	0 0 0 1 1 1 1 0	0 0 0 1 1 1 1 0				
	3	2 2 2 0 0 0 2 0	5 4 5 0 1 1 4 0	1 1 1 0 0 0 1 0	1 1 1 0 0 0 1 0				
	4	1 0 0 0 0 0 3 1	2 1 1 1 0 1 6 3	0 0 0 0 0 0 1 0	0 0 0 0 0 0 1 0				
	5	1 3 3 3 2 0 3 1	3 7 7 6 5 0 7 3	0 1 1 1 1 0 1 0	0 1 1 1 1 0 1 0				
	6	0 1 2 0 2 3 0 0	0 2 5 1 5 7 0 0	0 0 1 0 1 1 0 0	0 0 1 0 1 1 0 0				
	7	2 2 0 2 1 2 0 0	4 5 1 4 3 4 1 0	1 1 0 1 0 1 0 0	1 1 0 1 0 1 0 0				
Fiber	0	0 2 0 4 3 5 2 4	0 2 0 4 3 5 2 4	0 2 0 4 3 5 2 4	0 2 0 4 3 5 2 4				
	1	0 0 4 4 2 3 5 3	0 0 4 4 2 3 5 3	0 0 4 4 2 3 5 3	0 0 4 4 2 3 5 3				
	2	4 1 0 1 4 4 5 0	4 1 0 1 4 4 5 0	4 1 0 1 4 4 5 0	4 1 0 1 4 4 5 0				
	3	1 5 1 0 3 2 1 3	1 5 1 0 3 2 1 3	1 5 1 0 3 2 1 3	1 5 1 0 3 2 1 3				
	4	5 5 0 6 0 4 4 0	5 5 0 6 0 4 4 0	5 5 0 6 0 4 4 0	5 5 0 6 0 4 4 0				
	5	2 2 5 5 5 0 1 4	2 2 5 5 5 0 1 4	2 2 5 5 5 0 1 4	2 2 5 5 5 0 1 4				
	6	0 2 1 6 1 3 0 1	0 2 1 6 1 3 0 1	0 2 1 6 1 3 0 1	0 2 1 6 1 3 0 1				
	7	4 2 6 4 1 0 3 0	4 2 6 4 1 0 3 0	4 2 6 4 1 0 3 0	4 2 6 4 1 0 3 0				

The comparison of heuristic variations for different C - W - B combinations is performed for two fiber-resource situations. In the first fiber situation, it is assumed that fiber resources are scarce. Results in terms of F_{min} and the weighted port count at F_{min} are shown in Table 4.5. The best heuristic variation is the one that achieves the lowest F_{min} . If it happens that more than one

variation has the same F_{min} , then the best heuristic variation will be the one that achieves the lowest weighted port count. In the second fiber situation, it is assumed that fiber resources are plentiful. Results in terms of F_{opt} and the weighted port count at F_{opt} are shown in Table 4.6. The best heuristic variation in this situation is the one that achieves the lowest weighted port count at F_{opt} . If it happens that more than one variation has the same weighted port count, then the best heuristic variation will be the one that achieves the lowest F_{opt} .

From Tables 4.5 and 4.6, the following observations can be made. First, with the 10-4-4 combination, the best planning solutions, which are shown as the highlighted dark parts in the tables, can be obtained for both fiber situations. This means that the $C-W-B$ combination has an optimum combination and, accordingly, selecting the right combination can lead to substantial savings in the fiber requirement and weighted port count. Second, at a certain $C-W-B$ combination, the winning bifurcation scenario, which is shown as the highlighted part in the tables, alternates between the no-bifurcation and fiber-bifurcation scenarios. Furthermore, the winning bifurcation scenario in the fiber-scarce situation is not necessarily the winner in the fiber-plentiful situation. Moreover, the best sorting policy used along the bifurcation scenario is changing, and the best sorting policy in the fiber-scarce situation is different from the best policy in the fiber-plentiful situation. Therefore, the $C-W-B$ combination decides the best heuristic variation. Third, allowing demand bifurcation at all traffic granularities increases the fiber requirement and weighted port count (for the reasons explained in Subsection 4.4.5), most notably with the 40-2-2 combination due to the dramatic increase in sub-wavelength demands, as illustrated in Table 4.4.

Table 4.5: Heuristics comparison under the fiber-scarce situation for different C - B - W combinations, which lead to the same fiber capacity.

C [Gb/s]- W - B combination	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
10-4-4	1	16	4314	4	17	4106	1	17	5520
10-8-2	1	16	4600	4	16	4610	4	17	5738
10-2-8	1	16	4586	4	16	4555	2	18	5651
40-2-2	1	16	4586	4	17	4544	2	34	15379

Table 4.6: Heuristics comparison under the fiber-plentiful situation for different C - B - W combinations, which lead to the same fiber capacity.

C [Gb/s]- W - B combination	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
10-4-4	4	20	4114	4	22	4063	2	24	5139
10-8-2	4	18	4357	4	18	4357	4	23	5491
10-2-8	4	19	4423	4	22	4432	1	22	5518
40-2-2	4	18	4486	4	18	4486	4	41	15298

In the second part of this subsection, we look at the effect of changing the C - W - B combination in a way that leads to the increase in the fiber capacity. Table 4.7 shows the optimized multi-granularity demands for different fiber capacities.

The results of comparing heuristic variations using different fiber capacities for both fiber situations are shown in Tables 4.8 and 4.9. In the fiber-scarce situation, it is clear that using the 40-8-8 combination, which has the highest fiber capacity, requires the lowest fiber requirement. This means that in the fiber-scarce situation, increasing the fiber capacity usually leads to the best planning solution. However, if increasing the fiber capacity does not lead to a further reduction in F_{min} , then we need to look at the fiber capacity that achieves the lowest weighted port count. In the fiber-plentiful situation, using the 10-4-4 combination leads to the lowest weighted port count. Again, this result has to do with the fact the C - W - B combination has an optimum combination.

Therefore, this finding suggests that, especially in the fiber-plentiful situation, choosing the proper fiber capacity has a major impact on improving the planning solution. It is important to note here that as the fiber capacity increases (as is the case with the 10-8-8 and 40-8-8 combinations), the bifurcation of fiber demands will not occur since the fiber demand between any s - d pair is ≤ 1 , as shown in Table 4.7. Finally, similar to the observations made in the first part of this subsection, the C - W - B combination along with the fiber situation decides the best heuristic variation.

Table 4.7: The 8-node network optimized multi-granularity demands (which are generated from the raw traffic shown in Table 4.2) for different fiber capacities, given that the fiber capacity = $C \times B \times W$.

		C=10,W=4,B=4									C=10,W=8,B=8									C=40,W=8,B=8								
		Destination																										
		0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7			
Sub-λ [Gb/s]	0	0	6	2	7	0	1	3	4	0	6	2	7	0	1	3	4	0	16	12	37	10	11	23	14			
	1	6	0	3	1	3	2	5	9	6	0	3	1	3	2	5	9	26	0	3	31	23	32	5	39			
	2	2	8	0	2	2	4	0	2	2	8	0	2	2	4	0	2	12	38	0	22	2	34	30	32			
	3	2	8	5	0	6	9	7	7	2	8	5	0	6	9	7	7	32	18	35	0	36	39	7	7			
	4	7	1	4	2	0	9	7	0	7	1	4	2	0	9	7	0	7	31	34	32	0	39	7	20			
	5	4	8	8	5	5	0	9	1	4	8	8	5	5	0	9	1	24	38	28	15	25	0	39	21			
	6	7	5	6	7	7	0	0	6	7	5	6	7	7	0	0	6	7	5	26	27	37	30	0	6			
	7	6	6	3	6	3	0	5	0	6	6	3	6	3	0	5	0	16	36	23	16	33	10	25	0			
λ	0	0	1	1	3	1	1	2	1	0	1	1	3	5	5	6	1	0	2	2	2	5	7	1	0			
	1	2	0	0	3	2	3	0	3	6	0	0	3	6	7	0	3	1	0	2	0	1	7	6	4			
	2	1	3	0	2	0	3	3	3	1	7	0	2	4	3	3	7	0	5	0	6	3	2	6	1			
	3	3	1	3	0	3	3	0	0	3	1	3	0	3	3	0	0	6	6	6	0	4	0	6	4			
	4	0	3	3	3	0	3	0	2	4	3	3	3	0	3	4	6	5	4	0	0	0	0	3	1			
	5	2	3	2	1	2	0	3	2	6	7	6	5	2	0	7	6	1	3	7	7	6	0	7	1			
	6	0	0	2	2	3	3	0	0	0	4	2	2	3	7	0	0	0	1	6	0	6	7	0	4			
	7	1	3	2	1	3	1	2	0	1	3	2	1	7	1	2	0	2	2	0	2	5	2	4	0			
Source	0	0	2	2	2	1	3	1	0	0	5	1	1	6	3	4	0	0	1	0	2	1	2	1	2			
	1	1	0	2	0	1	3	2	0	0	0	1	0	4	7	3	6	0	0	2	2	1	1	2	1			
	2	0	1	0	2	3	2	2	1	0	2	0	3	1	1	3	0	2	0	0	0	2	2	2	0			
	3	2	2	2	0	0	0	2	0	3	3	3	0	6	4	3	6	0	2	0	0	1	1	0	1			
	4	1	0	0	0	0	0	3	1	2	2	0	4	0	0	1	0	2	2	0	3	0	2	2	0			
	5	1	3	3	3	2	0	3	1	4	5	3	3	3	0	3	0	1	1	2	2	2	0	0	2			
	6	0	1	2	0	2	3	0	0	0	4	3	4	3	7	0	2	0	1	0	3	0	1	0	0			
	7	2	2	0	2	1	2	0	0	1	5	4	1	2	1	6	0	2	1	3	2	0	0	1	0			
Waveband	0	0	2	0	4	3	5	2	4	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0			
	1	0	0	4	4	2	3	5	3	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0			
	2	4	1	0	1	4	4	5	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0			
	3	1	5	1	0	3	2	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	4	5	5	0	6	0	4	4	0	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0			
	5	2	2	5	5	5	0	1	4	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0			
	6	0	2	1	6	1	3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0			
	7	4	2	6	4	1	0	3	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0			
Fiber	0	0	2	0	4	3	5	2	4	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0			
	1	0	0	4	4	2	3	5	3	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0			
	2	4	1	0	1	4	4	5	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0			
	3	1	5	1	0	3	2	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	4	5	5	0	6	0	4	4	0	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0			
	5	2	2	5	5	5	0	1	4	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0			
	6	0	2	1	6	1	3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0			
	7	4	2	6	4	1	0	3	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0			

Table 4.8: Heuristics comparison under the fiber-scarce situation for different C - B - W combinations, which lead to different fiber capacities.

C [Gb/s]- W - B combination	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
10-4-4	1	16	4314	4	17	4106	1	17	5520
10-8-8	4	5	4220	4	5	4220	4	5	5371
40-8-8	1	2	5008	1	2	5008	2	3	14596

Table 4.9: Heuristics comparison under the fiber-plentiful situation for different C - B - W combinations, which lead to different fiber capacities.

C [Gb/s]- W - B combination	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
10-4-4	4	20	4114	4	22	4063	2	24	5139
10-8-8	4	7	4193	4	7	4193	4	6	5254
40-8-8	1	2	5008	1	2	5008	2	3	14596

4.4.7 Comparison of Heuristics

In this subsection, we evaluate through simulation different heuristic variations under different traffic patterns, network physical topologies, and fiber capacities. Heuristic variations are based on the combination of various bifurcation scenarios, namely the no-bifurcation, fiber-bifurcation, and all-bifurcation scenarios, with different sorting policies, namely Policies 1-4.

Traffic patterns are generated as follows [RaSi95b][RaSi96][BaMu97][BYCh97][Mukh97]:

- $(100-FR)\%$ of the raw traffic matrix elements is randomly and uniformly distributed over the range $(0, IN)$, where IN is the maximum offered traffic intensity per s - d pair
- $FR\%$ of elements is randomly and uniformly distributed over the range $(0, IN/100)$. FR is a measure of the density of the traffic pattern; increasing FR means that the traffic density is decreasing and the traffic thus becomes more concentrated among a few s - d pairs, while

decreasing FR means that the traffic density is increasing and the traffic thus becomes more evenly distributed among s - d pairs.

- Traffic patterns are generated based on the combination of the following parameters: $FR=0$, 20, 50, and 80%; $IN=500$, 1000, and 1500 Gb/s. If $FR=0\%$, then a uniform traffic pattern is generated; otherwise, a non-uniform traffic pattern is generated.

The physical topologies considered in our simulation are the 8-node sample network, the 14-node NSF (National Science Foundation) network [Mukh97], and the 11-node EON (European Optical Network) network [Gro04], as shown in Figs. 4.11, 4.26, and 4.27 respectively. These topologies are characterized as follows. The 8-node/NSF/EON network has an average network physical connectivity (or nodal degree) of 3.25/3/4.73 and, accordingly, the number of distinct routes between a network node pair can go up to 29/120/1720 routes.

Fig. 4.26: 14-node NSF network fiber layout with span distances in km.

Fig. 4.27: 11-node EON network fiber layout with span distances in km.

The fiber capacities used here are based on using the following C [Gb/s]- W - B combinations: 10-4-4, 10-8-8, and 40-8-8. The rest of the input parameters employed in the simulation are as follows: $1 \leq F \leq F_{sat}$, all MG-OXC/EXC ports have the same weight, and the 10/40 Gb/s-based EXC port weight is 2/5 times the MG-OXC port weight.

The results of the heuristic variations are compared in terms of the fiber requirement, weighted port count, and solve time under the fiber-scarce and fiber-plentiful situations. These results are based on averaging 10 simulation runs. In each simulation run, different seeds are used for Random Number Generators (RNGs) [PTVF92] that generate both $(0, IN)$ and $(0, IN/100)$ traffic ranges. Also, a different RNG with a different seed is used to decide which of the s - d pairs will be considered in the $(0, IN/100)$ traffic range. Detailed results with 95% confidence intervals are

provided in Appendix A. The mathematical derivation of the confidence interval can be found in Appendix D.

Since the total solve time for carrying out the network planning process is still essential, it is important to understand the factors that contribute to the increase in the solve time of the RMGPA problem at F_{min} and F_{opt} . From Tables A.1-A.9, the following observations can be made. First, increasing the amount of traffic demands imposed on the network by either increasing IN and fixing FR or decreasing FR and fixing IN increases the solve time. Second, increasing both the network size and connectivity increases the solve time due to the increase in the number of distinct routes between an $s-d$ pair that needs to be evaluated by the heuristic. This factor explains clearly (1) why the EON network has the longest solve time in comparison with other topologies, and (2) why the NSF network has a longer solve time than the 8-node network. Third, bifurcating demands also increases the solve time, since each unit of the same demand will be treated separately by the heuristic. This factor explains (1) why heuristics in which demand bifurcation is allowed at all granularity levels have the longest solve time, and (2) why heuristics in which demand bifurcation is not performed achieve the shortest solve time.

Heuristic variations using the same bifurcation scenario are compared under the fiber-scarce and fiber-plentiful situations using the same criteria explained in Subsection 4.4.6. Accordingly, Tables 4.10-4.27 summarize the results in Tables A.1-A.9 for both fiber situations. Likewise, deciding the best bifurcation scenario in Tables 4.10-4.27 is based on the same rules used in deciding the best policy. Accordingly, the best heuristic variations are highlighted in the tables.

Overall, as shown in Tables 4.10-4.27, it is relatively clear that regardless of the heuristic variation employed, increasing the traffic amount imposed on the network by either increasing IN and

fixing FR or decreasing FR and fixing IN results in an increase in both the weighted port count and fiber requirement. This increase occurs because more clear paths are needed to accommodate all demands.

We first evaluate heuristics under the fiber-scarce situation. From Tables 4.10-4.18, in comparing heuristics based on the bifurcation scenario used, it is apparent that for the majority of the traffic patterns, topologies, and fiber capacities tested, the heuristics based on the no- and fiber-bifurcation scenarios outperform those based on the all-bifurcation scenario. With the 8-node/NSF/EON network, compared to the winning heuristic variation, the increase in F_{min} using the all-bifurcation-based heuristic can go up to $\approx 14/19/35\%$, $\approx 58/21/43\%$, and $\approx 100/200/133\%$ when employing the 10-4-4, 10-8-8, and 40-8-8 combinations respectively. Even with traffic patterns where the same F_{min} is achieved using all heuristic variations, as shown in Table 4.12, the increase in the weighted port count at F_{min} can go up to $\approx 199\%$ with the use of the all-bifurcation-based heuristic in comparison to the weighted port count of the winning heuristic variation. This happens for the reasons we have already explained in Subsection 4.4.5. However, at a certain physical topology and fiber capacity, as IN increases and/or FR decreases, we can note that the difference in F_{min} drops. This drop stems from the increased grouping of unclear and clear paths at all levels, which increases the utilization of network resources. As a result of this trend, we can observe from Table 4.17 that in the case of the EON network (which has the highest physical connectivity) along with the use of the 10-8-8 combination, when $IN=1500$ Gb/s and $FR=0\%$ (which is the highest intensity uniform traffic pattern), allowing the bifurcation of all demands turns out to be more fiber-efficient since it achieves $\approx 8\%$ less F_{min} compared to the no-bifurcation-based heuristic. A possible explanation for this unique situation is as follows. When the traffic pattern is uniform and the traffic intensity is high, wavelength capacities, wavebands, and

fibers become fully utilized. Consequently, the (de)multiplexers used by the bifurcated units of a certain s - d demand, as we have explained in Subsection 4.4.5, become increasingly shared among the bifurcated units of other demands. Otherwise, this situation can lead to an inefficient use of network resources. Besides, when the network physical connectivity is high, the chance that all bifurcated units are using physical routes with the smallest (or close to the smallest) hop count increases, since using longer routes significantly duplicates resources and, accordingly increases F_{min} .

Moreover, with traffic patterns in which fiber demands exist, which happens at $IN=1000$ and 1500 /1500 Gb/s with the 10-4-4/10-8-8 combination, we can note that there is no clear winner between choosing not to bifurcate demands or to bifurcate fiber demands only. However, with the 8-node network and EON network, in which the physical connectivity is higher than the NSF network, the fiber-bifurcation-based heuristic tends to be more on the winning side, as is clearly illustrated through the comparison of Tables 4.10, 4.11, 4.13, 4.14, 4.16, and 4.17. This is because increasing the physical connectivity increases the chance that the alternative routes to be used by the bifurcated units of the same fiber demand can have the same physical hop count. As a result, the situation in which some of the bifurcated units of the same fiber demand use long routes (which leads to the duplication of resources) while the rest use short routes, as is the case with the NSF network, will be avoided.

In comparing heuristic variations based on the sorting policy used, results show that there is no clear winning sorting policy as the traffic pattern, physical topology, and fiber capacity change. Moreover, the set of winning policies, which consists of the winning policies of all traffic patterns, changes according to the physical topology and fiber capacity.

In addition, in looking for the C - W - B combination that can achieve the lowest F_{min} , it is intuitive that the combination that increases the fiber capacity will be the best choice. However, this is not always the case. For example, with the 8-node network at $IN=1000$ Gb/s and $FR=80\%$, as shown in Tables 4.11 and 4.12, we can notice that F_{min} is the same using the 10-8-8 and 40-8-8 combinations. Nevertheless, with the 10-8-8 combination, a lower weighted port count is realized in spite of the fact that the 10-8-8 combination leads to a lower fiber capacity than the 40-8-8 combination. Therefore, this indicates that choosing the best C - W - B combination in the fiber-scarce situation can be a function of the traffic pattern and the physical topology.

Table 4.10: Comparison of heuristic variations for different traffic patterns in the 8-node network using the 10-4-4 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	4	8.4	3004.9	4	8.8	3015.6	4	9.6	4320.8
(1000,0)	3	16.4	4027.5	3	16.4	4034.3	4	17.2	5260.7
(1500,0)	1	24.2	4737.6	1	23.8	4770.5	4	24.8	5939.2
(500,20)	4	7.6	2478.6	4	7.6	2472.9	4	8	3500.3
(1000,20)	4	13.4	3159.7	1	13.4	3182.9	4	14.4	4333.3
(1500,20)	4	19.8	3800.6	4	19.4	3813.8	1	19.8	5112.7
(500,50)	4	5.8	1789.3	4	5.8	1778.4	4	6	2667
(1000,50)	4	10.6	2294.2	2	10.2	2403.9	4	10.8	3470.1
(1500,50)	1	15.4	2862.9	4	15.2	2855.1	4	16	3889
(500,80)	4	3.4	1000.6	4	3.4	1006.8	2	3.8	1647.5
(1000,80)	1	5.8	1311.9	4	5.6	1292.6	2	6.2	2460
(1500,80)	1	8.8	1660.2	1	7.6	1727	1	8.4	2855

Table 4.11: Comparison of heuristic variations for different traffic patterns in the 8-node network using the 10-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	1	2.4	4079.6	1	2.4	4079.6	1	3.8	5265.7
(1000,0)	4	4.4	4386.2	4	4.4	4386.2	1	5.2	5725.1
(1500,0)	4	6.8	4723.2	4	6.8	4726.6	2	7.2	6022.2
(500,20)	4	2	3227.3	4	2	3227.3	4	2.4	4315.9
(1000,20)	4	4	3522	4	4	3522	4	4	4723.6
(1500,20)	4	6	3783.1	4	6	3782.9	4	6	4908.2
(500,50)	4	2	2247.5	4	2	2247.5	2	2	3086.9
(1000,50)	4	3.6	2525.7	4	3.6	2525.7	4	4	3548.2
(1500,50)	4	4.4	2769.5	4	4.4	2769.5	4	4.6	3842
(500,80)	4	2	1132.6	4	2	1132.6	2	2	1684.1
(1000,80)	4	2	1325.6	4	2	1325.6	4	2	2315.1
(1500,80)	1	2.4	1630.4	4	2.4	1605.5	4	2.8	2576.2

Table 4.12: Comparison of heuristic variations for different traffic patterns in the 8-node network using the 40-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	4	2	3812.2	4	2	3812.2	2	2	11381.4
(1000,0)	4	2	4875.4	4	2	4875.4	4	3	13134.8
(1500,0)	1	2	5517.8	1	2	5517.8	2	4	13022.9
(500,20)	4	2	3083	4	2	3083	2	2	8482.3
(1000,20)	4	2	3850.9	4	2	3850.9	2	2	9447.6
(1500,20)	4	2	4308.2	4	2	4308.2	4	2.6	10468.8
(500,50)	4	2	2127.5	4	2	2127.5	2	2	5829
(1000,50)	4	2	2720.7	4	2	2720.7	2	2	6543.4
(1500,50)	4	2	3035.3	4	2	3035.3	4	2	8113.5
(500,80)	4	2	1072.9	4	2	1072.9	2	2	2539.6
(1000,80)	4	2	1347	4	2	1347	2	2	3609.9
(1500,80)	4	2	1566.8	4	2	1566.8	2	2	4582.3

Table 4.13: Comparison of heuristic variations for different traffic patterns in the NSF network using the 10-4-4 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	3	23.8	11553.2	3	23.8	11553.2	4	26.8	17173
(1000,0)	3	46.8	14752.6	3	46.8	14772.6	3	49.6	21061.4
(1500,0)	3	69.8	17708.2	3	69.2	17738.5	3	72.6	23760.9
(500,20)	1	20.4	9573.2	1	20.4	9573.2	2	23.2	15011.7
(1000,20)	3	39.8	12496.4	3	39	12521.1	3	42.6	18472.3
(1500,20)	3	58.4	15000	3	58.2	14985.5	3	61	20816.3
(500,50)	1	14.9	6854.6	4	14.9	6788.8	2	17	11096.8
(1000,50)	1	28.4	8757.9	3	28.2	8902.1	3	30.6	14624.5
(1500,50)	3	41.8	10896.4	3	42.4	10917.5	1	44.6	15898.6
(500,80)	1	7.4	4027.3	1	7.4	4027.3	4	8.8	7334.9
(1000,80)	1	14.8	5076.8	1	14.6	5093.6	1	17	10425.8
(1500,80)	4	20.2	6169	2	20	6529.6	2	22.2	11112

Table 4.14: Comparison of heuristic variations for different traffic patterns in the NSF network using the 10-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	1	7	14777.9	1	7	14777.9	1	7.2	20865
(1000,0)	3	12.4	16298.6	3	12.4	16298.6	4	13.2	21721.5
(1500,0)	3	18.2	17440.4	3	18.2	17440.4	1	19	23079.3
(500,20)	2	5.6	12526.8	2	5.6	12526.8	4	6.8	17515.1
(1000,20)	3	10.6	13556.1	3	10.6	13556.1	2	11.4	19015.6
(1500,20)	1	15.4	14336	1	15.4	14336	1	16	19870
(500,50)	1	5	8445.4	1	5	8445.4	2	5	12708.9
(1000,50)	3	7.6	9600.4	3	7.6	9600.4	4	8.8	14716.1
(1500,50)	1	11.4	10258.1	1	11.4	10258.1	4	11.8	15262.2
(500,80)	1	3	4468.7	1	3	4468.7	1	3	7683.5
(1000,80)	2	4.6	5330	2	4.6	5330	4	5	10177.9
(1500,80)	2	5.4	6248.6	2	5.6	6223.2	3	6.4	11238.3

Table 4.15: Comparison of heuristic variations for different traffic patterns in the NSF network using the 40-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	4	3	13566	4	3	13566	4	6.4	53156.4
(1000,0)	1	3.4	17248.5	1	3.4	17248.5	2	7.6	58077.8
(1500,0)	4	5	19737.2	4	5	19737.2	2	9	59423
(500,20)	4	3	11293	4	3	11293	2	5	43028.2
(1000,20)	1	3	14322.4	1	3	14322.4	2	7	48467.4
(1500,20)	4	5	16317.2	4	5	16317.2	2	7.6	50105.5
(500,50)	4	1.6	7901.1	4	1.6	7901.1	2	4.4	28493.7
(1000,50)	1	3	9940.3	1	3	9940.3	2	5	33622.7
(1500,50)	2	3	11784.3	2	3	11784.3	2	6.2	37090
(500,80)	4	1	4291.8	4	1	4291.8	2	3	13562.1
(1000,80)	1	1.8	5520.8	1	1.8	5520.8	2	3	18487.8
(1500,80)	1	3	6014.6	1	3	6014.6	2	3.8	23684

Table 4.16: Comparison of heuristic variations for different traffic patterns in the EON network using the 10-4-4 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	4	37.6	7204.4	4	37	7190.5	1	40.4	9872.4
(1000,0)	1	70.2	9310	1	70	9267	1	72.2	11909.9
(1500,0)	1	100.8	11177.6	3	93.2	11255.2	3	99.2	13958.5
(500,20)	3	30.6	6214.3	3	30.2	6217.5	1	32	8437.2
(1000,20)	1	61	7853	1	62.2	7910.2	2	66.2	10244
(1500,20)	1	90.8	9576.2	3	88.6	9587.9	1	96.8	11969.8
(500,50)	2	20.8	4513.5	3	20.4	4417.5	2	22.6	5953.3
(1000,50)	1	40.6	5469.6	4	40.8	5451.6	4	42.2	7774.6
(1500,50)	1	56.8	6736.5	1	59.4	6736.5	1	63.6	8911
(500,80)	4	9	2434.7	4	8.8	2424.5	2	11	3800.6
(1000,80)	1	15.8	3130.5	4	15.8	3030.6	1	20.8	5500.4
(1500,80)	1	21.6	4025.5	1	22.6	3981.3	1	29.2	6120.2

Table 4.17: Comparison of heuristic variations for different traffic patterns in the EON network using the 10-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	1	9.8	9617.9	1	9.8	9617.9	4	11.4	12093.2
(1000,0)	3	18.4	10417.1	3	18.4	10417.1	4	19.8	12726.2
(1500,0)	4	29.6	10860.9	4	30	10853.9	2	27.4	13361
(500,20)	4	8.8	7972.4	4	8.8	7972.4	1	8.8	10354
(1000,20)	3	16.4	8787.7	3	16.4	8787.7	3	17	11312.2
(1500,20)	3	23.2	9248.6	3	23.2	9256.1	2	24.2	11435.2
(500,50)	4	6	5376.9	4	6	5376.9	2	6.6	7111.6
(1000,50)	4	10	5878.3	4	10	5878.3	4	11	8215.6
(1500,50)	4	15.2	6517.7	4	15.2	6517.7	4	15.8	8695.8
(500,80)	2	3	3013.4	2	3	3013.4	3	3.2	4465.4
(1000,80)	4	5.6	3257.9	4	5.6	3257.9	1	6.2	5518.6
(1500,80)	4	6	3798.8	4	7.4	3871.9	1	8.6	5845.7

Table 4.18: Comparison of heuristic variations for different traffic patterns in the EON network using the 40-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}	Best policy	F_{min}	Weighted port count @ F_{min}
(500,0)	2	3	9164.6	2	3	9164.6	4	7	24630.9
(1000,0)	1	5.6	11086.1	1	5.6	11086.1	2	8.8	27130.7
(1500,0)	4	8	12549.6	4	8	12549.6	2	11.6	28357.4
(500,20)	2	2.8	7652.9	2	2.8	7652.9	2	5.8	19160.2
(1000,20)	1	4.8	9081.4	1	4.8	9081.4	2	7.6	22190.9
(1500,20)	2	7.2	10751.2	2	7.2	10751.2	4	9.8	24176.4
(500,50)	4	2.8	4841.3	4	2.8	4841.3	2	4.2	11378.5
(1000,50)	4	3.2	6218	4	3.2	6218	2	5.8	14708.6
(1500,50)	1	4.6	7018.8	1	4.6	7018.8	2	6.2	16479.5
(500,80)	1	1	2582.5	1	1	2582.5	2	2	5749.6
(1000,80)	4	2.6	3223.5	4	2.6	3223.5	2	2.9	7816.2
(1500,80)	1	3	3713.3	1	3	3713.3	2	3.8	10393.4

We now evaluate heuristics under the fiber-plentiful situation. As we mentioned earlier in Subsection 4.4.3, going beyond F_{min} increases fiber resources and the choice of short physical routes for clear paths will be more likely; as a result, we expect to have a lower weighted port count. Depending on the traffic pattern, physical topology and fiber capacity, we expect up to an $\approx 88\%$ increase in the fiber requirement needed to reach the minimal weighted port count, which we call the weighted port count at F_{opt} . On the other hand, the saving achievable at the minimal weighted port count can go up to $\approx 20\%$ compared to the weighted port count at F_{min} , which is a considerable saving. It is worth mentioning here that sometimes going beyond F_{min} will not bring any further port count reduction, as is clearly demonstrated from the comparison of Table 4.12 with Table 4.21. This result usually occurs when the applied traffic volume is relatively low compared to the fiber capacity; as a result, the given resources will be sufficient to ensure that short routes are selected for all demands.

From Tables 4.19-4.27, in comparing heuristics based on the bifurcation scenario used, it is clear that for all traffic patterns, physical topologies, and fiber capacities tested, the heuristics based on bifurcating demands at all granularity levels drastically increases the weighted port count in comparison to the no- or fiber-bifurcation-based heuristics, which are highlighted in the tables. This observation is consistent with our finding in Subsection 4.4.5. With the 8-node/NSF/EON network, this increase can go up to $\approx 79/105/70\%$, $\approx 73/98/64\%$, and $\approx 198/293/175\%$ using the 10-4-4, 10-8-8, and 40-8-8 combinations respectively. It is interesting to note here that the use of the 40-8-8 combination leads to the worst increase in the weighted port count. This increase occurs because more sub-wavelength demands are needed with the 40 Gb/s wavelength capacity. This explanation is based on the fact that, as we mentioned in Subsection 4.4.5, treating each bifurcated unit of the sub-wavelength demand separately increases the chance that these units will

use separate EXC ports and wavelength and waveband (de)multiplexers. Consequently, this increase in the number of EXC ports and (de)multiplexers will have a ripple effect in duplicating the ports of the next coarse-granular crossconnects.

Furthermore, regarding traffic patterns in which fiber demands exist, which happens at $IN=1000$ and $1500/1500$ Gb/s with the 10-4-4/10-8-8 combination, we can note that choosing to bifurcate fiber demands in the fiber-plentiful situation becomes a less attractive scenario than not bifurcating demands. This is expected to occur with the 8-node network and NSF network, both of which have a lower physical connectivity than the EON network, as is clearly illustrated through the comparison of Tables 4.19/4.20/4.22/4.23/4.25/4.26 with 4.10/4.11/4.13/4.14/4.16/4.17. This finding happens because increasing the fiber resources, especially in low-connectivity networks, means that the same best route can be used by most of the fiber demand units.

In comparing heuristic variations based on the sorting policy used, it is quite clear that Policies 1 and 4 are the only contenders as the traffic pattern, physical topology, and fiber capacity change. Moreover, the set of winning policies, which consists of the winning policies of all traffic patterns, changes according to the physical topology and fiber capacity. Furthermore, Policy 4 tends to be the most cost-effective policy for the NSF network, which has the lowest physical connectivity, along with the use of the 10-4-4 combination, which has the lowest fiber capacity, as shown in Table 4.22. In general, Policies 1 and 4 are the clear winners, because both policies try to avoid the duplication of resources as follows. Policy 1 ensures that the biggest portion of traffic demands is served first using short routes in terms of hop count, whereas Policy 4 ensures that short routes are granted to the demands with the lowest physical hop requirements.

Finally, in looking for the *C-W-B* combination/fiber capacity that leads to the minimal weighted port count, Table 4.28 summarizes the winning *C-W-B* combination according to the traffic pattern and topology. Needless to say, the table clearly indicates that choosing the best/optimum *C-W-B* combination depends on the traffic pattern and physical topology.

Table 4.19: Comparison of heuristic variations for different traffic patterns in the 8-node network using the 10-4-4 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	10.2	2982.4	4	10.6	2989.5	2	12.4	4179.9
(1000,0)	4	21	3851.9	4	21.8	3855.4	2	22.8	5072.5
(1500,0)	4	29	4621.7	4	31.8	4617.8	4	31.6	5673.2
(500,20)	4	10	2423.5	4	9.8	2422.9	2	10.4	3362.1
(1000,20)	1	17.8	3098	4	16.8	3096.6	2	19.6	4199.5
(1500,20)	4	26.4	3727.9	4	26	3733.3	2	27.8	4765.9
(500,50)	4	7.8	1757.5	4	7.8	1757.5	2	8.6	2584.8
(1000,50)	4	12.8	2238.6	4	14.4	2239.6	4	14.4	3305.8
(1500,50)	4	19	2767.1	4	18.4	2776.1	4	19.8	3748.4
(500,80)	4	5	973	4	5	973	2	5.4	1558.4
(1000,80)	4	8.8	1231.5	4	8.8	1232.6	4	10	2198.8
(1500,80)	4	12.4	1584.8	4	12.8	1583.8	2	13.6	2487.1

Table 4.20: Comparison of heuristic variations for different traffic patterns in the 8-node network using the 10-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	3.4	4019	4	3.4	4019	2	4	5250.5
(1000,0)	4	5.6	4347.4	4	5.6	4347.4	2	6.6	5593.3
(1500,0)	4	7.8	4702.4	4	7.8	4702.4	1	9.4	5823.7
(500,20)	4	3	3211.3	4	3	3211.3	2	3.8	4203.2
(1000,20)	4	5.4	3489.7	4	5.4	3489.7	4	5.8	4629.9
(1500,20)	4	7	3766.6	4	7	3766.6	4	7.6	4820.5
(500,50)	4	2.6	2243.4	4	2.6	2243.4	2	2.4	3076.4
(1000,50)	4	4.4	2491.9	4	4.4	2491.9	4	4.4	3532
(1500,50)	4	5.6	2734	4	5.6	2734	4	6.4	3706.6
(500,80)	4	2	1132.6	4	2	1132.6	2	2	1681.1
(1000,80)	4	3.2	1308.2	4	3.2	1308.2	4	3.2	2268.2
(1500,80)	4	3.8	1546.8	4	3.8	1545.2	2	3.8	2440.3

Table 4.21: Comparison of heuristic variations for different traffic patterns in the 8-node network using the 40-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	2	3812.2	4	2	3812.2	2	2.8	11353.6
(1000,0)	4	2	4875.4	4	2	4875.4	2	4	12267.6
(1500,0)	1	2.4	5513.2	1	2.4	5513.2	2	4	13022.9
(500,20)	4	2	3083	4	2	3083	2	2	8482.3
(1000,20)	4	2	3850.9	4	2	3850.9	2	3.2	9433.7
(1500,20)	4	2.4	4305.3	4	2.4	4305.3	2	3.8	10301.1
(500,50)	4	2	2127.5	4	2	2127.5	2	2	5829
(1000,50)	4	2	2720.7	4	2	2720.7	2	2	6543.4
(1500,50)	4	2	3035.3	4	2	3035.3	2	3	7783.3
(500,80)	4	2	1072.9	4	2	1072.9	2	2	2539.6
(1000,80)	4	2	1347	4	2	1347	2	2	3609.9
(1500,80)	4	2	1566.8	4	2	1566.8	2	2	4582.3

Table 4.22: Comparison of heuristic variations for different traffic patterns in the NSF network using the 10-4-4 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	27.2	11088.3	4	27.2	11088.3	4	30	16976.9
(1000,0)	4	54.6	14101.7	4	54.6	14101.7	4	56.8	19823.9
(1500,0)	4	81.2	16950.3	4	80.8	16951.6	4	83.6	22564.6
(500,20)	4	23.6	9335	4	23.6	9335	4	25.2	14620.7
(1000,20)	4	46.8	11955.2	4	46.8	11955.2	4	49.4	17433.2
(1500,20)	4	67.4	14322.6	4	68	14326.7	4	69.2	19588.4
(500,50)	4	17.1	6694.7	4	17.1	6694.7	2	19.4	10984.5
(1000,50)	4	35.4	8440.3	4	35.2	8436.2	4	37.8	13681.4
(1500,50)	4	49	10308.2	4	51.4	10297.6	2	54	15249.3
(500,80)	4	9.2	3910.6	4	10.2	3916.1	2	11.8	7127.7
(1000,80)	4	20.3	4807.7	4	20.1	4805.5	4	21.4	9864.4
(1500,80)	4	26.2	6057.5	4	26.2	6091.1	2	30.6	10738.2

Table 4.23: Comparison of heuristic variations for different traffic patterns in the NSF network using the 10-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	7.8	14682.4	4	7.8	14682.4	4	8.2	20535.8
(1000,0)	1	14	15869.3	1	14	15869.3	4	14.4	21642.7
(1500,0)	4	21	16959.1	4	21	16959.1	1	21.2	22745.5
(500,20)	1	6.8	12207	1	6.8	12207	4	7	17505.9
(1000,20)	1	12.2	13227	1	12.2	13227	4	12.4	18822
(1500,20)	1	17	14253.4	1	17	14253.4	4	17.6	19548.3
(500,50)	4	5.2	8435.9	4	5.2	8435.9	2	5.6	12693.9
(1000,50)	1	9.6	9252	1	9.6	9252	4	9.6	14606.9
(1500,50)	1	13.8	10166.2	1	13.8	10166.2	2	14.8	15031.5
(500,80)	1	3	4468.7	1	3	4468.7	2	3	7647.2
(1000,80)	4	5.6	5068.1	4	5.6	5068.1	4	5.6	10017.3
(1500,80)	4	7.6	5873.9	4	7.6	5873.9	2	7.4	10471.6

Table 4.24: Comparison of heuristic variations for different traffic patterns in the NSF network using the 40-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	3	13566	4	3	13566	2	7.2	52486
(1000,0)	4	4.6	17133.8	4	4.6	17133.8	2	8.4	57963.6
(1500,0)	4	5.6	19694.8	4	5.6	19694.8	2	9.4	59402.5
(500,20)	4	3	11293	4	3	11293	2	6.2	42990.2
(1000,20)	4	3.6	14209	4	3.6	14209	2	7.8	48383.2
(1500,20)	4	5	16317.2	4	5	16317.2	2	8.8	50040
(500,50)	4	3	7808.3	4	3	7808.3	2	5	28450.4
(1000,50)	1	3	9940.3	1	3	9940.3	2	5.6	33522.3
(1500,50)	1	4.4	11279.6	1	4.4	11279.6	2	7	37050.1
(500,80)	4	1	4291.8	4	1	4291.8	2	3	13562.1
(1000,80)	4	2.8	5399.9	4	2.8	5399.9	2	3.4	18482.6
(1500,80)	1	3	6014.6	1	3	6014.6	2	5	23641.1

Table 4.25: Comparison of heuristic variations for different traffic patterns in the EON network using the 10-4-4 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	40.6	7187.1	4	38.4	7184.9	4	51.2	9621.3
(1000,0)	4	82.6	9249.4	1	73	9222.7	2	91.2	11667.9
(1500,0)	1	107	11135.9	1	115.6	11164.3	2	138.4	13535.4
(500,20)	4	36.4	6050.6	4	35.4	6050	2	41.4	8176.1
(1000,20)	1	62.4	7828.3	4	75.4	7830	2	77.2	10089.4
(1500,20)	4	100.4	9466.5	4	113.4	9553.1	2	109.4	11583.3
(500,50)	4	23	4245.3	4	23	4229.9	2	26.4	5848.5
(1000,50)	4	45.4	5454.2	4	44	5409.2	2	54	7686.9
(1500,50)	4	65.4	6701.2	1	62.4	6691.2	2	73.4	8634.5
(500,80)	4	10.6	2389.3	4	10	2390.1	2	14	3703.9
(1000,80)	4	23.2	3063.9	4	18.6	3018	2	30	5137.5
(1500,80)	1	24.6	3970.1	1	28	3940.5	2	42.8	5863.1

Table 4.26: Comparison of heuristic variations for different traffic patterns in the EON network using the 10-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	11.6	9399.4	4	11.6	9399.4	4	14.4	11937.2
(1000,0)	4	22.4	10131	4	22.4	10131	4	26.4	12489.4
(1500,0)	4	35	10744.4	4	35	10744.4	4	39.2	13109.1
(500,20)	4	10.2	7913.6	4	10.2	7913.6	2	11.8	10091.7
(1000,20)	1	17.6	8524.3	1	17.6	8524.3	4	22.2	10781.7
(1500,20)	1	25.4	9063.1	1	25.4	9063.1	4	29.8	11291.8
(500,50)	4	6.6	5362.8	4	6.6	5362.8	2	7.6	7086.6
(1000,50)	4	11.4	5829.9	4	11.4	5829.9	2	14.8	8115.8
(1500,50)	1	17.6	6432	1	17.6	6432	4	19.6	8502.2
(500,80)	1	3.6	2805.4	1	3.6	2805.4	2	3.2	4053.3
(1000,80)	4	6.4	3239.7	4	6.4	3239.7	2	6	5324.8
(1500,80)	4	7.6	3754.4	4	9.2	3825.2	2	9.8	5662.6

Table 4.27: Comparison of heuristic variations for different traffic patterns in the EON network using the 40-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	No bifurcation			Fiber bifurcation			All bifurcation		
	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}	Best policy	F_{opt}	Weighted port count @ F_{opt}
(500,0)	4	4	8731.1	4	4	8731.1	2	8.6	23211.8
(1000,0)	4	6.4	10999	4	6.4	10999	2	12	26302.7
(1500,0)	1	9.6	12495.4	1	9.6	12495.4	2	14.8	27574.3
(500,20)	4	3	7169.7	4	3	7169.7	2	6.8	18803.8
(1000,20)	1	5	9078.7	1	5	9078.7	2	10.6	21683.3
(1500,20)	4	8	10358.3	4	8	10358.3	2	12.4	22723.9
(500,50)	4	2.8	4841.3	4	2.8	4841.3	2	5.2	11315.3
(1000,50)	4	4.2	6169.3	4	4.2	6169.3	2	7.2	14424
(1500,50)	1	5.4	6997.7	1	5.4	6997.7	2	8.2	16071.9
(500,80)	4	1.2	2553	4	1.2	2553	2	2.6	5735.3
(1000,80)	4	2.6	3223.5	4	2.6	3223.5	2	3.4	7652.8
(1500,80)	1	3.4	3710.4	1	3.4	3710.4	2	5.1	10186.3

Table 4.28: The winning C - W - B combination that leads to the minimal weighted port count in the fiber-plentiful situation as the traffic pattern and topology change.

Traffic pattern: (IN Gb/s, FR %)	8-node network	NSF network	EON network
(500,0)	10-4-4	10-4-4	10-4-4
(1000,0)	10-4-4	10-4-4	10-4-4
(1500,0)	10-4-4	10-4-4	10-8-8
(500,20)	10-4-4	10-4-4	10-4-4
(1000,20)	10-4-4	10-4-4	10-4-4
(1500,20)	10-4-4	10-8-8	10-8-8
(500,50)	10-4-4	10-4-4	10-4-4
(1000,50)	10-4-4	10-4-4	10-4-4
(1500,50)	10-8-8	10-8-8	10-8-8
(500,80)	10-4-4	10-4-4	10-4-4
(1000,80)	10-4-4	10-4-4	10-4-4
(1500,80)	10-8-8	10-8-8	40-8-8

Chapter 5

Planning of GMPLS-Based Transport Networks with Conversion and Regeneration Capabilities

5.1 Introduction

The focus of this chapter is on planning the GMPLS-based transport network with the consideration of the color conversion capability and both with and without the optical signal regeneration capability. This means that the RMGPA problem here has to exclude the color-continuity constraints and either include or exclude the optical-reach constraints. Therefore, either clear or unclear paths are required for fiber, waveband, wavelength, and sub-wavelength demands. In this chapter, we will deal with three versions of the RMGPA problem that are explained as follows:

- *RMGPA problem without color-continuity or optical-reach constraints.* This version deals with the planning of the GMPLS-based transport network with the color conversion capability and without the optical signal regeneration capability. This version fits the planning problem in metro core transport networks, especially when fiber resources are scarce. The exact solution to this version of the problem can be obtained by formulating the problem as an MILP model.
- *RMGPA problem without color-continuity constraints, with optical-reach constraints, and without customizing the optical reach of clear paths.* This version deals with the planning of GMPLS-based transport networks with both the color conversion and optical signal regeneration capabilities. In addition, all EXC ports, which launch and terminate clear paths, have the same optical reach, and the lengths of all clear paths must be within a given maximum optical reach. In other words, the E/O ratio here is the same for all EXC ports of the identical GMPLS interface type, and the

ratio will be independent of the actual length of its clear path. This version fits the planning problem in long-haul transport networks. The exact solution to this version of the problem requires formulating the problem as an MILP model.

- *RMGPA problem without color-continuity constraints, with optical-reach constraints, and with customizing the optical reach of clear paths:* This version deals with the planning of GMPLS-based transport networks with both the color conversion and optical signal regeneration capabilities. In addition, the optical reach of each EXC port is customized based on the actual length of its clear path, although the lengths of all clear paths must still be within a given maximum optical reach value. In other words, the cost of the EXC port here will be a function of the actual length of its clear path. This version fits the planning problem in long-haul transport networks in which the selection of the transponders at the transport node is possible based on a variety of fine optical reach values. Using the reach-customization notion, the exact solution to this version of the problem can be obtained by formulating the problem as an NLP model.

This chapter proceeds with the MILP and NLP formulations of the afore-mentioned versions of the RMGPA problem. Then, the algorithms of the proposed heuristic approaches used to solve the three versions of the RMGPA problem are explained. Afterword, numerical results are presented in terms of the following: (1) the verification of heuristics, (2) demonstrations of the impact of input parameters and certain solution enhancements, and (3) comparisons of heuristics via simulation.

5.2 MILP Formulation

To achieve the optimum solution to the RMGPA problem without the color-continuity constraints, with/without the optical-reach constraints, and without customizing the optical reach

of clear paths, the problem will be formulated as an MILP model. The formulation proceeds as follows [NaMo08a][NaMo08b].

Parameters and Sets:

In addition to the parameters and sets defined in Chapter 4, other new parameters that we need in order to formulate the new versions of the RMGPA problem are the following:

- d_{ij} is the distance between node i and node j .
- R_{max} is the maximum optical reach.

Optimization Variables:

In addition to the optimization variables defined in Chapter 4, the following new variables are introduced:

- $\varphi_{p,k,b,f}^{sd,ij} / \phi_{p,b,f}^{sd,ij} / \phi_{p,f}^{sd,ij}$ is a binary variable that represents the amount of wavelength/ waveband/fiber flow of the s - d pair that is carried on the virtual link $VW_{f,b,k}^{ij,p} / VB_{f,b}^{ij,p} / VF_f^{ij,p}$.

Objective:

Minimize the total weighted port count in the GMPLS-based transport network:

Objective function in Equation 4.1

If the RMGPA problem considers the optical-reach constraints, then the E/O ratio will be a function of the maximum optical reach by using Equation 3.1. Accordingly, substituting Equation 3.1 into Equation 4.1 yields:

$$\min \left(\begin{array}{c} cf \cdot \sum_i FXC_i + cb \cdot \sum_i BXC_i + cw \cdot \sum_i WXC_i + \\ \text{RATIO}_{1000} \times 1.25^{\log_2 \left(\frac{R_{max}}{1000} \right)} \cdot \left(cf \cdot \sum_i (FSCO_i + FSCI_i) + cb \cdot \sum_i (BSCO_i + BSCI_i) + cw \cdot \sum_i (WSCO_i + WSCI_i) \right) \end{array} \right) \quad (5.1)$$

Constraints:

Subject to:

1) Port configurations at all switching stages of the GMPLS-based transport node:

Inequalities in Equations 4.2-4.10

2) WXC add and drop ports (refer to Fig. 4.1) are decided by the endpoints of the CWS-based virtual links needed to handle both wavelength and sub-wavelength demands; BXC/FXC add and drop ports are decided by the endpoints of the CBS/CFS-based virtual links. Adding and dropping virtual links here stem not only from add/drop demands, but also from color conversion and/or signal regeneration:

$$WA_s = \sum_{j \neq s} \sum_{m \neq s} \sum_p \sum_f \sum_b \sum_k (\gamma_{sm}^{sj,p} \cdot VS_{f,b,k}^{sj,p} + \gamma_{sm}^{sj,p} \cdot VW_{f,b,k}^{sj,p}) \quad \forall s \quad (5.2)$$

$$WA_s = \sum_{j \neq s} \sum_p \sum_f \sum_b \sum_k (VS_{f,b,k}^{sj,p} + VW_{f,b,k}^{sj,p}) \quad \forall s \quad (5.3)$$

$$WD_d = \sum_{i \neq d} \sum_{n \neq d} \sum_p \sum_f \sum_b \sum_k (\gamma_{nd}^{id,p} \cdot VS_{f,b,k}^{id,p} + \gamma_{nd}^{id,p} \cdot VW_{f,b,k}^{id,p}) \quad \forall d \quad (5.4)$$

$$WD_d = \sum_{i \neq d} \sum_p \sum_f \sum_b \sum_k (VS_{f,b,k}^{id,p} + VW_{f,b,k}^{id,p}) \quad \forall d \quad (5.5)$$

$$BA_s = \sum_{j \neq s} \sum_{m \neq s} \sum_p \sum_f \sum_b (\gamma_{sm}^{sj,p} \cdot VB_{f,b}^{sj,p}) \quad \forall s \quad (5.6)$$

$$BA_s \geq \sum_{d \neq s} \Lambda_{sd}^2 \quad \forall s \quad (5.7)$$

$$BD_d = \sum_{i \neq d} \sum_{n \neq d} \sum_p \sum_f \sum_b (\gamma_{nd}^{id,p} \cdot VB_{f,b}^{id,p}) \quad \forall d \quad (5.8)$$

$$BD_d \geq \sum_{s \neq d} \Lambda_{sd}^2 \quad \forall d \quad (5.9)$$

$$FA_s = \sum_j^{j \neq s} \sum_m \sum_p \sum_f (\gamma_{sm}^{sj,p} \cdot VF_f^{sj,p}) \quad \forall s \quad (5.10)$$

$$FA_s \geq \sum_d^{d \neq s} \Lambda_{sd}^3 \quad \forall s \quad (5.11)$$

$$FD_d = \sum_i^{i \neq d} \sum_n \sum_p \sum_f (\gamma_{nd}^{id,p} \cdot VF_f^{id,p}) \quad \forall d \quad (5.12)$$

$$FD_d \geq \sum_s^{s \neq d} \Lambda_{sd}^3 \quad \forall d \quad (5.13)$$

3) The multi-granular virtual topology must accommodate all multi-granularity traffic demands:

$$\sum_j^{j \neq s} \sum_p \sum_f \sum_b \sum_k \varphi_{p,k,b,f}^{sd,sj} = \Lambda_{sd}^0 \quad \forall s, d \mid s \neq d \quad (5.14)$$

$$\sum_i^{i \neq d} \sum_p \sum_f \sum_b \sum_k \varphi_{p,k,b,f}^{sd,id} = \Lambda_{sd}^0 \quad \forall s, d \mid s \neq d \quad (5.15)$$

$$\sum_j^{j \neq s} \sum_p \sum_f \sum_b \sum_k \varphi_{p,k,b,f}^{sd,sj} = \Lambda_{sd}^1 \quad \forall s, d \mid s \neq d \quad (5.16)$$

$$\sum_i^{i \neq d} \sum_p \sum_f \sum_b \sum_k \varphi_{p,k,b,f}^{sd,id} = \Lambda_{sd}^1 \quad \forall s, d \mid s \neq d \quad (5.17)$$

$$\sum_j^{j \neq s} \sum_p \sum_f \sum_b \varphi_{p,b,f}^{sd,sj} = \Lambda_{sd}^2 \quad \forall s, d \mid s \neq d \quad (5.18)$$

$$\sum_i^{i \neq d} \sum_p \sum_f \sum_b \varphi_{p,b,f}^{sd,id} = \Lambda_{sd}^2 \quad \forall s, d \mid s \neq d \quad (5.19)$$

$$\sum_j^{j \neq s} \sum_p \sum_f \varphi_{p,f}^{sd,sj} = \Lambda_{sd}^3 \quad \forall s, d \mid s \neq d \quad (5.20)$$

$$\sum_i^{i \neq d} \sum_p \sum_f \varphi_{p,f}^{sd,id} = \Lambda_{sd}^3 \quad \forall s, d \mid s \neq d \quad (5.21)$$

4) The summation of flows at any virtual link must not exceed its capacity:

$$\sum_s \sum_{d \neq s} \phi_{p,k,b,f}^{sd,ij} \leq VS_{f,b,k}^{ij,p} \cdot C \quad \forall p, f, b, k, i, j | i \neq j \quad (5.22)$$

$$\sum_s \sum_{d \neq s} \phi_{p,k,b,f}^{sd,ij} = VW_{f,b,k}^{ij,p} \quad \forall p, f, b, k, i, j | i \neq j \quad (5.23)$$

$$\sum_s \sum_{d \neq s} \phi_{p,b,f}^{sd,ij} = VB_{f,b}^{ij,p} \quad \forall p, f, b, i, j | i \neq j \quad (5.24)$$

$$\sum_s \sum_{d \neq s} \phi_{p,f}^{sd,ij} = VF_f^{ij,p} \quad \forall p, f, i, j | i \neq j \quad (5.25)$$

5) A pass-through CWS/CBS-based virtual link at each intermediate node can be switched at the 'BXC or WXC'/BXC for degrouping and grouping purposes; otherwise, it is switched at the FXC:

$$SPT_{f,b,k}^{sd,p,i,mn} + SBPT_{f,b,k}^{sd,p,i,mn} + SFPT_{f,b,k}^{sd,p,i,mn} = VS_{f,b,k}^{sd,p} \quad (5.26)$$

$$\forall k, b, f, p, i, j, m, n, s, d | s \neq d \neq i, m \neq d, n \neq s, m \neq n, \gamma_{in}^{sd,p} = 1, \gamma_{ni}^{sd,p} = 1$$

$$WPT_{f,b,k}^{sd,p,i,mn} + WBPT_{f,b,k}^{sd,p,i,mn} + WFPT_{f,b,k}^{sd,p,i,mn} = VW_{f,b,k}^{sd,p} \quad (5.27)$$

$$\forall k, b, f, p, i, j, m, n, s, d | s \neq d \neq i, m \neq d, n \neq s, m \neq n, \gamma_{in}^{sd,p} = 1, \gamma_{ni}^{sd,p} = 1$$

$$BPT_{f,b}^{sd,p,i,mn} + BFPT_{f,b}^{sd,p,i,mn} = VB_{f,b}^{sd,p} \quad (5.28)$$

$$\forall b, f, p, i, j, m, n, s, d | s \neq d \neq i, m \neq d, n \neq s, m \neq n, \gamma_{in}^{sd,p} = 1, \gamma_{ni}^{sd,p} = 1$$

6) Pass-through flow conservation must be ensured at each node in the multi-granular virtual topology:

$$\sum_{i \neq m} \sum_j \sum_p \sum_f \sum_b \sum_k (\phi_{p,k,b,f}^{sd,im} - \phi_{p,k,b,f}^{sd,mj}) = 0 \quad \forall m, s, d | \Lambda_{sd}^0 > 0, m \neq s \neq d \quad (5.29)$$

$$\sum_{i \neq m} \sum_j \sum_p \sum_f \sum_b \sum_k (\phi_{p,k,b,f}^{sd,im} - \phi_{p,k,b,f}^{sd,mj}) = 0 \quad \forall m, s, d | \Lambda_{sd}^1 > 0, m \neq s \neq d \quad (5.30)$$

$$\sum_{i \neq m} \sum_j \sum_p \sum_f \sum_b (\phi_{p,b,f}^{sd,im} - \phi_{p,b,f}^{sd,mj}) = 0 \quad \forall m, s, d | \Lambda_{sd}^2 > 0, m \neq s \neq d \quad (5.31)$$

$$\sum_{i \neq m} \sum_{j \neq m} \sum_p \sum_f (\varphi_{p,f}^{sd,im} - \varphi_{p,f}^{sd,mj}) = 0 \quad \forall m, s, d \mid \Lambda_{sd}^3 > 0, m \neq s \neq d \quad (5.32)$$

7) WXC/BXC/FXC non-add and non-drop ports (refer to Fig. 4.1) are decided based on add, drop, and pass-through virtual links in a way that ensures a non-blocking architecture at all optical switching stages:

$$\begin{aligned} wo_i^{n,f,b,k} &= \sum_{d \neq i} \sum_p (\gamma_{in}^{id,p} \cdot VW_{f,b,k}^{id,p} + \gamma_{in}^{id,p} \cdot VS_{f,b,k}^{id,p}) + \\ &\sum_{s \neq n} \sum_{d \neq s} \sum_{m \neq n} \sum_{p \neq d} (\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot WPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SPT_{f,b,k}^{sd,p,i,mn}) \end{aligned} \quad (5.33)$$

$$\forall i, n, f, b, k \mid i \neq n, \delta_{in} > 0$$

$$WO_i = \sum_n \sum_f \sum_b \sum_k (\delta_{in} \cdot wo_i^{n,f,b,k}) \quad \forall i \quad (5.34)$$

$$wb_i^{n,f,b} \geq \sum_k \left(\frac{wo_i^{n,f,b,k}}{W} \right) \quad \forall i, n, f, b \mid i \neq n, \delta_{in} > 0 \quad (5.35)$$

$$WB_i = \sum_n \sum_f \sum_b (\delta_{in} \cdot wb_i^{n,f,b}) \quad \forall i \quad (5.36)$$

$$\begin{aligned} wi_i^{m,f,b,k} &= \sum_{s \neq i} \sum_p (\gamma_{mi}^{si,p} \cdot VW_{f,b,k}^{si,p} + \gamma_{mi}^{si,p} \cdot VS_{f,b,k}^{si,p}) + \\ &\sum_{s \neq d} \sum_{d \neq m} \sum_{i \neq n} \sum_{p \neq m} (\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot WPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SPT_{f,b,k}^{sd,p,i,mn}) \end{aligned} \quad (5.37)$$

$$\forall i, m, f, b, k \mid i \neq m, \delta_{mi} > 0$$

$$WI_i = \sum_m \sum_f \sum_b \sum_k (\delta_{mi} \cdot wi_i^{m,f,b,k}) \quad \forall i \quad (5.38)$$

$$bw_i^{m,f,b} \geq \sum_k \left(\frac{wi_i^{m,f,b,k}}{W} \right) \quad \forall i, m, f, b \mid i \neq m, \delta_{mi} > 0 \quad (5.39)$$

$$BW_i = \sum_m \sum_f \sum_b (\delta_{mi} \cdot bw_i^{m,f,b}) \quad \forall i \quad (5.40)$$

$$\begin{aligned}
bo_i^{n,f,b} &\geq \sum_d \sum_p^{d \neq i} (\gamma_{in}^{id,p} \cdot VB_{f,b}^{id,p}) + w b_i^{n,f,b} + \sum_s \sum_d^{s \neq n, d \neq s \neq i, m \neq n \neq d \neq i} \sum_m \sum_p (\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot BPT_{f,b}^{sd,p,i,mn}) + \\
&\sum_s \sum_d \sum_m \sum_p^{s \neq n, d \neq s \neq i, m \neq n \neq d \neq i} \frac{(\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot WBPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SBPT_{f,b,k}^{sd,p,i,mn})}{W} \\
&\forall i, n, f, b \mid i \neq n, \delta_{in} > 0
\end{aligned} \tag{5.41}$$

$$BO_i = \sum_n \sum_f \sum_b^{n \neq i} (\delta_{in} \cdot bo_i^{n,f,b}) \forall i \tag{5.42}$$

$$bf_i^{n,f} \geq \sum_b \left(\frac{bo_i^{n,f,b}}{B} \right) \forall i, n, f \mid i \neq n, \delta_{in} > 0 \tag{5.43}$$

$$BF_i = \sum_n \sum_f^{n \neq i} (\delta_{in} \cdot bf_i^{n,f}) \forall i \tag{5.44}$$

$$\begin{aligned}
bi_i^{m,f,b} &= \sum_s \sum_p^{s \neq i} (\gamma_{mi}^{si,p} \cdot VB_{f,b}^{si,p}) + b w_i^{m,f,b} + \sum_s \sum_d^{s \neq d \neq i, d \neq m \neq i, n \neq m \neq s} \sum_n \sum_p (\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot BPT_{f,b}^{sd,p,i,mn}) + \\
&\sum_s \sum_d \sum_n \sum_p^{s \neq d \neq i, d \neq m \neq i, n \neq m \neq s} \frac{(\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot WBPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SBPT_{f,b,k}^{sd,p,i,mn})}{W} \\
&\forall i, m, f, b \mid i \neq m, \delta_{mi} > 0
\end{aligned} \tag{5.45}$$

$$BI_i = \sum_m \sum_f \sum_b^{m \neq i} (\delta_{mi} \cdot bi_i^{m,f,b}) \forall i \tag{5.46}$$

$$fb_i^{m,f} \geq \sum_b \left(\frac{bi_i^{m,f,b}}{B} \right) \forall i, m, f \mid i \neq m, \delta_{mi} > 0 \tag{5.47}$$

$$FB_i = \sum_m \sum_f^{m \neq i} (\delta_{mi} \cdot fb_i^{m,f}) \forall i \tag{5.48}$$

$$\begin{aligned}
fo_i^{n,f} &\geq \sum_d \sum_p^{d \neq i} (\gamma_{in}^{id,p} \cdot VF_f^{id,p}) + b f_i^{n,f} + \sum_s \sum_d^{s \neq n, d \neq s \neq i, m \neq n \neq d \neq i} \sum_m \sum_p (\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot VF_f^{sd,p}) + \\
&\sum_s \sum_d \sum_m \sum_p^{s \neq n, d \neq s \neq i, m \neq n \neq d \neq i} \frac{(\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot BFPT_{f,b}^{sd,p,i,mn})}{B} + \\
&\sum_s \sum_d \sum_m \sum_p^{s \neq n, d \neq s \neq i, m \neq n \neq d \neq i} \frac{(\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot WFPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SFPT_{f,b,k}^{sd,p,i,mn})}{W \cdot B} \\
&\forall i, n, f \mid i \neq n, \delta_{in} > 0
\end{aligned} \tag{5.49}$$

$$FO_i = \sum_n \sum_f^{n \neq i} (\delta_{in} \cdot fo_i^{n,f}) \forall i \tag{5.50}$$

$$\begin{aligned}
f_i^{m,f} \geq & \sum_s \sum_p^{s \neq i} (\gamma_{mi}^{si,p} \cdot VF_f^{si,p}) + f_i^{m,f} + \sum_s \sum_d^{s \neq d \neq i \neq m \neq n \neq m \neq s} \sum_n \sum_p (\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot VF_f^{sd,p}) + \\
& \sum_s \sum_d^{s \neq d \neq i \neq m \neq n \neq m \neq s} \sum_n \sum_p \frac{(\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot BFPT_{f,b}^{sd,p,i,mn})}{B} + \\
& \sum_s \sum_d^{s \neq d \neq i \neq m \neq n \neq m \neq s} \sum_n \sum_p \frac{(\gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot WFPT_{f,b,k}^{sd,p,i,mn} + \gamma_{mi}^{sd,p} \cdot \gamma_{in}^{sd,p} \cdot SFPT_{f,b,k}^{sd,p,i,mn})}{W \cdot B}
\end{aligned} \tag{5.51}$$

$$\forall i, m, f \mid i \neq m, \delta_{mi} > 0$$

$$FI_i = \sum_m \sum_f^{m \neq i} (\delta_{mi} \cdot f_i^{m,f}) \quad \forall i \tag{5.52}$$

8) Port count conservation must be ensured at all optical switching stages:

Inequalities in Equations 4.53-4.55

9) The length of the CWS/CBS/CFS-based virtual link must be within the maximum optical reach value (note that these constraints will be excluded from the MILP formulation if the optical signal regeneration capability is not considered):

$$\sum_i \sum_j^{j \neq i} (\gamma_{ij}^{sd,p} \cdot d_{ij} \cdot VS_{f,b,k}^{sd,p}) \leq R_{\max} \quad \forall s, d, f, b, k, p \mid s \neq d \tag{5.53}$$

$$\sum_i \sum_j^{j \neq i} (\gamma_{ij}^{sd,p} \cdot d_{ij} \cdot VW_{f,b,k}^{sd,p}) \leq R_{\max} \quad \forall s, d, f, b, k, p \mid s \neq d \tag{5.54}$$

$$\sum_i \sum_j^{j \neq i} (\gamma_{ij}^{sd,p} \cdot d_{ij} \cdot VB_{f,b}^{sd,p}) \leq R_{\max} \quad \forall s, d, f, b, p \mid s \neq d \tag{5.55}$$

$$\sum_i \sum_j^{j \neq i} (\gamma_{ij}^{sd,p} \cdot d_{ij} \cdot VF_f^{sd,p}) \leq R_{\max} \quad \forall s, d, f, p \mid s \neq d \tag{5.56}$$

5.3 NLP Formulation

To achieve the optimum solution to the RMGPA problem without the color-continuity constraints, with the optical-reach constraints, and with the customization of the optical reach of

clear paths, the problem will be formulated as an NLP model. The NLP model consists of a non-linear objective function and linear constraints. The formulation proceeds as follows.

Parameters, Sets, and Optimization Variables:

Parameters, sets, and optimization variables are the same as those used in the MILP formulation.

Objective:

Minimize the total weighted port count in the GMPLS-based transport network. Here, Equation 3.1 is used to determine the weighted port count of the EXC segment, as follows. The cost of the FSC/BSC/LSC-based EXC port relative to the cost of the FXC/BXC/WXC-based MG-OXC port is a function of the CFS/CBS/CWS-based virtual link length:

$$\min \left(\begin{aligned} & cf \cdot \sum_i FXC_i + cb \cdot \sum_i BXC_i + cw \cdot \sum_i WXC_i + \\ & 2 \times \text{RATIO}_{1000} \cdot \left(\begin{aligned} & cf \cdot \sum_{s,d,f,p}^{s \neq d} 1.25 \left(\log_2 \left(\frac{\sum_{i,j}^{i \neq j} (\gamma_{ij}^{sd,p} \cdot d_{ij} \cdot VF_{f,p}^{sd,p})}{1000} \right) \right) + \\ & cb \cdot \sum_{s,d,f,b,p}^{s \neq d} 1.25 \left(\log_2 \left(\frac{\sum_{i,j}^{i \neq j} (\gamma_{ij}^{sd,p} \cdot d_{ij} \cdot VB_{f,b}^{sd,p})}{1000} \right) \right) + \\ & cw \cdot \sum_{s,d,f,b,k,p}^{s \neq d} 1.25 \left(\log_2 \left(\frac{\sum_{i,j}^{i \neq j} (\gamma_{ij}^{sd,p} \cdot d_{ij} \cdot VW_{f,b,k}^{sd,p})}{1000} \right) \right) + \\ & 1.25 \left(\log_2 \left(\frac{\sum_{i,j}^{i \neq j} (\gamma_{ij}^{sd,p} \cdot d_{ij} \cdot VS_{f,b,k}^{sd,p})}{1000} \right) \right) \end{aligned} \right) \end{aligned} \right) \quad (5.57)$$

Constraints:

Subject to Constraints 1-9 used in the previous MILP formulation.

5.4 Heuristic Approach

The computational complexity of the MILP and NLP models calls for the use of heuristics to solve the problem sub-optimally in a reasonable amount of time. A high-level view of the approach to be taken to solve the three versions of the RMGPA problem heuristically is shown in Fig. 5.1. The heuristic approach consists of two phases. The task of the first phase is to build the multi-granular virtual topology. The tasks of the second phase, which we call the adjustment phase, are (1) to decrease the port count of the pass-through segments of the built virtual links; and (2) to customize the optical reach of EXC ports based on the length of their virtual links, if the optical-reach customization is considered. Both phases are explained respectively as follows.

Fig. 5.1: A high-level view of the heuristic approach proposed to solve the RMGPA problem without the color-continuity constraints, with/without the optical-reach constraints, and with/without customizing the optical reach.

The objective of the first phase is to build a multi-granular virtual topology that can accommodate all traffic demands with the lowest weighted port count. In this phase, clear and unclear paths will be assigned to fiber, waveband, wavelength, and sub-wavelength demands. The sequence in which s - d pairs are served needs to follow a certain policy. In addition to the four sorting policies adopted in Chapter 4, here we add two distance-based sorting policies that will be used if the optical-reach

constraints are considered in the RMGPA problem, and they are explained as follows. In Policy 5/6, s - d pairs are sorted in the decreasing/increasing order of their shortest route lengths, which are obtained via Dijkstra's algorithm using the distance as a cost metric. The multi-granular virtual topology is constructed using the following algorithm [NaMo07b][NaMo07c][NaMo07e][NaMo07f]:

Multi-Granular Virtual Topology Algorithm;

Input: Network physical topology, adjusted multi-granularity traffic demands, C, W, B, F, R_{max} , MG-OXC port weights, EXC port weights (obtained from Equation 3.1)

Output: Sub-optimum multi-granular virtual topology

Begin

1. Initialization:

- For all nodes, mark all WXC/BXC/FXC add, drop, input, and output ports as unused; a WXC add/output port is designated as <wavelength k , waveband b , fiber f , next destination node>; a WXC drop/input port is designated as <wavelength k , waveband b , fiber f , arriving from node>; a BXC add/output port is designated as <waveband b , fiber f , next destination node>; a BXC drop/input port is designated as <waveband b , fiber f , arriving from node>; a FXC add/output port is designated as <fiber f , next destination node>; a FXC drop/input port is designated as <fiber f , arriving from node>
- For all nodes, mark all EXC output and input ports as unused; a LSC output/input port is designated as <wavelength k , waveband b , fiber f , 'next destination'/'arriving from' node>; a BSC output/input port is designated as <waveband b , fiber f , 'next destination'/'arriving from' node>; a FSC output/input port is designated as <fiber f , 'next destination'/'arriving from' node>

2. Fiber-Switched Path Assignment:

- Let $M = \{m_0, m_1, \dots\}$ be a set of unserved fiber demands whose traffic $\neq 0$
- While ($M \neq \emptyset$)
 - {
 - Order unserved fiber demands in M according to the sorting policy used
 - Set served demand = fiber demand, Λ_{sd}^3 , at the top of the sorted list, which is the element m_0 of M
 - Set $D=1$, if fiber demand bifurcation is allowed; otherwise, set $D =$ served demand
 - While (served demand $\neq 0$)

{

- Evaluate the cost of all physical links according to the availability of fibers along the physical link; $link\ cost = 1$ if the remaining unused fibers $\geq D$, otherwise $link\ cost = \infty$
- Find all possible physical routes for the served demand using the All Distinct Routes algorithm
- For every eligible physical route, perform the following for every unit of the served demand:

{

- Try to choose the color (fiber index) that ensures color-continuity along the whole route using the First-Fit color assignment scheme. If a color that satisfies the color-continuity constraint exists and the optical-reach constraint is considered, then check whether signal regeneration is required along the route. Signal regeneration is needed if the distance summation of consecutive route spans $> R_{max}$. If regeneration is needed, then the unit of the served fiber demand will use an UFS path that consists of a concatenation of CFS paths; otherwise, the unit of the served demand will use a CFS path
- If it is not possible to satisfy the color-continuity constraint, then the color assignment will be done at each route span using the First-Fit color assignment scheme. The need for color conversion means that the unit of the served demand will use an UFS path that consists of a concatenation of CFS paths. If the optical-reach constraint is considered, then entering the OEO domain conversion process for the purpose of color conversion is an opportunity to refresh the reach of the optical signal. Also, check whether signal regeneration is required along the CFS paths that constitute the UFS path. If regeneration is required, then a CFS path will be broken into further CFS paths

}

- If there is no feasible route, then end the algorithm
- Evaluate the incremental port count requirement for all feasible routes; the incremental port count for a feasible eligible route is the summation of all unused FXC and EXC ports needed by all units of the served demand along the route, but these ports will not be marked as used at this step
- Choose the candidate route that incurs the lowest incremental port count
- Along the best route, update the residual fiber resources and mark the required FXC and EXC ports as used

- Create CFS-based virtual link(s) along the best route of the s - d pair served; the virtual link attributes are the best sub-route/route and the color used along the sub-route/route
 - Set $\text{served demand} = \text{served demand} - D$
- }
- Remove m_0 from M
- }

3. Waveband-Switched Path Assignment:

- Let $M = \{m_0, m_1, \dots\}$ be a set of unserved waveband demands whose traffic $\neq 0$
- While ($M \neq \emptyset$)
 - {
 - Order unserved waveband demands in M according to the sorting policy used
 - Set $\text{served demand} = \text{waveband demand}, \Lambda_{sd}^2$, at the top of the sorted list
 - Set $D=1$, if waveband demand bifurcation is allowed; otherwise, set $D = \text{served demand}$
 - While ($\text{served demand} \neq 0$)
 - {
 - Evaluate the cost of all physical links according to the availability of wavebands along the physical link; $\text{link cost} = 1$ if the remaining unused wavebands $\geq D$, otherwise $\text{link cost} = \infty$
 - Find all possible physical routes for the served demand using the All Distinct Routes algorithm
 - For every eligible physical route, perform the following for every unit of the served demand:
 - {
 - Try to choose the color (the combination of waveband and fiber indices) that ensures color-continuity along the whole route using the First-Fit color assignment scheme. If a color that satisfies the color-continuity constraint exists and the optical-reach constraint is considered, then check whether signal regeneration is required along the route. If regeneration is needed, then the unit of the served waveband demand will use an UBS path that consists of a concatenation of CBS paths; otherwise, the unit of the served demand will use a CBS path
 - If it is not possible to satisfy the color-continuity constraint, then the color assignment will be done at each route span using the First-Fit color assignment scheme. The need for color conversion means that the unit of the served demand

will use an UBS path that consists of a concatenation of CBS paths. If the optical-reach constraint is considered, then check whether signal regeneration is required along the CBS paths that constitute the UBS path. If regeneration is required, then a CBS path will be broken into further CBS paths

}

- If there is no feasible route, then end the algorithm
- Evaluate the worst incremental port count requirement for all feasible routes; the incremental port count for a feasible eligible route is the summation of all unused FXC, BXC, and EXC ports needed by all units of the served demand along the route. The worst scenario for deciding the unused ports is based on the fact that a waveband-switched path at an intermediate node can be (1) switched at the FXC if the fiber utilization at both the incoming and outgoing links is zero and there are no further add/drop waveband/wavelength/sub-wavelength demands at this intermediate node, or (2) switched at the BXC otherwise
- Choose the candidate route that incurs the lowest incremental port count
- Along the best route, update the residual waveband resources and mark the required FXC, BXC, and EXC ports as used
- Create CBS-based virtual link(s) along the best route of the s - d pair served
- Set $served\ demand = served\ demand - D$

}

- Remove m_0 from M

}

4. Wavelength-Switched Path Assignment:

- Let $M = \{m_0, m_1, \dots\}$ be a set of unserved wavelength demands whose traffic $\neq 0$
- While ($M \neq \emptyset$)
 - {
 - Order unserved wavelength demands in M according to the sorting policy used
 - Set served demand = wavelength demand, Λ_{sd}^1 , on the top of the sorted list
 - Set $D=1$, if wavelength demand bifurcation is allowed; otherwise, set $D = served\ demand$
 - While (served demand $\neq 0$)
 - {
 - Evaluate the cost of all physical links according to the availability of wavelengths along the physical link; $link\ cost = 1$ if the remaining unused wavelengths $\geq D$, otherwise $link\ cost = \infty$

- Find all possible physical routes for the served demand using the All Distinct Routes algorithm
- For every eligible physical route, perform the following for every unit of the served demand:
 - {
 - Try to choose the color (the combination of wavelength, waveband, and fiber indices) that ensures color-continuity along the whole route using the First-Fit color assignment scheme. If a color that satisfies the color-continuity constraint exists and the optical-reach constraint is considered, then check whether signal regeneration is required along the route. If regeneration is needed, then the unit of the served wavelength demand will use an UWS path that consists of a concatenation of CWS paths; otherwise, the unit of the served demand will use a CWS path
 - If it is not possible to satisfy the color-continuity constraint, then the color assignment will be done at each route span using the First-Fit color assignment scheme. The need for color conversion means that the unit of the served demand will use an UWS path that consists of a concatenation of CWS paths. If the optical-reach constraint is considered, then check whether signal regeneration is required along the CWS paths that constitute the UWS path. If regeneration is required, then a CWS path will be broken into further CWS paths
 - }
- If there is no feasible route, then end the algorithm
- Evaluate the worst incremental port count requirement for all feasible routes; the incremental port count for a feasible eligible route is the summation of all unused FXC, BXC, WXC, and EXC ports needed by all units of the served demand along the route. The worst scenario for deciding the unused ports is based on the fact that a wavelength-switched path at an intermediate node can be (1) switched at the FXC if the fiber and waveband utilization at both the incoming and outgoing links is zero and there are no further add/drop wavelength/sub-wavelength demands at this intermediate node, (2) switched at the BXC if the waveband utilization at both the incoming and outgoing links is zero and there are no further add/drop wavelength/sub-wavelength demands at this intermediate node, or (3) switched at the WXC otherwise
- Choose the candidate route that incurs the lowest incremental port count

- Along the best route, update the residual wavelength resources and mark the required FXC, BXC, WXC, and EXC ports as used
- Create CWS-based virtual link(s) along the best route of the s-d pair served
- Set *served demand* = *served demand* - *D*

}

- Remove m_0 from M

}

5. Sub-Wavelength-Switched Path Assignment:

- Let $M = \{m_0, m_1, \dots\}$ be a set of unserved sub-wavelength demands whose traffic $\neq 0$
- While ($M \neq \emptyset$)
 - {
 - Order unserved sub-wavelength demands in M according to the sorting policy used
 - Set *served demand* = sub-wavelength demand, Λ_{sd}^0 , at the top of the sorted list
 - Set $D=1$, if sub-wavelength demand bifurcation is allowed; otherwise, set $D = \text{served demand}$
 - While (*served demand* $\neq 0$)
 - {
 - Evaluate the cost of all CWS-based virtual links according to the availability of wavelength capacities along the physical link; *link cost* = 1 if the remaining wavelength capacity $\geq D$, otherwise *link cost* = ∞
 - Find the shortest virtual route over the existing CWS-based virtual topology via Dijkstra's algorithm using the number of virtual hops as a cost metric
 - If a virtual route exists (which means that there is an UWS path and no new ports are required)
 - {
 - Update the residual wavelength-capacity resources along the best path
 - Set *served demand* = *served demand* - D
 - Else (which means that there is a need to build a CWS/UWS path and new ports are required)
 - {
 - Evaluate the cost of all physical links according to the availability of wavelengths along the physical link; *link cost* = 1 if the remaining unused wavelengths ≥ 1 , otherwise *link cost* = ∞

- Find all possible physical routes for the served demand using the All Distinct Routes algorithm
- For every eligible physical route, perform the following:
 - {
 - ◆ Try to choose the color (the combination of wavelength, waveband, and fiber indices) that ensures color-continuity along the whole route using the First-Fit color assignment scheme. If a color that satisfies the color-continuity constraint exists and the optical-reach constraint is considered, then check whether signal regeneration is required along the route. If regeneration is needed, then the served demand will use an UWS path that consists of a concatenation of CWS paths; otherwise, the served demand will use a CWS path
 - ◆ If it is not possible to satisfy the color-continuity constraint, then the color assignment will be done at each route span using the First-Fit color assignment scheme. The need for color conversion means that the served demand will use an UWS path that consists of a concatenation of CWS paths. If the optical-reach constraint is considered, then check whether signal regeneration is required along the CWS paths that constitute the UWS path. If regeneration is required, then a CWS path will be broken into further CWS paths
 - }
- If there is no feasible route, then end the algorithm
- Evaluate the worst incremental port count requirement for all feasible routes; the incremental port count for a feasible eligible route is the summation of all unused FXC, BXC, WXC, and EXC ports needed along the route. The worst scenario for deciding the unused ports is based on the fact that a wavelength-switched path at an intermediate node can be (1) switched at the FXC if the fiber and waveband utilization at both the incoming and outgoing links is zero and there are no further add/drop sub-wavelength demands at this intermediate node, (2) switched at the BXC if the waveband utilization at both the incoming and outgoing links is zero and there are no further add/drop sub-wavelength demands at this intermediate node, or (3) switched at the WXC otherwise
- Choose the candidate route that incurs the lowest incremental port count

- Along the best route, update the residual wavelength and wavelength-capacity resources and mark the required FXC, BXC, WXC, and EXC ports as used
- Create CWS-based virtual link(s) along the best route of the s - d pair served
- Set $served\ demand = served\ demand - D$

}

}

- Remove m_0 from M

}

6. If the resultant multi-granular virtual topology can handle all demands, then this virtual topology is both feasible and sub-optimum

End.

In the second phase of the heuristic, the Pass-Through Adjustment algorithm explained in Section 4.3 is used to minimize the port count of the pass-through segments of the built virtual links. If the optical-reach customization is not considered, then the resultant weighted port count of the Pass-Through Adjustment algorithm will be the final weighted port count. Otherwise, the output of the algorithm will decide the final weighted port count of all MG-OXC, whereas the final weighted port count of all EXCs will be decided by customizing the optical reach of the EXC ports according to the length of their virtual links, which are launched and terminated at these EXC ports. The Optical Reach Customization algorithm works as follows [NaMo07c]:

Optical Reach Customization Algorithm;

Input: Feasible multi-granular virtual topology, W , B , F , MG-OXC port weights (cf, cb, cw), weighted port count of all MG-OXC

Output: Sub-optimum weighted port count

Begin

1. **Initialization:** Set sub-optimum weighted port count = weighted port count of all MG-OXC
2. **For all CWS/CBS/CFS-based virtual links, do the following:**
 - Calculate the length, l , of the CFS/CBS/CWS-based virtual link

- Using Equation 3.1, set the cost of the CFS/CBS/CWS-based EXC port (the cost of one of the virtual link ends) = $cgf(l)/cgb(l)/cgw(l) = cf / cb / cw \times \text{RATIO}_{1000} \times 1.25^{\log_2(l/1000)}$
- Set sub-optimum weighted port count = sub-optimum weighted port count + $2 \times cgf(l)/cgb(l)/cgw(l)$

End.

5.5 Numerical Results and Analysis

5.5.1 Verification of the Heuristic Approach

Since the exact solution to the RMGPA problem with the consideration of the optical-reach customization requires solving a complicated NLP model that cannot be solved by the current optimization methods implemented in CPLEX software [CPLEX], here we focus only on solving the RMGPA problem without the optical-reach customization. To verify the heuristic approach, we compare its results with the results obtained from the MILP formulation. Due to the complexity of the MILP model, the optimization is conducted on a small-sized planning problem. In this subsection, we consider the 5-node sample network shown in Fig. 4.1 as a physical topology. To keep the problem computationally manageable, we use a set of a few adjusted traffic demands, as illustrated in Table 5.1. The rest of input parameters used in this subsection are as follows: $C=10$ Gb/s, $W=3$, $B=3$, $F \geq 1$, MG-OXC/EXC ports have the same weight, the ratio of EXC port weight to MG-OXC port weight is decided by Equation 3.1 with $\text{RATIO}_{1000}=2$ (i.e.

$$\frac{cgf(R_{\max})}{cf} = \frac{cgb(R_{\max})}{cb} = \frac{cgw(R_{\max})}{cw} = 2 \times (1.25)^{\log_2(R_{\max}/1000)}, \text{ and } 1000 \leq R_{\max} \leq 4000 \text{ km.}$$

Table 5.1 illustrates the solution to the RMGPA problem using both optimization methods for various traffic demand instances at different maximum optical reach values. From the table, it is clear that imposing more traffic on the network exponentially increases the problem solve time needed by CPLEX until it becomes difficult to obtain an optimum solution in a reasonable

amount of time. The solve time generally increases in proportion to the increase in the maximum optical reach value because (1) the size of the problem increases, and (2) the number of feasible solutions decreases. Accordingly, CPLEX exhaustively searches the branch-and-bound tree, which grows as the number of variables increases, in an effort to find a feasible solution. However, randomness plays a big role in speeding up the search process in finding the first feasible solution, because by finding the first feasible solution many tree nodes can be pruned. This randomness factor explains why in some higher reach values we actually obtained a shorter solve time.

In contrast, solving the RMGPA problem using the heuristic approach takes less than one second in all cases. Most importantly, the solutions produced by the heuristic approach are within ≈ 0 -10% of the MILP formulation solutions and can be accepted as good approximations of the optimum solutions. In addition, results show that allowing the bifurcation of fiber demands can improve the planning solutions.

Moreover, it is quite clear from Table 5.1 that the maximum optical reach has an optimum value that leads to a minimal weighted port count. This stems from the fact that increasing the maximum optical reach increases the cost of EXC ports and reduces the number of OEO conversions, which offsets the increase in the weighted port count. As a result, this increase leads to a crossover situation in which the minimal weighted port count occurs. It is interesting to note here that the optimum (or best) optical reach changes according to the traffic demand set. Also, beyond the optimum maximum optical reach, the “weighted” port count is expected to increase. Fig. 5.2, which is based on the solutions obtained from using the first demand set in Table 5.1, demonstrates how changing the maximum optical reach can change the resultant multi-granular virtual topology. Figs. 5.2 (b), (c), and (d) illustrate that beyond a certain reach the virtual topology will not change, and the weighted port count will increase due to the increase in the cost of EXC

ports. In other words, the “unweighted” port count remains unchanged when the problem solution yields the same virtual topology.

Table 5.1: Comparison between the results obtained using the MILP formulation and heuristic approach for the 5-node network example of solving the RMGPA problem without the color-continuity constraints, with the optical-reach constraints, and without the optical-reach customization.

# of traffic elements per granularity matrix	Adjusted traffic demands	Max. optical reach [km]	E/O ratio	F_{min}	MILP				Heuristic			
					# of constraints	# of variables	Total solve time [sec]	Weighted Port count	Total solve time [sec]	# of OEO conversions	Weighted port count	Best bifurcation scenario
1	$\Lambda_{20}^0 = 1$	1000	2	1	1214	9355	10.0156	96	0.04	3	96	No Bifurcation
	$\Lambda_{02}^1 = 1$	2000	2.5	1	1988	16144	47.7188	71	0.03	0	71	
	$\Lambda_{10}^2 = 2$	3000	2.849	1	3268	24828	650.188	74.486	0.01	0	74.486	
	$\Lambda_{03}^3 = 1$	4000	3.125	1	4458	31789	563.312	77.25	0.04	0	77.25	
1	$\Lambda_{20}^0 = 2$	1000	2	1	1019	7663	0.625	108	0.07	3	108	Bifurcating fiber demands
	$\Lambda_{34}^1 = 2$	2000	2.5	1	1988	16134	11.391	96	0.03	1	96	
	$\Lambda_{01}^2 = 2$	3000	2.849	1	3268	24848	80.359	93.880	0.07	0	93.880	
	$\Lambda_{43}^3 = 2$	4000	3.125	1	4458	31789	115.5	97.75	0.031	0	97.75	
1	$\Lambda_{32}^0 = 1$	1000	2	1	1214	9367	0.766	<u>104</u>	0.06	4	<u>112</u>	Bifurcating fiber demands
	$\Lambda_{42}^1 = 2$	2000	2.5	1	1988	16115	5.890	80	0.1	0	80	
	$\Lambda_{30}^2 = 1$	3000	2.849	1	3268	24845	693.453	84.183	0.03	0	84.183	
	$\Lambda_{14}^3 = 2$	4000	3.125	1	4458	31789	284.844	87.5	0.03	0	87.5	
1	$\Lambda_{31}^0 = 2$	1000	2	1	1214	9367	0.234	148	0.111	8	148	Bifurcating fiber demands
	$\Lambda_{12}^1 = 2$	2000	2.5	1	1988	16115	29.766	<u>108</u>	0.09	1	<u>114</u>	
	$\Lambda_{24}^2 = 2$	3000	2.849	1	3268	24845	779.672	<u>101.88</u>	0.04	0	<u>111.88</u>	
	$\Lambda_{02}^3 = 2$	4000	3.125	1	4458	31789	250.859	<u>105.75</u>	0.04	0	<u>115.75</u>	
2	$\Lambda_{20}^0 = \Lambda_{34}^0 = 2$	1000	2	1	1234	9576	35.922	<u>156</u>	0.03	5	<u>172</u>	No Bifurcation
	$\Lambda_{01}^1 = \Lambda_{43}^1 = 2$	2000	2.5	1	2008	16494	387.328	134	0.03	0	134	
	$\Lambda_{30}^2 = \Lambda_{14}^2 = 1$	3000	2.849	1	3288	25362	24510.6	140.972	0.03	0	140.972	
	$\Lambda_{01}^3 = \Lambda_{13}^3 = 1$	4000	3.125	1	4478	32405	47721.4	146.5	0.03	0	146.5	
2	$\Lambda_{31}^0 = \Lambda_{24}^0 = 2$	1000	2	1	1234	9594	770	<u>180</u>	0.08	8	<u>196</u>	No Bifurcation
	$\Lambda_{01}^1 = \Lambda_{02}^1 = 2$	2000	2.5	1	2008	16470	4151.19	147	0.08	1	147	
	$\Lambda_{04}^2 = \Lambda_{40}^2 = 1$	3000	2.849	1	3288	25336	31852.7	146.972	0.04	0	146.972	
	$\Lambda_{41}^3 = \Lambda_{42}^3 = 1$	4000	3.125	1	4478	32405	78265.8	152.5	0.03	0	152.5	
3	$\Lambda_{31}^0 = \Lambda_{24}^0 = \Lambda_{30}^0 = 2$	1000	2	2	2278	19493	>32295.7 (PC ran out of memory)	N/A	0.02	10	268	No Bifurcation
	$\Lambda_{04}^1 = \Lambda_{40}^1 = 1, \Lambda_{02}^1 = 2$	2000	2.5	2	3826	33537		N/A	0.02	2	233	
	$\Lambda_{41}^2 = \Lambda_{42}^2 = 1, \Lambda_{01}^2 = 2$	3000	2.849	2	6386	51565		N/A	0.02	0	222.394	
	$\Lambda_{31}^3 = 1, \Lambda_{14}^3 = \Lambda_{24}^3 = 2$	4000	3.125	2	8766	65917		N/A	0.01	0	222.394	
3	$\Lambda_{30}^0 = \Lambda_{31}^0 = \Lambda_{24}^0 = 1$	1000	2	2	2278	19531	>25125.4 (PC ran out of memory)	N/A	0.02	7	220	No Bifurcation
	$\Lambda_{01}^1 = \Lambda_{14}^1 = \Lambda_{41}^1 = 1$	2000	2.5	2	3826	33551		N/A	0.01	0	185	
	$\Lambda_{01}^2 = \Lambda_{14}^2 = \Lambda_{41}^2 = 1$	3000	2.849	2	6386	51571		N/A	0.02	0	185	
	$\Lambda_{24}^3 = \Lambda_{31}^3 = \Lambda_{34}^3 = 1$	4000	3.125	2	8766	65917		N/A	0.02	0	185

Fig. 5.2: Multi-granular virtual topology solutions for the 5-node network example, given that $C=10$ Gb/s, $W=3$, $B=3$, $F=F_{min}$, and $1000 \leq R_{max} \leq 4000$ km.

5.5.2 Impact of Color Conversion

This subsection demonstrates the impact of performing color conversion at all granularity levels through the use of OEO domain conversion at the EXC segment. To conduct this demonstration, we solve the RMGPA problem with/without the color-continuity constraints and without the optical-reach constraints. The input data and parameters used here are as follows: the physical topology used is that of the 8-node network, as shown in Fig. 4.11; the raw traffic demands are

chosen randomly from the range (0,1500) Gb/s, as shown in Table 5.2; $C=10$ Gb/s; $W=4$; $B=4$; $F \geq F_{min}$; all MG-OXC/EXC ports have the same weight; and the EXC port weight is twice the MG-OXC port weight. The optimized multi-granularity traffic demands are shown in Table 5.3. The results of solving the planning problem using different heuristic variations with and without color conversions at $F=F_{min}$ and F_{opt} are shown in Figs. 5.3-5.5.

Table 5.2: The 8-node network raw traffic demands, which are chosen randomly from the range (0,1500) Gb/s.

		Destination							
		0	1	2	3	4	5	6	7
Source	0	0	624	138	1135	795	1396	575	981
	1	100	0	1084	1007	575	948	1327	779
	2	977	356	0	393	1144	1130	1364	109
	3	409	1347	412	0	774	539	370	730
	4	1270	1247	51	1487	0	1019	1150	90
	5	576	717	1422	1402	1357	0	478	1052
	6	11	548	399	1480	415	944	0	249
	7	1104	655	1474	1105	350	136	757	0

Table 5.3: The 8-node network multi-granularity demands, which are generated from the (0,1500) Gb/s range raw demands along with the use of the $C=10$ Gb/s, $W=4$, & $B=4$ combination.

Source	Destination								
	0	1	2	3	4	5	6	7	
	0	0	4	8	5	5	6	5	1
	1	0	0	4	7	5	8	7	9
	2	7	6	0	3	4	0	4	9
	3	9	7	2	0	4	9	0	0
	4	0	7	1	7	0	9	0	0
	5	6	7	2	2	7	0	8	2
6	1	8	9	0	5	4	0	9	
7	4	5	4	5	0	6	7	0	
Sub- λ [Gb/s]									
	λ								
	0	1	2	3	4	5	6	7	
	0	0	2	1	1	3	3	1	2
	1	2	0	0	0	1	2	0	1
	2	1	3	0	3	2	1	0	2
	3	0	2	1	0	1	1	1	1
	4	3	0	1	0	0	1	3	1
	5	1	3	2	0	3	0	3	1
6	1	2	3	0	1	2	0	0	
7	2	1	3	2	3	1	3	0	
Waveband									
	Fiber								
	0	1	2	3	4	5	6	7	
	0	0	3	0	7	4	8	3	6
	1	2	0	3	1	2	3	1	3
	2	0	0	0	1	0	0	2	2
	3	2	1	2	0	3	1	1	2
	4	3	3	1	1	0	1	0	2
	5	2	1	3	3	1	0	3	2
6	0	1	1	1	2	3	0	2	
7	3	0	0	3	0	3	2	0	

From Fig. 5.3 (a), it is clear that allowing color conversions by using UWS, UBS, and UFS paths, which utilize resources efficiently, decreases the minimum fiber requirement, which can be quite

useful in the fiber-scarce situation. Also, the figure illustrates that the amount of reduction in F_{min} obtained through the use of color conversions depends on both the bifurcation scenario and sorting policy used in the heuristic. However, the decrease in F_{min} can come at the expense of an increased weighted port count, as shown in Fig. 5.4 (a). This trade-off is due to the need for OEO conversions, as is shown in Fig. 5.5. Moreover, the need for OEO conversions tends to vanish at F_{opt} , as shown in Fig. 5.5. This occurs because, as the parameter F increases, more resources will be available and the choice of a clear path rather than an unclear path will be more likely. It is worth mentioning here that, in some cases, OEO conversions can still occur at F_{opt} , as shown in Fig. 5.5. This is because when path candidates are being evaluated for a certain $s-d$ pair while building the multi-granular virtual topology, a short unclear path will be selected rather than an expensive long clear path. Still, this path selection does not guarantee that the final weighted port count at F_{opt} will be lower than the weighted port count achieved without color conversions, as is the case when the heuristic uses the fiber-bifurcation scenario with Policy 1 (this observation can be made from Figs. 5.4 (b) and 5.5). Furthermore, provided that OEO conversions are not needed at F_{opt} , it is expected that heuristics using both the same bifurcation scenario and sorting policy will yield the same weighted port counts regardless of whether color conversions are allowed. However, on some occasions, as shown in Fig. 5.4 (b), a heuristic that considers color conversions will yield a solution with no OEO conversions, but its weighted port count will be slightly higher/lower than that of a heuristic that does not consider color conversions. These slight differences are expected because the heuristic with color conversions works differently than the heuristic without color conversions. Finally, Figs. 5.3 (a) and 5.4 (a) clearly show that in the fiber-scarce situation, the best heuristic variation with the color-continuity constraints is not necessarily the best without these constraints.

Fig. 5.3: Fiber requirements for the case of the 8-node network and (0,1500) Gb/s range demands with E/O ratio=2 using different heuristic variations with/without color conversions: (a) F_{min} ; (b) F_{opt}

Fig. 5.4: Weighted port count for the case of the 8-node network and (0,1500) Gb/s range demands with E/O ratio=2 using different heuristic variations with/without color conversions: (a) weighted port count at F_{min} ; (b) weighted port count at F_{opt}

Fig. 5.5: The number of OEO conversions for the case of the 8-node network and (0,1500) Gb/s range demands with E/O ratio=2 using different heuristic variations with color conversions.

5.5.3 Impact of E/O Cost Ratio with Color-Continuity Constraints

The goal of this subsection is to see how changing the E/O cost ratio will affect the solution to the planning problem involving the color conversion capability. Using the same input data and parameters considered in Subsection 5.5.2, except that the E/O cost ratio=2 and 3, the results of different heuristic variations with and without color conversions at $F=F_{min}$ and F_{opt} are shown in Figs. 5.6-5.8.

In comparing Figs. 5.3-5.5 with Figs. 5.6-5.8, the following observations can be made. First, it is clear that increasing the E/O ratio can change the fiber requirement. This change occurs because when path candidates are evaluated for a certain $s-d$ pair, a long clear path will be selected rather than an expensive short unclear path. This also means that the long path will consume more resources. As a result, if fiber resources are scarce, other $s-d$ pairs might be forced to use unclear paths instead of clear paths or unclear paths with many virtual hops instead of those having a few virtual hops, either of which scenario means that more OEO conversions would be required. If fiber resources are plentiful, then other $s-d$ pairs can still use clear paths or unclear paths with a few virtual hops. These explain why, as illustrated by the comparison of Fig. 5.8 with Fig. 5.5, (1) in the fiber-scarce situation (at F_{min}) with some heuristic variations, the number of OEO conversions with the E/O ratio=3 is more than the number achieved with the E/O ratio=2; and (2) in the fiber-plentiful situation (at F_{opt}), the number of OEO conversions vanishes as the E/O ratio increases. Second, increasing the E/O ratio changes the best heuristic variation. Figs. '5.3 (a) and 5.4 (a)'/5.6 (a) and 5.7 (a)' demonstrate that in the fiber-scarce situation, when the E/O ratio=2/3, the best variation is the one that employs 'Policy 4 along with the no-bifurcation scenario'/'Policy 4 along with the fiber-bifurcation scenario'. On the other hand, Figs. '5.3 (b) and 5.4 (b)'/5.6 (b) and 5.7 (b)' demonstrate that in the fiber-plentiful situation, when the E/O ratio=2/3, the best heuristic

variation is the one that utilizes ‘Policy 4 along with the no- or fiber-bifurcation scenario’/‘Policy 4 along with the no-bifurcation scenario’. Third, varying the E/O cost ratio changes the resultant multi-granular virtual topology even in situations where F_{min} is the same. For instance, the use of Policy 4 along with the no-bifurcation scenario in the heuristic leads to the same $F_{min}=22$ using both E/O ratios. The first clue to the virtual topology alteration is the change in the number of OEO conversions by comparing Fig. 5.5 with Fig. 5.8. The second clue is the difference in the port count breakdown at all nodes between both E/O ratios, as shown in Fig. 5.9. In short, the design of the multi-granular virtual topology without considering the color-continuity constraints is sensitive to the E/O cost ratio. This result is contrary to the finding made in Subsection 4.4.4, where it was demonstrated that the multi-granular virtual topology is insensitive to the E/O cost ratio when the color-continuity constraints are satisfied.

Fig. 5.6: Fiber requirements for the case of the 8-node network and (0,1500) Gb/s range demands with E/O ratio=3 using different heuristic variations with/without color conversions: (a) at F_{min} ; (b) at F_{opt}

Fig. 5.7: Weighted port count for the case of the 8-node network and (0,1500) Gb/s range demands with E/O ratio=3 using different heuristic variations with/without color conversions: (a) at F_{min} ; (b) at F_{opt}

Fig. 5.8: The number of OEO conversions for the case of the 8-node network and (0,1500) Gb/s range demands with E/O ratio=3 using different heuristic variations with color conversions.

Fig. 5.9: The resultant "unweighted" port count breakdown at all nodes of the 8-node network at $F_{min}=22$ using Policy 4 and the no-bifurcation scenario in the heuristic: (a) with E/O ratio=2; (b) with E/O ratio=3.

5.5.4 Effects of Maximum Optical Reach

This subsection demonstrates the effect of changing the value of the maximum optical reach on the planning solution. Here, we solve the RMGPA problem without the color-continuity constraints, with the optical-reach constraints, and without customizing the optical reach. We use the same input data and parameters used in Subsection 5.5.2, except that the ratio of the EXC port weight to the MG-OXC port weight is decided by the relation given in Equation 3.1 with $\text{RATIO}_{1000}=2$ and $1000 \leq R_{\max} \leq 10000$ km. Heuristic variations in this example are based on using Policies 1-6 and the no-bifurcation scenario. The results of solving the RMGPA problem at $F=F_{\min}$ and F_{opt} are shown in Figs. 5.10-5.12.

In comparing solutions at both $F_{\min}$ and F_{opt} and at a certain maximum optical reach value, we observe that the weighted port count at F_{opt} can achieve greater savings at the expense of having a higher fiber requirement, as shown in Figs. 5.10 and 5.11. This port count saving stems from the increase in the number of clear paths since the need for OEO conversions to perform color conversions vanishes as fiber resources becomes plentiful. The decrease in the number of color conversions can be implied from the decrease in the number of OEO conversions, as shown by the comparison of Figs. 5.12 (a) and 5.12 (b) (note that Fig. 5.12 shows the total number of OEO conversions regardless of whether they are originated from color conversions or signal regenerations).

Moreover, from Figs. 5.10-5.12, it is quite clear that when the maximum optical reach value is close to 1000 km, the fiber requirement, weighted port count, and number of OEO conversions are extremely high. This can be explained as follows. When the maximum optical reach value is less than the length of some physical spans and the network connectivity is low (note that the average physical connectivity of the 8-node network is 3.25, which is considered to be low), *s-d*

pairs will have limited choices for route selection and some will be forced to use relatively long routes that duplicate resources unnecessarily. This situation leads to the continual usage of the same set of long routes; as a result, significantly more fiber resources, port count, and OEO conversions are required. In contrast, when the reach value exceeds the length of all physical spans, $s-d$ pairs will have more choices for route selection. As a result, shorter and less congested routes are expected to require less fiber resources, port count, and OEO conversions.

However, as we have mentioned in Subsection 5.5.1, increasing the maximum optical reach value raises the cost of the EXC port and reduces the number of OEO conversions. Accordingly, increasing the reach value leads to a crossover situation in which the minimal weighted port count occurs, as shown in Fig. 5.11. Fig. 5.11 (b) clearly shows that the maximum optical reach of 3000 km along with the use of Policy 6 is the most cost-effective combination for this case study, provided that fiber resources are plentiful. In addition, increasing the maximum optical reach decreases the fiber requirement until it becomes almost unchanged, as shown in Fig. 5.10. This occurs because the number of OEO conversions due to signal regeneration completely vanishes as the maximum optical reach increases. After they vanish, the remaining OEO conversions will be due to color conversions, which are quite noticeable at F_{min} as depicted in Fig. 5.12 (a).

Now, with the consideration of the optical-reach constraints, deciding the best planning solution for a given range of the maximum optical reach values will be as follows. In the fiber-scarce situation, deciding the best combination in terms of the heuristic variation and maximum optical reach value used will be based on the following criteria. The best combination is the one that achieves the lowest F_{min} . If more than one combination has the same F_{min} , then the best combination will be the one that yields the lowest weighted port count at F_{min} . If we still have more than one winning combination, then the one with the lowest maximum optical reach value will be

selected. Accordingly, Figs. 5.10 (a) and 5.11 (a) demonstrate that the use of Policy 4 with the maximum optical reach of 5000 km is the most fiber-efficient combination for this case study. On the other hand, in the fiber-plentiful situation, the best combination is the one that realizes the lowest weighted port count at F_{opt} . If more than one combination has the same weighted port count, then the best combination will be the one that achieves the lowest F_{opt} . If still we have more than one winning combination, which is unlikely to occur, we will then choose the one with the lowest maximum optical reach value. Thus, as we have mentioned earlier, the use of Policy 6 with the maximum optical reach of 3000 km is the most cost-efficient combination for this case study. This finding also shows that the best combination changes according to the fiber situation. For the rest of this thesis, we will refer to the maximum optical reach value that leads to the best solution, whether in fiber-plentiful or scarce situations, as the “best” maximum optical reach.

Fig. 5.10: Fiber requirements vs. maximum optical reach for the case of the 8-node network and (0,1500) Gb/s range demands using heuristics with Policies 1-6 and the no-bifurcation scenario and without customizing the optical reach: (a) at F_{min} ; (b) at F_{opt}

Fig. 5.11: Weighted port count vs. maximum optical reach for the case of the 8-node network and (0,1500) Gb/s range demands using heuristics with Policies 1-6 and the no-bifurcation scenario and without customizing the optical reach: (a) at F_{min} ; (b) at F_{opt}

Fig. 5.12: Number of OEO conversions vs. maximum optical reach for the case of the 8-node network and (0,1500) Gb/s range demands using heuristics with Policies 1-6 and the no-bifurcation scenario and without customizing the optical reach: (a) at F_{min} ; (b) at F_{opt}

5.5.5 Benefits of Customizing the Optical Reach

The aim of this subsection is to demonstrate the significance of customizing the optical reach of all clear paths based on their actual lengths rather than utilizing the same maximum optical reach with all clear paths. Here, we solve the RMGPA problem without the color-continuity constraints, with the optical-reach constraints, and with customizing the optical reach. The same example and

heuristic variations used in the previous subsection are used here. The results at $F=F_{min}$ and F_{opt} are shown in Figs. 5.13-5.15.

In the fiber-plentiful situation, even though the cost of the EXC port in the customized reach case is a function of the length of its clear path, varying the maximum optical reach value still leads to a minimal weighted port count as shown in Fig. 5.14 (b). Moreover, for all maximum optical reach values tested, customizing the optical reach for all clear paths leads to consistent savings in the weighted port count compared to the non-customized reach case, as illustrated by the comparison of Fig. 5.14 (b) with Fig. 5.11 (b). It is worth mentioning here that even though the $\approx 9\%$ saving obtained with the optical-reach customization comes at the expense of an increase from 3000 km to 6000 km in the best maximum optical reach, customizing the reach at the maximum optical reach of 3000 km can still achieve a saving of $\approx 6\%$.

In fiber-scarce situations, although the same F_{min} is achieved in both the customized reach case and non-customized reach case, a lower weighted port count at F_{min} is obtained with the customized reach case, as shown by the comparison of Figs. 5.13 (a) and 5.14 (a) with Figs. 5.10 (a) and 5.11 (a). Similar to the observation made in the fiber-plentiful situation, while the $\approx 14\%$ saving in the weighted port count obtained with the optical-reach customization comes at the expense of an increase from 5000 km to 7000 km in the best maximum optical reach, customizing the reach at the maximum optical reach of 5000 km can still achieve a saving of $\approx 13.5\%$.

Furthermore, in comparing the number of OEO conversions with and without customizing the optical reach for all maximum optical reach values tested, it is clear that the number of OEO conversions at F_{min} is identical, as shown in the comparison of Fig. 5.12 (a) with Fig. 5.15 (a). In addition, at F_{opt} there is a slight difference between the two cases, as illustrated by the comparison

of Fig. 5.12 (b) with Fig. 5.15(b). As expected, these results imply that at a certain maximum optical reach value (1) customizing the optical reach does not change the resultant multi-granular virtual topology at F_{min} since the customization part is performed upon deciding the virtual topology; and (2) customizing the optical reach may lead to a different multi-granular virtual topology at F_{opt} , because with both reach cases the optimum virtual topology has to be decided from the range $[F_{min}, F_{sat}]$.

Fig. 5.13: Fiber requirements vs. maximum optical reach for the case of the 8-node network and (0,1500) Gb/s range demands using heuristics with Policies 1-6 and the no-bifurcation scenario and with customizing the optical reach: (a) at F_{min} ; (b) at F_{opt} .

Fig. 5.14: Weighted port count vs. maximum optical reach for the case of the 8-node network and (0,1500) Gb/s range demands using heuristics with Policies 1-6 and the no-bifurcation scenario and with customizing the optical reach: (a) at F_{min} ; (b) at F_{opt} .

Fig. 5.15: Number of OEO conversions vs. maximum optical reach for the case of the 8-node network and (0,1500) Gb/s range demands using heuristics with Policies 1-6 and the no-bifurcation scenario and with customizing the optical reach: (a) at F_{min} ; (b) at F_{opt}

5.5.6 Impact of E/O Cost Ratio with Optical-Reach Constraints

The goal of this subsection is to demonstrate the sensitivity of the planning solution to the change in the E/O cost ratio. Here we solve the RMGPA problem without the color-continuity constraints, with the optical-reach constraints, and with/without customizing the optical reach. We employ the same input data and parameters used in Subsection 5.5.2, except that the ratio of the EXC port weight to the MG-OXC weight is decided by the relation given in Equation 3.1 with $RATIO_{1000}=2$ and 3 and $1000 \leq R_{max} \leq 10000$ km. Heuristic variations in this example are based on using Policies 1-6 and the no-bifurcation scenario. Results of the best combination in terms of the best maximum optical reach and best heuristic variation in both fiber situations using both reach cases are shown in Tables 5.4 and 5.5.

From the tables, it is clear that changing the E/O cost ratio has an impact on changing the winning combination, especially in the fiber-plentiful situations. Overall, for similar reasons to those explained in Subsection 5.5.3, changing the cost ratio leads to the change in the optimum multi-granular virtual topology. Even when the winning combination does not change, still the

change in the virtual topology can be implied from the change in the number of OEO conversions, as shown in Table 5.4. Besides, decreasing the E/O cost ratio decreases the amount of savings in the weighted port count achieved with customizing the optical reach in both fiber situations. Tables 5.4 and 5.5 demonstrate that the saving using the E/O cost ratio=3 is $\approx 14/20\%$, whereas the saving using the E/O ratio=2 is $\approx 9/10\%$, in the fiber-scarce/fiber-plentiful situation.

Table 5.4: Summary of the heuristics comparison in the fiber-scarce situation with and without the optical-reach customization for the case of the 8-node network and (0,1500) Gb/s range demands using different E/O cost ratios.

RATIO ₁₀₀₀	Without Customized Reach					With Customized Reach				
	Best R_{max} [km]	Best policy	F_{min}	Weighted port count @ F_{min}	# of OEO Conversions @ F_{min}	Best R_{max} [km]	Best policy	F_{min}	Weighted port count @ F_{min}	# of OEO Conversions @ F_{min}
2	5000	4	22	7920.33	166	7000	4	22	6805.15	161
3	5000	4	22	10018.92	165	9000	4	22	7972.35	130

Table 5.5: Summary of the heuristics comparison in the fiber-plentiful situation with and without the optical-reach customization for the case of the 8-node network and (0,1500) Gb/s range demands using different E/O cost ratios.

RATIO ₁₀₀₀	Without Customized Reach					With Customized Reach				
	Best R_{max} [km]	Best policy	F_{opt}	Weighted port count @ F_{opt}	# of OEO Conversions @ F_{opt}	Best R_{max} [km]	Best policy	F_{opt}	Weighted port count @ F_{opt}	# of OEO Conversions @ F_{opt}
2	3000	6	30	5930.19	33	6000	6	28	5409.11	0
3	3000	1	29	7341.14	32	9000	4	30	6617.36	0

5.5.7 Comparison of Heuristics with Color Conversion Capability

In this subsection, we evaluate heuristics via simulation without the consideration of either the color-continuity or optical-reach constraints. In addition, to investigate the impact of performing color conversion at all granularity levels, we compare the results of the heuristic variations with the results obtained in Subsection 4.4.7, in which the color-continuity constraints are considered.

Heuristic variations that are based on the all-bifurcation scenario are excluded from our comparisons in this subsection and the following subsection. This is because we expect the performance of such heuristics to be worse when employing the color conversion and signal regeneration capabilities, since the use of separate unclear paths by the bifurcated units of traffic demands for the purposes of color conversion and signal regeneration will further duplicate resources and port requirements.

The procedure for generating traffic patterns used in Subsection 4.4.7 is utilized again here. The physical topologies considered in the simulation are the 8-node, NSF, and EON networks, as shown in Figs. 4.11, 4.26, and 4.27 respectively. The fiber capacities used here are based on using the 10-4-4, 10-8-8, and 40-8-8 combinations. However, due to the space limitation in this and the following subsection, the sensitivity analysis of the fiber capacity is carried out only on the 8-node network using the three combinations. On the other hand, the sensitivity analysis of the physical topology is carried out on all three topologies using only the 10-8-8 combination. The rest of the input parameters employed in the simulation are as follows: $1 \leq F \leq F_{sat}$, all MG-OXC/EXC ports have the same weight, and the 10/40 Gb/s-based EXC port weight is 2/5 times the MG-OXC port weight.

Detailed results based on averaging 10 simulation runs with 95% confidence intervals are shown in Appendix B. In addition to the fiber requirements and weighted port counts, the results of the heuristic variations are also compared in terms of the number of OEO conversions. Tables ‘5.6-5.10’/‘5.11-5.15’ summarize the results in Tables B.1-B.6 and provide comparisons with the results in Tables ‘4.10-4.12, 4.14, and 4.17’/‘4.19-4.21, 4.23, and 4.26’ under the fiber-scarce/plentiful situation.

We first analyze the results obtained in the fiber-scarce situation. Overall, from Tables 5.6-5.10, the following observations can be made. First, allowing color conversions has an obvious affect on reducing the minimum fiber requirement (up to $\approx 67\%$ reduction) compared to the case in which color conversions are not allowed. The amount of reduction varies according to the traffic pattern, network topology, and fiber capacity. This reduction is the result of using unclear paths when fiber resources are not sufficient to establish clear paths. Second, the reduction in the fiber requirement can be accompanied by either a decrease (up to $\approx 6\%$) or an increase (up to $\approx 12\%$) in the weighted port count compared to the case in which color conversions are not allowed. Third, even with traffic patterns in which there are no reductions in F_{min} , performing color conversions can still bring further slight weighted port count reductions (up to $\approx 4\%$). It is interesting to note that this slight reduction can be realized either with or without OEO conversions. This observation can be made by first identifying these reduction situations in Tables 5.6-5.10. Then both the corresponding traffic pattern and the winning heuristic variation can be located in Appendix B, after which the corresponding number of OEO conversions at F_{min} can be found. The reduction in the weighted port count with the existence of OEO conversions is due to the fact that some $s-d$ pairs prefer short unclear paths to long expensive clear paths. On the other hand, the reduction in the weighted port count with no OEO conversions occurs because the heuristic with color conversions works differently than the heuristic without color conversions.

In comparing the winning heuristic variations with and without maintaining the color-continuity constraints, as shown by the comparison of Tables 4.10-4.12, 4.14, and 4.17 with Tables 5.6-5.10, the following comments can be made. First, the winning sets of bifurcation scenarios/sorting policies for all traffic patterns tested, each at a certain physical topology and fiber capacity, are not the same. Second, it is interesting to see that Policy 3 is out of the contest in all traffic patterns

tested with the 8-node and NSF networks, in which the physical connectivity is lower than in the EON network, compared to the case where color conversions are not allowed. Therefore, not only is choosing the best heuristic variation a function of the traffic pattern, physical topology and fiber capacity, but it is also a function of whether color conversions are allowed.

Furthermore, in looking for the C - W - B combination/fiber capacity that can achieve the best results in the fiber-scarce situation by comparing Tables 5.6-5.8, it is clear that the 40-8-8 combination is the best choice for all traffic patterns. In contrast, without color conversions, as shown in Tables 4.10-4.12, although the best combination for the majority of traffic patterns is the 40-8-8 combination, the best choice for the traffic pattern with $IN=1000$ Gb/s and $FR=80\%$ is the 10-8-8 combination. Thus, this result indicates that choosing the best C - W - B combination in the fiber-scarce situation is also a function of whether color conversions are allowed.

Tables 5.7, 5.9, and 5.10 indicate beyond doubt that the physical topology has an enormous impact on reducing the minimum fiber requirement. In the EON network, which has the highest physical connectivity in comparison to the 8-node and NSF networks, a significant reduction in F_{min} in the range of ≈ 50 -67% is achieved with all traffic patterns. These reductions can come with a weighted port count decrease/increase of up to $\approx 6.5/12\%$. This dramatic reduction stems from the fact that the number of distinct routes between an s - d pair can be as high as 1720 routes in the EON network, which increases the availability of unclear paths at a certain F . On the other hand, in the 8-node and NSF networks the number of distinct routes between an s - d pair is relatively low, which relatively decreases the availability of unclear paths at the same F .

Table 5.6: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the 8-node network using the 10-4-4 combination under the fiber-scarce situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{min}	Weighted port count @ F_{min}	Difference in F_{min}	Difference in Weighted port count @ F_{min}
(500,0)	No bifurcation	4	8.2	3004.70	-2.38%	-0.01%
(1000,0)	No bifurcation	4	15.4	3980.30	-6.10%	-1.17%
(1500,0)	Fiber bifurcation	4	22.4	4981.90	-5.88%	4.43%
(500,20)	Fiber bifurcation	4	6.6	2542.80	-13.16%	2.83%
(1000,20)	Fiber bifurcation	2	12.6	3319.50	-5.97%	5.06%
(1500,20)	Fiber bifurcation	4	18	4011.30	-7.22%	5.18%
(500,50)	No bifurcation	4	5.4	1813.00	-6.90%	1.95%
(1000,50)	No bifurcation	1	9.6	2376.00	-5.88%	-1.16%
(1500,50)	Fiber bifurcation	4	14.6	2978.70	-3.95%	4.33%
(500,80)	No bifurcation	4	3.4	998.80	0.00%	-0.18%
(1000,80)	Fiber bifurcation	4	5.6	1290.30	0.00%	-0.18%
(1500,80)	Fiber bifurcation	1	7.6	1725.60	0.00%	-0.08%

Table 5.7: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the 8-node network using the 10-8-8 combination under the fiber-scarce situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{min}	Weighted port count @ F_{min}	Difference in F_{min}	Difference in Weighted port count @ F_{min}
(500,0)	No bifurcation	4	2.2	4081.60	-8.33%	0.05%
(1000,0)	No bifurcation	4	4.4	4384.50	0.00%	-0.04%
(1500,0)	No bifurcation	4	6.2	4822.50	-8.82%	2.10%
(500,20)	No bifurcation	4	2	3212.50	0.00%	-0.46%
(1000,20)	No bifurcation	4	4	3499.60	0.00%	-0.64%
(1500,20)	No bifurcation	4	5.8	3823.60	-3.33%	1.08%
(500,50)	No bifurcation	4	1.9	2239.70	-5.00%	-0.35%
(1000,50)	No bifurcation	4	3.4	2521.70	-5.56%	-0.16%
(1500,50)	No bifurcation	4	4.4	2763.00	0.00%	-0.23%
(500,80)	No bifurcation	4	1	1136.20	-50.00%	0.32%
(1000,80)	No bifurcation	4	1.8	1335.30	-10.00%	0.73%
(1500,80)	Fiber bifurcation	4	2.3	1600.60	-4.17%	-0.31%

Table 5.8: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the 8-node network using the 40-8-8 combination under the fiber-scarce situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{min}	Weighted port count @ F_{min}	Difference in F_{min}	Difference in Weighted port count @ F_{min}
(500,0)	No bifurcation	4	1	3798.00	-50.00%	-0.37%
(1000,0)	No bifurcation	4	1.5	4894.80	-25.00%	0.40%
(1500,0)	No bifurcation	4	2	5496.10	0.00%	-0.39%
(500,20)	No bifurcation	4	1	3082.80	-50.00%	-0.01%
(1000,20)	No bifurcation	4	1	3868.10	-50.00%	0.45%
(1500,20)	No bifurcation	1	1.9	4390.10	-5.00%	1.90%
(500,50)	No bifurcation	4	1	2124.90	-50.00%	-0.12%
(1000,50)	No bifurcation	4	1	2716.60	-50.00%	-0.15%
(1500,50)	No bifurcation	4	1.2	3055.00	-40.00%	0.65%
(500,80)	No bifurcation	4	1	1069.80	-50.00%	-0.29%
(1000,80)	No bifurcation	4	1	1337.50	-50.00%	-0.71%
(1500,80)	No bifurcation	4	1	1558.40	-50.00%	-0.54%

Table 5.9: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the NSF network using the 10-8-8 combination under the fiber-scarce situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{min}	Weighted port count @ F_{min}	Difference in F_{min}	Difference in Weighted port count @ F_{min}
(500,0)	No bifurcation	4	7	14709.50	0.00%	-0.46%
(1000,0)	No bifurcation	1	11.8	16324.20	-4.84%	0.16%
(1500,0)	No bifurcation	4	17.6	17325.30	-3.30%	-0.66%
(500,20)	No bifurcation	1	5.2	12338.90	-7.14%	-1.50%
(1000,20)	No bifurcation	2	10.2	13789.40	-3.77%	1.72%
(1500,20)	No bifurcation	1	14.4	15205.00	-6.49%	6.06%
(500,50)	No bifurcation	4	4.8	8498.40	-4.00%	0.63%
(1000,50)	No bifurcation	1	7	9483.80	-7.89%	-1.21%
(1500,50)	Fiber bifurcation	4	10.4	10724.60	-8.77%	4.55%
(500,80)	No bifurcation	1	3	4465.90	0.00%	-3.54%
(1000,80)	No bifurcation	4	4.4	5116.90	-4.35%	-4.00%
(1500,80)	No bifurcation	1	5.2	6080.70	-7.14%	-2.29%

Table 5.10: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the EON network using the 10-8-8 combination under the fiber-scarce situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{min}	Weighted port count @ F_{min}	Difference in F_{min}	Difference in Weighted port count @ F_{min}
(500,0)	No bifurcation	3	4	9626.70	-59.18%	0.09%
(1000,0)	No bifurcation	1	7.4	10244.90	-59.78%	-1.65%
(1500,0)	No bifurcation	3	9.8	10968.70	-66.89%*	0.99%*
(500,20)	No bifurcation	1	3.2	8095.20	-63.64%	1.54%
(1000,20)	No bifurcation	2	6	8873.60	-63.41%	0.98%
(1500,20)	No bifurcation	3	8.6	9203.20	-62.93%	-0.49%
(500,50)	No bifurcation	1	3	5716.00	-50.00%	6.31%
(1000,50)	No bifurcation	1	4.2	5785.10	-58.00%	-1.59%
(1500,50)	Fiber bifurcation	3	5.8	6523.80	-61.84%	0.09%
(500,80)	No bifurcation	4	1	2818.60	-66.67%	-6.46%
(1000,80)	No bifurcation	2	2.8	3643.70	-50.00%	11.84%
(1500,80)	Fiber bifurcation	1	3	3719.10	-50.00%	-2.10%

* These percentages are relative to the results obtained using the no-bifurcation-based heuristic without color conversions, since the all-bifurcation scenario is not considered in this Chapter.

Now, we analyze the results obtained in the fiber-plentiful situation. In general, in comparing Tables 5.11-5.15 with Tables 5.6-5.10, it is clear that increasing the fiber resources leads to a reduction in the weighted port count. This is due to the decrease in the number of unclear paths and/or the number of clear paths that constitute the unclear path (or the decrease in the virtual hop count of the unclear path), as clear paths becomes favorable choices for s - d pairs. This decrease can be implied from the fading of the number of OEO conversions at F_{opt} with respect to the equivalent number at F_{min} as shown in Appendix B.

Moreover, from Tables 5.11-5.15 and Tables B.1-B.6, for most traffic patterns the reduction/increase in the weighted port count at F_{opt} compared to the case in which color conversions are not allowed is up to $\approx 3/1\%$. This slight difference can be achieved both with and without the need for OEO conversions at F_{opt} , explained as follows. (1) The number of OEO

conversions at F_{opt} can be zero, and there is a decrease in the weighted port count. (2) The number of OEO conversions at F_{opt} is greater than zero, but there is a slight increase in the weighted port count. Both the former and latter results can occur because, as we mentioned earlier, the heuristic with color conversions works differently than the heuristic without color conversions. (3) OEO conversions exist at F_{opt} and there is a slight decrease in the weighted port count (up to $\approx 3\%$). This result stems from the fact that, for a certain s - d pair, selecting a short unclear path rather than a long clear path is more cost-effective. It is worth mentioning here that this decrease in the weighted port count can be accompanied by a reduction in F_{opt} as well (up to $\approx 57\%$).

In comparing the winning heuristic variations with and without keeping the color-continuity constraints, as shown by the comparison of Tables 4.19-4.21, 4.23, and 4.26 with Tables 5.11-5.15, the following observations can be made. First, Policies 1 and 4 are still the only contenders. Second, in the 8-node and NSF networks, which have a lower connectivity than the EON network, the winning sets of bifurcation scenarios/sorting policies are slightly different for all traffic patterns tested at a certain topology and fiber capacity. In contrast, in the EON network, the winning sets are noticeably different. This result is expected because the achieved differences in the weighted port count are greater with the EON network than with the 8-node and NSF networks, as illustrated in Tables 5.12, 5.14, and 5.15. In short, in the fiber-plentiful situation, as in the fiber-scarce situation, the winning heuristic variation is still a function of whether color conversions are allowed.

In looking for the C - W - B combination/fiber capacity that can achieve the best planning results by comparing Tables 5.11-5.13, it is clear that the best choices for all traffic patterns are similar to those obtained without color conversions, as shown in Table 4.28. Again, this similarity has to do with the insignificant difference in the weighted port count between heuristics with and without

color conversions. Therefore, this finding indicates that choosing the best C - W - B combination in the fiber-plentiful situation, as apposed to the fiber-scarce situation, is less sensitive to whether color conversions are allowed.

Finally, Tables 5.12, 5.14, and 5.15 capture the impact of color conversions as the physical topology changes. Although increasing both the connectivity and size of the topology with the use of color conversions has a slight impact on reducing the weighted port count at F_{opt} as is the case with the EON network (in which the reduction comes with the number of OEO $\neq$ 0, as shown in Appendix B), the decrease in F_{opt} is still considerable. This dramatic decrease stems from the fact that the high number of distinct routes between an s - d pair increases the availability of short unclear paths, which avoids the duplication of resources. It is interesting to note that allowing the bifurcation of fiber demands in the EON network is quite beneficial when color conversions are considered, as shown by the comparison of Table 4.26 with Table 5.15. This is because the availability of less expensive unclear paths for a bifurcated unit of the fiber demand is greater than when the fiber demand is treated as a whole entity.

Table 5.11: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the 8-node network using the 10-4-4 combination under the fiber-plentiful situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{opt}	Weighted port count @ F_{opt}	Difference in F_{opt}	Difference in Weighted port count @ F_{opt}
(500,0)	No bifurcation	4	9.40	2981.10	-7.84%	-0.04%
(1000,0)	Fiber bifurcation	4	21.20	3841.10	0.95%	-0.28%
(1500,0)	No bifurcation	4	27.40	4613.30	-13.84%	-0.10%
(500,20)	Fiber bifurcation	4	9.60	2417.20	-2.04%	-0.24%
(1000,20)	Fiber bifurcation	1	18.20	3089.40	8.33%	-0.23%
(1500,20)	Fiber bifurcation	4	25.00	3722.80	-5.30%	-0.14%
(500,50)	Fiber bifurcation	4	7.00	1750.40	-10.26%	-0.40%
(1000,50)	No bifurcation	4	13.20	2237.90	3.12%	-0.03%
(1500,50)	No bifurcation	4	19.60	2762.70	3.16%	-0.16%
(500,80)	No bifurcation	4	5.00	975.80	0.00%	0.29%
(1000,80)	No bifurcation	4	8.80	1224.80	0.00%	-0.54%
(1500,80)	No bifurcation	4	12.60	1573.70	-1.56%	-0.64%

Table 5.12: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the 8-node network using the 10-8-8 combination under the fiber-plentiful situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{opt}	Weighted port count @ F_{opt}	Difference in F_{opt}	Difference in Weighted port count @ F_{opt}
(500,0)	No bifurcation	1	4	4023.30	17.65%	0.11%
(1000,0)	No bifurcation	4	5.6	4345.70	0.00%	-0.04%
(1500,0)	No bifurcation	4	8	4717.90	2.56%	0.33%
(500,20)	No bifurcation	4	2.8	3197.40	-6.67%	-0.43%
(1000,20)	No bifurcation	4	4.8	3487.90	-11.11%	-0.05%
(1500,20)	No bifurcation	4	7.2	3776.80	2.86%	0.27%
(500,50)	No bifurcation	4	2.5	2236.20	-3.85%	-0.32%
(1000,50)	No bifurcation	4	4.2	2489.50	-4.55%	-0.10%
(1500,50)	No bifurcation	4	5.6	2730.80	0.00%	-0.12%
(500,80)	No bifurcation	4	1.8	1127.20	-10.00%	-0.48%
(1000,80)	No bifurcation	4	3.4	1307.20	6.25%	-0.08%
(1500,80)	Fiber bifurcation	4	3.7	1540.60	-2.63%	-0.30%

Table 5.13: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the 8-node network using the 40-8-8 combination under the fiber-plentiful situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{opt}	Weighted port count @ F_{opt}	Difference in F_{opt}	Difference in Weighted port count @ F_{opt}
(500,0)	No bifurcation	4	1	3798.00	-50.00%	-0.37%
(1000,0)	No bifurcation	4	2.3	4849.90	15.00%	-0.53%
(1500,0)	No bifurcation	4	2.4	5488.40	0.00%	-0.45%
(500,20)	No bifurcation	4	1	3082.80	-50.00%	-0.01%
(1000,20)	No bifurcation	4	2.4	3831.10	20.00%	-0.52%
(1500,20)	No bifurcation	4	2	4292.40	-16.67%	-0.30%
(500,50)	No bifurcation	4	1	2124.90	-50.00%	-0.12%
(1000,50)	No bifurcation	4	1.4	2713.20	-30.00%	-0.28%
(1500,50)	No bifurcation	4	2	3030.70	0.00%	-0.15%
(500,80)	No bifurcation	4	1	1069.80	-50.00%	-0.29%
(1000,80)	No bifurcation	4	1	1337.50	-50.00%	-0.71%
(1500,80)	No bifurcation	4	1.2	1557.40	-40.00%	-0.60%

Table 5.14: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the NSF network using the 10-8-8 combination under the fiber-plentiful situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{opt}	Weighted port count @ F_{opt}	Difference in F_{opt}	Difference in Weighted port count @ F_{opt}
(500,0)	No bifurcation	4	7.6	14673.30	-2.56%	-0.06%
(1000,0)	No bifurcation	1	14.2	15878.10	1.43%	0.06%
(1500,0)	No bifurcation	4	20.4	16974.10	-2.86%	0.09%
(500,20)	No bifurcation	1	6.4	12192.10	-5.88%	-0.12%
(1000,20)	No bifurcation	1	12.4	13216.80	1.64%	-0.08%
(1500,20)	No bifurcation	1	17.2	14274.10	1.18%	0.15%
(500,50)	No bifurcation	4	5	8422.30	-3.85%	-0.16%
(1000,50)	No bifurcation	1	9.6	9287.10	0.00%	0.38%
(1500,50)	No bifurcation	1	13.8	10162.50	0.00%	-0.04%
(500,80)	No bifurcation	1	3	4465.90	0.00%	-0.06%
(1000,80)	No bifurcation	4	5.4	5061.20	-3.57%	-0.14%
(1500,80)	No bifurcation	4	7.2	5880.80	-5.26%	0.12%

Table 5.15: Results of the best heuristic variation with the color conversion capability for different traffic patterns in the EON network using the 10-8-8 combination under the fiber-plentiful situation. The difference in results is relative to the best results obtained by keeping the color-continuity constraints.

Traffic pattern: (IN Gb/s, FR %)	Best bifurcation scenario	Best policy	F_{opt}	Weighted port count @ F_{opt}	Difference in F_{opt}	Difference in Weighted port count @ F_{opt}
(500,0)	No bifurcation	4	11	9375.40	-5.17%	-0.26%
(1000,0)	No bifurcation	1	9.8	9925.90	-56.25%	-2.02%
(1500,0)	Fiber bifurcation	1	15	10451.10	-57.14%	-2.73%
(500,20)	No bifurcation	1	5.2	7892.70	-49.02%	-0.26%
(1000,20)	No bifurcation	1	9.2	8315.50	-47.73%	-2.45%
(1500,20)	Fiber bifurcation	1	12.8	8818.40	-49.61%	-2.70%
(500,50)	No bifurcation	4	5.8	5361.10	-12.12%	-0.03%
(1000,50)	No bifurcation	1	5.4	5741.80	-52.63%	-1.51%
(1500,50)	No bifurcation	1	10.4	6291.30	-40.91%	-2.19%
(500,80)	No bifurcation	1	2.6	2759.10	-27.78%	-1.65%
(1000,80)	No bifurcation	4	6	3244.00	-6.25%	0.13%
(1500,80)	Fiber bifurcation	1	5.2	3691.00	-31.58%	-1.69%

5.5.8 Comparison of Heuristics with Signal Regeneration Capability

This subsection compares different heuristic variations via simulation without the consideration of the color-continuity constraints and with the consideration of the optical-reach constraints. In this subsection, we also try to gain a greater understanding of the factors that lead to the change in both the best maximum optical reach and the amount of saving achieved in deciding between customizing the optical reach of all clear paths and using the same reach with all clear paths. Heuristic variations are based on combinations of bifurcation scenarios, namely the no-bifurcation and fiber-bifurcation scenarios, and sorting policies, namely Policies 1-6. Moreover, heuristic variations are evaluated both with and without the optical-reach customization.

The input data and parameters used for the simulation are given as follows. (1) The procedure for generating traffic patterns used in Section 4.4.7 is utilized again here. Due to space limitations, the traffic patterns here will be generated based on the combination of only the following parameter values: $FR=0$ and 80% ; $IN=500$ and 1500 Gb/s. (2) The topologies considered in the simulation are again the 8-node, NSF, and EON networks, as shown in Figs. 4.11, 4.26, and 4.27 respectively. It is important to mention here that the average node-to-node distance, which represents the distance characterization of the topology, in the 8-node/NSF/EON network is $1061.91/1538.46/578.65$ km. (3) All MG-OXC/EXC ports have the same weight, and the ratio of the 10/40G-based EXC port weight to the MG-OXC port weight is decided by the relation given in Equation 3.1 with $RATIO_{1000}=2/5$. (4) Similar to Subsection 5.5.7, fiber capacities used with the 8-node network are based on using the 10-4-4, 10-8-8, and 40-8-8 combinations, whereas the fiber capacity used with the NSF and EON networks is based on the 10-8-8 combination. (5) The maximum optical reach value, R_{max} , is tested over a range of 1000-10000 km for the 8-node and EON networks, whereas for the NSF network, the tested range is 2000-10000 km. The reason behind this difference in the optical reach range is explained as follows. The lengths of all physical spans originating from Nodes 0 and 6 of the NSF network are greater than 1000 km, as shown in Fig. 4.26, which means that with the 1000 km optical reach, demands originating from/destined to these nodes cannot be served; as a result, the RMGPA problem cannot be solved for any value of the parameter F . (6) The RMGPA problem is solved for $1 \leq F \leq F_{sat}$.

Detailed results based on averaging 10 simulation runs with 95% confidence intervals are shown in Appendix C. Tables 5.16-5.20 and Tables 5.21-5.25 summarize the results in Tables C.1-C.12 for the fiber-scarce and plentiful situations respectively, based on the scheme adopted in Subsection 5.5.4, which is used to decide both the best maximum optical reach and best heuristic variation.

In the fiber-scarce situation, as shown in Tables 5.16-5.20, the following observations can be extracted. First, it is clear that the best maximum optical reach needed to achieve the lowest F_{min} varies according to the physical topology, traffic pattern, and fiber capacity, as well as whether the optical reach of all clear paths is customized. Second, by comparing Tables 5.17, 5.19, and 5.20, it is quite clear that, at a certain traffic pattern, the best R_{max} is the largest in the NSF network and the smallest in the EON network. This finding is due to the fact that the average node-to-node distance is the largest in the NSF network and the smallest in the EON network. Third, even though customizing the optical reach leads to the same F_{min} obtained without customizing the reach, it achieves a consistent saving in the weighted port count at F_{min} . The saving is in the range of $\approx 6-13\%$, and it varies according to the traffic pattern, physical topology, and fiber capacity. Fourth, the best R_{max} with the optical-reach customization is always equal to or greater than the best R_{max} achieved without the reach customization. This occurs because, with the optical-reach customization, increasing the optical reach further can be an opportunity for many $s-d$ pairs to use (1) clear paths with a few long-reach expensive EXC ports rather than unclear paths with many short-reach less-expensive EXC ports, and/or (2) unclear paths with both a low virtual hop count and a few long-reach expensive EXC ports instead of unclear paths with both a greater virtual hop count and many short-reach less-expensive EXC ports. Both scenarios can be implied from the reduction in the number of OEO conversions at F_{min} , as shown by the comparison of Tables C.1, C.3, C.5, C.7, C.9, and C.11 with Tables C.2, C.4, C.6, C.8, C.10, and C.12. On the other hand, without the optical-reach customization, although increasing the reach reduces the number of unclear paths and decreases the virtual hop count of the remaining unclear paths (this can be implied from the reduction in the number of OEO conversions at F_{min} as shown in Appendix C), it is the fact that all EXC ports are assigned the same cost that increases the weighted port count beyond the best R_{max} .

In comparing the winning heuristic variations with and without the optical-reach customization, the following remarks can be made. First, as we have seen before, it is apparent that the winning bifurcation scenario/sorting policy changes according to the traffic pattern, physical topology, and fiber capacity. Second, the winning heuristic variation with the reach customization is not necessarily also the best without the reach customization, as is clearly shown in Table 5.18. Third, there is no clear sorting policy winner. However, Policy 6, which is a distance-based sorting policy, turns out to be fiber-efficient for some traffic patterns in both the 8-node and NSF networks, in which the ‘node-to-node distance’/‘physical connectivity’ is greater/lower than in the EON network. In contrast, Policy 5, which is also a distance-based policy, is clearly out of the contest in all cases tested. Moreover, Policy 3 is out of the contest in all traffic patterns tested with the 8-node and NSF networks, as is the case when both the optical-reach and color-continuity constraints are not imposed in the fiber-scarce situation. Fourth, the winning set of heuristic variations for all traffic patterns tested at a certain topology and fiber capacity is not the same set obtained by (1) keeping the color-continuity constraints without the consideration of the optical-reach constraints (this observation can be made by the comparison of Tables 5.16-5.20 with Tables 4.10, 4.11, 4.12, 4.14, and 4.17); and (2) not keeping the color-continuity constraints but retaining the consideration of the optical-reach constraints (this observation can be made by the comparison of Tables 5.16-5.20 with Tables 5.6-5.10). This finding clearly indicates that choosing the best heuristic variation in the fiber-scarce situation is also a function of whether optical-reach constraints are imposed.

Furthermore, in looking for the *C-W-B* combination/fiber capacity that can achieve the best results in the fiber-scarce situation, the following observations can be made from Tables 5.16-5.18. First, the saving achieved by customizing the optical reach is the greatest with the 40-8-8

combination due to its high E/O cost ratio relative to the ratio used with the 10-4-4 and 10-8-8 combinations. Second, the best C - W - B combination with the reach customization is not necessarily the best without the reach customization, as is the case with the $IN=500$ Gb/s and $FR=80\%$ scenario, the best choice for which is the 10-8-8/40-8-8 combination without/with the optical-reach customization. More to the point, the best combination set obtained here, which represents the winners of all traffic patterns, are not exactly the same sets obtained without considering optical-reach constraints, as shown in Tables 4.10-4.12 (without color conversions) and Tables 5.6-5.8 (with color conversions). Accordingly, one can conclude that choosing the best C - W - B combination in the fiber-scarce situation is also a function of whether the optical-reach constraints are imposed and the optical reach is customized.

Table 5.16: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the 8-node network using the 10-4-4 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{min} [km]	F_{min}	Weighted port count @ F_{min}
(500,0)	Without customization	No bifurcation	1	4000	8	3712.3
	With customization	No bifurcation	1	4000	8	3409.02 (8.17% ↓)
(500,80)	Without customization	Fiber bifurcation	6	5000	3.2	1199.32
	With customization	Fiber bifurcation	6	8000	3.2	1074.46 (10.41% ↓)
(1500,0)	Without customization	No bifurcation	6	3000	22.2	6187.08
	With customization	No bifurcation	6	3000	22.2	5792.86 (6.37% ↓)
(1500,80)	Without customization	Fiber bifurcation	2	4000	7.4	2205.25
	With customization	Fiber bifurcation	2	4000	7.4	2051.17 (6.99% ↓)

Table 5.17: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the 8-node network using the 10-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{min} [km]	F_{min}	Weighted port count @ F_{min}
(500,0)	Without customization	No bifurcation	4	4000	3	4864.15
	With customization	No bifurcation	4	4000	3	4439.47 (8.73% ↓)
(500,80)	Without customization	No bifurcation	6	4000	1	1345.35
	With customization	No bifurcation	6	6000	1	1215.51 (9.65% ↓)
(1500,0)	Without customization	Fiber bifurcation	4	3000	6.4	6153.47
	With customization	Fiber bifurcation	4	3000	6.4	5772.54 (6.19% ↓)
(1500,80)	Without customization	Fiber bifurcation	6	4000	2.8	1905.33
	With customization	Fiber bifurcation	6	7000	2.8	1744.03 (8.47% ↓)

Table 5.18: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the 8-node network using the 40-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{min} [km]	F_{min}	Weighted port count @ F_{min}
(500,0)	Without customization	No bifurcation	4	3000	1	4987.31
	With customization	No bifurcation	6	4000	1	4421.99 (11.34% ↓)
(500,80)	Without customization	No bifurcation	6	3000	1	1351.79
	With customization	No bifurcation	6	4000	1	1189.21 (12.03% ↓)
(1500,0)	Without customization	No bifurcation	1	3000	3	7257.57
	With customization	No bifurcation	6	4000	3	6424.49 (11.48% ↓)
(1500,80)	Without customization	No bifurcation	4	3000	1	1986.55
	With customization	No bifurcation	6	4000	1	1802.62 (9.26% ↓)

Table 5.19: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the NSF network using the 10-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{min} [km]	F_{min}	Weighted port count @ F_{min}
(500,0)	Without customization	No bifurcation	6	5000	7	18243.97
	With customization	No bifurcation	6	8000	7	16166.20 (11.39% ↓)
(500,80)	Without customization	No bifurcation	6	5000	3	5341.52
	With customization	No bifurcation	6	7000	3	4782 (10.48% ↓)
(1500,0)	Without customization	No bifurcation	4	4000	17.2	24012.28
	With customization	No bifurcation	4	4000	17.2	21646.31 (9.85% ↓)
(1500,80)	Without customization	No bifurcation	1	7000	5.2	7717.50
	With customization	No bifurcation	1	8000	5.2	6744.37 (12.61% ↓)

Table 5.20: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the EON network using the 10-8-8 combination under the fiber-scarce situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{min} [km]	F_{min}	Weighted port count @ F_{min}
(500,0)	Without customization	No bifurcation	2	1000	3.4	13381.5
	With customization	No bifurcation	2	1000	3.4	12597.1 (5.86% ↓)
(500,80)	Without customization	No bifurcation	1	3000	1	3263.01
	With customization	No bifurcation	1	5000	1	2882.79 (11.65% ↓)
(1500,0)	Without customization	No bifurcation	3	1000	9	13819.90
	With customization	No bifurcation	3	1000	9	13000.58 (5.93% ↓)
(1500,80)	Without customization	Fiber bifurcation	1	4000	3	4363.53
	With customization	Fiber bifurcation	1	6000	3	3801.85 (12.87% ↓)

In the second part of this subsection, we analyze the results obtained in the fiber-plentiful situation. From Tables 5.21-5.25, the same observations that have been made in the fiber-scarce situation regarding the best R_{max} are generally applicable here. In addition, the following comments can be made. First, the best R_{max} with the optical-reach customization in the EON network, where $IN=1500$ Gb/s and $FR=0\%$ (uniform traffic pattern with high intensity), surprisingly exceeds the corresponding best R_{max} of other topologies. This exceptional scenario can be explained as follows. With the high physical connectivity of the EON network and the availability of fibers, some $s-d$ pairs tend to select significantly longer unclear paths rather than short clear paths in order to maximize intermediate grouping with other $s-d$ pairs. Here the benefit of grouping offsets the cost associated with the resource duplication resulting from using long routes instead of short routes. In other words, the choice of short clear paths here would be more expensive because grouping opportunities are limited. Now, increasing the optical reach reduces the virtual hop count of the unclear path, which means that fewer OEO conversions are needed along the unclear path. This observation can be implied from the slight decrease in the number of OEO conversions at F_{opt} as the reach value increases, as shown in Table C.10. However, the fact that at the best $R_{max}=10000$ km, the average number of OEO conversions=39, as well as the fact that fiber resources are plentiful and thus no OEO conversions are expected at this reach value for the purpose of color conversions, clearly indicates that the lengths of some clear path segments of unclear paths are in the range of 10000 km. Second, the range of savings obtained with the optical-reach customization is $\approx 5-14\%$, which is close to what has been achieved in the fiber-scarce situation.

In comparing the winning heuristic variations with and without customizing the optical reach, the first and second observations that have been made in this regard in the fiber-scarce situation are also valid here. Furthermore, the following comments can be made. First, in comparing Tables

5.16-5.20 with Tables 5.21-5.25, it is quite clear that the winning sets of heuristic variations are different in both fiber situations. Second, it is interesting to see Policy 5, which is a distance-based sorting policy, as a cost-effective sorting policy for one of the traffic patterns in the EON network when the optical reach is customized. Third, Policy 1, which is a traffic-based sorting policy, becomes a major contender in the EON network, which has the highest physical connectivity and lowest node-to-node distance. Conversely, Policy 6, which is a distance-based sorting policy, becomes a major contender in the 8-node and NSF networks, which have a lower physical connectivity and higher node-to-node distance than the EON network. Fourth, Policies 2 and 3 are out of the contest in all cases tested, as is the case when the optical-reach constraints are not considered in the fiber-plentiful situation. Fifth, similar to the fiber-scarce situation, the winning set of heuristic variations for all traffic patterns tested at a certain topology and fiber capacity is not the same set attained by (1) keeping the color-continuity constraints without the consideration of the optical-reach constraints (this observation can be made through the comparison of Tables 5.21-5.25 with Tables 4.19, 4.20, 4.21, 4.23, and 4.26); and (2) relaxing the color-continuity constraints without the consideration of the optical-reach constraints (this observation can be made through the comparison of Tables 5.21-5.25 with Tables 5.11-5.15). This finding clearly shows that in the fiber-plentiful situation, choosing the best heuristic variation is still a function of whether optical-reach constraints are imposed.

Finally, in searching for the *C-W-B* combination/fiber capacity that can achieve the best results in the fiber-plentiful situation, the following observations can be made from Tables 5.21-5.23. First, similar to the fiber-scarce situation, the saving achieved with the optical-reach customization is the greatest with the 40-8-8 combination due to its high E/O cost ratio. Second, the best *C-W-B* combinations with the reach customization for all traffic patterns are similar to the ones without

the reach customization. It is interesting to note that the best C - W - B combination set is similar to the set obtained by not considering the optical-reach constraints, as shown in Tables 4.19-4.21 (without color conversions) and Tables 5.11-5.13 (with color conversions). Therefore, one can conclude that, unlike in the fiber-scarce situation, choosing the best C - W - B combination in the fiber-plentiful situation for a certain traffic pattern and physical topology is less sensitive to whether the optical-reach constraints are imposed and the optical reach is customized.

Table 5.21: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the 8-node network using the 10-4-4 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{opt} [km]	F_{opt}	Weighted port count @ F_{opt}
(500,0)	Without customization	No bifurcation	1	3000	11.6	3560.28
	With customization	No bifurcation	4	4000	10.6	3280.67 (7.85% ↓)
(500,80)	Without customization	No bifurcation	6	4000	4.8	1106
	With customization	No bifurcation	6	5000	4.8	1012.51 (8.45% ↓)
(1500,0)	Without customization	No bifurcation	4	3000	30.8	5580.31
	With customization	No bifurcation	4	4000	29.2	5094.01 (8.71% ↓)
(1500,80)	Without customization	No bifurcation	1	3000	8.8	1988.55
	With customization	No bifurcation	1	3000	8.8	1886.39 (5.14% ↓)

Table 5.22: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the 8-node network using the 10-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{opt} [km]	F_{opt}	Weighted port count @ F_{opt}
(500,0)	Without customization	No bifurcation	4	3000	3.4	4853.11
	With customization	No bifurcation	4	4000	3.2	4437.64 (8.56% ↓)
(500,80)	Without customization	No bifurcation	6	3000	2	1307.89
	With customization	No bifurcation	6	6000	2	1200.13 (8.24% ↓)
(1500,0)	Without customization	No bifurcation	1	4000	8.6	5724.3
	With customization	No bifurcation	1	4000	8.2	5225.31 (8.72% ↓)
(1500,80)	Without customization	No bifurcation	6	3000	4.4	1827.83
	With customization	No bifurcation	6	3000	4.2	1685.07 (7.81% ↓)

Table 5.23: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the 8-node network using the 40-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{opt} [km]	F_{opt}	Weighted port count @ F_{opt}
(500,0)	Without customization	No bifurcation	4	3000	1	4987.31
	With customization	No bifurcation	6	4000	1.2	4415.82 (11.46% ↓)
(500,80)	Without customization	No bifurcation	6	3000	1	1351.79
	With customization	No bifurcation	6	4000	1	1189.21 (12.03% ↓)
(1500,0)	Without customization	No bifurcation	1	3000	3	7257.57
	With customization	No bifurcation	6	4000	3	6424.48 (11.48% ↓)
(1500,80)	Without customization	No bifurcation	6	3000	1.4	1979.68
	With customization	No bifurcation	6	4000	1.6	1783.22 (9.92% ↓)

Table 5.24: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the NSF network using the 10-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{opt} [km]	F_{opt}	Weighted port count @ F_{opt}
(500,0)	Without customization	No bifurcation	6	5000	7.8	18224.9
	With customization	No bifurcation	6	8000	7.6	16127.67 (11.51% ↓)
(500,80)	Without customization	No bifurcation	6	5000	3	5341.52
	With customization	No bifurcation	6	7000	3	4782 (10.48% ↓)
(1500,0)	Without customization	No bifurcation	4	5000	20.2	21181.6
	With customization	No bifurcation	6	6000	20.4	18736.2 (11.55% ↓)
(1500,80)	Without customization	No bifurcation	6	5000	7.4	7147.14
	With customization	Fiber bifurcation	6	9000	7.2	6418.01 (10.20% ↓)

Table 5.25: Results of the best heuristic variation with the color conversion and signal regeneration capabilities with/without the optical-reach customization for different traffic patterns in the EON network using the 10-8-8 combination under the fiber-plentiful situation.

Traffic pattern: (IN Gb/s, FR %)	Optical reach customization scenario	Best bifurcation scenario	Best policy	Best R_{max} @ F_{opt} [km]	F_{opt}	Weighted port count @ F_{opt}
(500,0)	Without customization	No bifurcation	4	4000	11.2	11157.35
	With customization	No bifurcation	5	5000	4.2	9810.38 (12.07% ↓)
(500,80)	Without customization	No bifurcation	1	4000	2.6	3225.05
	With customization	No bifurcation	1	5000	1.4	2864.62 (11.18% ↓)
(1500,0)	Without customization	Fiber bifurcation	1	3000	13	12416.24
	With customization	No bifurcation	1	10000	12.6	10723.61 (13.63% ↓)
(1500,80)	Without customization	Fiber bifurcation	1	4000	5.4	4324.28
	With customization	Fiber bifurcation	1	6000	3	3801.85 (12.08% ↓)

Conclusions and Future Research

6.1 Conclusions

Although the multi-granular optical network promises exciting opportunities, it also presents new design challenges that have been the focus of research and development in this area. Much work has been devoted to developing node architectures and efficient methods for planning the multi-granular optical network. Extending these efforts in this thesis, important contributions have been made to the ongoing research in this area by covering many issues that have not yet been considered elsewhere.

First, a novel problem in planning the GMPLS-based transport network, called the RMGPA problem, has been defined. The problem addresses the following issues for the first time in the domain of multi-granular networks:

- Considering all traffic granularities defined in GMPLS;
- Creating/adjusting multi-granularity traffic demands;
- Grouping and degrouping traffic flows at all granularity levels;
- Allowing the bifurcation of multi-granularity traffic demands among different physical routes;
- Allowing wavelength, waveband, and fiber conversions;
- Considering the optical-reach limitation of optical signals;
- Considering the optical-reach customization of all-optical paths.

Moreover, in order to realize the issues addressed in the RMGPA problem, a new GMPLS-based node architecture that can handle the entire traffic hierarchy defined in GMPLS has been

proposed. The new architecture is capable of performing switching, grouping/degrouping, color conversion and optical signal regeneration at all granularity levels.

In addition, four versions of the RMGPA problem with the same optimization objective, which is to minimize the total weighted port count, have been proposed. These versions are as follows:

1. RMGPA problem with the color-continuity constraints but without the optical-reach constraints. This version is the best fit for the planning problem in metro core (or regional) transport networks in which the control plane requires that the color-continuity constraints be kept in order to reduce resource fragmentation.
2. RMGPA problem without either the color-continuity or optical-reach constraints. This version fits the planning problem in metro core transport networks, especially when fiber resources are scarce.
3. RMGPA problem without the color-continuity constraints, with the optical-reach constraints, and without the optical-reach customization. This version fits the planning problem in long-haul transport networks.
4. RMGPA problem without the color-continuity constraints, with the optical-reach constraints, and with the optical-reach customization. This version fits the planning problem in long-haul transport networks in which it is possible to select the transponders based on a variety of fine optical reach values.

Furthermore, in order to obtain the exact solution to the planning problem, the first three versions of the RMGPA problem have been formulated as MILP models while the last version has been formulated as an NLP model. Due to the computational complexity of the problem, only the MILP models have been solved for small-sized planning problems. To satisfy the planning speed requirement, various heuristics have been proposed to solve different versions of the planning

problem sub-optimally for large-sized problems. The solutions to the MILP models have been used as benchmarks in order to validate the heuristic approaches. Comparing the results of both optimization methods has shown that the proposed heuristics can achieve a good approximation of the exact solution to the planning problem. Additionally, the feasibility of the solutions obtained using both optimization methods have been validated.

Besides, many illustrative examples of all versions of the RMGPA problem have been shown to elaborate on the effects of input parameters, heuristic variations, and heuristic enhancements on the planning solution. The following effects have been demonstrated:

- Adding the adjustment phase upon designing the multi-granular virtual topology leads to a consistent saving in the weighted port count. This saving can be achieved by (1) decreasing the port requirement of the pass-through segments of virtual links, and (2) customizing the optical reach of virtual links instead of using the same reach with all virtual links.
- If fiber resources are plentiful, then solving the RMGPA problem beyond the minimum fiber requirement needed to obtain a feasible solution can lead to a minimal weighted port count.
- Heuristic variations based on the bifurcation of all demands always lead to the highest weighted port count in comparison to other bifurcation scenarios.
- Color (or label) conversions are quite beneficial in the fiber-scarce situation since they can significantly reduce the minimum fiber requirements. However, in the fiber-plentiful situation, color conversions can bring a slight decrease in the weighted port count.
- The maximum optical reach has an optimum value that leads to a minimal weighted port count.

- The selection of the wavelength capacity, waveband size, and number of wavebands per fiber such that it leads to the same or different fiber capacity has an optimum combination that can further improve the planning solution.
- Changing the ratio of EXC port weight to the MG-OXC port weight does not change the resultant multi-granular virtual topology if the color-continuity constraints are kept and the optical-reach constraints are not imposed. Otherwise, changing the ratio can alter the resultant virtual topology, best maximum optical reach, and winning heuristic variation.

Finally, a thorough investigation of the heuristic variations proposed for different versions of the RMGPA problem has been conducted via simulation using different physical topologies, traffic patterns, fiber capacities, and maximum optical reach values. The analysis and simulation results have provided valuable insights into many issues in both fiber-scarce and fiber-plentiful situations. Among these issues are the definition of the best heuristic variation, fiber capacity/ C - W - B combination, and maximum optical reach as well as the significance of color conversions, demand bifurcation, and customizing the optical reach. The findings of this investigation suggest the following:

- Heuristics based on the bifurcation of demands at all traffic granularity levels can only be beneficial in the fiber-scarce environment provided that the traffic pattern is uniform and both the traffic intensity and network physical connectivity are high. Otherwise, they offer no advantage over not bifurcating demands or bifurcating only fiber demands.
- With the existence of fiber demands, there is no clear winner between the heuristic based on the bifurcation of fiber demands and the one that does not bifurcate. However, the likelihood that the latter outperforms the former increases in the case when the network physical connectivity is low and fiber resources are plentiful.

- In the fiber-scarce situation, there is no clear overall sorting policy winner. However, without/with the consideration of the color-continuity/optical-reach constraints, the heuristic variations based on Policy 3 are out of the contest when the network physical connectivity is low. Moreover, with the optical-reach constraints, Policy 5 is out of the contest. Accordingly, Policies 3 and 5 can be excluded from the planning process in these problem situations if the planning time is an issue.
- In the fiber-plentiful situation, the size of the contender set is smaller than in the fiber-scarce situation. Without the optical-reach constraints, Policies 1 and 4 are the main contenders, and Policy 4 tends to be more cost-effective in the case where both the network physical connectivity and fiber capacity are low. On the other hand, with the optical-reach constraints, Policies '1, 4, and 6'/'Policies 1, 4, 5, and 6' are the main contenders without/with customizing the optical reach. However, Policy 6/1 shows potential where the network physical connectivity is low/high and the node-to-node distance is high/low. Accordingly, to save on the planning time, the heuristics based on Policies 2 and 3 can be excluded from the planning process, and what should be included in terms of the sorting policies depends on the version of the RMGPA problem.
- The best heuristic variation is decided by the traffic pattern, physical topology, fiber capacity/*C-W-B* combination, ratio of EXC port weight to the MG-OXC port weight, whether the color-continuity and optical-reach constraints are imposed, whether the optical-reach customization is considered, and whether fiber resources are scarce or plentiful.
- Color conversions not only reduce the fiber requirement in fiber-scarce situation, but can also cause a marginal reduction in the weighted port count in the fiber-plentiful situation. Color conversions are beneficial when the network physical connectivity is high. However, the

amount of savings achieved with color conversions is also a function of the traffic pattern and fiber capacity/ C - W - B combination.

- The best maximum optical reach is a function of the physical topology, traffic pattern, fiber capacity/ C - W - B combination, whether the optical-reach customization is considered, and whether fiber resources are scarce or plentiful.
- Customizing the optical reach always brings a consistent saving (up to $\approx 14\%$) in the weighted port count. This saving varies according to the physical topology, traffic pattern, fiber capacity/ C - W - B combination, and condition of fiber resources. Although at the same maximum optical reach the saving is always achieved by customizing the optical reach, further savings can be realized by increasing the maximum optical reach. Some of these savings are achieved by increasing the maximum optical reach value up to 10000 km compared with 5000 km, which is feasible nowadays, if the reach is not customized. Now, assuming that the NSF and EON network cases are representative long-haul network references and given the fact that a lot of research is being conducted in order to extend the optical reach to thousands of kms, this saving will justify the need for system vendors to target an optical reach around 10000 km.
- The best fiber capacity/ C - W - B combination is a function of the physical topology and traffic pattern, whether the optical-reach customization is considered, and whether fiber resources are scarce or plentiful. However, the selection of the best fiber capacity/ C - W - B combination is less sensitive to the consideration of both the color-continuity and optical-reach constraints in the fiber-plentiful situation than it is in the case where fiber resources are scarce.

6.2 Future Research

As an extension to this work, we conclude this thesis with a list of open problems based on our current work:

- Our optimization approaches can be extended for use in other GMPLS-based node architectures. One possible architecture with which to start is to replace the multi-layer-based MG-OXC architecture used in the optical segment of our GMPLS-based node architecture with the single-layer-based MG-OXC proposed in [CAQi04][CAQi06].
- More efforts can be directed toward improving the optimization approach used to solve the RMGPA problem sub-optimally while satisfying the planning speed requirement at the same time. This improvement can be made by (1) developing new sorting policies and multi-granular virtual topology design approaches, and (2) using other optimization techniques such as genetic programming and tabu search methods. Our heuristics can be used as a benchmark for the newly developed optimization approaches.
- Extending the size of the solvable MILP models to increase the precision of the validation procedure can be achieved as follows. (1) The computing resources can be increased through the use of super computers. (2) Since finding an initial feasible solution in the branch-and-bound tree takes a considerable amount of time, reducing the size of the branch-and-bound tree in the MILP model can be done by feeding the feasible solution obtained through the heuristic approach to the tree. This means that a considerable number of tree nodes will be trimmed and the optimum solution can be obtained in a shorter amount of time. However, the challenge here is how to provide a feasible solution to CPLEX software. (3) The use of the latest version of CPLEX software (version 11.0) can significantly reduce the solve time.

- Further research is still needed to conduct a sensitivity analysis of the cost weight of all MG-OXC and EXC port types using up-to-date cost models from the industry. The objective of this investigation is to see how changing the cost points will alter our findings in this thesis.
- To improve the reliability of the GMPLS-based transport network, the RMGPA problem can include the availability calculations in the route selection criteria while building the multi-granular virtual topology. In order to achieve this, availability parameters such as the mean time to failure of all MG-OXC and EXC elements are required. Good resources for this work can be found in [HWNM03][Gro04][TMPa05][KMOk08].
- Protection techniques can be incorporated into our proposed approaches. This will be also a good opportunity to examine both the single- and multi-layer-based MG-OXC architectures under protected traffic conditions. We recommend that the focus be on the p-cycle technique, since it is receiving more attention recently in both industry and academia because it offers a ring-like restoration speed and mesh-like capacity efficiency. Good references for beginning this work can be found in [Gro04][WaMo05].
- With the advances in optical signal processing, our approaches can also be extended to tackle the planning problem in which changing colors (or labels) can occur optically without the need of the EXC. Moreover, optical converters can be used in the MG-OXC architecture, meaning that the EXC will be required mainly for (de)grouping and switching sub-wavelength flows as well as optical signal regeneration.
- Our approaches can also be extended to solve the adaptive (also known as scheduled) planning problem in which the problem is solved for several traffic demand matrices, where each matrix represents the average traffic demands over a certain period (e.g. hours, days, months, or years). Useful references for such work can be found in [GADO01][ZZMo02][Kur+03].

- Minimizing the number of MG-XC cross-points instead of the number of MG-XC ports is the most accurate way to determine the node cost. Solving such a problem exactly requires formulating it as an NLP model. It will be interesting to incorporate this notion into our approaches and compare it with the approach in which the number of cross-points is decided upon solving the optimization problem, as is the case in [Lee+02][HMWu03].
- Incorporating the physical impairments, such as PMD and CD, in the RMGPA problem will lead to a more realistic planning of the GMPLS-based transport network. This requires developing impairment accumulation models, and satisfying the optical-reach constraint in this case means that the impairments accumulate without exceeding predefined thresholds. However, solving such a problem exactly requires formulating it as an NLP model. Good related papers on this subject can be found in [MVT04][ZZFZ04][Lav+07][Li+07][PRMa07][Tomk07].
- Our focus in this thesis has been on the solution to the off-line case of the RMGPA problem. Extending our approaches to solve the on-line case of the RMGPA will be very useful as a control-plane algorithm. Moreover, it can be useful in the post-planning evaluation phase, in which a more extensive evaluation of the designed network can be performed. Such evaluations can include the analysis of the network behavior for unexpected failure scenarios and dynamic traffic conditions. Good papers with which to start this work can be found in [HoMo02a][CAQi04][ZXWu06][CAQi07].
- Although our approach has addressed a new problem by considering the whole GMPLS traffic hierarchy, it will be interesting to change the approach to accommodate different granularity options and compare the modified versions of the approach with other existing approaches that address the same type of problems.

Appendix A

Results of Heuristics Comparison without Conversion and Regeneration Capabilities

In this appendix, we present the detailed results with 95% confidence intervals of the heuristics comparison without the consideration of the color conversion and optical signal regeneration capabilities. Tables A.1-A.3, A.4-A.6, and A.7-A.9 show the results for the 8-node network, 14-node NSF network, and 11-node EON network respectively.

Table A.1: Comparison of no-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the 8-node network.

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted Port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	500	0	1	9	0.7543	3031.5000	85.5564	0.0844	0.0094	10.8	0.7390	2998.3999	90.4513	0.1081	0.0134
10	4	4	2	500	0	2	8.8	0.7390	3119.3000	112.2423	0.0798	0.0097	11	1.2162	3078.7000	96.7856	0.1172	0.0095
10	4	4	2	500	0	3	9	0.7543	3115.5000	109.4364	0.0907	0.0102	10	0.9541	3083.3000	91.4389	0.1078	0.0144
10	4	4	2	500	0	4	8.4	0.6034	3004.8999	82.6747	0.0846	0.0107	10.2	1.2531	2982.3999	93.5395	0.1048	0.0148
10	4	4	2	1000	0	1	16.8	0.7390	3925.5000	161.7139	0.1062	0.0115	21.4	1.7912	3859.2000	165.5073	0.1641	0.0160
10	4	4	2	1000	0	2	16.8	1.2068	3999.5000	166.7372	0.1156	0.0140	20.6	1.9141	3956.2000	158.6373	0.1608	0.0167
10	4	4	2	1000	0	3	16.4	1.3151	4027.5000	174.0147	0.1032	0.0094	21.6	1.7592	3937.3999	163.8274	0.1846	0.0195
10	4	4	2	1000	0	4	16.6	0.6913	3923.6001	172.8657	0.1141	0.0160	21	1.6866	3851.8999	170.5986	0.1765	0.0119
10	4	4	2	1500	0	1	24.2	1.4231	4737.6001	173.4190	0.1359	0.0192	30.2	3.5983	4628.8999	166.3445	0.2157	0.0379
10	4	4	2	1500	0	2	25.2	1.6798	4808.2002	178.3084	0.1656	0.0213	31.4	2.9445	4723.2002	169.7951	0.2421	0.0235
10	4	4	2	1500	0	3	24.8	1.6798	4814.2998	178.8907	0.1547	0.0153	31.8	3.1245	4727.8999	168.2903	0.2548	0.0237
10	4	4	2	1500	0	4	24.4	0.9051	4691.7998	167.6866	0.1545	0.0213	29	2.8820	4621.7002	156.8362	0.2140	0.0204
10	4	4	2	500	20	1	8	0.0000	2471.1001	76.3849	0.0705	0.0109	9.6	1.1289	2452.1001	74.2526	0.0874	0.0108
10	4	4	2	500	20	2	7.8	0.4526	2527.6001	79.4154	0.0716	0.0121	8.8	1.2068	2515.3000	79.7463	0.0856	0.0143
10	4	4	2	500	20	3	7.6	0.6034	2554.7000	90.8309	0.0704	0.0109	9	1.2162	2523.2000	79.3241	0.0875	0.0160
10	4	4	2	500	20	4	7.6	0.6034	2478.6001	72.1912	0.0688	0.0095	10	0.9541	2423.5000	72.5191	0.0983	0.0119
10	4	4	2	1000	20	1	13.4	0.6913	3188.0000	115.1340	0.0780	0.0105	17.8	1.8414	3098.0000	131.1679	0.1248	0.0142
10	4	4	2	1000	20	2	14.4	0.9051	3215.3999	140.9036	0.1000	0.0077	18.4	1.3151	3158.8999	133.6510	0.1390	0.0096
10	4	4	2	1000	20	3	13.8	0.8124	3267.6001	150.2072	0.0875	0.0095	18.6	2.7027	3193.7000	131.7111	0.1391	0.0239
10	4	4	2	1000	20	4	13.4	0.6913	3159.7000	112.5960	0.0828	0.0091	16.2	1.9611	3100.5000	131.6420	0.1185	0.0176
10	4	4	2	1500	20	1	20.2	0.8124	3808.2000	116.4765	0.1064	0.0070	26.8	2.7153	3734.0000	133.1352	0.1734	0.0201
10	4	4	2	1500	20	2	21.4	0.9659	3883.6001	122.8580	0.1311	0.0151	23.6	1.4780	3859.1001	129.5385	0.1655	0.0191
10	4	4	2	1500	20	3	19.8	0.8124	3908.3999	144.1909	0.1155	0.0129	26	3.0170	3843.3999	128.8461	0.1876	0.0257
10	4	4	2	1500	20	4	19.8	1.0560	3800.6001	125.3299	0.1078	0.0112	26.4	3.2912	3727.8999	115.1249	0.1872	0.0223
10	4	4	2	500	50	1	5.8	0.4526	1841.7000	71.3102	0.0530	0.0079	8	0.9541	1807.6000	84.0754	0.0688	0.0092
10	4	4	2	500	50	2	6	0.0000	1888.1000	77.3007	0.0547	0.0060	7.4	0.9659	1874.2000	73.0806	0.0656	0.0089
10	4	4	2	500	50	3	5.8	0.4526	1926.8000	65.1447	0.0564	0.0120	7.8	1.2531	1885.5000	81.7257	0.0751	0.0087
10	4	4	2	500	50	4	5.8	0.4526	1789.3000	75.8667	0.0562	0.0077	7.8	1.2531	1757.5000	75.2260	0.0687	0.0092
10	4	4	2	1000	50	1	10.6	1.3577	2332.0000	127.0694	0.0642	0.0153	13.8	1.8414	2265.8000	122.6293	0.0937	0.0119
10	4	4	2	1000	50	2	10.8	1.0006	2369.8000	142.3838	0.0686	0.0058	13.2	1.3826	2326.6001	127.9885	0.0921	0.0098
10	4	4	2	1000	50	3	10.8	1.0006	2392.5000	127.8889	0.0780	0.0092	13.6	2.0013	2344.3999	133.7326	0.0984	0.0093
10	4	4	2	1000	50	4	10.6	0.6913	2294.2000	143.7668	0.0733	0.0074	12.8	1.8102	2238.6001	129.5019	0.0921	0.0098
10	4	4	2	1500	50	1	15.4	1.7912	2862.8999	159.7891	0.0780	0.0140	18.8	2.7153	2788.8000	146.6631	0.1187	0.0254
10	4	4	2	1500	50	2	17.2	2.3564	2897.5000	129.6490	0.1047	0.0224	19.4	2.1387	2867.1001	140.0110	0.1344	0.0151
10	4	4	2	1500	50	3	16.2	1.7133	2954.3999	166.4941	0.0889	0.0093	19.6	2.5061	2892.7000	157.4708	0.1344	0.0176
10	4	4	2	1500	50	4	16.2	2.1808	2824.6001	150.0921	0.0922	0.0170	19	2.0518	2767.1001	137.4116	0.1296	0.0211
10	4	4	2	500	80	1	3.4	0.6913	1011.8000	76.7626	0.0283	0.0071	4.8	0.7390	985.3000	92.4801	0.0404	0.0056
10	4	4	2	500	80	2	3.4	0.6913	1096.4000	99.0228	0.0297	0.0082	4.8	1.0006	1077.9000	99.2995	0.0390	0.0080
10	4	4	2	500	80	3	3.4	0.6913	1129.4000	92.6258	0.0326	0.0082	4.8	0.7390	1102.1000	95.3862	0.0468	0.0052
10	4	4	2	500	80	4	3.4	0.6913	1000.6000	85.6567	0.0296	0.0082	5	0.7543	973.0000	92.0194	0.0455	0.0062
10	4	4	2	1000	80	1	5.8	0.4526	1311.9000	119.9287	0.0342	0.0089	8.2	1.4231	1264.6000	95.2517	0.0533	0.0058
10	4	4	2	1000	80	2	6.2	0.8124	1364.5000	105.2755	0.0391	0.0078	8.6	1.5160	1323.0000	104.1463	0.0579	0.0056
10	4	4	2	1000	80	3	5.8	0.4526	1383.5000	114.5496	0.0421	0.0094	9.2	1.9318	1328.0000	97.4323	0.0609	0.0083
10	4	4	2	1000	80	4	6	0.6746	1274.0000	105.1050	0.0391	0.0107	8.8	1.3826	1231.5000	106.4764	0.0623	0.0092

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted Port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	1500	80	1	8.8	1.0006	1660.2000	138.0495	0.0577	0.0119	13.4	2.4371	1587.3000	119.8943	0.0889	0.0105
10	4	4	2	1500	80	2	8.8	1.0006	1720.0000	139.1410	0.0578	0.0107	11.8	2.1808	1670.7000	130.2286	0.0859	0.0132
10	4	4	2	1500	80	3	8.8	1.0006	1748.9000	141.8934	0.0608	0.0083	12	2.1333	1708.1000	133.7429	0.0875	0.0150
10	4	4	2	1500	80	4	9.2	1.2068	1636.1000	129.3644	0.0642	0.0097	12.4	2.5061	1584.8000	123.7193	0.0841	0.0092
10	8	8	2	500	0	1	2.4	0.6034	4079.6001	208.8682	0.1188	0.0422	3.6	0.6034	4032.1001	197.6337	0.2047	0.0340
10	8	8	2	500	0	2	2.8	0.7390	4106.2002	198.0289	0.1704	0.0443	3.4	0.6913	4090.6001	195.1066	0.2061	0.0354
10	8	8	2	500	0	3	3.4	0.6913	4128.8999	188.6138	0.2048	0.0426	3.8	0.4526	4118.5000	200.0473	0.2344	0.0091
10	8	8	2	500	0	4	2.6	0.6913	4032.3999	195.5143	0.1437	0.0430	3.4	0.6913	4019.0000	192.6145	0.1938	0.0421
10	8	8	2	1000	0	1	4.6	0.6913	4373.3999	173.4220	0.1906	0.0519	5.4	0.6913	4349.8999	190.6616	0.2421	0.0343
10	8	8	2	1000	0	2	4.4	0.6034	4446.2002	196.8247	0.1906	0.0493	6	0.6746	4425.7998	198.9350	0.2890	0.0177
10	8	8	2	1000	0	3	5	0.7543	4452.7002	193.2929	0.2249	0.0437	6.4	0.6034	4434.0000	188.6125	0.3029	0.0152
10	8	8	2	1000	0	4	4.4	0.6034	4386.2002	200.0443	0.1828	0.0426	5.6	0.9051	4347.3999	209.0310	0.2562	0.0406
10	8	8	2	1500	0	1	6.8	0.7390	4773.0000	144.5203	0.2327	0.0507	8.6	0.6913	4740.5000	158.9058	0.3439	0.0294
10	8	8	2	1500	0	2	7	0.7543	4846.6001	153.1411	0.2860	0.0478	8	0.6746	4827.2998	151.7401	0.3422	0.0281
10	8	8	2	1500	0	3	6.8	0.7390	4838.0000	167.0014	0.2468	0.0468	8.4	0.6034	4797.5000	155.3379	0.3453	0.0368
10	8	8	2	1500	0	4	6.8	0.7390	4723.2002	148.8737	0.2609	0.0448	7.8	1.0560	4702.3999	132.2676	0.3079	0.0475
10	8	8	2	500	20	1	2	0.0000	3258.3999	154.5882	0.1062	0.0127	3.2	0.7390	3238.6001	152.4877	0.1626	0.0318
10	8	8	2	500	20	2	2	0.0000	3282.6001	141.7541	0.1313	0.0184	3.2	0.7390	3263.2000	142.5699	0.1718	0.0247
10	8	8	2	500	20	3	2	0.0000	3328.0000	148.1743	0.1297	0.0116	3.4	0.6913	3293.8999	132.8351	0.1859	0.0232
10	8	8	2	500	20	4	2	0.0000	3227.3000	141.5790	0.1297	0.0106	3	0.7543	3211.3000	134.8062	0.1641	0.0264
10	8	8	2	1000	20	1	4	0.0000	3548.2000	163.9650	0.1544	0.0179	5.4	0.6913	3518.3000	155.6236	0.2219	0.0248
10	8	8	2	1000	20	2	4	0.0000	3573.2000	143.9617	0.1845	0.0171	4.6	0.6913	3564.8000	140.1873	0.2032	0.0267
10	8	8	2	1000	20	3	4	0.0000	3601.8000	158.0883	0.1688	0.0147	5.6	0.6034	3575.8000	148.6725	0.2374	0.0286
10	8	8	2	1000	20	4	4	0.0000	3522.0000	163.7495	0.1704	0.0122	5.4	0.6913	3489.7000	153.6247	0.2221	0.0221
10	8	8	2	1500	20	1	6	0.0000	3828.3000	137.9737	0.2078	0.0167	7.6	0.9051	3794.8000	141.9529	0.2780	0.0257
10	8	8	2	1500	20	2	6	0.0000	3888.2000	139.0501	0.2329	0.0200	7.2	1.0006	3876.0000	127.3641	0.2705	0.0422
10	8	8	2	1500	20	3	6	0.0000	3916.3999	127.9547	0.2233	0.0183	7.2	0.7390	3879.7000	119.7248	0.2749	0.0327
10	8	8	2	1500	20	4	6	0.0000	3783.1001	136.4890	0.2173	0.0122	7	1.0119	3766.6001	128.0009	0.2548	0.0329
10	8	8	2	500	50	1	2	0.0000	2283.8000	141.8711	0.1187	0.0078	2.2	0.4526	2280.0000	144.4817	0.1233	0.0063
10	8	8	2	500	50	2	2	0.0000	2347.3000	154.5256	0.1219	0.0114	2.4	0.6034	2340.3000	147.3029	0.1373	0.0179
10	8	8	2	500	50	3	2	0.0000	2370.7000	155.9355	0.1250	0.0128	2.4	0.6034	2362.3999	156.2548	0.1359	0.0149
10	8	8	2	500	50	4	2	0.0000	2247.5000	167.2744	0.1187	0.0095	2.6	0.6913	2243.3999	165.9880	0.1327	0.0160
10	8	8	2	1000	50	1	3.6	0.6034	2529.1001	171.1499	0.1375	0.0349	4.2	0.4526	2505.5000	171.6308	0.1656	0.0121
10	8	8	2	1000	50	2	3.8	0.4526	2571.8000	170.7547	0.1564	0.0205	4.2	0.4526	2562.0000	167.2941	0.1705	0.0134
10	8	8	2	1000	50	3	3.8	0.4526	2581.5000	182.6428	0.1563	0.0211	4.2	0.4526	2570.8999	171.9326	0.1734	0.0169
10	8	8	2	1000	50	4	3.6	0.6034	2525.7000	176.2147	0.1313	0.0303	4.4	0.6034	2491.8999	168.8148	0.1655	0.0169
10	8	8	2	1500	50	1	4.4	0.6034	2783.3999	158.3664	0.1471	0.0318	5.6	0.9051	2742.8000	162.0346	0.2016	0.0261
10	8	8	2	1500	50	2	4.4	0.6034	2843.6001	171.3070	0.1501	0.0299	5.8	0.8124	2807.5000	167.1203	0.2187	0.0240
10	8	8	2	1500	50	3	4.4	0.6034	2866.7000	176.1917	0.1578	0.0339	5.8	0.8124	2796.8000	159.0802	0.2294	0.0183
10	8	8	2	1500	50	4	4.4	0.6034	2769.5000	173.3636	0.1514	0.0298	5.6	0.9051	2734.0000	167.5448	0.2125	0.0266
10	8	8	2	500	80	1	2	0.0000	1138.8000	108.4513	0.0782	0.0054	2	0.0000	1138.8000	108.4513	0.0782	0.0054
10	8	8	2	500	80	2	2	0.0000	1208.8000	112.6545	0.0876	0.0056	2	0.0000	1208.8000	112.6545	0.0876	0.0056
10	8	8	2	500	80	3	2	0.0000	1230.2000	114.3769	0.0939	0.0075	2	0.0000	1230.2000	114.3769	0.0939	0.0075
10	8	8	2	500	80	4	2	0.0000	1132.6000	110.3856	0.0845	0.0077	2	0.0000	1132.6000	110.3856	0.0845	0.0077
10	8	8	2	1000	80	1	2	0.0000	1350.3000	121.9708	0.0764	0.0111	2.8	0.7390	1337.1000	116.1031	0.0983	0.0176
10	8	8	2	1000	80	2	2	0.0000	1399.3000	107.9335	0.0844	0.0095	2.6	0.6913	1393.7000	105.0530	0.1002	0.0199

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	±CI	Weighted Port count @ F_{min}	±CI	Solve time [sec]	±CI	F_{opt}	±CI	Weighted port count @ F_{opt}	±CI	Solve time [sec]	±CI
10	8	8	2	1000	80	3	2	0.0000	1406.8000	120.1951	0.0906	0.0104	2.6	0.6913	1393.6000	112.6860	0.1046	0.0159
10	8	8	2	1000	80	4	2	0.0000	1325.6000	122.0976	0.0815	0.0115	3.2	0.7390	1308.2000	118.1529	0.1110	0.0162
10	8	8	2	1500	80	1	2.4	0.6034	1630.4000	121.0410	0.0766	0.0199	4	0.9541	1569.4000	111.1938	0.1358	0.0210
10	8	8	2	1500	80	2	3	0.7543	1661.2000	106.4184	0.1140	0.0292	3.8	1.0560	1637.0000	121.7775	0.1421	0.0300
10	8	8	2	1500	80	3	2.6	0.6913	1679.3000	114.9882	0.0987	0.0258	4	1.1685	1655.0000	117.3952	0.1453	0.0270
10	8	8	2	1500	80	4	2.6	0.6913	1589.9000	99.3911	0.0889	0.0258	3.8	1.0560	1546.8000	115.7863	0.1312	0.0281
40	8	8	5	500	0	1	2	0.0000	3853.1001	142.9209	0.1903	0.0102	2	0.0000	3853.1001	142.9209	0.1903	0.0102
40	8	8	5	500	0	2	2	0.0000	3943.3999	151.6374	0.1956	0.0095	2	0.0000	3943.3999	151.6374	0.1956	0.0095
40	8	8	5	500	0	3	2	0.0000	3977.5000	159.4312	0.1984	0.0055	2	0.0000	3977.5000	159.4312	0.1984	0.0055
40	8	8	5	500	0	4	2	0.0000	3812.2000	151.2714	0.1842	0.0048	2	0.0000	3812.2000	151.2714	0.1842	0.0048
40	8	8	5	1000	0	1	2	0.0000	4902.8999	172.8631	0.1828	0.0075	2	0.0000	4902.8999	172.8631	0.1828	0.0075
40	8	8	5	1000	0	2	2	0.0000	5003.5000	181.9356	0.1858	0.0064	2	0.0000	5003.5000	181.9356	0.1858	0.0064
40	8	8	5	1000	0	3	2	0.0000	5016.1001	170.2962	0.1907	0.0116	2	0.0000	5016.1001	170.2962	0.1907	0.0116
40	8	8	5	1000	0	4	2	0.0000	4875.3999	159.1011	0.1842	0.0070	2	0.0000	4875.3999	159.1011	0.1842	0.0070
40	8	8	5	1500	0	1	2	0.0000	5517.9999	183.6209	0.1798	0.0059	2.4	0.6034	5513.2002	185.6186	0.1909	0.0175
40	8	8	5	1500	0	2	2	0.0000	5642.1001	207.6442	0.1750	0.0166	2.4	0.6034	5639.5000	208.4456	0.1890	0.0261
40	8	8	5	1500	0	3	2	0.0000	5678.7998	197.7403	0.1720	0.0148	3.4	0.6913	5657.7998	199.4719	0.2391	0.0268
40	8	8	5	1500	0	4	2	0.0000	5524.5000	180.3029	0.1719	0.0175	2.4	0.6034	5519.0000	183.0581	0.1859	0.0221
40	8	8	5	500	20	1	2	0.0000	3139.0000	135.5951	0.1501	0.0058	2	0.0000	3139.0000	135.5951	0.1501	0.0058
40	8	8	5	500	20	2	2	0.0000	3248.8999	129.8639	0.1561	0.0074	2	0.0000	3248.8999	129.8639	0.1561	0.0074
40	8	8	5	500	20	3	2	0.0000	3277.2000	115.0425	0.1654	0.0058	2	0.0000	3277.2000	115.0425	0.1654	0.0058
40	8	8	5	500	20	4	2	0.0000	3083.0000	123.7884	0.1439	0.0071	2	0.0000	3083.0000	123.7884	0.1439	0.0071
40	8	8	5	1000	20	1	2	0.0000	3886.5000	120.6672	0.1533	0.0088	2	0.0000	3886.5000	120.6672	0.1533	0.0088
40	8	8	5	1000	20	2	2	0.0000	4007.0000	144.0890	0.1640	0.0081	2	0.0000	4007.0000	144.0890	0.1640	0.0081
40	8	8	5	1000	20	3	2	0.0000	4031.3999	138.8476	0.1687	0.0088	2	0.0000	4031.3999	138.8476	0.1687	0.0088
40	8	8	5	1000	20	4	2	0.0000	3850.8999	137.7370	0.1486	0.0079	2	0.0000	3850.8999	137.7370	0.1486	0.0079
40	8	8	5	1500	20	1	2	0.0000	4356.6001	176.5940	0.1498	0.0095	2.2	0.4526	4354.7998	175.5045	0.1561	0.0107
40	8	8	5	1500	20	2	2	0.0000	4491.1001	184.1622	0.1640	0.0059	2	0.0000	4491.1001	184.1622	0.1640	0.0059
40	8	8	5	1500	20	3	2	0.0000	4515.3999	165.7438	0.1611	0.0119	2.4	0.6034	4514.7998	165.5901	0.1752	0.0165
40	8	8	5	1500	20	4	2	0.0000	4308.2002	186.8067	0.1485	0.0079	2.4	0.6034	4305.2998	187.2318	0.1594	0.0146
40	8	8	5	500	50	1	2	0.0000	2188.0000	110.2633	0.1063	0.0070	2	0.0000	2188.0000	110.2633	0.1063	0.0070
40	8	8	5	500	50	2	2	0.0000	2356.0000	103.2262	0.1234	0.0036	2	0.0000	2356.0000	103.2262	0.1234	0.0036
40	8	8	5	500	50	3	2	0.0000	2388.7000	103.7277	0.1250	0.0076	2	0.0000	2388.7000	103.7277	0.1250	0.0076
40	8	8	5	500	50	4	2	0.0000	2127.5000	109.7603	0.1064	0.0071	2	0.0000	2127.5000	109.7603	0.1064	0.0071
40	8	8	5	1000	50	1	2	0.0000	2746.6001	153.2195	0.1234	0.0080	2	0.0000	2746.6001	153.2195	0.1234	0.0080
40	8	8	5	1000	50	2	2	0.0000	2888.3999	147.1229	0.1343	0.0057	2	0.0000	2888.3999	147.1229	0.1343	0.0057
40	8	8	5	1000	50	3	2	0.0000	2922.3999	139.7327	0.1406	0.0074	2	0.0000	2922.3999	139.7327	0.1406	0.0074
40	8	8	5	1000	50	4	2	0.0000	2720.7000	154.9337	0.1281	0.0047	2	0.0000	2720.7000	154.9337	0.1281	0.0047
40	8	8	5	1500	50	1	2	0.0000	3075.8000	177.6371	0.1233	0.0063	2	0.0000	3075.8000	177.6371	0.1233	0.0063
40	8	8	5	1500	50	2	2	0.0000	3202.8999	164.1015	0.1327	0.0058	2	0.0000	3202.8999	164.1015	0.1327	0.0058
40	8	8	5	1500	50	3	2	0.0000	3251.1001	175.9554	0.1361	0.0092	2.2	0.4526	3249.3000	174.8297	0.1423	0.0099
40	8	8	5	1500	50	4	2	0.0000	3035.3000	176.8756	0.1235	0.0034	2	0.0000	3035.3000	176.8756	0.1235	0.0034
40	8	8	5	500	80	1	2	0.0000	1122.7000	137.4089	0.0659	0.0071	2	0.0000	1122.7000	137.4089	0.0659	0.0071
40	8	8	5	500	80	2	2	0.0000	1268.6000	82.8801	0.0783	0.0075	2	0.0000	1268.6000	82.8801	0.0783	0.0075
40	8	8	5	500	80	3	2	0.0000	1371.8000	102.3372	0.0844	0.0076	2	0.0000	1371.8000	102.3372	0.0844	0.0076
40	8	8	5	500	80	4	2	0.0000	1072.9000	120.7003	0.0610	0.0082	2	0.0000	1072.9000	120.7003	0.0610	0.0082

C [Gb/s]	W	B	E/O cost ratio	DN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted Port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
40	8	8	5	1000	80	1	2	0.0000	1405.4000	158.3973	0.0751	0.0069	2	0.0000	1405.4000	158.3973	0.0751	0.0069
40	8	8	5	1000	80	2	2	0.0000	1536.4000	124.4252	0.0890	0.0053	2	0.0000	1536.4000	124.4252	0.0890	0.0053
40	8	8	5	1000	80	3	2	0.0000	1598.7000	123.8812	0.0938	0.0093	2	0.0000	1598.7000	123.8812	0.0938	0.0093
40	8	8	5	1000	80	4	2	0.0000	1347.0000	138.8611	0.0765	0.0112	2	0.0000	1347.0000	138.8611	0.0765	0.0112
40	8	8	5	1500	80	1	2	0.0000	1584.8000	157.0040	0.0827	0.0074	2	0.0000	1584.8000	157.0040	0.0827	0.0074
40	8	8	5	1500	80	2	2	0.0000	1720.3000	129.7244	0.0907	0.0071	2	0.0000	1720.3000	129.7244	0.0907	0.0071
40	8	8	5	1500	80	3	2	0.0000	1784.9000	138.2696	0.0969	0.0048	2	0.0000	1784.9000	138.2696	0.0969	0.0048
40	8	8	5	1500	80	4	2	0.0000	1566.8000	154.2562	0.0844	0.0079	2	0.0000	1566.8000	154.2562	0.0844	0.0079

Table A.2: Comparison of fiber-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the 8-node network.

C	W	B	E/O cost	IN	FR	Policy	F _{min}	Weighted port count		Solve time [sec]	±CI	F _{opt}	Weighted port count		Solve time [sec]	±CI	
								±CI	@F _{min}				±CI	@F _{opt}			
[Gb/s]																	
10	4	4	2	500	0	1	9	0.7543	3033.3000	87.0350	0.0889	0.0118	10.8	2998.3999	90.4513	0.1123	0.0104
10	4	4	2	500	0	2	8.8	0.7390	3112.3999	109.8260	0.0799	0.0097	11	3078.7000	96.7856	0.1218	0.0103
10	4	4	2	500	0	3	8.8	0.7390	3125.0000	114.8813	0.0892	0.0106	10	3084.2000	91.0716	0.1127	0.0174
10	4	4	2	500	0	4	8.8	0.7390	3015.6001	87.8360	0.0892	0.0118	10.6	2989.5000	99.3068	0.1188	0.0175
10	4	4	2	1000	0	1	16.6	0.6913	3919.0000	165.7176	0.1173	0.0130	20.6	3864.8999	173.6243	0.1734	0.0226
10	4	4	2	1000	0	2	16.8	1.0006	4021.2000	167.3066	0.1266	0.0110	19.8	3961.3000	159.9441	0.1704	0.0200
10	4	4	2	1000	0	3	16.4	1.1289	4034.3000	155.6726	0.1250	0.0139	22.2	3939.6001	164.3619	0.2047	0.0134
10	4	4	2	1000	0	4	16.6	0.6913	3903.8000	162.2188	0.1281	0.0115	21.8	3855.3999	166.5259	0.1921	0.0188
10	4	4	2	1500	0	1	23.8	1.2531	4770.5000	169.3729	0.1529	0.0114	31.8	3358.4650	149.9283	0.2609	0.0365
10	4	4	2	1500	0	2	25	1.6866	4834.7998	168.9352	0.1764	0.0160	32	2524.4733	168.5897	0.2768	0.0258
10	4	4	2	1500	0	3	24.6	1.5160	4842.3999	170.9799	0.1703	0.0063	33	2546.4740	164.6824	0.2968	0.0236
10	4	4	2	1500	0	4	24.6	1.1782	4723.2002	163.6295	0.1782	0.0119	31.8	2897.4617	156.6448	0.2687	0.0337
10	4	4	2	500	20	1	8	0.0000	2471.1001	76.3849	0.0735	0.0092	9.6	2452.1001	74.2526	0.0922	0.0110
10	4	4	2	500	20	2	7.6	0.6034	2536.8999	74.3483	0.0703	0.0079	8.8	2513.6001	81.1795	0.0842	0.0095
10	4	4	2	500	20	3	7.6	0.6034	2567.5000	78.0512	0.0702	0.0107	9.2	2524.2000	78.3230	0.0937	0.0158
10	4	4	2	500	20	4	7.6	0.6034	2472.8999	71.0227	0.0703	0.0078	9.8	2422.8999	73.0733	0.0983	0.0128
10	4	4	2	1000	20	1	13.4	0.6913	3182.8999	119.8760	0.0875	0.0133	17.6	1884.3104	800.130	0.1343	0.0130
10	4	4	2	1000	20	2	13.8	0.8124	3241.6001	148.8769	0.0997	0.0095	18	1508.5316	7.8999	0.1374	0.0136
10	4	4	2	1000	20	3	13.6	0.9051	3268.1001	135.9381	0.0970	0.0103	18.8	2154.3193	300.131	0.1564	0.0196
10	4	4	2	1000	20	4	13.6	0.6034	3141.1001	124.6135	0.0968	0.0088	16.8	1931.8309	6.6001	0.1327	0.0160
10	4	4	2	1500	20	1	19.4	0.9659	3846.3000	112.4544	0.1187	0.0120	27.6	2681.3738	700.130	0.2031	0.0240
10	4	4	2	1500	20	2	20.2	0.8124	3907.5000	133.3586	0.1358	0.0127	24.8	3945.3869	600.113	0.1889	0.0366
10	4	4	2	1500	20	3	19.4	0.6913	3953.8999	149.6606	0.1297	0.0118	26.2	2651.3852	100.125	0.2142	0.0264
10	4	4	2	1500	20	4	19.4	0.6913	3813.8000	134.4596	0.1281	0.0117	26	2337.3733	300.117	0.2000	0.0195
10	4	4	2	500	50	1	5.8	0.4526	1840.1000	71.5470	0.0500	0.0072	8	1809.7000	83.3454	0.0703	0.0080
10	4	4	2	500	50	2	6	0.0000	1889.6000	71.3398	0.0578	0.0053	7.2	1006.1870	600.74	0.0658	0.0071
10	4	4	2	500	50	3	5.8	0.4526	1930.9000	71.3854	0.0548	0.0080	7.6	1128.1885	500.81	0.0718	0.0094
10	4	4	2	500	50	4	5.8	0.4526	1778.4000	85.7397	0.0531	0.0078	7.8	1757.5000	75.2260	0.0717	0.0079
10	4	4	2	1000	50	1	10.8	1.3826	2346.0000	120.8527	0.0703	0.0120	14.4	1624.2268	800.121	0.1028	0.0142
10	4	4	2	1000	50	2	10.2	1.0560	2403.8999	145.1356	0.0673	0.0092	13.4	1357.2325	899.129	0.1016	0.0109
10	4	4	2	1000	50	3	10.2	1.2531	2407.3999	125.9864	0.0719	0.0107	13.2	1810.2348	300.135	0.1031	0.0120
10	4	4	2	1000	50	4	10.4	1.1289	2342.6001	149.6088	0.0719	0.0120	14.4	1478.2239	600.130	0.1078	0.0143
10	4	4	2	1500	50	1	15.4	1.7912	2870.2000	154.9641	0.0905	0.0115	21.4	3376.2794	600.138	0.1562	0.0246
10	4	4	2	1500	50	2	15.4	2.1387	2944.5000	151.0947	0.0952	0.0169	19.4	3028.2873	200.145	0.1422	0.0215
10	4	4	2	1500	50	3	15.4	1.7912	2981.5000	150.9527	0.0983	0.0129	19.6	2765.2906	0.296	0.1438	0.0189
10	4	4	2	1500	50	4	15.2	1.8102	2855.1001	154.5088	0.0971	0.0137	18.4	2776.1001	142.2206	0.1342	0.0152
10	4	4	2	500	80	1	3.4	0.6913	1013.8000	78.1900	0.0298	0.0063	5.2	1006.985	300.92	0.0406	0.0059
10	4	4	2	500	80	2	3.4	0.6913	1097.8000	100.5703	0.0296	0.0084	4.8	1006.1077	900.99	0.0437	0.0089
10	4	4	2	500	80	3	3.4	0.6913	1129.8000	93.0631	0.0362	0.0092	4.8	739.1102	100.95	0.0453	0.0034
10	4	4	2	500	80	4	3.4	0.6913	1006.8000	90.8251	0.0328	0.0065	5	754.973	0.973	0.0438	0.0071
10	4	4	2	1000	80	1	5.6	0.6034	1315.2000	112.1235	0.0356	0.0051	8.4	1759.1263	600.95	0.0593	0.0104
10	4	4	2	1000	80	2	5.6	0.6034	1391.1000	118.0854	0.0391	0.0060	9	1390.1324	600.102	0.0625	0.0091
10	4	4	2	1000	80	3	5.6	0.6034	1376.5000	114.2771	0.0391	0.0060	8.6	2025.1327	200.96	0.0611	0.0082

C	W	B	E/O cost ratio	IN	FR	Policy	F_{min}	Weighted port count			Solve time [sec]	Weighted port count			Solve time [sec]	$\pm CI$	Solve time [sec]	$\pm CI$
								$\pm CI$	@ F_{min}	$\pm CI$		@ F_{opt}	$\pm CI$	$\pm CI$				
[Gb/s]				[Gb/s]	[%]													
10	4	4	2	1000	80	4	5.6	0.6034	1292.6000	118.7161	0.0375	0.0080	8.8	1.3826	1232.6000	107.4152	0.0608	0.0097
10	4	4	2	1500	80	1	7.6	1.6247	1727.0000	134.6537	0.0423	0.0119	13.8	2.2828	1590.6000	122.1223	0.0939	0.0129
10	4	4	2	1500	80	2	7.6	1.4780	1773.1000	118.5158	0.0484	0.0112	13.4	2.1387	1674.0000	133.1403	0.0952	0.0154
10	4	4	2	1500	80	3	7.8	1.4231	1801.7000	125.9249	0.0514	0.0106	13	2.1598	1704.3000	129.2758	0.0924	0.0169
10	4	4	2	1500	80	4	7.8	1.4231	1683.5000	139.4760	0.0532	0.0120	12.8	2.3564	1583.8000	128.7351	0.0939	0.0128
10	8	8	2	500	0	1	2.4	0.6034	4079.6001	208.8682	0.1172	0.0429	3.6	0.6034	4032.1001	197.6337	0.2078	0.0398
10	8	8	2	500	0	2	2.8	0.7390	4106.2002	198.0289	0.1689	0.0440	3.4	0.6913	4090.6001	195.1066	0.2048	0.0374
10	8	8	2	500	0	3	3.4	0.6913	4128.8999	188.6138	0.2124	0.0424	3.8	0.4526	4118.5000	200.0473	0.2388	0.0077
10	8	8	2	500	0	4	2.6	0.6913	4032.3999	195.5143	0.1485	0.0435	3.4	0.6913	4019.0000	192.6145	0.2015	0.0410
10	8	8	2	1000	0	1	4.6	0.6913	4373.3999	173.4220	0.1875	0.0522	5.4	0.6913	4349.8999	190.6616	0.2422	0.0384
10	8	8	2	1000	0	2	4.4	0.6034	4446.2002	196.8247	0.1967	0.0464	6	0.6746	4425.7998	198.9350	0.2842	0.0165
10	8	8	2	1000	0	3	5	0.7543	4452.7002	193.2929	0.2297	0.0415	6.4	0.6034	4434.0000	188.6125	0.3047	0.0151
10	8	8	2	1000	0	4	4.4	0.6034	4386.2002	200.0443	0.1844	0.0431	5.6	0.9051	4347.3999	209.0310	0.2579	0.0382
10	8	8	2	1500	0	1	6.8	0.7390	4773.0000	144.5203	0.2296	0.0497	8.6	0.6913	4740.5000	158.9058	0.3452	0.0277
10	8	8	2	1500	0	2	6.8	0.7390	4852.6001	152.0046	0.2671	0.0556	8	0.6746	4826.7002	151.7986	0.3392	0.0362
10	8	8	2	1500	0	3	6.8	0.7390	4831.7998	167.1259	0.2514	0.0451	8.2	0.8124	4793.5000	155.0080	0.3359	0.0422
10	8	8	2	1500	0	4	6.8	0.7390	4726.6001	143.6917	0.2657	0.0451	7.8	1.0560	4702.3999	132.2676	0.3125	0.0459
10	8	8	2	500	20	1	2	0.0000	3258.3999	154.5882	0.1125	0.0165	3.2	0.7390	3238.6001	152.4877	0.1656	0.0308
10	8	8	2	500	20	2	2	0.0000	3282.6001	141.7541	0.1296	0.0197	3.2	0.7390	3263.2000	142.5699	0.1782	0.0270
10	8	8	2	500	20	3	2	0.0000	3328.0000	148.1743	0.1250	0.0158	3.4	0.6913	3293.8999	132.8351	0.1904	0.0246
10	8	8	2	500	20	4	2	0.0000	3227.3000	141.5790	0.1344	0.0078	3	0.7543	3211.3000	134.8062	0.1641	0.0218
10	8	8	2	1000	20	1	4	0.0000	3548.2000	163.9650	0.1514	0.0190	5.4	0.6913	3518.3000	155.6236	0.2219	0.0248
10	8	8	2	1000	20	2	4	0.0000	3573.2000	143.9617	0.1875	0.0157	4.6	0.6913	3564.8000	140.1873	0.2094	0.0275
10	8	8	2	1000	20	3	4	0.0000	3601.8000	158.0883	0.1749	0.0183	5.6	0.6034	3575.8000	148.6725	0.2344	0.0259
10	8	8	2	1000	20	4	4	0.0000	3522.0000	163.7495	0.1734	0.0112	5.4	0.6913	3489.7000	153.6247	0.2233	0.0229
10	8	8	2	1500	20	1	6	0.0000	3828.3000	137.9737	0.2095	0.0185	7.6	0.9051	3794.8000	141.9529	0.2765	0.0251
10	8	8	2	1500	20	2	6	0.0000	3890.3999	139.6940	0.2283	0.0200	7.2	1.0006	3876.0000	127.3641	0.2717	0.0421
10	8	8	2	1500	20	3	6	0.0000	3916.3999	127.9547	0.2201	0.0171	7.2	0.7390	3879.7000	119.7248	0.2780	0.0357
10	8	8	2	1500	20	4	6	0.0000	3782.8999	136.4073	0.2154	0.0103	7	1.0119	3766.6001	128.0009	0.2545	0.0363
10	8	8	2	500	50	1	2	0.0000	2283.8000	141.8711	0.1187	0.0095	2.2	0.4526	2280.0000	144.4817	0.1249	0.0106
10	8	8	2	500	50	2	2	0.0000	2347.3000	154.5256	0.1219	0.0114	2.4	0.6034	2340.3000	147.3029	0.1375	0.0182
10	8	8	2	500	50	3	2	0.0000	2370.7000	155.9355	0.1265	0.0111	2.4	0.6034	2362.3999	156.2548	0.1374	0.0127
10	8	8	2	500	50	4	2	0.0000	2247.5000	167.2744	0.1154	0.0140	2.6	0.6913	2243.3999	165.9880	0.1356	0.0183
10	8	8	2	1000	50	1	3.6	0.6034	2529.1001	171.1499	0.1329	0.0299	4.2	0.4526	2505.5000	171.6308	0.1594	0.0157
10	8	8	2	1000	50	2	3.8	0.4526	2571.8000	170.7547	0.1564	0.0218	4.2	0.4526	2562.0000	167.2941	0.1736	0.0169
10	8	8	2	1000	50	3	3.8	0.4526	2581.5000	182.6428	0.1565	0.0243	4.2	0.4526	2570.8999	171.9326	0.1784	0.0191
10	8	8	2	1000	50	4	3.6	0.6034	2525.7000	176.2147	0.1314	0.0308	4.4	0.6034	2491.8999	168.8148	0.1672	0.0204
10	8	8	2	1500	50	1	4.4	0.6034	2783.3999	158.3664	0.1486	0.0281	5.6	0.9051	2742.8000	162.0346	0.2016	0.0260
10	8	8	2	1500	50	2	4.4	0.6034	2851.8000	174.6323	0.1533	0.0287	5.8	0.8124	2807.5000	167.1203	0.2202	0.0245
10	8	8	2	1500	50	3	4.4	0.6034	2860.5000	171.5791	0.1626	0.0320	5.8	0.8124	2796.8000	159.0802	0.2280	0.0218
10	8	8	2	1500	50	4	4.4	0.6034	2769.5000	173.3636	0.1497	0.0290	5.6	0.9051	2734.0000	167.5448	0.2110	0.0266
10	8	8	2	500	80	1	2	0.0000	1138.8000	108.4513	0.0811	0.0047	2	0.0000	1138.8000	108.4513	0.0811	0.0047
10	8	8	2	500	80	2	2	0.0000	1208.8000	112.6545	0.0858	0.0057	2	0.0000	1208.8000	112.6545	0.0858	0.0057
10	8	8	2	500	80	3	2	0.0000	1230.2000	114.3769	0.0938	0.0092	2	0.0000	1230.2000	114.3769	0.0938	0.0092
10	8	8	2	500	80	4	2	0.0000	1132.6000	110.3856	0.0828	0.0076	2	0.0000	1132.6000	110.3856	0.0828	0.0076

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	8	8	2	1000	80	1	2	0.0000	1350.3000	121.9708	0.0749	0.0089	2.8	1337.1000	116.1031	0.1001	0.0193
10	8	8	2	1000	80	2	2	0.0000	1399.3000	107.9335	0.0876	0.0078	2.6	1393.7000	105.0530	0.1032	0.0175
10	8	8	2	1000	80	3	2	0.0000	1406.8000	120.1951	0.0890	0.0118	2.6	1393.6000	112.6860	0.1046	0.0158
10	8	8	2	1000	80	4	2	0.0000	1325.6000	122.0976	0.0782	0.0118	3.2	1308.2000	118.1529	0.1076	0.0153
10	8	8	2	1500	80	1	2.4	0.6034	1630.4000	121.0410	0.0767	0.0193	4	1569.4000	111.1938	0.1344	0.0249
10	8	8	2	1500	80	2	2.8	0.7390	1664.2000	105.9088	0.1080	0.0366	3.8	1637.0000	121.7775	0.1439	0.0327
10	8	8	2	1500	80	3	2.6	0.6913	1679.3000	114.9882	0.1001	0.0282	4	1655.0000	117.3952	0.1452	0.0294
10	8	8	2	1500	80	4	2.4	0.6034	1605.5000	98.8440	0.0828	0.0247	3.8	1545.2000	115.3926	0.1283	0.0301
40	8	8	5	500	0	1	2	0.0000	3853.1001	142.9209	0.1842	0.0071	2	3853.1001	142.9209	0.1842	0.0071
40	8	8	5	500	0	2	2	0.0000	3943.3999	151.6374	0.1952	0.0079	2	3943.3999	151.6374	0.1952	0.0079
40	8	8	5	500	0	3	2	0.0000	3977.5000	159.4312	0.1953	0.0079	2	3977.5000	159.4312	0.1953	0.0079
40	8	8	5	500	0	4	2	0.0000	3812.2000	151.2714	0.1860	0.0063	2	3812.2000	151.2714	0.1860	0.0063
40	8	8	5	1000	0	1	2	0.0000	4902.8999	172.8631	0.1812	0.0057	2	4902.8999	172.8631	0.1812	0.0057
40	8	8	5	1000	0	2	2	0.0000	5003.5000	181.9356	0.1877	0.0093	2	5003.5000	181.9356	0.1877	0.0093
40	8	8	5	1000	0	3	2	0.0000	5016.1001	170.2962	0.1939	0.0110	2	5016.1001	170.2962	0.1939	0.0110
40	8	8	5	1000	0	4	2	0.0000	4875.3999	159.1011	0.1893	0.0083	2	4875.3999	159.1011	0.1893	0.0083
40	8	8	5	1500	0	1	2	0.0000	5517.7998	183.6209	0.1782	0.0108	2.4	5513.2002	185.6186	0.1909	0.0197
40	8	8	5	1500	0	2	2	0.0000	5642.1001	207.6442	0.1767	0.0106	2.4	5639.5000	208.4456	0.1891	0.0225
40	8	8	5	1500	0	3	2	0.0000	5678.7998	197.7403	0.1734	0.0186	3.4	5657.7998	199.4719	0.2421	0.0232
40	8	8	5	1500	0	4	2	0.0000	5524.5000	180.3029	0.1721	0.0218	2.4	5519.0000	183.0581	0.1892	0.0249
40	8	8	5	500	20	1	2	0.0000	3139.0000	135.5951	0.1560	0.0076	2	3139.0000	135.5951	0.1560	0.0076
40	8	8	5	500	20	2	2	0.0000	3248.8999	129.8639	0.1609	0.0091	2	3248.8999	129.8639	0.1609	0.0091
40	8	8	5	500	20	3	2	0.0000	3277.2000	115.0425	0.1685	0.0070	2	3277.2000	115.0425	0.1685	0.0070
40	8	8	5	500	20	4	2	0.0000	3083.0000	123.7884	0.1455	0.0055	2	3083.0000	123.7884	0.1455	0.0055
40	8	8	5	1000	20	1	2	0.0000	3886.5000	120.6672	0.1548	0.0035	2	3886.5000	120.6672	0.1548	0.0035
40	8	8	5	1000	20	2	2	0.0000	4007.0000	144.0890	0.1704	0.0097	2	4007.0000	144.0890	0.1704	0.0097
40	8	8	5	1000	20	3	2	0.0000	4031.3999	138.8476	0.1671	0.0055	2	4031.3999	138.8476	0.1671	0.0055
40	8	8	5	1000	20	4	2	0.0000	3850.8999	137.7370	0.1502	0.0094	2	3850.8999	137.7370	0.1502	0.0094
40	8	8	5	1500	20	1	2	0.0000	4356.6001	176.5940	0.1500	0.0077	2.2	4354.7998	175.5045	0.1563	0.0092
40	8	8	5	1500	20	2	2	0.0000	4491.1001	184.1622	0.1687	0.0048	2	4491.1001	184.1622	0.1687	0.0048
40	8	8	5	1500	20	3	2	0.0000	4515.3999	165.7438	0.1688	0.0129	2.4	4514.7998	165.5901	0.1828	0.0167
40	8	8	5	1500	20	4	2	0.0000	4308.2002	186.8067	0.1545	0.0084	2.4	4305.2998	187.2318	0.1639	0.0143
40	8	8	5	500	50	1	2	0.0000	2188.0000	110.2633	0.1093	0.0076	2	2188.0000	110.2633	0.1093	0.0076
40	8	8	5	500	50	2	2	0.0000	2356.0000	103.2262	0.1204	0.0053	2	2356.0000	103.2262	0.1204	0.0053
40	8	8	5	500	50	3	2	0.0000	2388.7000	103.7277	0.1360	0.0054	2	2388.7000	103.7277	0.1360	0.0054
40	8	8	5	500	50	4	2	0.0000	2127.5000	109.7603	0.1062	0.0087	2	2127.5000	109.7603	0.1062	0.0087
40	8	8	5	1000	50	1	2	0.0000	2746.6001	153.2195	0.1188	0.0057	2	2746.6001	153.2195	0.1188	0.0057
40	8	8	5	1000	50	2	2	0.0000	2888.3999	147.1229	0.1360	0.0054	2	2888.3999	147.1229	0.1360	0.0054
40	8	8	5	1000	50	3	2	0.0000	2922.3999	139.7327	0.1422	0.0063	2	2922.3999	139.7327	0.1422	0.0063
40	8	8	5	1000	50	4	2	0.0000	2720.7000	154.9337	0.1265	0.0034	2	2720.7000	154.9337	0.1265	0.0034
40	8	8	5	1500	50	1	2	0.0000	3075.8000	177.6371	0.1236	0.0062	2	3075.8000	177.6371	0.1236	0.0062
40	8	8	5	1500	50	2	2	0.0000	3202.8999	164.1015	0.1314	0.0078	2	3202.8999	164.1015	0.1314	0.0078
40	8	8	5	1500	50	3	2	0.0000	3251.1001	175.9554	0.1377	0.0071	2.2	3249.3000	174.8297	0.1408	0.0074
40	8	8	5	1500	50	4	2	0.0000	3035.3000	176.8756	0.1235	0.0034	2	3035.3000	176.8756	0.1235	0.0034
40	8	8	5	500	80	1	2	0.0000	1122.7000	137.4089	0.0659	0.0072	2	1122.7000	137.4089	0.0659	0.0072

C	W	B	E/O cost	IN	FR	Policy	F_{min}	Weighted port count $@F_{min}$	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	Weighted port count $@F_{opt}$	$\pm CI$	Solve time [sec]	$\pm CI$
[Gb/s]			ratio	[Gb/s]	[%]											
40	8	8	5	500	80	2	2	1268.6000	0.0000	0.0766	0.0061	2	1268.6000	0.0000	0.0766	0.0061
40	8	8	5	500	80	3	2	1371.8000	0.0000	0.0827	0.0076	2	1371.8000	0.0000	0.0827	0.0076
40	8	8	5	500	80	4	2	1072.9000	0.0000	0.0608	0.0083	2	1072.9000	0.0000	0.0608	0.0083
40	8	8	5	1000	80	1	2	1405.4000	0.0000	0.0731	0.0076	2	1405.4000	0.0000	0.0731	0.0076
40	8	8	5	1000	80	2	2	1536.4000	0.0000	0.0843	0.0079	2	1536.4000	0.0000	0.0843	0.0079
40	8	8	5	1000	80	3	2	1598.7000	0.0000	0.0906	0.0072	2	1598.7000	0.0000	0.0906	0.0072
40	8	8	5	1000	80	4	2	1347.0000	0.0000	0.0779	0.0093	2	1347.0000	0.0000	0.0779	0.0093
40	8	8	5	1500	80	1	2	1584.8000	0.0000	0.0827	0.0076	2	1584.8000	0.0000	0.0827	0.0076
40	8	8	5	1500	80	2	2	1720.3000	0.0000	0.0923	0.0036	2	1720.3000	0.0000	0.0923	0.0036
40	8	8	5	1500	80	3	2	1784.9000	0.0000	0.1015	0.0058	2	1784.9000	0.0000	0.1015	0.0058
40	8	8	5	1500	80	4	2	1566.8000	0.0000	0.0845	0.0077	2	1566.8000	0.0000	0.0845	0.0077

Table A.3: Comparison of all-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the 8-node network.

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	500	0	1	10	0.0000	4356.6001	113.7827	0.0316	4233.1001	140.2789	0.2876	0.0264
10	4	4	2	500	0	2	9.8	0.4526	4309.6001	156.0220	0.0325	4179.8999	172.1918	0.2876	0.0168
10	4	4	2	500	0	3	10	0.6746	4344.1001	141.8289	0.0347	4384.2998	120.6624	0.3252	0.0201
10	4	4	2	500	0	4	9.6	0.6034	4320.7998	109.8201	0.0307	4218.7002	143.7016	0.2985	0.0213
10	4	4	2	1000	0	1	17.2	1.0006	5392.1001	214.7848	0.0293	5183.3999	209.1478	0.4609	0.0184
10	4	4	2	1000	0	2	17.8	1.2531	5297.8999	246.3329	0.0308	5072.5000	192.6937	0.4391	0.0455
10	4	4	2	1000	0	3	18	0.9541	5553.5000	198.9728	0.0316	5310.0000	204.1327	0.4969	0.0324
10	4	4	2	1000	0	4	17.2	0.7390	5260.7002	185.4669	0.0278	5113.5000	181.1852	0.4016	0.0476
10	4	4	2	1500	0	1	25	1.2162	6073.5000	240.5509	0.0278	5752.7002	201.3438	0.6155	0.0458
10	4	4	2	1500	0	2	25.4	1.5160	5982.8999	223.5233	0.0391	5701.6001	211.1877	0.5985	0.0474
10	4	4	2	1500	0	3	26	1.5085	6197.8999	211.8260	0.0373	5894.7998	196.8918	0.6639	0.0767
10	4	4	2	1500	0	4	24.8	1.2068	5939.2002	225.7223	0.0248	5673.2002	222.1371	0.5389	0.0755
10	4	4	2	500	20	1	8	0.0000	3638.8999	144.3787	0.0130	3469.1001	97.2087	0.2282	0.0242
10	4	4	2	500	20	2	8	0.0000	3507.3999	162.6214	0.0141	3362.1001	107.1173	0.2095	0.0249
10	4	4	2	500	20	3	8	0.0000	3763.5000	163.5010	0.0140	3610.3999	94.2394	0.2547	0.0205
10	4	4	2	500	20	4	8	0.0000	3500.3000	145.9220	0.0118	3403.3999	123.9184	0.2170	0.0219
10	4	4	2	1000	20	1	14.4	0.6034	4468.2998	207.1281	0.0215	4271.8999	177.9007	0.3579	0.0532
10	4	4	2	1000	20	2	14.6	0.6913	4361.2002	196.7646	0.0167	4199.5000	148.8991	0.3344	0.0449
10	4	4	2	1000	20	3	14.6	0.9659	4610.8999	225.6980	0.0194	4407.2998	184.2785	0.3920	0.0606
10	4	4	2	1000	20	4	14.4	0.6034	4333.2998	202.3750	0.0216	4200.2002	171.4419	0.3329	0.0473
10	4	4	2	1500	20	1	19.8	0.8124	5112.7002	179.6223	0.0252	4826.0000	164.8609	0.4533	0.0643
10	4	4	2	1500	20	2	20.4	0.9051	4967.5000	212.5373	0.0291	4765.8999	153.9977	0.4265	0.0535
10	4	4	2	1500	20	3	20.2	0.4526	5278.7002	228.6650	0.0311	5007.7002	186.8095	0.5156	0.0586
10	4	4	2	1500	20	4	20.2	0.8124	4944.0000	215.8840	0.0151	4770.2998	185.4196	0.4466	0.0549
10	4	4	2	500	50	1	6.2	0.4526	2766.1001	169.8275	0.0143	2652.5000	176.9049	0.1654	0.0132
10	4	4	2	500	50	2	6.2	0.4526	2708.6001	167.5313	0.0134	2584.8000	152.7202	0.1531	0.0181
10	4	4	2	500	50	3	6.4	0.6034	2909.2000	142.3203	0.0233	2814.7000	159.9456	0.1766	0.0236
10	4	4	2	500	50	4	6	0.0000	2667.0000	186.2783	0.0092	2593.8999	170.0782	0.1578	0.0151
10	4	4	2	1000	50	1	11.4	0.6913	3574.1001	266.2537	0.0192	3386.3000	227.1975	0.2483	0.0314
10	4	4	2	1000	50	2	11	0.7543	3494.5000	233.7780	0.0193	3315.7000	202.7735	0.2407	0.0304
10	4	4	2	1000	50	3	11.2	0.7390	3723.3000	277.0663	0.0170	3537.1001	244.0066	0.2702	0.0373
10	4	4	2	1000	50	4	10.8	0.7390	3470.1001	266.5823	0.0242	3305.8000	245.0033	0.2455	0.0438
10	4	4	2	1500	50	1	16	1.7849	4084.1001	263.0298	0.0279	3855.3000	207.5726	0.3248	0.0524
10	4	4	2	1500	50	2	16.2	1.9611	3966.3000	210.4461	0.0402	3769.7000	218.1662	0.3078	0.0455
10	4	4	2	1500	50	3	16	2.0239	4223.7002	225.3225	0.0318	3987.8999	206.6638	0.3578	0.0571
10	4	4	2	1500	50	4	16	1.9081	3889.0000	228.3399	0.0438	3748.3999	224.7426	0.2953	0.0575
10	4	4	2	500	80	1	3.8	0.4526	1702.9000	182.6525	0.0641	1582.8000	158.8630	0.0954	0.0133
10	4	4	2	500	80	2	3.8	0.4526	1647.5000	191.7591	0.0672	1558.4000	168.3920	0.0859	0.0120
10	4	4	2	500	80	3	3.8	0.4526	1874.7000	181.1769	0.0733	1766.1000	169.1300	0.1016	0.0121
10	4	4	2	500	80	4	3.8	0.4526	1654.9000	154.3246	0.0671	1578.0000	180.0651	0.0858	0.0121
10	4	4	2	1000	80	1	6.4	1.1289	2464.0000	146.0307	0.0241	2286.3999	200.4373	0.1717	0.0263
10	4	4	2	1000	80	2	6.2	1.0560	2460.0000	193.8105	0.0954	2243.7000	173.4567	0.1672	0.0259
10	4	4	2	1000	80	3	6.4	1.1289	2569.3000	171.8166	0.0242	2427.2000	184.3938	0.1799	0.0220
10	4	4	2	1000	80	4	6.6	0.9659	2349.3000	223.1299	0.0139	2198.8000	198.6422	0.1642	0.0249

C [Gb/s]	W	B	E/O cost ratio	JN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	Solve time [sec]	$\pm CI$
10	4	4	2	1500	80	1	8.4	1.3151	2855.0000	222.1387	0.1079	14	0.0185	2584.7000	0.2077	0.0255
10	4	4	2	1500	80	2	8.6	0.9659	2730.1001	181.8403	0.1188	13.6	0.0143	2487.1001	0.1953	0.0254
10	4	4	2	1500	80	3	8.8	1.2068	2953.3999	176.2438	0.1281	13.8	0.0183	2757.7000	0.2234	0.0303
10	4	4	2	1500	80	4	8.6	1.3577	2661.8999	155.5854	0.1156	13.6	0.0133	2515.5000	0.1984	0.0216
10	8	8	2	500	0	1	3.8	0.4526	5265.7002	194.1317	0.6842	4	0.0977	5254.3999	0.7218	0.0292
10	8	8	2	500	0	2	4	0.0000	5250.5000	202.4237	0.7063	4	0.0000	5250.5000	0.7063	0.0268
10	8	8	2	500	0	3	4	0.0000	5452.7002	194.6906	0.7466	4	0.0000	5452.7002	0.7466	0.0263
10	8	8	2	500	0	4	3.8	0.4526	5313.6001	200.5165	0.6830	3.8	0.0963	5313.6001	0.6830	0.0963
10	8	8	2	1000	0	1	5.2	0.7390	5725.1001	221.3175	0.7013	6.2	0.1777	5646.1001	0.8970	0.0775
10	8	8	2	1000	0	2	5.6	0.6034	5641.5000	259.9563	0.7360	6.6	0.1160	5593.2998	0.8812	0.0656
10	8	8	2	1000	0	3	5.8	0.4526	5907.8999	242.4653	0.7767	7.2	0.0790	5833.2998	1.0032	0.0683
10	8	8	2	1000	0	4	5.4	0.6913	5709.7998	289.8811	0.7500	6	0.0000	5638.2998	0.8720	0.0479
10	8	8	2	1500	0	1	7.4	0.6913	5938.2998	142.4622	0.7985	9.4	0.1037	5823.7002	1.1485	0.0698
10	8	8	2	1500	0	2	7.2	0.7390	6022.2002	239.0538	0.7361	9.4	0.1485	5825.7002	1.1234	0.0761
10	8	8	2	1500	0	3	7.4	0.6913	6148.6001	193.4548	0.7312	9.2	0.0976	6007.1001	1.1641	0.1312
10	8	8	2	1500	0	4	7.4	0.6913	5929.5000	196.5154	0.7890	8.6	0.0913	5836.0000	1.0170	0.1257
10	8	8	2	500	20	1	2.6	0.6913	4394.2002	188.0966	0.3953	3.8	0.1012	4258.7002	0.5671	0.0402
10	8	8	2	500	20	2	2.8	0.7390	4285.3999	175.3775	0.3939	3.8	0.1030	4203.2002	0.5358	0.0592
10	8	8	2	500	20	3	2.4	0.6034	4579.1001	239.3874	0.3562	4	0.0000	4400.3999	0.6016	0.0242
10	8	8	2	500	20	4	2.4	0.6034	4315.8999	191.7306	0.3721	3.6	0.0792	4228.6001	0.5375	0.0743
10	8	8	2	1000	20	1	4	0.0000	4802.6001	267.3715	0.4753	6.2	0.0447	4663.6001	0.7579	0.0694
10	8	8	2	1000	20	2	4.2	0.4526	4748.6001	195.3426	0.4845	5.8	0.0689	4664.1001	0.6829	0.1070
10	8	8	2	1000	20	3	4	0.0000	5023.6001	301.4679	0.4468	6.2	0.0528	4843.6001	0.7719	0.1067
10	8	8	2	1000	20	4	4	0.0000	4723.6001	241.3480	0.4940	5.8	0.0778	4629.8999	0.7221	0.0829
10	8	8	2	1500	20	1	6	0.0000	4992.1001	169.6874	0.5891	7.6	0.0606	4877.5000	0.8186	0.0914
10	8	8	2	1500	20	2	6	0.0000	4948.0000	163.9082	0.5766	7.8	0.0638	4874.5000	0.8313	0.0719
10	8	8	2	1500	20	3	6	0.0000	5154.7002	165.0451	0.5862	7.8	0.0586	5003.0000	0.8641	0.0731
10	8	8	2	1500	20	4	6	0.0000	4908.2002	149.0452	0.5936	7.6	0.0634	4820.5000	0.8203	0.0675
10	8	8	2	500	50	1	2	0.0000	3161.3999	258.4572	0.3344	3	0.0294	3131.0000	0.4157	0.0673
10	8	8	2	500	50	2	2	0.0000	3086.8999	212.1572	0.3236	2.4	0.0333	3076.3999	0.3517	0.0417
10	8	8	2	500	50	3	2	0.0000	3349.3000	231.2843	0.3062	3.8	0.04526	3255.7000	0.4578	0.0445
10	8	8	2	500	50	4	2	0.0000	3125.2000	244.3075	0.3060	2.8	0.0454	3083.6001	0.3688	0.0717
10	8	8	2	1000	50	1	4	0.0000	3623.6001	288.9599	0.4751	4.8	0.0493	3600.2000	0.5358	0.0652
10	8	8	2	1000	50	2	4	0.0000	3574.3999	254.3835	0.4532	4.4	0.0634	3558.6001	0.5424	0.0729
10	8	8	2	1000	50	3	4	0.0000	3764.6001	282.3004	0.4877	4.4	0.0634	3749.7000	0.5316	0.0809
10	8	8	2	1000	50	4	4	0.0000	3548.2000	291.7238	0.4640	4.4	0.0634	3532.0000	0.5015	0.0695
10	8	8	2	1500	50	1	4.6	0.6913	3897.1001	283.7396	0.4187	6.2	0.1035	3747.2000	0.6219	0.0836
10	8	8	2	1500	50	2	4.6	0.6913	3903.3000	286.5902	0.3922	6.4	0.1113	3722.8000	0.6139	0.0832
10	8	8	2	1500	50	3	4.8	0.7390	4037.7000	229.1643	0.4626	6.4	1.1289	3919.3000	0.6626	0.1036
10	8	8	2	1500	50	4	4.6	0.6913	3842.0000	274.5641	0.3950	6.4	0.0965	3706.6001	0.6218	0.0673
10	8	8	2	500	80	1	2	0.0000	1725.5000	178.9286	0.2015	2.2	0.0199	1715.7000	0.2094	0.0242
10	8	8	2	500	80	2	2	0.0000	1684.1000	180.6059	0.1940	2.2	0.0167	1681.1000	0.2018	0.0199
10	8	8	2	500	80	3	2	0.0000	1873.8000	171.2331	0.2189	2.2	0.0198	1870.9000	0.2065	0.0260
10	8	8	2	500	80	4	2	0.0000	1724.8000	197.9919	0.2033	2.2	0.0230	1724.1000	0.2112	0.0265
10	8	8	2	1000	80	1	2	0.0000	2414.3999	248.1723	0.2297	3	0.0356	2343.2000	0.3108	0.0610
10	8	8	2	1000	80	2	2	0.0000	2393.3000	213.4320	0.2220	3.6	0.0634	2323.8999	0.3297	0.0442

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	±CI	Weighted port count @ F_{min}	±CI	Solve time [sec]	±CI	F_{opt}	±CI	Weighted port count @ F_{opt}	±CI	Solve time [sec]	±CI
10	8	8	2	1000	80	3	2	0.0000	2549.6001	219.4555	0.2468	0.0331	3	0.7543	2489.3999	201.7387	0.3342	0.0541
10	8	8	2	1000	80	4	2	0.0000	2315.1001	229.5115	0.2186	0.0294	3.2	0.7390	2268.2000	204.2939	0.3172	0.0580
10	8	8	2	1500	80	1	3	0.7543	2623.2000	191.9087	0.2672	0.0733	4.4	0.9051	2522.2000	152.8025	0.3814	0.0583
10	8	8	2	1500	80	2	3	0.7543	2622.3999	190.1969	0.2641	0.0784	4.2	0.4526	2440.3000	206.5249	0.3563	0.0311
10	8	8	2	1500	80	3	3	0.7543	2768.7000	147.8731	0.2736	0.0878	4.4	0.9051	2692.2000	157.6256	0.3955	0.0707
10	8	8	2	1500	80	4	2.8	0.7390	2576.2000	159.2365	0.2453	0.0735	4	0.6746	2461.2000	171.0054	0.3439	0.0521
40	8	8	5	500	0	1	2	0.0000	12213.2998	805.5988	1.1563	0.0731	2.6	0.6913	12111.9004	781.8986	1.2623	0.1289
40	8	8	5	500	0	2	2	0.0000	11381.4004	818.9689	1.1267	0.0824	2.8	0.7390	11353.5996	813.5812	1.2874	0.1469
40	8	8	5	500	0	3	2.2	0.4526	13420.2002	821.2775	1.2499	0.1316	3.8	0.4526	12965.0996	762.7253	1.5516	0.1459
40	8	8	5	500	0	4	2	0.0000	11864.5996	652.7150	1.1671	0.0574	3	0.7543	11839.7002	635.1409	1.4046	0.2030
40	8	8	5	1000	0	1	3.4	0.6913	13576.9004	936.5787	1.4515	0.2383	3.8	0.4526	13488.0996	946.6119	1.5485	0.1846
40	8	8	5	1000	0	2	3.4	0.6913	12299.5996	825.8901	1.3141	0.2255	4	0.0000	12267.5996	851.2211	1.4330	0.1072
40	8	8	5	1000	0	3	4	0.0000	14241.4004	909.7531	1.6579	0.1074	4	0.0000	14241.4004	909.7531	1.6579	0.1074
40	8	8	5	1000	0	4	3	0.7543	13134.7998	797.4838	1.2939	0.2556	4	0.0000	13090.5000	816.2798	1.5265	0.1012
40	8	8	5	1500	0	1	4	0.0000	13736.5000	734.9930	1.5062	0.0839	4	0.0000	13736.5000	734.9930	1.5062	0.0839
40	8	8	5	1500	0	2	4	0.0000	13022.9004	580.0920	1.4296	0.0661	4	0.0000	13022.9004	580.0920	1.4296	0.0661
40	8	8	5	1500	0	3	4	0.0000	14648.4004	724.2143	1.6030	0.0716	4.2	0.4526	14627.2002	701.8326	1.6484	0.1498
40	8	8	5	1500	0	4	4	0.0000	13613.5000	803.5738	1.5049	0.0812	4	0.0000	13613.5000	803.5738	1.5049	0.0812
40	8	8	5	500	20	1	2	0.0000	9600.5996	616.0547	0.9300	0.0605	2	0.0000	9600.5996	616.0547	0.9300	0.0605
40	8	8	5	500	20	2	2	0.0000	8482.2998	522.2762	0.8564	0.0590	2	0.0000	8482.2998	522.2762	0.8564	0.0590
40	8	8	5	500	20	3	2	0.0000	10312.0996	617.0544	0.9593	0.0438	2.8	0.7390	10214.2998	518.0486	1.0969	0.1555
40	8	8	5	500	20	4	2	0.0000	8839.5000	509.6622	0.8686	0.0541	2	0.0000	8839.5000	509.6622	0.8686	0.0541
40	8	8	5	1000	20	1	2	0.0000	10477.2998	650.2213	0.8733	0.0621	3.6	0.6034	10257.0000	592.1976	1.1593	0.1541
40	8	8	5	1000	20	2	2	0.0000	9447.5996	666.8641	0.8532	0.0624	3.2	0.7390	9433.7002	667.3139	1.0218	0.1346
40	8	8	5	1000	20	3	2.6	0.6913	11520.7998	561.1271	1.0138	0.1504	4	0.0000	11082.0996	515.3127	1.2703	0.0639
40	8	8	5	1000	20	4	2	0.0000	9786.5996	637.7780	0.8376	0.0480	2.8	0.7390	9768.4004	626.6736	1.0002	0.1527
40	8	8	5	1500	20	1	3.2	0.7390	11081.7002	803.9310	1.0361	0.2175	3.8	0.4526	10932.5996	754.7614	1.1798	0.1660
40	8	8	5	1500	20	2	3	0.7543	10370.0996	656.7443	0.9749	0.1766	3.8	0.4526	10301.0996	659.6321	1.1171	0.1241
40	8	8	5	1500	20	3	4	0.0000	11775.2002	792.2910	1.3079	0.0903	4	0.0000	11775.2002	792.2910	1.3079	0.0903
40	8	8	5	1500	20	4	2.6	0.6913	10468.7998	669.4219	0.8734	0.2173	4	0.0000	10417.5996	700.6265	1.1657	0.0878
40	8	8	5	500	50	1	2	0.0000	6684.5000	751.1651	0.6610	0.0738	2	0.0000	6684.5000	751.1651	0.6610	0.0738
40	8	8	5	500	50	2	2	0.0000	5829.0000	686.4578	0.5968	0.0741	2	0.0000	5829.0000	686.4578	0.5968	0.0741
40	8	8	5	500	50	3	2	0.0000	7335.2998	729.7890	0.7110	0.0699	2.2	0.4526	7272.7002	695.4055	0.7406	0.1084
40	8	8	5	500	50	4	2	0.0000	6073.5000	706.8793	0.6188	0.0760	2	0.0000	6073.5000	706.8793	0.6188	0.0760
40	8	8	5	1000	50	1	2	0.0000	7492.2998	587.2869	0.6690	0.0396	2.8	0.7390	7383.2998	541.7461	0.7704	0.1098
40	8	8	5	1000	50	2	2	0.0000	6543.3999	749.6504	0.6046	0.0672	2	0.0000	6543.3999	749.6504	0.6046	0.0672
40	8	8	5	1000	50	3	2	0.0000	8316.5000	568.5054	0.7345	0.0413	3	0.7543	8143.1001	571.2816	0.8861	0.1221
40	8	8	5	1000	50	4	2	0.0000	7039.5000	642.6742	0.6609	0.0583	2.2	0.4526	7038.8999	642.4975	0.6798	0.0803
40	8	8	5	1500	50	1	2.4	0.6034	8640.5000	956.3925	0.7703	0.1335	3.6	0.6034	8373.2998	843.4617	0.9343	0.1462
40	8	8	5	1500	50	2	2.2	0.4526	7821.5000	744.4745	0.7094	0.1327	3	0.7543	7783.2998	724.5013	0.8078	0.1546
40	8	8	5	1500	50	3	2.6	0.6913	9592.0996	843.7310	0.8874	0.1508	3.6	0.6034	9285.9004	782.3022	1.0328	0.1394
40	8	8	5	1500	50	4	2	0.0000	8113.5000	734.9966	0.6764	0.0462	2.6	0.6913	8102.7998	724.5354	0.8156	0.1907
40	8	8	5	500	80	1	2	0.0000	3071.6001	729.3679	0.2936	0.0720	2	0.0000	3071.6001	729.3679	0.2936	0.0720
40	8	8	5	500	80	2	2	0.0000	2539.6001	496.3504	0.2360	0.0475	2	0.0000	2539.6001	496.3504	0.2360	0.0475
40	8	8	5	500	80	3	2	0.0000	3623.8999	661.2964	0.3423	0.0663	2	0.0000	3623.8999	661.2964	0.3423	0.0663
40	8	8	5	500	80	4	2	0.0000	2553.3999	792.6859	0.2468	0.0770	2	0.0000	2553.3999	792.6859	0.2468	0.0770

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]
40	8	8	5	1000	80	1	2	0.0000	4258.2002	613.4163	0.4094	0.0580	2	0.0000	4258.2002	613.4163	0.4094
40	8	8	5	1000	80	2	2	0.0000	3609.8999	480.9185	0.3420	0.0522	2	0.0000	3609.8999	480.9185	0.3420
40	8	8	5	1000	80	3	2	0.0000	4935.7998	504.6039	0.4641	0.0467	2	0.0000	4935.7998	504.6039	0.4641
40	8	8	5	1000	80	4	2	0.0000	3847.3999	492.5404	0.3735	0.0490	2	0.0000	3847.3999	492.5404	0.3735
40	8	8	5	1500	80	1	2	0.0000	5258.0000	710.4502	0.4876	0.0613	2.4	0.6034	5242.7998	695.3568	0.5250
40	8	8	5	1500	80	2	2	0.0000	4582.2998	514.8717	0.4406	0.0675	2	0.0000	4582.2998	514.8717	0.4406
40	8	8	5	1500	80	3	2	0.0000	6228.0000	585.5266	0.5798	0.0689	2.2	0.4526	6213.2002	580.5676	0.6032
40	8	8	5	1500	80	4	2	0.0000	5084.5000	768.4363	0.4859	0.0800	2	0.0000	5084.5000	768.4363	0.4859

Table A.4: Comparison of no-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the NSF network.

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	500	0	1	24.2	0.8124	11344.0000	237.9081	3.1220	26.4	1.1289	11211.9004	204.0718	3.9733	0.3197
10	4	4	2	500	0	2	25	1.8165	11581.5996	241.4491	3.3984	26.8	1.3826	11436.2002	218.4072	4.1078	0.2274
10	4	4	2	500	0	3	23.8	0.8124	11553.2002	214.5634	3.1782	27.2	1.0006	11408.7002	216.7787	4.4059	0.2358
10	4	4	2	500	0	4	25	1.2162	11137.0000	203.3596	3.7515	27.2	1.8102	11088.2998	192.6792	4.3937	0.3135
10	4	4	2	1000	0	1	47.4	1.7912	14491.4004	253.1176	5.3857	53.4	3.7592	14302.7998	226.7645	9.8545	1.9695
10	4	4	2	1000	0	2	49.6	3.0768	14626.2002	196.3571	7.0905	55.2	2.9561	14486.7002	213.6712	11.4891	1.6306
10	4	4	2	1000	0	3	46.8	2.0462	14752.5996	221.9937	5.2359	53	3.5857	14535.4004	201.9805	10.1438	2.0630
10	4	4	2	1000	0	4	49	1.6866	14255.2998	154.6412	6.8317	54.6	3.2389	14101.7002	166.0921	10.6702	1.8695
10	4	4	2	1500	0	1	70.6	2.7027	17389.9004	169.2719	9.9532	81	5.5323	17181.5000	194.4602	17.9030	2.6779
10	4	4	2	1500	0	2	72	3.2354	17569.1992	235.1496	11.5952	79.4	4.4264	17344.8008	175.0940	17.2282	1.6613
10	4	4	2	1500	0	3	69.8	2.8181	17708.1992	192.3064	9.9687	79.6	3.2912	17382.1992	146.6002	17.6938	1.6308
10	4	4	2	1500	0	4	74.4	3.6204	17100.1992	186.6263	13.2844	81.2	3.9453	16950.3008	120.1114	17.4468	1.4981
10	4	4	2	500	20	1	20.4	1.3151	9573.2002	185.6649	2.4216	24.2	1.4231	9402.5000	178.9264	3.5217	0.1190
10	4	4	2	500	20	2	20.8	1.3826	9739.7002	208.8080	2.6860	24	0.6746	9605.9004	190.6022	3.6188	0.0763
10	4	4	2	500	20	3	20.6	1.3577	9764.2998	196.3635	2.6829	22.6	0.9659	9655.7002	168.7126	3.4109	0.2271
10	4	4	2	500	20	4	21	1.2162	9479.2998	254.7376	2.7748	23.6	1.3151	9335.0000	233.3642	3.5548	0.1411
10	4	4	2	1000	20	1	40.4	2.0013	12247.2998	197.8488	3.4734	46.2	2.1808	12000.5996	161.5538	6.5377	0.9489
10	4	4	2	1000	20	2	41.4	2.2426	12404.5000	199.0469	4.1189	46.4	3.1498	12245.0996	177.0535	7.0467	1.3293
10	4	4	2	1000	20	3	39.8	1.8414	12496.4004	219.1452	3.3781	46	2.6985	12284.2002	215.0229	6.9874	1.1034
10	4	4	2	1000	20	4	42	2.2375	12091.2002	221.7865	4.4719	46.8	3.1786	11955.2002	200.4290	7.0217	1.3086
10	4	4	2	1500	20	1	59.4	2.8662	14681.5000	232.8981	7.9393	65.4	3.5087	14502.2998	247.2716	12.0155	1.4206
10	4	4	2	1500	20	2	60	2.8622	14868.2002	268.2368	9.0499	67	4.8765	14674.4004	257.7009	13.3624	1.9075
10	4	4	2	1500	20	3	58.4	3.0768	15000.0000	246.3789	7.9718	65	4.1723	14739.0996	253.1103	12.9532	1.6506
10	4	4	2	1500	20	4	61.2	2.4510	14518.0000	229.3779	9.1421	67.4	2.7027	14322.5996	248.7644	13.0530	1.0192
10	4	4	2	500	50	1	14.9	0.5280	6854.6001	134.9328	1.7311	17.9	1.5254	6794.8999	151.9111	2.3781	0.1270
10	4	4	2	500	50	2	15.2	0.8796	7054.7002	157.3580	1.8453	17.4	1.5160	6987.6001	172.0912	2.3186	0.2472
10	4	4	2	500	50	3	14.9	0.5280	7080.1001	171.3758	1.8111	16.45	1.1709	6971.3999	172.0208	2.5156	0.1325
10	4	4	2	500	50	4	15.1	0.6265	6784.6001	141.3840	1.8546	17.1	1.0369	6694.7002	163.6473	2.2452	0.1534
10	4	4	2	1000	50	1	28.4	1.4780	8757.9004	155.2431	2.1752	34.8	3.3866	8553.4004	136.8198	3.9688	0.6687
10	4	4	2	1000	50	2	29.2	2.0462	8906.4004	187.1403	2.3783	34.6	3.6981	8722.5000	157.3863	4.0077	0.8776
10	4	4	2	1000	50	3	28.6	1.1782	8923.7998	155.6604	2.3500	32.6	2.4371	8722.0000	142.8291	3.5251	0.4411
10	4	4	2	1000	50	4	29.4	1.5160	8578.7002	173.7637	2.5391	35.4	3.6361	8440.2998	155.0985	4.1235	0.7668
10	4	4	2	1500	50	1	42	2.5242	10633.4004	234.1231	3.3938	49.2	2.7979	10448.0996	202.6147	6.9360	1.1154
10	4	4	2	1500	50	2	43	1.6866	10771.4004	250.3388	4.4268	49.4	2.4371	10610.7002	242.4507	7.4968	1.2885
10	4	4	2	1500	50	3	41.8	2.5645	10896.4004	200.2602	3.5330	50.4	3.2912	10693.4004	202.3039	8.1938	1.6100
10	4	4	2	1500	50	4	43.6	1.6247	10430.0000	224.7185	4.2752	49	2.6345	10308.2002	217.5509	7.0576	1.1850
10	4	4	2	500	80	1	7.4	0.9051	4027.3000	134.4271	0.7714	10.4	0.9659	3937.8999	129.0333	1.2516	0.1479
10	4	4	2	500	80	2	7.6	0.6913	4204.2998	135.5465	0.8500	10.2	1.0006	4099.7998	126.5408	1.3292	0.1022
10	4	4	2	500	80	3	8	0.7543	4295.3999	124.6349	0.9938	10.8	1.0560	4228.6001	121.5770	1.4534	0.1110
10	4	4	2	500	80	4	7.6	0.6913	3965.8999	94.5625	0.8562	9.2	1.0560	3910.6001	105.1548	1.1296	0.1868
10	4	4	2	1000	80	1	14.8	1.6456	5076.7998	163.5687	1.0104	19.7	2.2577	4883.7002	175.1720	1.8440	0.2406
10	4	4	2	1000	80	2	15.5	1.4799	5166.5000	145.2084	1.2794	19.2	2.3863	5049.8999	123.5908	1.9408	0.2559
10	4	4	2	1000	80	3	15.2	1.3408	5252.8999	164.6031	1.2016	19.6	2.5733	5107.7002	146.6325	1.8560	0.3481
10	4	4	2	1000	80	4	15.7	1.5839	4928.8999	135.8887	1.3128	20.3	2.3863	4807.7002	151.9357	1.9558	0.2253

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	1500	80	1	22.4	3.9221	6341.7998	217.2269	1.8812	0.9249	28.6	2.6172	6154.1001	223.1323	3.2376	0.6226
10	4	4	2	1500	80	2	21.2	1.3826	6489.7002	224.6306	1.9986	0.3524	24.8	2.6302	6379.0000	219.6532	2.7006	0.3632
10	4	4	2	1500	80	3	21.8	1.7133	6597.7998	219.0966	2.0996	0.2989	27.2	2.1546	6474.6001	201.7035	3.1700	0.4914
10	4	4	2	1500	80	4	20.2	1.4231	6169.0000	237.6670	1.7890	0.2793	26.2	3.1965	6057.5000	214.0836	2.8484	0.4483
10	8	8	2	500	0	1	7	0.0000	14777.9004	266.1053	5.7686	0.2491	7.2	0.4526	14775.5000	266.8825	6.0124	0.4181
10	8	8	2	500	0	2	7.2	0.4526	14998.5000	248.7372	6.1312	0.3695	7.6	0.6913	14987.7002	244.9508	6.6047	0.6877
10	8	8	2	500	0	3	7	0.0000	14971.2002	254.4556	5.8077	0.2961	8	0.7543	14955.7998	252.4410	7.1374	0.8918
10	8	8	2	500	0	4	7.2	0.4526	14692.5000	246.9837	5.7248	0.4329	7.8	0.7390	14682.4004	241.7726	6.4000	0.8726
10	8	8	2	1000	0	1	12.6	0.9051	15998.7002	308.1104	8.8501	2.4041	14	1.0119	15869.2998	299.6356	13.1375	2.3418
10	8	8	2	1000	0	2	12.8	0.4526	16357.0996	329.8903	10.2171	1.5405	14.4	0.9659	16220.4004	248.3195	14.9217	2.0654
10	8	8	2	1000	0	3	12.4	0.6913	16298.5996	281.7478	9.0658	2.0786	14	0.7543	16134.0996	281.4748	14.0063	1.8423
10	8	8	2	1000	0	4	13.2	0.8124	15939.0996	251.2650	10.8641	2.1365	14	0.7543	15893.7002	246.5149	13.2799	1.7013
10	8	8	2	1500	0	1	18.6	0.9659	17104.8008	351.3119	15.2034	2.2173	20.2	1.4231	17047.4004	337.7231	20.2078	3.6091
10	8	8	2	1500	0	2	18.8	1.0006	17529.0996	302.9256	16.9250	2.4965	20.6	1.3577	17440.5000	299.1271	22.3485	2.8461
10	8	8	2	1500	0	3	18.2	0.4526	17440.4004	272.0317	14.7703	1.5404	21	1.3908	17287.0000	272.5377	23.9314	2.9813
10	8	8	2	1500	0	4	19	1.0119	17105.9004	302.1959	16.2910	1.6604	21	1.0119	16959.0996	310.8813	22.2717	2.2166
10	8	8	2	500	20	1	6.2	0.7390	12222.2998	159.3380	4.7139	0.5157	6.8	0.4526	12207.0000	155.0005	5.1780	0.1264
10	8	8	2	500	20	2	5.6	0.6913	12526.7998	211.8129	4.0546	0.7821	6.6	0.6034	12441.7998	189.8864	5.1779	0.3654
10	8	8	2	500	20	3	5.8	0.7390	12575.9004	192.8263	4.1953	0.9041	7	0.6746	12484.7002	168.5152	5.6782	0.5913
10	8	8	2	500	20	4	6.4	0.6913	12228.5996	164.3315	4.7579	0.6148	6.6	0.6034	12214.2002	176.2336	4.9953	0.3758
10	8	8	2	1000	20	1	10.8	0.4526	13366.5996	234.5159	6.0828	1.0552	12.2	0.7390	13227.0000	232.3779	9.6405	1.4859
10	8	8	2	1000	20	2	11.2	0.4526	13553.2998	222.5253	7.5841	1.1381	12.4	0.6913	13478.0000	197.9348	10.5954	1.3083
10	8	8	2	1000	20	3	10.6	0.6034	13556.0996	228.4561	6.3175	1.3329	12.2	1.0006	13439.4004	209.9649	10.3454	2.1193
10	8	8	2	1000	20	4	10.8	0.8124	13331.0996	271.4484	6.5484	1.5122	12.2	1.2068	13263.2998	248.6670	9.6444	2.4479
10	8	8	2	1500	20	1	15.4	0.9051	14336.0000	292.1659	11.5435	1.5495	17	0.6746	14253.4004	255.9388	15.7718	1.1005
10	8	8	2	1500	20	2	15.6	0.6913	14694.0996	234.6137	12.2905	1.0690	17	0.9541	14620.2002	242.4849	16.1798	2.0013
10	8	8	2	1500	20	3	15.5	0.6954	14648.9004	315.1989	11.7203	1.3709	17.5	0.8433	14519.5996	279.9826	17.4360	1.5821
10	8	8	2	1500	20	4	15.6	0.6913	14379.7998	286.7582	11.6891	1.2098	17.4	1.3151	14306.4004	270.8681	16.0985	2.5991
10	8	8	2	500	50	1	5	0.0000	8445.4004	165.6492	3.5046	0.1252	5.2	0.4526	8443.2002	162.3783	3.6358	0.2171
10	8	8	2	500	50	2	5	0.0000	8606.9004	166.7646	3.6640	0.0818	5.2	0.4526	8593.0000	153.5032	3.7438	0.2137
10	8	8	2	500	50	3	5	0.0000	8676.7998	145.4693	3.8062	0.0990	5	0.0000	8676.7998	145.4693	3.8062	0.0990
10	8	8	2	500	50	4	5	0.0000	8449.2002	156.8372	3.5391	0.1165	5.2	0.4526	8435.9004	142.1626	3.6485	0.1871
10	8	8	2	1000	50	1	8.2	0.7390	9300.7998	265.4924	4.1156	0.7428	9.6	0.6913	9252.0000	270.6746	6.0282	1.0856
10	8	8	2	1000	50	2	7.8	0.7390	9524.7998	249.0114	3.9531	0.8914	9	0.6746	9464.4004	254.0066	5.4781	0.6953
10	8	8	2	1000	50	3	7.6	0.6913	9600.4004	244.6148	3.4235	1.0004	9.8	1.0006	9469.7002	268.3955	6.7750	1.5120
10	8	8	2	1000	50	4	8.2	0.7390	9364.5000	244.1975	4.2374	0.9559	9	0.6746	9287.5000	258.5611	5.2452	0.7302
10	8	8	2	1500	50	1	11.4	0.6034	10258.0996	195.3683	6.0454	1.2238	13.8	1.2068	10166.2002	192.0086	11.9139	2.2202
10	8	8	2	1500	50	2	11.6	0.6913	10501.7002	227.6175	6.9826	1.7961	13.6	1.1782	10414.9004	198.9629	11.6826	2.2832
10	8	8	2	1500	50	3	11.4	0.6034	10478.0000	204.8496	6.7214	1.6440	12.6	1.1289	10419.0996	178.8374	9.5982	2.3399
10	8	8	2	1500	50	4	11.8	0.7390	10251.2998	154.3002	7.2172	1.7193	13.2	1.0560	10187.5996	170.9709	10.5588	2.3519
10	8	8	2	500	80	1	3	0.0000	4468.7002	182.9633	2.0984	0.0857	3	0.0000	4468.7002	182.9633	2.0984	0.0857
10	8	8	2	500	80	2	3	0.0000	4629.7002	189.6739	2.2064	0.0848	3	0.0000	4629.7002	189.6739	2.2064	0.0848
10	8	8	2	500	80	3	3	0.0000	4735.2998	195.0222	2.3096	0.0807	3	0.0000	4735.2998	195.0222	2.3096	0.0807
10	8	8	2	500	80	4	3	0.0000	4473.5000	184.1661	2.1410	0.0756	3	0.0000	4473.5000	184.1661	2.1410	0.0756
10	8	8	2	1000	80	1	4.8	0.4526	5137.1001	228.5947	2.3380	0.3327	5.6	0.6913	5099.8999	210.0270	2.8736	0.4074
10	8	8	2	1000	80	2	4.6	0.6034	5330.0000	215.0267	2.1674	0.4373	6.2	0.7390	5245.5000	210.2176	3.2976	0.3728

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	8	8	2	1000	80	3	4.8	0.4526	5308.7998	219.0140	2.5226	0.2774	5.6	0.6913	5289.2002	214.1084	3.0488	0.4375
10	8	8	2	1000	80	4	4.8	0.4526	5086.2002	223.0181	2.4168	0.2407	5.6	0.6913	5068.1001	219.3137	2.9326	0.4190
10	8	8	2	1500	80	1	6	1.0119	6072.3999	247.6985	2.8170	1.0748	8	1.2162	5960.3999	215.0103	5.1716	1.3445
10	8	8	2	1500	80	2	5.4	0.6034	6248.6001	202.2156	2.5546	0.4540	7.6	0.6913	6132.1001	204.4431	4.8214	0.7436
10	8	8	2	1500	80	3	6	0.7543	6334.7002	223.0785	2.9470	0.5387	8.2	1.0006	6211.3999	225.8483	5.7190	1.2119
10	8	8	2	1500	80	4	5.8	0.7390	5965.2002	220.9296	2.7644	0.5530	7.6	0.9659	5873.8999	213.0247	4.6092	0.8711
40	8	8	5	500	0	1	3	0.0000	13619.5996	238.5331	4.3844	0.0744	3	0.0000	13619.5996	238.5331	4.3844	0.0744
40	8	8	5	500	0	2	3	0.0000	14017.5000	164.2020	4.5798	0.0692	3	0.0000	14017.5000	164.2020	4.5798	0.0692
40	8	8	5	500	0	3	3	0.0000	13962.7998	167.2610	4.6640	0.0556	3	0.0000	13962.7998	167.2610	4.6640	0.0556
40	8	8	5	500	0	4	3	0.0000	13566.0000	227.6757	4.3985	0.0707	3	0.0000	13566.0000	227.6757	4.3985	0.0707
40	8	8	5	1000	0	1	3.4	0.6034	17248.5000	413.5899	3.8548	0.6351	4.8	0.4526	17146.5000	331.8770	5.2018	0.3375
40	8	8	5	1000	0	2	4.4	0.6913	17586.1992	369.2242	4.9999	0.6538	4.8	0.4526	17562.1992	372.9807	5.3765	0.3544
40	8	8	5	1000	0	3	3.8	0.7390	17597.8008	369.0727	4.5095	0.8035	4.8	0.4526	17541.0000	339.1030	5.5969	0.1400
40	8	8	5	1000	0	4	3.8	0.7390	17164.3008	366.9295	4.4611	0.5078	4.6	0.6034	17133.8008	369.6658	5.0061	0.4744
40	8	8	5	1500	0	1	5	0.0000	19782.5000	468.2657	5.2299	0.1980	5.6	0.6913	19760.3008	444.9411	5.6799	0.3519
40	8	8	5	1500	0	2	5.2	0.4526	20121.3008	429.0099	5.0267	0.5240	6	0.7543	20098.0996	430.5148	5.7439	0.6738
40	8	8	5	1500	0	3	5	0.0000	20181.3008	462.9068	5.3845	0.2708	6	0.7543	20160.9004	459.0824	6.1580	0.4573
40	8	8	5	1500	0	4	5	0.0000	19737.1992	428.2782	5.0999	0.2461	5.6	0.6913	19694.8008	422.2466	5.5346	0.3874
40	8	8	5	500	20	1	3	0.0000	11405.0000	152.3149	3.6812	0.0815	3	0.0000	11405.0000	152.3149	3.6812	0.0815
40	8	8	5	500	20	2	3	0.0000	11747.0996	155.4705	3.8499	0.0765	3	0.0000	11747.0996	155.4705	3.8499	0.0765
40	8	8	5	500	20	3	3	0.0000	11799.2998	152.0378	4.0111	0.0704	3	0.0000	11799.2998	152.0378	4.0111	0.0704
40	8	8	5	500	20	4	3	0.0000	11293.0000	157.5065	3.6703	0.0917	3	0.0000	11293.0000	157.5065	3.6703	0.0917
40	8	8	5	1000	20	1	3	0.0000	14322.4004	361.3049	3.6718	0.2433	3.8	0.7390	14282.7002	352.2026	4.1234	0.2504
40	8	8	5	1000	20	2	3	0.0000	14667.0996	309.8788	3.9469	0.1661	3.4	0.6034	14643.4004	306.9254	4.1766	0.2624
40	8	8	5	1000	20	3	3	0.0000	14749.9004	294.4384	3.7986	0.4301	3.4	0.6034	14710.9004	316.5806	4.2048	0.3683
40	8	8	5	1000	20	4	3.2	0.4526	14216.5000	309.7942	3.9250	0.1869	3.6	0.6913	14209.0000	311.7409	4.1158	0.2425
40	8	8	5	1500	20	1	5	0.0000	16362.5000	329.7524	4.7032	0.1263	5	0.0000	16362.5000	329.7524	4.7032	0.1263
40	8	8	5	1500	20	2	5	0.0000	16833.9004	419.4422	4.8236	0.1185	5.2	0.4526	16817.4004	393.2497	4.9642	0.2419
40	8	8	5	1500	20	3	5	0.0000	16865.4004	341.5843	5.0031	0.1076	5	0.0000	16865.4004	341.5843	5.0031	0.1076
40	8	8	5	1500	20	4	5	0.0000	16317.2002	398.2380	4.6842	0.0971	5	0.0000	16317.2002	398.2380	4.6842	0.0971
40	8	8	5	500	50	1	1.8	0.7390	7959.7998	165.0516	1.9781	0.5608	3	0.0000	7916.1001	178.8091	2.8016	0.1065
40	8	8	5	500	50	2	1.8	0.7390	8335.4004	213.8858	2.0610	0.6160	3	0.0000	8281.4004	235.0964	3.0046	0.1232
40	8	8	5	500	50	3	2.6	0.6034	8525.5000	189.9875	2.7686	0.6355	3	0.0000	8498.0000	213.2576	3.1608	0.0991
40	8	8	5	500	50	4	1.6	0.6913	7901.1001	256.1890	1.8924	0.5046	3	0.0000	7808.2998	227.5430	2.8221	0.1245
40	8	8	5	1000	50	1	3	0.0000	9940.2998	245.4269	3.0562	0.1112	3	0.0000	9940.2998	245.4269	3.0562	0.1112
40	8	8	5	1000	50	2	3	0.0000	10262.0996	248.7192	3.1655	0.1105	3	0.0000	10262.0996	248.7192	3.1655	0.1105
40	8	8	5	1000	50	3	3	0.0000	10462.2998	232.3464	3.3612	0.0764	3	0.0000	10462.2998	232.3464	3.3612	0.0764
40	8	8	5	1000	50	4	3	0.0000	9960.2002	328.7784	3.0234	0.1222	3.2	0.4526	9959.5000	328.0999	3.1187	0.1921
40	8	8	5	1500	50	1	3.2	0.4526	11338.7002	187.0545	2.6438	0.3933	4.4	0.6913	11279.5996	211.8375	3.3970	0.2802
40	8	8	5	1500	50	2	3	0.0000	11784.2998	213.1077	2.6407	0.2835	4.8	0.4526	11695.9004	201.3998	3.7359	0.2220
40	8	8	5	1500	50	3	3	0.0000	11893.0000	165.8092	2.9171	0.3098	4.6	0.6034	11836.0996	168.4147	3.8343	0.2859
40	8	8	5	1500	50	4	3.2	0.4526	11345.2002	184.9462	2.8328	0.3000	4	0.7543	11282.2002	187.0976	3.2874	0.2576
40	8	8	5	500	80	1	1	0.0000	4364.6001	182.7340	1.5014	0.0971	1.2	0.4526	4362.6001	179.7749	1.5468	0.1765
40	8	8	5	500	80	2	1	0.0000	4649.1001	120.6565	1.6593	0.0623	1	0.0000	4649.1001	120.6565	1.6593	0.0623
40	8	8	5	500	80	3	1	0.0000	5108.7002	119.3607	1.8937	0.0933	1	0.0000	5108.7002	119.3607	1.8937	0.0933
40	8	8	5	500	80	4	1	0.0000	4291.7998	123.7487	1.5096	0.0573	1	0.0000	4291.7998	123.7487	1.5096	0.0573

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
40	8	8	5	1000	80	1	1.8	0.7390	5520.7998	210.2935	1.3077	0.4531	2.8	0.4526	5446.7002	169.1662	1.9453	0.2915
40	8	8	5	1000	80	2	2.2	0.7390	5747.7998	114.5623	1.7469	0.4728	2.8	0.4526	5718.2998	99.8557	2.1110	0.2281
40	8	8	5	1000	80	3	2.4	0.6913	6040.6001	101.4306	2.0423	0.4581	2.8	0.4526	6027.6001	104.5151	2.2860	0.3190
40	8	8	5	1000	80	4	2	0.7543	5477.7998	151.4525	1.5593	0.4225	2.8	0.4526	5399.8999	150.9324	1.9936	0.2287
40	8	8	5	1500	80	1	3	0.0000	6014.6001	242.7992	2.1031	0.0828	3	0.0000	6014.6001	242.7992	2.1031	0.0828
40	8	8	5	1500	80	2	3	0.0000	6365.2002	207.1135	2.3093	0.0612	3	0.0000	6365.2002	207.1135	2.3093	0.0612
40	8	8	5	1500	80	3	3	0.0000	6575.8999	202.4341	2.4795	0.0556	3	0.0000	6575.8999	202.4341	2.4795	0.0556
40	8	8	5	1500	80	4	3	0.0000	6028.3999	227.9108	2.1924	0.0514	3	0.0000	6028.3999	227.9108	2.1924	0.0514

Table A.5: Comparison of fiber-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the NSF network.

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	Solve time [sec]	$\pm CI$
10	4	4	2	500	0	1	24.2	0.8124	11344.0000	237.9081	0.2741	26.4	1.1289	11211.9004	204.0718	0.3209
10	4	4	2	500	0	2	25	1.8165	11581.5996	241.4491	0.5442	26.8	1.3826	11436.2002	218.4072	0.2358
10	4	4	2	500	0	3	23.8	0.8124	11553.2002	214.5634	0.3551	27.2	1.0006	11408.7002	216.7787	0.2289
10	4	4	2	500	0	4	25	1.2162	11137.0000	203.3596	0.3062	27.2	1.8102	11088.2998	192.6792	0.3138
10	4	4	2	1000	0	1	47	1.6866	14477.0996	230.8853	5.7657	53.4	3.7592	14302.7998	226.7645	1.9924
10	4	4	2	1000	0	2	49.4	3.6981	14680.4004	241.9326	7.7423	55.6	3.4267	14505.7002	227.1000	1.7708
10	4	4	2	1000	0	3	46.8	1.6798	14772.5996	231.0741	6.0736	53	3.5857	14535.4004	201.9805	1.0609
10	4	4	2	1000	0	4	50.4	2.6816	14245.5996	185.8258	8.5483	54.6	3.2389	14101.7002	166.0921	1.8083
10	4	4	2	1500	0	1	70.2	2.7362	17431.3008	189.0713	11.3481	81	5.5323	17181.5000	194.4602	2.7045
10	4	4	2	1500	0	2	74	5.0484	17553.5000	248.9912	14.6233	79	4.0054	17337.9004	177.4191	1.5118
10	4	4	2	1500	0	3	69.2	2.6302	17738.5000	163.3377	11.0955	79	3.3221	17382.5996	146.1036	1.7505
10	4	4	2	1500	0	4	75	3.6486	17063.8008	150.1904	15.2124	80.8	4.3302	16951.5996	119.2831	1.8568
10	4	4	2	500	20	1	20.4	1.3151	9573.2002	185.6649	2.5686	24.2	1.4231	9402.5000	178.9264	0.1316
10	4	4	2	500	20	2	20.8	1.3826	9739.7002	208.8080	2.8312	24	0.6746	9605.9004	190.6022	0.0838
10	4	4	2	500	20	3	20.6	1.3577	9764.2998	196.3635	2.8314	22.6	0.9659	9655.7002	168.7126	0.2292
10	4	4	2	500	20	4	21	1.2162	9479.2998	254.7376	2.9264	23.6	1.3151	9335.0000	233.3642	0.1473
10	4	4	2	1000	20	1	40.4	2.0013	12256.2002	195.2146	4.1922	45.6	2.5953	11993.2002	162.3310	1.1112
10	4	4	2	1000	20	2	42	2.6985	12427.5000	174.1226	5.1123	47	2.4557	12229.0000	179.7514	0.0076
10	4	4	2	1000	20	3	39	2.2628	12521.0996	197.1141	3.8720	45.8	3.2669	12305.4004	201.9453	1.3050
10	4	4	2	1000	20	4	42.2	1.8414	12084.0000	240.2010	5.2312	46.8	3.1786	11955.2002	200.4290	1.3388
10	4	4	2	1500	20	1	59.6	2.8462	14678.5996	218.5812	9.3282	65.2	4.0590	14500.5000	244.6237	1.7577
10	4	4	2	1500	20	2	61.2	3.0321	14853.5000	248.0155	10.8000	68.4	4.3616	14678.4004	256.1954	1.7552
10	4	4	2	1500	20	3	58.2	2.8977	14985.5000	231.6078	9.0625	66	3.7561	14749.9004	248.7617	1.5079
10	4	4	2	1500	20	4	61.8	2.2828	14503.5000	234.9512	10.6235	68	2.0239	14326.7002	249.3343	0.8133
10	4	4	2	500	50	1	14.9	0.5280	6854.6001	134.9328	1.8282	17.9	1.5254	6794.8999	151.9111	0.1304
10	4	4	2	500	50	2	15.2	0.8796	7050.2002	159.4956	1.9406	17.4	1.5160	6985.6001	173.8842	0.2517
10	4	4	2	500	50	3	14.9	0.5280	7080.1001	171.3758	1.9110	17.7	1.1709	6971.3999	172.0208	0.1307
10	4	4	2	500	50	4	14.9	0.7875	6788.7998	136.9771	1.8996	17.1	1.0369	6694.7002	163.6473	0.1546
10	4	4	2	1000	50	1	28.4	1.4780	8740.4004	173.6478	2.6088	34.8	3.3866	8553.4004	136.8198	0.4246
10	4	4	2	1000	50	2	29.6	1.8841	8878.5996	190.9206	2.9202	35	3.6486	8724.0996	158.0943	0.6786
10	4	4	2	1000	50	3	28.2	1.2531	8902.0996	179.5489	2.6528	33.6	3.2213	8721.9004	144.2604	0.7077
10	4	4	2	1000	50	4	29	1.5458	8623.0000	194.5973	2.8118	35.2	3.7074	8436.2002	160.3157	0.8231
10	4	4	2	1500	50	1	42.6	2.1387	10622.5000	223.7199	4.2446	49	3.7104	10467.0996	196.9890	1.5867
10	4	4	2	1500	50	2	46.6	3.6981	10783.0996	235.7361	6.3234	52.4	3.9797	10602.0000	237.6028	2.0486
10	4	4	2	1500	50	3	42.4	2.3174	10917.5000	161.0190	4.4686	52.4	4.1477	10689.2002	204.5572	2.0294
10	4	4	2	1500	50	4	45.6	4.5656	10457.4004	214.2201	5.8078	51.4	3.8192	10297.5996	227.7612	1.9769
10	4	4	2	500	80	1	7.4	0.9051	4027.3000	134.4271	0.8094	10.4	0.9659	3937.8999	129.0333	0.1468
10	4	4	2	500	80	2	7.6	0.6913	4205.0000	141.7211	0.8394	10.2	1.0006	4099.7998	126.5408	0.1089
10	4	4	2	500	80	3	7.8	0.7390	4285.1001	114.0261	0.9762	10.8	1.0560	4228.6001	121.5770	0.1106
10	4	4	2	500	80	4	7.6	0.6913	4003.6001	112.7056	0.8860	10.2	1.0006	3916.1001	110.5341	0.1336
10	4	4	2	1000	80	1	14.6	1.8227	5093.6001	142.7886	1.0926	20.2	2.2577	4885.3999	176.6014	1.9924
10	4	4	2	1000	80	2	15.7	1.7216	5235.1001	135.2353	1.3780	20.1	2.1977	5043.2002	124.7688	2.1608
10	4	4	2	1000	80	3	14.9	1.5622	5275.3999	171.4679	1.2700	19.9	2.5567	5106.5000	125.7487	0.3610
10	4	4	2	1000	80	4	15.9	1.4489	4902.8999	141.1755	1.4902	20.1	2.3959	4805.5000	151.7443	0.3015

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	1500	80	1	21.6	3.9221	6350.8999	244.4457	1.9466	0.9491	28	3.0170	6163.7998	213.0729	3.4180	0.7431
10	4	4	2	1500	80	2	20	1.5085	6529.6001	243.8520	1.8926	0.2016	26.2	2.7362	6365.1001	215.6046	3.0124	0.3996
10	4	4	2	1500	80	3	21.6	2.4136	6622.7998	211.6055	2.0592	0.3314	28	2.8622	6475.0000	208.9735	3.5622	0.5509
10	4	4	2	1500	80	4	20.2	1.7133	6257.6001	264.4096	1.7452	0.1878	26.2	3.0508	6091.1001	214.7337	3.0172	0.5473
10	8	8	2	500	0	1	7	0.0000	14777.9004	266.1053	5.7736	0.2502	7.2	0.4526	14775.5000	266.8825	6.0172	0.4170
10	8	8	2	500	0	2	7.2	0.4526	14998.5000	248.7372	6.1219	0.3722	7.6	0.6913	14987.7002	244.9508	6.5954	0.6921
10	8	8	2	500	0	3	7	0.0000	14971.2002	254.4556	5.8111	0.2865	8	0.7543	14955.7998	252.4410	7.1376	0.8850
10	8	8	2	500	0	4	7.2	0.4526	14692.5000	246.9837	5.7234	0.4274	7.8	0.7390	14682.4004	241.7726	6.3983	0.8730
10	8	8	2	1000	0	1	12.6	0.9051	15998.7002	308.1104	8.8327	2.4060	14	1.0119	15869.2998	299.6356	13.1374	2.3582
10	8	8	2	1000	0	2	12.8	0.4526	16357.0996	329.8903	10.2062	1.5461	14.4	0.9659	16220.4004	248.3195	14.9280	2.0670
10	8	8	2	1000	0	3	12.4	0.6913	16298.5996	281.7478	9.0655	2.0722	14	0.7543	16134.0996	281.4748	14.0078	1.8515
10	8	8	2	1000	0	4	13.2	0.8124	15939.0996	251.2650	10.8561	2.1319	14	0.7543	15893.7002	246.5149	13.2702	1.7118
10	8	8	2	1500	0	1	18.6	0.9659	17104.8008	351.3119	15.3296	2.2632	20.2	1.4231	17047.4004	337.7231	20.3219	3.6189
10	8	8	2	1500	0	2	18.8	1.0006	17529.0996	302.9256	16.9812	2.4871	20.6	1.3577	17440.5000	299.1271	22.3985	2.8349
10	8	8	2	1500	0	3	18.2	0.4526	17440.4004	272.0317	14.8373	1.5387	21	1.3908	17287.0000	272.5377	24.0343	2.9919
10	8	8	2	1500	0	4	19	1.0119	17105.9004	302.1959	16.3767	1.6626	21	1.0119	16959.0996	310.8813	22.1405	2.3031
10	8	8	2	500	20	1	6.2	0.7390	12222.2998	159.3380	4.7205	0.5182	6.8	0.4526	12207.0000	155.0005	5.1829	0.1221
10	8	8	2	500	20	2	5.6	0.6913	12526.7998	211.8129	4.0547	0.7818	6.6	0.6034	12441.7998	189.8864	5.1799	0.3657
10	8	8	2	500	20	3	5.8	0.7390	12575.9004	192.8263	4.2063	0.9029	7	0.6746	12484.7002	168.5152	5.6797	0.5937
10	8	8	2	500	20	4	6.4	0.6913	12228.5996	164.3315	4.7547	0.6146	6.6	0.6034	12214.2002	176.2336	4.9923	0.3762
10	8	8	2	1000	20	1	10.8	0.4526	13366.5996	234.5159	6.0831	1.0593	12.2	0.7390	13227.0000	232.3779	9.6341	1.4787
10	8	8	2	1000	20	2	11.2	0.4526	13553.2998	222.5253	7.5860	1.1337	12.4	0.6913	13478.0000	197.9348	10.6092	1.3142
10	8	8	2	1000	20	3	10.6	0.6034	13556.0996	228.4561	6.3203	1.3345	12.2	1.0006	13439.4004	209.9649	10.3547	2.1312
10	8	8	2	1000	20	4	10.8	0.8124	13331.0996	271.2484	6.5468	1.5137	12.2	1.2068	13263.2998	248.6670	9.6763	2.4485
10	8	8	2	1500	20	1	15.4	0.9051	14336.0000	292.1659	11.6029	1.5554	17	0.6746	14253.4004	255.9388	15.8235	1.1006
10	8	8	2	1500	20	2	15.6	0.6913	14694.0996	234.6137	12.3611	1.0689	17	0.9541	14620.2002	242.4849	16.2515	2.0028
10	8	8	2	1500	20	3	15.5	0.6954	14648.9004	315.1989	11.7529	1.3752	17.5	0.8433	14519.5996	279.9826	17.5079	1.5918
10	8	8	2	1500	20	4	15.6	0.6913	14379.7998	286.7582	11.7655	1.2238	17.4	1.3151	14306.4004	270.8681	16.1905	2.6176
10	8	8	2	500	50	1	5	0.0000	8445.4004	165.6497	3.5110	0.1227	5.2	0.4526	8443.2002	162.3783	3.6359	0.2058
10	8	8	2	500	50	2	5	0.0000	8606.9004	166.7646	3.6578	0.0818	5.2	0.4526	8593.0000	153.5032	3.7374	0.2179
10	8	8	2	500	50	3	5	0.0000	8676.7998	145.4693	3.7627	0.1005	5	0.0000	8676.7998	145.4693	3.7627	0.1005
10	8	8	2	500	50	4	5	0.0000	8449.2002	156.8372	3.5298	0.1138	5.2	0.4526	8435.9004	142.1626	3.6376	0.1853
10	8	8	2	1000	50	1	8.2	0.7390	9300.7998	265.4924	4.1218	0.7436	9.6	0.6913	9252.0000	270.6746	6.0343	1.0817
10	8	8	2	1000	50	2	7.8	0.7390	9524.7998	249.0114	3.9485	0.8928	9	0.6746	9464.4004	254.0066	5.4844	0.7022
10	8	8	2	1000	50	3	7.6	0.6913	9600.4004	244.6148	3.4187	0.9993	9.8	1.0006	9469.7002	268.3955	6.7702	1.5073
10	8	8	2	1000	50	4	8.2	0.7390	9364.5000	244.1975	4.2329	0.9559	9	0.6746	9287.5000	258.5611	5.2437	0.7330
10	8	8	2	1500	50	1	11.4	0.6034	10258.0996	195.3683	6.0689	1.2170	13.8	1.2068	10166.2002	192.0086	11.9546	2.2202
10	8	8	2	1500	50	2	11.6	0.6913	10487.4004	212.8817	7.0716	1.8335	13.6	1.1782	10414.9004	198.9629	11.7642	2.2757
10	8	8	2	1500	50	3	11.4	0.6034	10465.2998	190.7939	6.8546	1.6057	12.6	1.1289	10419.0996	178.8374	9.6550	2.3500
10	8	8	2	1500	50	4	11.8	0.7390	10251.2998	154.3002	7.2500	1.7223	13.2	1.0560	10187.5996	170.9709	10.5922	2.3584
10	8	8	2	500	80	1	3	0.0000	4468.7002	182.9633	2.0986	0.0881	3	0.0000	4468.7002	182.9633	2.0986	0.0881
10	8	8	2	500	80	2	3	0.0000	4629.7002	189.6739	2.2018	0.0805	3	0.0000	4629.7002	189.6739	2.2018	0.0805
10	8	8	2	500	80	3	3	0.0000	4735.2998	195.0222	2.3152	0.0822	3	0.0000	4735.2998	195.0222	2.3152	0.0822
10	8	8	2	500	80	4	3	0.0000	4473.5000	184.1661	2.1390	0.0761	3	0.0000	4473.5000	184.1661	2.1390	0.0761
10	8	8	2	1000	80	1	4.8	0.4526	5137.1001	228.5947	2.3376	0.3311	5.6	0.6913	5099.8999	210.0270	2.8784	0.4109
10	8	8	2	1000	80	2	4.6	0.6034	5330.0000	215.0267	2.1658	0.4396	6.2	0.7390	5245.5000	210.2176	3.3002	0.3741

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	Weighted			Solve			Weighted			Solve		
								$\pm CI$	port count	$\pm CI$	time [sec]	$\pm CI$	F_{opt}	port count	$\pm CI$	time [sec]	$\pm CI$	time [sec]	$\pm CI$
10	8	8	2	1000	80	3	4.8	0.4526	5308.7998	219.0140	2.5218	0.2814	5.6	0.6913	5289.2002	214.1084	3.0530	0.4426	0.4426
10	8	8	2	1000	80	4	4.8	0.4526	5086.2002	223.0181	2.4140	0.2416	5.6	0.6913	5068.1001	219.3137	2.9310	0.4212	0.4212
10	8	8	2	1500	80	1	6	1.0119	6072.3999	247.6985	2.8326	1.0843	8	1.2162	5960.3999	215.0103	5.1800	1.3462	1.3462
10	8	8	2	1500	80	2	5.6	0.6913	6223.2002	221.7539	2.7374	0.5423	7.4	0.6034	6123.2002	206.7616	4.5754	0.8104	0.8104
10	8	8	2	1500	80	3	6	0.7543	6337.3999	241.4710	2.9736	0.5425	8.2	1.0006	6211.3999	225.8483	5.7530	1.2286	1.2286
10	8	8	2	1500	80	4	5.8	0.7390	5965.2002	220.9295	2.7712	0.5534	7.6	0.9659	5873.8999	213.0247	4.6256	0.8714	0.8714
40	8	8	5	500	0	1	3	0.0000	13619.5996	238.5331	4.3969	0.0781	3	0.0000	13619.5996	238.5331	4.3969	0.0781	0.0781
40	8	8	5	500	0	2	3	0.0000	14017.5000	164.2020	4.5798	0.0663	3	0.0000	14017.5000	164.2020	4.5798	0.0663	0.0663
40	8	8	5	500	0	3	3	0.0000	13962.7998	167.2610	4.6673	0.0550	3	0.0000	13962.7998	167.2610	4.6673	0.0550	0.0550
40	8	8	5	500	0	4	3	0.0000	13566.0000	227.6757	4.4128	0.0678	3	0.0000	13566.0000	227.6757	4.4128	0.0678	0.0678
40	8	8	5	1000	0	1	3.4	0.6034	17248.5000	413.5899	3.8595	0.6343	4.8	0.4526	17146.5000	331.8770	5.1999	0.3372	0.3372
40	8	8	5	1000	0	2	4.4	0.6913	17586.1992	369.2242	4.9924	0.6524	4.8	0.4526	17562.1992	372.9807	5.3675	0.3563	0.3563
40	8	8	5	1000	0	3	3.8	0.7390	17597.8008	369.0727	4.5077	0.7992	4.8	0.4526	17541.0000	339.1030	5.5875	0.1314	0.1314
40	8	8	5	1000	0	4	3.8	0.7390	17164.3008	366.9295	4.4608	0.5106	4.6	0.6034	17133.8008	369.6658	5.0079	0.4748	0.4748
40	8	8	5	1500	0	1	5	0.0000	19782.5000	468.2657	5.2220	0.2000	5.6	0.6913	19760.3008	444.9411	5.6799	0.3603	0.3603
40	8	8	5	1500	0	2	5.2	0.4526	20121.3008	429.0099	5.0203	0.5224	6	0.7543	20098.0996	430.5148	5.7341	0.6694	0.6694
40	8	8	5	1500	0	3	5	0.0000	20181.3008	462.9068	5.3827	0.2657	6	0.7543	20160.9004	459.0824	6.1498	0.4524	0.4524
40	8	8	5	1500	0	4	5	0.0000	19737.1992	458.2782	5.1016	0.2453	5.6	0.6913	19694.8008	422.2466	5.5375	0.3883	0.3883
40	8	8	5	500	20	1	3	0.0000	11405.0000	152.3149	3.6858	0.0795	3	0.0000	11405.0000	152.3149	3.6858	0.0795	0.0795
40	8	8	5	500	20	2	3	0.0000	11747.0996	155.4705	3.8468	0.0817	3	0.0000	11747.0996	155.4705	3.8468	0.0817	0.0817
40	8	8	5	500	20	3	3	0.0000	11799.2998	152.0378	4.0079	0.0635	3	0.0000	11799.2998	152.0378	4.0079	0.0635	0.0635
40	8	8	5	500	20	4	3	0.0000	11293.0000	157.5065	3.6735	0.0876	3	0.0000	11293.0000	157.5065	3.6735	0.0876	0.0876
40	8	8	5	1000	20	1	3	0.0000	14322.4004	361.3049	3.6656	0.2485	3.8	0.7390	14282.7002	352.2026	4.1250	0.2603	0.2603
40	8	8	5	1000	20	2	3	0.0000	14667.0996	309.8788	3.9533	0.1629	3.4	0.6034	14643.4004	306.9254	4.1799	0.2586	0.2586
40	8	8	5	1000	20	3	3	0.0000	14749.9004	294.4308	3.8029	0.4299	3.4	0.6034	14710.9004	316.5806	4.2046	0.3640	0.3640
40	8	8	5	1000	20	4	3.2	0.4526	14216.5000	309.7942	3.9297	0.1879	3.6	0.6913	14209.0000	311.7409	4.1187	0.2396	0.2396
40	8	8	5	1500	20	1	5	0.0000	16362.5000	329.7524	4.6998	0.1233	5	0.0000	16362.5000	329.7524	4.6998	0.1233	0.1233
40	8	8	5	1500	20	2	5	0.0000	16833.9004	491.4422	4.8141	0.1202	5.2	0.4526	16817.4004	393.2497	4.9563	0.2440	0.2440
40	8	8	5	1500	20	3	5	0.0000	16865.4004	341.5843	4.9845	0.1087	5	0.0000	16865.4004	341.5843	4.9845	0.1087	0.1087
40	8	8	5	1500	20	4	5	0.0000	16317.2002	398.2380	4.6830	0.0951	5	0.0000	16317.2002	398.2380	4.6830	0.0951	0.0951
40	8	8	5	500	50	1	1.8	0.7390	7959.7998	165.0516	1.9798	0.5574	3	0.0000	7916.1001	178.8091	2.7983	0.1045	0.1045
40	8	8	5	500	50	2	1.8	0.7390	8335.4004	213.8858	2.0593	0.6124	3	0.0000	8281.4004	235.0964	2.9986	0.1167	0.1167
40	8	8	5	500	50	3	2.6	0.6034	8525.5000	189.9875	2.7564	0.6309	3	0.0000	8498.0000	213.2576	3.1454	0.1002	0.1002
40	8	8	5	500	50	4	1.6	0.6913	7901.1001	256.1890	1.8969	0.4981	3	0.0000	7808.2998	227.5430	2.8111	0.1227	0.1227
40	8	8	5	1000	50	1	3	0.0000	9940.2998	245.4269	3.0453	0.1126	3	0.0000	9940.2998	245.4269	3.0453	0.1126	0.1126
40	8	8	5	1000	50	2	3	0.0000	10262.0996	248.7192	3.1594	0.1087	3	0.0000	10262.0996	248.7192	3.1594	0.1087	0.1087
40	8	8	5	1000	50	3	3	0.0000	10462.2998	232.3464	3.3578	0.0771	3	0.0000	10462.2998	232.3464	3.3578	0.0771	0.0771
40	8	8	5	1000	50	4	3	0.0000	9960.2002	328.7784	3.0157	0.1235	3.2	0.4526	9959.5000	328.0999	3.1110	0.1951	0.1951
40	8	8	5	1500	50	1	3.2	0.4526	11338.7002	187.0545	2.6454	0.3908	4.4	0.6913	11279.5996	211.8375	3.3920	0.2781	0.2781
40	8	8	5	1500	50	2	3	0.0000	11784.2998	213.1077	2.6360	0.2820	4.8	0.4526	11695.9004	201.3998	3.7329	0.2234	0.2234
40	8	8	5	1500	50	3	3	0.0000	11893.0000	165.8092	2.9171	0.3117	4.6	0.6034	11836.0996	168.4147	3.8251	0.2893	0.2893
40	8	8	5	1500	50	4	3.2	0.4526	11345.2002	184.9462	2.8327	0.3017	4	0.7543	11282.2002	187.0976	3.2858	0.2559	0.2559
40	8	8	5	500	80	1	1	0.0000	4364.6001	182.7340	1.5011	0.0964	1.2	0.4526	4362.6001	179.7749	1.5434	0.1700	0.1700
40	8	8	5	500	80	2	1	0.0000	4649.1001	120.6565	1.6638	0.0649	1	0.0000	4649.1001	120.6565	1.6638	0.0649	0.0649
40	8	8	5	500	80	3	1	0.0000	5108.7002	119.3607	1.8983	0.0907	1	0.0000	5108.7002	119.3607	1.8983	0.0907	0.0907
40	8	8	5	500	80	4	1	0.0000	4291.7998	123.7487	1.5111	0.0607	1	0.0000	4291.7998	123.7487	1.5111	0.0607	0.0607

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	Solve time [sec]	$\pm CI$
40	8	8	5	1000	80	1	1.8	0.7390	5520.7998	210.2935	1.3077	0.4535	2.8	5446.7002	1.9421	0.2899
40	8	8	5	1000	80	2	2.2	0.7390	5747.7998	114.5623	1.7408	0.4692	2.8	5718.2998	2.1032	0.2268
40	8	8	5	1000	80	3	2.4	0.6913	6040.6001	101.4306	2.0422	0.4554	2.8	6027.6001	2.2859	0.3142
40	8	8	5	1000	80	4	2	0.7543	5477.7998	151.4525	1.5609	0.4232	2.8	5399.8999	1.9937	0.2299
40	8	8	5	1500	80	1	3	0.0000	6014.6001	242.7992	2.1001	0.0830	3	6014.6001	2.1001	0.0830
40	8	8	5	1500	80	2	3	0.0000	6365.2002	207.1135	2.3001	0.0622	3	6365.2002	2.3001	0.0622
40	8	8	5	1500	80	3	3	0.0000	6575.8999	202.4341	2.4689	0.0588	3	6575.8999	2.4689	0.0588
40	8	8	5	1500	80	4	3	0.0000	6028.3999	227.9108	2.1874	0.0499	3	6028.3999	2.1874	0.0499

Table A.6: Comparison of all-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the NSF network.

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR Policy [%]	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	500	0	1	26.8	0.8124	17487.0996	338.1635	10.3141	0.8185	30.2	1.3826	17119.3008	347.1414
10	4	4	2	500	0	2	26.8	1.2531	17280.3008	366.2973	10.3782	0.7491	30.2	1.8102	17013.6992	331.8541
10	4	4	2	500	0	3	27.2	0.4526	17831.5000	351.1900	11.0343	0.7327	30	1.4780	17562.5000	297.4134
10	4	4	2	500	0	4	26.8	0.8124	17173.0000	289.7598	10.4985	0.5315	30	1.8165	16976.9004	234.0359
10	4	4	2	1000	0	1	50	2.1598	20559.5000	483.8929	20.2064	3.2978	57	2.7815	20042.4004	500.4554
10	4	4	2	1000	0	2	51.8	3.1786	20246.9004	494.0867	23.9656	4.8901	57.4	2.9251	19909.1992	403.6814
10	4	4	2	1000	0	3	49.6	1.7912	21061.4004	654.3698	19.5502	3.0957	57.2	3.1965	20407.6992	418.2807
10	4	4	2	1000	0	4	51.6	2.2426	20186.4004	457.0767	24.1233	4.6658	56.8	2.8181	19823.9004	451.4037
10	4	4	2	1500	0	1	73.2	2.6517	23422.4004	453.1357	35.1328	2.8373	84.2	4.2238	22888.8008	353.3730
10	4	4	2	1500	0	2	75.2	4.7440	23217.8008	453.9018	39.7845	6.7898	84.2	4.9666	22702.5000	333.9833
10	4	4	2	1500	0	3	72.6	2.7651	23760.9004	468.0867	34.9406	3.3726	83.8	4.6837	23154.6992	394.6921
10	4	4	2	1500	0	4	76.8	3.3358	22893.5000	455.2553	43.6014	4.6909	83.6	4.6274	22564.5996	394.2404
10	4	4	2	500	20	1	23.6	1.3577	14916.0000	243.0228	8.7904	0.7096	25.8	1.0006	14761.0996	279.0847
10	4	4	2	500	20	2	23.2	1.4231	15011.7002	282.6049	8.3546	0.9663	25.8	1.3826	14666.0000	305.5110
10	4	4	2	500	20	3	23.4	1.3151	15431.5996	245.3595	8.6636	1.0844	26.4	1.3577	15120.0000	296.5895
10	4	4	2	500	20	4	23.4	1.1289	14767.2998	280.8017	8.7906	0.7081	25.2	1.7133	14620.7002	302.4457
10	4	4	2	1000	20	1	42.6	2.2170	18162.3008	414.5626	12.7372	1.7069	48.8	1.8414	17672.9004	374.9568
10	4	4	2	1000	20	2	44	2.1598	17925.1992	418.4178	14.8064	2.6891	48.6	2.6816	17498.0000	376.5573
10	4	4	2	1000	20	3	42.6	2.2170	18472.3008	420.0225	13.2008	1.9759	49	2.6985	17879.9004	442.2364
10	4	4	2	1000	20	4	44.2	1.5384	17709.6992	494.1808	15.3048	1.9944	49.4	2.7651	17433.1992	415.0171
10	4	4	2	1500	20	1	62.4	2.7027	20204.4004	374.8307	28.8164	2.5794	70.4	3.0208	19769.0000	343.3017
10	4	4	2	1500	20	2	64.6	3.0768	19926.6992	360.6047	32.3716	3.2025	69.8	3.3187	19656.0996	308.4584
10	4	4	2	1500	20	3	61	2.6985	20816.3008	397.0435	26.7992	3.4153	70.4	3.3084	20146.1992	282.2392
10	4	4	2	1500	20	4	64.6	2.1119	19839.5996	364.1841	32.3316	1.9159	69.2	2.8977	19588.4004	311.9120
10	4	4	2	500	50	1	17.2	0.4526	11327.0996	271.0569	5.7476	0.5221	20	1.5458	11153.2998	279.5572
10	4	4	2	500	50	2	17	0.9541	11096.7998	258.5379	5.6060	0.6227	19.4	1.1289	10984.5000	294.3693
10	4	4	2	500	50	3	17	0.6746	11665.0996	255.5631	5.7324	0.6329	19.8	1.2068	11484.2002	215.4556
10	4	4	2	500	50	4	17	0.6746	11189.5996	216.0145	5.7740	0.5638	19.4	1.1289	11072.5000	225.5847
10	4	4	2	1000	50	1	30.8	1.2531	14334.9004	365.7207	8.0820	0.9204	37.8	3.8282	13972.2002	338.3054
10	4	4	2	1000	50	2	31.6	1.5160	14112.0996	456.2842	8.6288	0.8411	37.4	4.0925	13699.7002	360.2793
10	4	4	2	1000	50	3	30.6	1.3151	14624.5000	364.0566	8.0248	0.9993	38.6	3.6827	14195.9004	309.7939
10	4	4	2	1000	50	4	31.6	0.9659	13947.2998	415.8693	8.7720	1.0498	37.8	4.2773	13681.4004	347.9021
10	4	4	2	1500	50	1	44.6	1.7592	15898.5996	442.1485	11.9288	2.2792	54.2	3.5184	15529.5000	388.0634
10	4	4	2	1500	50	2	47.4	3.0768	15598.2998	463.9478	15.5684	4.6320	54	3.3899	15249.2998	400.4749
10	4	4	2	1500	50	3	44.6	1.7592	16254.7998	427.9553	12.4676	1.9358	53.8	2.9561	15899.5000	399.8610
10	4	4	2	1500	50	4	46.4	4.4775	15627.2998	424.2878	14.9072	6.7141	51.8	3.9453	15287.0996	331.2746
10	4	4	2	500	80	1	9.2	0.8124	7444.0000	351.3247	2.6356	0.3879	11.8	0.7390	7202.2002	308.2810
10	4	4	2	500	80	2	9	0.6746	7333.1001	370.7011	2.6204	0.3662	11.8	0.7390	7127.7002	323.1357
10	4	4	2	500	80	3	9.4	0.9051	7888.5999	361.2085	2.9260	0.5155	12.2	0.7390	7665.0000	310.8399
10	4	4	2	500	80	4	8.8	0.4526	7334.8999	363.7989	2.5480	0.2354	11.2	1.4231	7178.3999	342.9260
10	4	4	2	1000	80	1	17	1.9081	10425.7998	489.8941	4.2944	0.8482	23.2	2.6517	10050.2998	508.9465
10	4	4	2	1000	80	2	18	1.5458	10205.0000	492.6533	5.0860	0.7930	22.6	2.5061	9894.7002	473.7654
10	4	4	2	1000	80	3	17.8	1.6798	10698.5000	452.1629	4.7920	0.7950	23.8	2.5422	10264.0996	458.9852
10	4	4	2	1000	80	4	18	1.5458	10098.5000	435.0533	5.0768	0.8400	21.4	1.7592	9864.4004	479.8181
																6.5856
																0.7979

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]
10	4	4	2	1500	80	1	24	4.1174	11377.5996	438.9448	6.2328	3.1128	29.8	3.0321	10957.4004	376.7924	9.6980
10	4	4	2	1500	80	2	22.2	1.5384	11112.0000	354.8938	5.1520	0.4368	30.6	2.5953	10738.2002	297.3511	9.9448
10	4	4	2	1500	80	3	23	2.2375	11673.0000	399.3120	5.4520	0.7805	30.4	3.2389	11286.0996	305.3673	10.8128
10	4	4	2	1500	80	4	22.8	1.5749	11176.7002	393.0360	5.2872	0.4766	29.8	2.7153	10786.9004	353.2043	9.6088
10	8	8	2	500	0	1	7.2	0.4526	20865.0000	441.0879	21.0733	1.4312	8.4	0.6913	20746.9004	428.3328	26.0908
10	8	8	2	500	0	2	7.2	0.4526	20983.6992	494.5413	20.0748	1.7528	8.4	0.6913	20794.4004	416.8467	25.6485
10	8	8	2	500	0	3	7.2	0.4526	21246.1992	412.2867	20.8483	2.2138	8.4	0.9659	21086.3008	431.8634	27.5092
10	8	8	2	500	0	4	7.4	0.6034	20577.9004	465.4862	21.3125	2.2377	8.2	0.7390	20535.8008	432.4959	24.8155
10	8	8	2	1000	0	1	13.2	0.4526	21846.6992	473.4933	40.7735	4.7547	14.4	0.9659	21682.4004	408.4875	54.5142
10	8	8	2	1000	0	2	13.4	0.6034	22027.5000	522.3108	41.5173	5.3203	14.8	0.8124	21819.4004	454.8238	57.3201
10	8	8	2	1000	0	3	13.2	0.4526	22178.5996	557.6390	39.5077	5.3151	14.8	0.8124	21939.0000	434.7110	58.9655
10	8	8	2	1000	0	4	13.2	0.4526	21721.5000	523.9329	40.7037	4.4217	14.4	0.6913	21642.6992	483.5955	54.5041
10	8	8	2	1500	0	1	19	0.6746	23079.3008	639.6172	61.0036	7.1101	21.2	1.2531	22745.5000	533.7714	88.9408
10	8	8	2	1500	0	2	19.2	0.4526	23199.3008	450.8382	64.5116	7.0552	21	1.1685	22947.5996	488.4721	85.5310
10	8	8	2	1500	0	3	19	0.6746	23381.9004	512.1974	62.2660	8.0676	21.4	1.6247	23065.1992	549.5191	94.0598
10	8	8	2	1500	0	4	19.6	0.6913	23058.9004	491.8044	69.1188	8.3000	21.6	1.3577	22864.1992	572.6486	93.1410
10	8	8	2	500	20	1	6.8	0.4526	17794.5996	335.0291	18.2160	0.8468	7.2	0.4526	17775.8008	327.1647	19.6520
10	8	8	2	500	20	2	6.8	0.4526	17730.3008	313.5026	17.8944	0.5691	7.2	0.8124	17688.9004	312.3766	19.7688
10	8	8	2	500	20	3	7	0.0000	18007.0000	259.0146	19.1224	0.6800	7.2	0.4526	17989.4004	274.2312	20.1488
10	8	8	2	500	20	4	6.8	0.4526	17515.0996	310.4156	18.1596	0.6528	7	0.6746	17505.9004	321.0334	19.0128
10	8	8	2	1000	20	1	11.6	0.6913	19056.4004	535.1555	29.5412	6.2309	12.6	0.6034	18897.0000	458.7990	39.2084
10	8	8	2	1000	20	2	11.4	0.6034	19015.5996	579.2512	27.0604	4.7209	12.8	0.8124	18877.4004	490.8087	40.3244
10	8	8	2	1000	20	3	11.6	0.6913	19433.9004	432.7120	27.8580	7.1921	13	0.6746	19183.5996	423.4817	42.5024
10	8	8	2	1000	20	4	12	0.7543	18845.0996	367.2082	33.5868	5.7194	12.4	0.6913	18822.0000	373.5450	37.0472
10	8	8	2	1500	20	1	16	0.7543	19870.0000	524.0067	45.2928	5.9431	17.8	0.7390	19548.8008	450.2856	62.9264
10	8	8	2	1500	20	2	16.4	0.9659	19961.4004	524.5877	48.4968	7.4708	18	0.7543	19699.5996	471.4778	64.0732
10	8	8	2	1500	20	3	16.4	0.9659	20270.5000	427.6338	48.8172	7.8025	18.4	0.6913	19928.6992	460.9027	68.6788
10	8	8	2	1500	20	4	16.4	0.9659	19646.8008	353.4026	49.6116	7.6022	17.6	1.1782	19548.3008	394.2501	61.1860
10	8	8	2	500	50	1	5	0.0000	12848.5000	268.7044	11.7340	0.6247	5.4	0.6034	12800.9004	249.7969	12.5888
10	8	8	2	500	50	2	5	0.0000	12708.9004	269.2279	11.8336	0.4210	5.6	0.6913	12693.9004	265.5579	12.7336
10	8	8	2	500	50	3	5	0.0000	13230.4004	241.4778	12.3364	0.6160	5.6	0.6913	13196.0000	289.5776	13.3848
10	8	8	2	500	50	4	5	0.0000	12796.5996	295.6999	12.1216	0.5306	5	0.0000	12796.5996	295.6999	12.1216
10	8	8	2	1000	50	1	8.8	0.4526	14787.2998	419.6918	17.3032	2.0483	10	1.0119	14614.0996	430.9603	24.9068
10	8	8	2	1000	50	2	8.8	0.4526	14776.7002	540.7919	16.5640	2.4068	10	1.0119	14612.5996	495.0627	24.4640
10	8	8	2	1000	50	3	9	0.0000	15051.9004	431.4771	18.5960	1.6057	10.2	1.2068	14962.2002	490.2881	26.8368
10	8	8	2	1000	50	4	8.8	0.4526	14716.0996	498.7992	17.2392	2.1024	9.6	0.6913	14606.9004	452.2231	21.9368
10	8	8	2	1500	50	1	11.8	0.7390	15415.5996	465.0289	22.0720	5.2209	13.8	1.0006	15135.5996	454.0402	39.2408
10	8	8	2	1500	50	2	12.4	0.9659	15309.4004	437.7874	26.6704	7.4395	14.8	1.0560	15031.5000	426.3797	46.0904
10	8	8	2	1500	50	3	12.2	0.7390	15663.4004	453.3802	25.6632	5.2107	14.2	1.0006	15462.0000	371.6859	43.7440
10	8	8	2	1500	50	4	11.8	0.7390	15262.2002	342.0056	22.4032	6.0254	13.4	0.9051	15098.7998	322.0299	36.1544
10	8	8	2	500	80	1	3	0.0000	7683.5000	343.5767	6.4992	0.3450	3.8	0.7390	7671.2998	336.8558	7.1344
10	8	8	2	500	80	2	3	0.0000	7705.8999	314.8853	6.1960	0.4470	3.6	0.6913	7647.2002	289.8856	6.8096
10	8	8	2	500	80	3	3	0.0000	8210.0996	332.0338	6.7208	0.3883	3.6	0.6913	8172.0000	316.8780	7.3232
10	8	8	2	500	80	4	3	0.0000	7693.2002	367.4905	6.5040	0.5135	3.4	0.6034	7691.1001	367.6798	6.8232
10	8	8	2	1000	80	1	5.2	0.4526	10235.7002	567.4150	9.4360	1.3688	6.4	0.6913	10164.4004	531.5577	12.3832
10	8	8	2	1000	80	2	5.4	0.6034	10238.5000	554.3077	9.9040	1.6012	6.2	0.7390	10143.2002	488.6924	11.9896

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	±CI	Weighted port count @ F_{min}	±CI	Solve time [sec]	±CI	F_{opt}	±CI	Weighted port count @ F_{opt}	±CI	Solve time [sec]	±CI
10	8	8	2	1000	80	3	5.2	0.4526	10548.0996	517.7769	9.8392	1.3557	6.6	0.6034	10404.2002	458.3543	12.9552	1.1414
10	8	8	2	1000	80	4	5	0.0000	10177.9004	580.2620	8.7968	0.9009	6.4	0.6913	10017.2998	505.9721	12.2776	1.3125
10	8	8	2	1500	80	1	7.2	0.4526	10762.5000	415.5852	11.8136	2.2631	8.2	1.0006	10621.2998	352.9481	16.4328	4.4725
10	8	8	2	1500	80	2	6.6	0.6034	10711.7002	475.6650	9.9072	1.9421	7.8	0.7390	10471.5996	327.5490	14.5976	2.9839
10	8	8	2	1500	80	3	6.4	0.6913	11238.2998	345.4776	9.9128	2.3007	8	1.0119	11004.4004	322.3247	16.4528	3.8494
10	8	8	2	1500	80	4	6.8	0.4526	10636.2998	285.1899	10.7928	1.6432	7.6	0.6913	10544.2002	326.8413	13.9072	2.6455
40	8	8	5	500	0	1	6.4	0.6913	53833.1016	1736.9689	54.8953	7.5015	6.8	0.4526	53752.0000	1751.8329	58.7735	4.5781
40	8	8	5	500	0	2	6.8	0.4526	52516.3984	1621.1198	58.3627	5.3818	7.2	0.4526	52486.0000	1628.5712	64.4455	8.9057
40	8	8	5	500	0	3	6.8	0.4526	55683.3984	1814.7261	57.9922	6.1212	7.2	0.4526	55568.5000	1744.1427	64.5811	11.5228
40	8	8	5	500	0	4	6.4	0.6913	53156.3984	1587.6593	54.5169	8.4594	7.2	0.4526	53110.6016	1609.8234	65.5491	11.5940
40	8	8	5	1000	0	1	7.8	0.7390	59350.0000	809.7107	67.2672	11.5837	8.6	0.6034	59206.1992	722.4487	81.3748	10.8973
40	8	8	5	1000	0	2	7.6	0.6913	58077.8008	655.0876	62.8414	12.3394	8.4	0.6913	57963.6016	623.2366	77.0936	11.7196
40	8	8	5	1000	0	3	8	0.7543	61887.1992	966.5772	70.2688	13.6856	9	0.0000	61278.8008	718.6002	87.2048	2.2962
40	8	8	5	1000	0	4	7.6	0.6913	58676.5000	677.5610	62.4304	13.5706	8.8	0.4526	58617.1992	694.4229	84.5540	8.3436
40	8	8	5	1500	0	1	9	0.0000	60528.8008	1149.4507	71.8732	2.6499	9.6	0.6913	60516.6016	1143.7145	84.6712	14.5931
40	8	8	5	1500	0	2	9	0.0000	59423.0000	1143.5220	71.4216	2.4958	9.4	0.6034	59402.5000	1151.0161	79.8344	12.3179
40	8	8	5	1500	0	3	9	0.0000	62384.3008	1414.6489	71.8572	2.4262	9.4	0.6034	62341.6016	1410.1788	80.3012	12.7718
40	8	8	5	1500	0	4	9	0.0000	59881.6016	1275.8466	70.0064	2.3174	10	0.7543	59850.8008	1255.3180	92.3276	16.3210
40	8	8	5	500	20	1	5.2	0.4526	44703.8984	1573.3043	37.2320	4.8951	6	0.7543	44668.3984	1564.0967	44.0056	6.8252
40	8	8	5	500	20	2	5	0.0000	43028.1992	1467.4445	33.8024	0.8156	6.2	0.7390	42990.1992	1436.3867	44.6576	6.9341
40	8	8	5	500	20	3	5.2	0.4526	46468.6016	1475.2897	37.4016	4.6061	6.6	0.6034	46308.0000	1483.4075	49.4944	5.4789
40	8	8	5	500	20	4	5.2	0.4526	43573.8984	1516.1399	36.1064	5.2843	6	0.7543	43485.5000	1460.5439	43.6120	8.0065
40	8	8	5	1000	20	1	7	0.0000	49951.1992	1314.0013	48.8856	1.2304	7.4	0.6034	49925.5000	1295.6626	55.0736	8.9560
40	8	8	5	1000	20	2	7	0.0000	48467.3984	1148.2185	47.2352	0.9488	7.8	0.7390	48383.1992	1086.3759	60.3168	11.8517
40	8	8	5	1000	20	3	7	0.0000	52295.0000	1332.1169	48.6848	1.6157	8.2	0.7390	51971.1016	1145.4897	68.0600	11.6429
40	8	8	5	1000	20	4	7	0.0000	49292.8008	1115.0251	48.5832	1.3521	7.2	0.4526	49281.8008	1107.7972	52.3296	9.2794
40	8	8	5	1500	20	1	7.6	0.6913	51394.1992	606.4378	48.9336	8.2706	9	0.0000	51012.1016	632.1255	68.1064	2.2421
40	8	8	5	1500	20	2	7.6	0.6913	50105.5000	773.8972	49.4888	8.6226	8.8	0.4526	50040.0000	784.5154	64.9432	5.3192
40	8	8	5	1500	20	3	8.4	0.6913	53294.0000	534.8650	61.2336	8.2586	9	0.0000	53193.6016	545.5803	69.2168	1.7059
40	8	8	5	1500	20	4	7.6	0.6913	50959.3008	853.6703	49.0640	8.4074	9	0.0000	50810.5000	838.7175	68.7344	2.1890
40	8	8	5	500	50	1	5	0.0000	30678.6992	901.2603	25.4176	0.8016	5	0.0000	30678.6992	901.2603	25.4176	0.8016
40	8	8	5	500	50	2	4.4	0.6913	28493.6992	1030.6660	21.9712	1.9069	5	0.0000	28450.4004	1010.9325	23.7096	0.7156
40	8	8	5	500	50	3	5	0.0000	32386.0000	1060.9233	26.3544	0.8160	5	0.0000	32386.0000	1060.9233	26.3544	0.8160
40	8	8	5	500	50	4	4.4	0.6913	29815.8008	1226.8518	22.9696	2.7385	4.8	0.4526	29730.4004	1197.7883	24.6080	1.6805
40	8	8	5	1000	50	1	5	0.0000	35394.8984	878.3375	26.7920	1.3744	6.2	0.7390	35233.3008	911.9998	34.4544	4.5961
40	8	8	5	1000	50	2	5	0.0000	33622.6992	1093.8070	26.2032	0.9739	5.6	0.9659	33522.3008	947.5811	31.4368	9.4856
40	8	8	5	1000	50	3	5	0.0000	37741.8008	1287.3542	28.3376	1.3295	6.4	0.6913	37432.1992	1131.4591	36.3376	3.9917
40	8	8	5	1000	50	4	5	0.0000	34951.8008	1246.8217	26.8768	1.0201	5.4	0.6034	34936.3008	1238.3737	29.3216	3.9561
40	8	8	5	1500	50	1	6.6	0.6034	38457.6016	1162.0332	35.0512	3.1808	6.8	0.4526	38392.8008	1226.7321	36.0848	2.2360
40	8	8	5	1500	50	2	6.2	0.7390	37090.0000	1144.4344	31.9728	4.3850	7	0.0000	37050.1016	1173.2013	35.5648	1.4090
40	8	8	5	1500	50	3	6.8	0.4526	40813.3008	1172.1744	37.5328	2.1451	6.8	0.4526	40813.3008	1172.1744	37.5328	2.1451
40	8	8	5	1500	50	4	6.4	0.6913	38360.3008	1153.2740	33.9872	4.1598	6.8	0.4526	38306.0000	1150.0198	36.3856	2.1831
40	8	8	5	500	80	1	3	0.0000	15338.9004	1261.8798	10.3376	1.1250	3.2	0.4526	15334.9004	1254.5693	10.7024	1.7911
40	8	8	5	500	80	2	3	0.0000	13562.0996	928.5302	9.4640	0.9386	3	0.0000	13562.0996	928.5302	9.4640	0.9386
40	8	8	5	500	80	3	3	0.0000	17046.0000	1160.9617	11.2800	1.1019	3	0.0000	17046.0000	1160.9617	11.2800	1.1019
40	8	8	5	500	80	4	3	0.0000	14222.0000	1128.4697	9.8432	1.0644	3	0.0000	14222.0000	1128.4697	9.8432	1.0644

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
40	8	8	5	1000	80	1	3	0.0000	20448.5996	929.6032	12.6496	1.2035	0.7390	20243.1992	997.6710	15.1024	1.4883
40	8	8	5	1000	80	2	3	0.0000	18487.8008	823.7185	12.1520	0.8117	0.6034	18482.5996	826.1065	12.7200	0.9902
40	8	8	5	1000	80	3	3.4	0.6034	22470.1992	991.8368	15.1568	2.0715	0.6034	22316.6992	1000.7120	17.2768	1.7066
40	8	8	5	1000	80	4	3	0.0000	20129.5996	990.9657	13.1808	0.9996	0.6913	20112.5000	991.1170	14.3456	1.6711
40	8	8	5	1500	80	1	4.2	0.7390	25200.3008	1390.1351	18.2016	2.4415	0.4526	25136.4004	1455.7755	19.6848	1.3980
40	8	8	5	1500	80	2	3.8	0.7390	23684.0000	1196.5021	16.4784	2.1870	0.0000	23641.0996	1215.1573	18.8640	1.0169
40	8	8	5	1500	80	3	4.8	0.4526	27444.0996	1155.6809	21.2976	1.4090	0.0000	27423.5996	1165.9922	21.6384	0.9766
40	8	8	5	1500	80	4	4	0.7543	25180.5996	1193.2501	17.3904	2.7606	0.4526	25143.5000	1195.8292	19.5968	1.7188

Table A.7: Comparison of no-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the EON network.

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	Solve time [sec]	±CI	Weighted port count @F _{opt}	±CI	Solve time [sec]	±CI		
10	4	4	2	500	0	1	38.6	2.7651	7289.6001	132.1023	54.2142	3.4256	43	1.6525	7217.2998	155.3532	56.8045	4.2258
10	4	4	2	500	0	2	38.8	2.4741	7510.2002	126.4869	54.1188	3.5121	40.8	2.5645	7439.0000	110.9904	55.8485	4.8006
10	4	4	2	500	0	3	39.4	2.2170	7406.2002	113.2734	56.2515	2.5058	42	3.5216	7379.7998	105.0729	58.5609	3.6305
10	4	4	2	500	0	4	37.6	2.0295	7204.3999	118.3417	51.0356	3.1533	40.6	3.8637	7187.1001	107.8794	54.9030	3.7302
10	4	4	2	1000	0	1	70.2	8.0447	9310.0000	145.9675	77.3220	3.9111	76.4	8.7194	9252.7998	152.3812	77.0642	5.8780
10	4	4	2	1000	0	2	76.2	6.2997	9529.0000	163.5019	76.5292	4.3038	84.8	3.7833	9501.0996	159.5479	83.6572	5.3259
10	4	4	2	1000	0	3	71.8	11.9391	9458.4004	180.1435	83.0168	6.4447	74.6	11.8165	9394.2002	166.8837	85.6764	6.7051
10	4	4	2	1000	0	4	76	9.4266	9292.5996	175.4557	76.3464	5.5806	82.6	11.4448	9249.4004	159.4369	80.8368	7.5732
10	4	4	2	1500	0	1	100.8	13.7008	11177.5996	190.3790	86.2816	7.8973	107	15.2650	11135.9004	209.2033	90.2776	9.3063
10	4	4	2	1500	0	2	120.6	9.8412	11502.5000	201.3368	103.0224	8.3600	127	10.9156	11431.7002	184.5524	110.6088	7.4734
10	4	4	2	1500	0	3	103.2	12.9845	11284.2998	235.5741	95.6272	5.6559	106	15.3697	11269.0996	225.5510	99.0176	6.8973
10	4	4	2	1500	0	4	110.2	8.7753	11220.2002	185.6042	93.7008	6.9396	118	6.7209	11175.2002	170.9604	95.6736	7.4102
10	4	4	2	500	20	1	31.4	1.8841	6118.2998	182.9198	40.6720	4.8158	33	2.2375	6075.0000	141.9209	40.9008	4.4832
10	4	4	2	500	20	2	35.6	2.4371	6353.5000	177.3526	45.3088	4.9527	38.4	2.1387	6281.3999	181.3000	48.0112	3.6346
10	4	4	2	500	20	3	30.6	1.7592	6214.2998	155.1224	42.4624	4.3042	33.2	3.5983	6207.1001	150.8883	44.9024	4.2061
10	4	4	2	500	20	4	32.4	2.3418	6064.8999	155.6296	41.3568	4.1987	36.4	4.5780	6050.6001	148.6498	45.4784	6.8290
10	4	4	2	1000	20	1	61	7.1713	7853.0000	235.5951	56.2048	4.6163	62.4	7.9551	7828.2998	215.3246	57.5280	5.1775
10	4	4	2	1000	20	2	64.8	4.9781	8102.3999	236.6180	61.6336	4.3882	71	6.5058	8032.2002	190.9917	65.1008	5.8248
10	4	4	2	1000	20	3	64.6	7.5365	8027.5000	194.7356	64.0736	5.8439	67	6.3285	7998.6001	211.4114	64.7776	4.5964
10	4	4	2	1000	20	4	69.6	7.8399	7895.3999	222.9335	60.9824	6.1816	74	7.1793	7837.5000	221.8474	64.3952	5.6907
10	4	4	2	1500	20	1	90.8	12.3927	9576.2002	217.9104	77.9648	13.1646	93.6	13.1344	9532.2998	228.0410	79.8976	13.0288
10	4	4	2	1500	20	2	98.2	5.9275	9808.2998	229.2924	84.1856	6.4621	106	6.2943	9713.0996	203.1102	89.5616	5.6374
10	4	4	2	1500	20	3	93.8	7.9594	9747.5996	215.1603	82.9472	7.7285	105	5.0844	9669.0000	203.9169	90.7776	7.4877
10	4	4	2	1500	20	4	96.8	9.1374	9512.2002	219.7484	77.8496	6.9370	100	10.2767	9466.5000	205.3481	80.3584	7.1991
10	4	4	2	500	50	1	21.6	3.0208	4306.5000	184.7272	27.5296	3.3220	22.4	3.2389	4282.7998	175.3660	27.4816	3.3093
10	4	4	2	500	50	2	20.8	2.3804	4513.5000	182.4910	26.6624	4.2817	23.4	3.2912	4474.7002	173.4501	26.8640	3.2853
10	4	4	2	500	50	3	21	2.7815	4463.3999	150.9315	25.3664	2.9999	23.4	3.2213	4434.1001	137.3478	27.1648	3.2616
10	4	4	2	500	50	4	21.8	3.0321	4261.2002	150.3358	23.7760	2.8818	23	2.5242	4245.2998	152.1302	24.7776	3.6251
10	4	4	2	1000	50	1	40.6	3.3596	5469.6001	148.0546	35.4848	4.3580	42.4	3.9366	5455.5000	147.4717	35.4816	4.8122
10	4	4	2	1000	50	2	41.8	2.3564	5674.6001	193.7122	37.1872	3.5375	43.8	3.5825	5642.8999	194.8753	42.0992	10.1404
10	4	4	2	1000	50	3	46	5.2365	5688.0000	241.0396	41.4016	5.6593	49.8	5.3206	5651.2002	234.6296	44.6656	5.7001
10	4	4	2	1000	50	4	42.4	3.8192	5479.8999	218.7322	36.4928	3.4087	45.4	5.0394	5454.2002	217.2109	37.8976	3.6688
10	4	4	2	1500	50	1	56.8	8.2196	6736.5000	192.8566	49.6192	7.5547	66.4	9.6367	6704.7002	195.5705	51.4880	7.4454
10	4	4	2	1500	50	2	66.6	4.6642	7017.3999	223.4619	55.1424	4.1408	72	4.9229	6940.6001	188.8163	58.2144	3.6833
10	4	4	2	1500	50	3	61.6	9.3003	6984.7998	202.9296	53.7216	8.4394	68.2	10.6497	6907.0000	189.1026	56.5024	9.4984
10	4	4	2	1500	50	4	61.8	3.1062	6762.2998	186.1124	49.3152	2.3952	65.4	4.1477	6701.2002	185.0781	51.0784	4.1288
10	4	4	2	500	80	1	9.2	2.0739	2433.1001	101.9890	13.1264	3.1139	10.2	2.6302	2422.7000	96.7562	13.6320	2.9941
10	4	4	2	500	80	2	10	2.0518	2614.6001	118.0607	17.3760	2.6141	10.6	2.8462	2612.3999	115.7428	17.2320	2.6992
10	4	4	2	500	80	3	9	1.7849	2633.1001	118.4927	18.4928	4.2807	11	2.7815	2609.1001	109.4874	18.3168	4.1425
10	4	4	2	500	80	4	9	1.9081	2434.7000	106.3367	15.0560	2.9387	10.6	2.8462	2389.3000	94.5467	15.0464	2.7126
10	4	4	2	1000	80	1	15.8	3.8282	3130.5000	134.1544	18.9728	5.7849	22.4	6.1108	3098.8000	119.2448	24.7904	8.0532
10	4	4	2	1000	80	2	18.6	3.5570	3304.8000	176.7378	23.2960	6.9599	21.8	4.4341	3275.3000	165.7921	24.1952	7.1268
10	4	4	2	1000	80	3	19.6	2.8662	3265.8000	138.4507	23.0464	7.0299	22.4	4.3223	3233.8999	129.0218	24.9760	6.4995
10	4	4	2	1000	80	4	18.8	2.2828	3101.8999	143.9011	21.8464	4.7915	23.2	4.3433	3063.8999	136.5323	24.2336	5.2161

C	W	B	E/O cost ratio	IN [Gb/s]	ER [%]	Policy	F _{min}	±CI	Weighted port count @ F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @ F _{opt}	Solve time [sec]	±CI		
10	4	4	2	1500	80	1	21.6	6.7479	4025.5000	159.9332	25.0144	5.4937	24.6	8.0334	3970.1001	163.7166	26.2560	6.6615
10	4	4	2	1500	80	2	28.6	7.1332	4264.2002	174.4583	27.0112	5.9858	34.6	8.6077	4211.2998	155.4737	32.2144	6.7767
10	4	4	2	1500	80	3	25.8	5.8112	4202.7998	118.9510	28.6912	4.6214	31.2	7.3422	4171.0000	132.4631	31.8976	5.4207
10	4	4	2	1500	80	4	32.2	5.5713	4033.7000	151.5690	28.2496	4.1980	35.8	6.7866	4001.0000	135.8424	31.5872	5.2602
10	8	8	2	500	0	1	9.8	0.7390	9617.9004	106.9999	43.6284	3.0992	11	0.9541	9577.5996	129.7586	47.4003	3.9109
10	8	8	2	500	0	2	10.4	0.6913	9951.4004	173.3593	48.1875	3.2623	12	1.0119	9914.2998	162.0523	54.4206	3.8164
10	8	8	2	500	0	3	10.8	1.0560	9775.5996	186.4667	49.6595	3.8744	12.2	1.0006	9710.7002	182.0625	54.6800	2.2688
10	8	8	2	500	0	4	10	0.7543	9434.5996	187.2588	44.0717	3.3973	11.6	1.3577	9399.4004	210.3685	48.4313	5.2292
10	8	8	2	1000	0	1	19.8	1.3826	10228.0996	166.5522	60.9453	3.0847	22	2.0518	10177.4004	164.9610	68.5381	7.4870
10	8	8	2	1000	0	2	21.2	1.7133	10657.0996	173.6246	70.3742	6.7749	23.8	2.3564	10548.4004	192.7795	77.5354	7.9367
10	8	8	2	1000	0	3	18.4	1.6594	10417.0996	142.9026	65.0524	2.5239	21.6	3.0208	10335.4004	171.5283	75.2288	7.5588
10	8	8	2	1000	0	4	19.4	1.6247	10218.7998	225.7649	61.8288	5.4267	22.4	1.6594	10131.0000	208.6502	70.3368	7.1161
10	8	8	2	1500	0	1	31.2	2.5645	10831.5000	281.6946	80.4188	8.8564	33.4	2.3174	10770.2998	271.8616	87.1628	10.0093
10	8	8	2	1500	0	2	30.8	1.5749	11179.5996	285.6039	81.6972	5.6636	33	3.0170	11112.9004	239.9741	90.2072	8.3858
10	8	8	2	1500	0	3	30	2.8019	10966.2002	211.5280	82.9856	3.5097	32.6	2.6816	10915.0996	207.4948	89.2744	6.7320
10	8	8	2	1500	0	4	29.6	2.7027	10860.9004	227.7907	77.9992	8.3088	35	3.3050	10744.4004	199.8082	95.2144	12.5653
10	8	8	2	500	20	1	9.8	0.7390	8108.8999	203.3944	38.5416	4.3471	10.4	0.9659	8093.1001	199.5941	40.0592	4.4891
10	8	8	2	500	20	2	9	0.6746	8262.7002	204.9071	36.7336	3.9121	10	1.0119	8230.9004	181.5550	40.2072	4.7665
10	8	8	2	500	20	3	9.4	1.3151	8179.2002	208.3705	40.1040	5.0117	10.2	1.2068	8112.3999	194.9788	42.8096	3.8844
10	8	8	2	500	20	4	8.8	0.8124	7972.3999	213.1021	35.1016	4.2551	10.2	1.5384	7913.6001	171.6119	39.0104	6.1025
10	8	8	2	1000	20	1	17	1.6525	8543.5000	221.6242	49.9928	5.5873	17.6	1.7912	8524.2998	220.6094	50.8136	6.9301
10	8	8	2	1000	20	2	17.2	1.5749	8922.9004	238.7599	53.5592	5.7073	18.4	2.0295	8885.7998	262.1292	56.9112	6.0268
10	8	8	2	1000	20	3	16.4	1.7912	8787.7002	203.0385	51.2288	4.7204	19.4	2.4136	8721.2002	205.3491	61.2312	6.5722
10	8	8	2	1000	20	4	17.2	1.4231	8597.0000	251.7847	50.3872	4.8348	20.2	2.2577	8532.4004	240.6698	59.8576	6.7831
10	8	8	2	1500	20	1	24.4	3.0952	9071.0000	189.2662	66.0264	6.4273	25.4	3.4267	9063.0996	184.7553	66.7088	6.9290
10	8	8	2	1500	20	2	26.4	2.4371	9531.7998	177.2668	74.2328	4.6817	29.2	2.4741	9471.9004	162.2598	83.7272	6.7736
10	8	8	2	1500	20	3	23.2	3.8430	9248.5996	174.4036	66.4816	13.1599	24.8	4.6958	9239.2998	173.4439	72.3264	15.4909
10	8	8	2	1500	20	4	26	3.1099	9167.5000	153.1612	71.4096	8.5690	29	3.6330	9089.4004	136.1797	78.9552	10.1734
10	8	8	2	500	50	1	6	0.7543	5459.3999	233.0627	22.1232	3.5964	7	1.1685	5432.2002	244.0447	24.6256	4.6079
10	8	8	2	500	50	2	6	0.7543	5697.8999	244.3514	22.2496	1.9707	6.8	0.8124	5678.1001	243.3614	23.2512	2.5010
10	8	8	2	500	50	3	6.4	0.6913	5726.2998	297.4656	24.1088	1.1781	6.8	1.0560	5703.7002	277.8680	25.4736	2.7551
10	8	8	2	500	50	4	6	0.7543	5376.8999	205.7423	20.1680	1.8116	6.6	0.9051	5362.7998	208.7979	21.1992	3.1217
10	8	8	2	1000	50	1	11.4	1.3151	5850.2998	226.2527	33.5856	3.6636	11.8	1.5384	5841.6001	222.2982	34.3616	3.8096
10	8	8	2	1000	50	2	11.8	1.2068	6119.8999	206.3577	36.3624	4.2451	13.4	1.1289	6111.0000	213.9139	38.8448	4.1511
10	8	8	2	1000	50	3	10.8	1.2531	6081.2002	222.9028	34.8920	3.6587	12.4	1.5160	6037.0000	220.1034	38.0008	2.8632
10	8	8	2	1000	50	4	10	1.0119	5878.2998	188.4142	30.4288	6.4323	11.4	1.6247	5829.8999	177.2719	32.9792	6.5179
10	8	8	2	1500	50	1	17	1.3492	6455.1001	189.9869	44.8656	3.9728	17.6	1.1782	6432.0000	208.7311	46.4400	3.5832
10	8	8	2	1500	50	2	15.8	1.0006	6788.6001	177.9064	47.6272	3.9053	17.6	1.7912	6763.3999	199.3425	52.0192	5.5048
10	8	8	2	1500	50	3	16	1.5458	6755.1001	238.4609	46.6896	6.3461	19.2	2.3804	6724.0000	245.7091	54.3568	7.6044
10	8	8	2	1500	50	4	15.2	1.9611	6517.7002	203.1387	41.6112	5.0804	17.8	2.1546	6465.5000	193.4474	46.7744	7.1628
10	8	8	2	500	80	1	3.4	0.6034	2812.8999	121.4680	13.4896	2.0666	3.6	0.6913	2805.3999	119.2936	13.8624	1.8624
10	8	8	2	500	80	2	3	0.6746	3013.3999	174.7640	13.5792	2.3394	3.2	0.8124	3012.3999	174.1800	13.6608	2.4866
10	8	8	2	500	80	3	3.2	0.4526	3022.2000	182.0643	16.5808	1.9920	3.8	0.7390	3015.3999	176.4660	17.3184	1.6837
10	8	8	2	500	80	4	3.2	0.4526	2884.0000	170.0369	13.9600	2.0296	3.6	0.6913	2854.1001	154.4094	14.4464	1.8898
10	8	8	2	1000	80	1	6.2	0.7390	3308.6001	136.4763	19.8608	3.7701	6.6	1.1289	3299.0000	133.3811	21.1072	4.3773
10	8	8	2	1000	80	2	5.6	0.6913	3538.8000	140.9256	19.9344	2.9394	6	1.0119	3527.7000	140.6991	20.4304	3.3320

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	±CI	Weighted port count @ F_{min}	±CI	Solve time [sec]	±CI	Weighted port count @ F_{opt}	±CI	Solve time [sec]	±CI
10	8	8	2	1000	80	3	5.6	0.9659	3477.7000	184.5333	21.5008	6.1348	3457.3999	179.6242	24.3456	6.1236
10	8	8	2	1000	80	4	5.6	0.9659	3257.8999	172.0939	21.3376	5.1499	3239.7000	164.6876	23.0528	5.2237
10	8	8	2	1500	80	1	7.8	1.5384	3837.2000	228.8756	22.9648	5.2362	3795.6001	220.3354	27.2576	7.2525
10	8	8	2	1500	80	2	9	1.6525	4077.3999	166.9817	28.2944	5.1853	4062.2000	171.5869	30.6480	5.7104
10	8	8	2	1500	80	3	8.6	1.3151	4045.0000	158.4730	27.5744	4.3146	4030.8999	160.0737	30.7504	5.7089
10	8	8	2	1500	80	4	6	1.6866	3798.8000	214.8541	21.0288	5.0983	3754.3999	201.1276	24.0160	6.7767
40	8	8	5	500	0	1	3.4	0.6034	8877.0996	186.4552	34.3703	3.1333	8859.4004	181.4158	36.0250	1.9709
40	8	8	5	500	0	2	3	0.0000	9164.5996	144.5408	34.2220	1.8844	9138.0000	127.0788	35.9797	2.5706
40	8	8	5	500	0	3	3.2	0.4526	9077.5996	193.9737	35.9797	1.2047	9068.0996	189.6585	37.1126	1.6622
40	8	8	5	500	0	4	3.2	0.4526	8748.0996	154.9945	32.9390	2.3556	8731.0996	154.0073	34.2766	2.5440
40	8	8	5	1000	0	1	5.6	0.6913	11086.0996	139.4361	40.4876	2.3765	11037.5000	128.3409	42.0922	2.6782
40	8	8	5	1000	0	2	5.6	0.6913	11402.0000	161.3884	40.7424	2.5629	11386.7998	172.2916	44.1985	4.1514
40	8	8	5	1000	0	3	6.2	0.7390	11274.7002	208.2200	44.6440	2.5545	11269.7002	207.2506	45.1500	2.5573
40	8	8	5	1000	0	4	8.2	0.7390	11003.2002	181.3225	41.4058	3.4543	10999.0000	184.1351	41.7746	3.1643
40	8	8	5	1500	0	1	8.2	1.0006	12559.2998	287.4492	48.0078	6.1881	12495.4004	318.1457	56.0814	6.8787
40	8	8	5	1500	0	2	8.4	1.1782	12914.2998	270.9130	52.6268	7.2469	12912.5000	271.5337	53.3756	7.8842
40	8	8	5	1500	0	3	8.6	0.6034	12903.5996	255.6586	55.8908	3.6784	12824.0996	246.3246	65.3844	2.5574
40	8	8	5	1500	0	4	8	0.7543	12549.5996	278.2109	48.9066	4.3111	12514.5000	268.0460	54.5258	4.9628
40	8	8	5	500	20	1	3	0.0000	7260.7002	169.1160	27.0680	2.8080	7260.7002	169.1160	27.0680	2.8080
40	8	8	5	500	20	2	2.8	0.4526	7652.8999	256.4400	28.3772	3.7056	7650.8999	254.1318	28.7036	3.7773
40	8	8	5	500	20	3	3	0.0000	7659.1001	184.4727	30.3580	2.2457	7654.0000	176.3357	30.5356	2.3309
40	8	8	5	500	20	4	3	0.0000	7169.7002	168.4764	26.3932	2.9315	7169.7002	168.4764	26.3932	2.9315
40	8	8	5	1000	20	1	4.8	0.4526	9081.4004	240.6537	31.8364	1.8706	9078.7002	237.8646	31.9428	1.8747
40	8	8	5	1000	20	2	5.2	0.4526	9511.7998	34.2848	2.7798	5.8	9495.0996	210.3396	35.3484	2.5218
40	8	8	5	1000	20	3	5	0.6746	9472.0000	204.8366	36.3904	5.1461	9441.5000	196.0415	37.7948	4.5816
40	8	8	5	1000	20	4	5	0.0000	9133.2002	262.1435	31.4852	3.0648	9111.7002	266.8381	33.9624	3.3752
40	8	8	5	1500	20	1	7.4	0.6034	10423.2998	148.1628	40.2940	4.3604	10393.0996	148.7994	44.7604	5.2434
40	8	8	5	1500	20	2	7.2	0.4526	10751.2002	224.2702	40.4460	3.8111	10699.2002	214.7913	47.4388	6.1481
40	8	8	5	1500	20	3	7.8	0.7390	10710.5000	189.4858	43.7192	4.6422	10697.9004	201.6635	47.5572	4.7326
40	8	8	5	1500	20	4	7.6	0.6913	10383.0000	178.7122	40.9432	4.8816	10358.2998	175.2704	43.2268	4.1271
40	8	8	5	500	50	1	2.8	0.4526	4900.2002	171.4924	17.8132	2.3215	4900.2002	171.4924	17.8132	2.3215
40	8	8	5	500	50	2	3	0.0000	5275.0000	219.5034	20.3024	1.9382	5275.0000	219.5034	20.3024	1.9382
40	8	8	5	500	50	3	2.8	0.4526	5401.1001	194.6147	22.3168	2.5491	5401.1001	194.6147	22.3168	2.5491
40	8	8	5	500	50	4	2.8	0.4526	4841.2998	147.7256	18.3784	1.7742	4841.2998	147.7256	18.3784	1.7742
40	8	8	5	1000	50	1	3.4	0.6034	6279.2002	201.9125	22.1760	1.9737	6256.2998	203.8516	22.4336	1.9422
40	8	8	5	1000	50	2	3.4	0.6034	6554.5000	233.0346	22.1080	1.9847	6527.6001	227.4102	23.0552	1.7448
40	8	8	5	1000	50	3	3.2	0.4526	6619.2002	226.7056	25.8160	1.4329	6603.2002	220.2038	26.7240	1.1236
40	8	8	5	1000	50	4	3.2	0.4526	6218.0000	190.1338	21.4144	1.7773	6169.2998	194.4672	22.3536	2.0307
40	8	8	5	1500	50	1	4.6	0.6034	7018.7998	240.0278	23.7128	2.0042	6997.7002	246.1736	24.7448	2.2956
40	8	8	5	1500	50	2	5	0.0000	7365.5000	241.8218	25.8928	3.1298	7358.6001	232.7315	26.4272	3.4942
40	8	8	5	1500	50	3	5.4	0.9051	7419.7998	212.7886	28.7792	1.5945	7419.7998	212.7886	28.7792	1.5945
40	8	8	5	1500	50	4	5	0.0000	7043.7998	231.0694	23.9784	2.3544	7021.3999	240.1587	25.1216	1.4776
40	8	8	5	500	80	1	1	0.0000	2582.5000	131.7608	11.5344	1.7921	2569.8000	124.2356	11.4784	1.9094
40	8	8	5	500	80	2	1	0.0000	2779.3000	151.3331	13.1824	1.9177	2775.1001	146.5232	13.3024	1.8805
40	8	8	5	500	80	3	1	0.0000	3073.5000	138.4496	16.7808	1.7300	3063.0000	142.7096	16.6440	1.6970
40	8	8	5	500	80	4	1.2	0.4526	2553.0000	158.9694	10.9016	1.0677	2553.0000	158.9694	10.9016	1.0677

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	Solve time [sec]	$\pm CI$
40	8	8	5	1000	80	1	2.8	0.4526	3297.3999	150.7747	16.5448	2.9298	0.0000	3281.6001	15.9488	2.7427
40	8	8	5	1000	80	2	2.8	0.4526	3516.8000	239.8673	16.9416	2.7128	0.4526	3516.8000	16.9416	2.7128
40	8	8	5	1000	80	3	3	0.0000	3679.3999	202.2662	20.0352	1.8881	0.0000	3679.3999	20.0352	1.8881
40	8	8	5	1000	80	4	2.6	0.6034	3223.5000	148.0957	16.2048	2.6673	0.6034	3223.5000	16.2048	2.6673
40	8	8	5	1500	80	1	3	0.0000	3713.3000	209.9597	15.0272	2.0971	0.6034	3710.3999	15.3384	2.3021
40	8	8	5	1500	80	2	3.2	0.4526	4013.5000	191.1431	16.5472	1.6973	0.6034	4009.5000	16.7456	1.6722
40	8	8	5	1500	80	3	3	0.0000	4087.0000	185.4399	19.0256	1.2275	0.4526	4081.1001	19.1560	1.3968
40	8	8	5	1500	80	4	3	0.0000	3729.8999	145.9061	16.7376	1.6332	0.4526	3728.8999	16.8848	1.5652

Table A.8: Comparison of fiber-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the EON network.

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	500	0	1	38.6	2.7651	7289.6001	132.1023	57.3938	2.9534	43	1.6525	7217.2998	155.3532	60.8222	4.5485
10	4	4	2	500	0	2	38.2	2.6302	7448.6001	111.3288	57.7813	3.0095	39.2	2.8181	7438.6001	108.0447	59.5422	3.4961
10	4	4	2	500	0	3	40.2	2.5422	7413.0000	110.3236	61.7779	1.4056	42.6	3.5570	7390.6001	100.7920	63.8987	2.5514
10	4	4	2	500	0	4	37	2.4324	7190.5000	108.1805	56.7262	4.8033	38.4	3.7592	7184.8999	107.5673	58.7278	4.6062
10	4	4	2	1000	0	1	70	8.1025	9267.0000	181.6110	96.8304	4.3379	73	9.1759	9222.7002	174.0372	98.5650	4.9134
10	4	4	2	1000	0	2	75	11.9353	9496.5996	248.9364	102.6600	11.6833	80	13.3441	9423.5996	221.1042	107.3620	12.2274
10	4	4	2	1000	0	3	70	12.5714	9408.7998	179.2265	109.3176	13.4032	70.8	12.7903	9393.5000	170.5098	110.0264	13.2089
10	4	4	2	1000	0	4	78	9.0069	9345.2002	128.4528	98.4704	5.0216	84	9.8285	9263.5000	142.1585	103.4216	7.1111
10	4	4	2	1500	0	1	103.8	12.5523	11225.2998	182.2083	127.8344	12.2139	115.6	10.7316	11164.2998	197.1927	137.5576	14.9086
10	4	4	2	1500	0	2	120.8	14.0615	11501.5000	209.4916	145.9504	10.7940	126.2	15.5339	11461.0000	198.6981	158.2096	15.5941
10	4	4	2	1500	0	3	93.2	17.2847	11255.2002	244.1948	146.6640	25.5042	99.6	20.0586	11204.9004	225.2476	152.4928	26.8593
10	4	4	2	1500	0	4	116.6	10.9364	11254.7998	177.3756	141.8464	8.0046	121.6	9.4218	11194.7998	190.2683	147.9680	8.2119
10	4	4	2	500	20	1	31.4	1.8841	6118.2998	182.9198	43.9744	5.9390	33	2.2375	6075.0000	141.9209	44.0320	5.3252
10	4	4	2	500	20	2	35.4	2.6816	6346.7998	182.5959	47.4560	5.5379	38.4	2.1387	6281.3999	181.3000	50.0512	4.2066
10	4	4	2	500	20	3	30.2	3.0321	6217.5000	172.8186	46.6560	4.9191	33	4.5755	6201.7998	159.1035	48.4704	4.7718
10	4	4	2	500	20	4	32.4	2.3418	6063.3999	156.3989	43.9456	4.6224	35.4	3.7440	6050.0000	147.8145	47.1456	6.7835
10	4	4	2	1000	20	1	62.2	7.8732	7910.2002	223.8029	71.8528	6.6541	65	7.6919	7853.0000	203.6827	74.5120	6.9427
10	4	4	2	1000	20	2	63.2	5.0687	8081.1001	192.7492	77.6544	6.0734	66.4	5.9217	8007.7998	174.0515	78.2368	6.4410
10	4	4	2	1000	20	3	65.6	8.6932	8025.2998	221.2318	83.7120	7.5915	67.6	8.0687	7989.7002	227.2022	84.7616	7.4207
10	4	4	2	1000	20	4	70.8	7.3422	7863.6001	215.8411	78.1728	6.9653	75.4	7.2282	7830.0000	214.2835	82.2208	7.2617
10	4	4	2	1500	20	1	93.6	11.2492	9643.2002	207.3029	114.2048	15.4769	100.8	11.4179	9580.5996	225.1862	118.6336	15.0231
10	4	4	2	1500	20	2	93	14.9791	9717.9004	283.4429	110.8384	16.7518	99.6	17.8622	9688.4004	273.1920	116.7968	19.1620
10	4	4	2	1500	20	3	88.6	15.2322	9587.9004	342.0823	110.2816	18.4050	93	16.5386	9555.7998	317.9506	114.0864	22.1278
10	4	4	2	1500	20	4	108.2	10.7982	9595.7002	213.2608	123.9968	14.7828	113.4	10.3374	9553.0996	221.0878	128.5696	15.6325
10	4	4	2	500	50	1	22.4	2.8662	4300.2002	173.0589	30.1984	3.9305	23.2	2.8181	4282.8999	174.2742	29.8112	3.4593
10	4	4	2	500	50	2	21	2.5242	4499.5000	181.2128	29.0816	4.7263	23.2	3.4033	4465.8999	173.4771	29.7856	4.4069
10	4	4	2	500	50	3	20.4	4.2157	4417.5000	196.1143	26.3168	4.9248	22.2	4.8741	4386.8999	175.9418	28.0576	5.5212
10	4	4	2	500	50	4	22.2	2.7153	4237.7998	141.3013	27.8144	4.7276	23	3.0915	4229.8999	143.2708	27.9488	4.7686
10	4	4	2	1000	50	1	40.8	3.3358	5505.7998	153.1803	45.9456	3.9421	45.4	3.0019	5468.7002	142.6586	49.0496	4.3816
10	4	4	2	1000	50	2	41.4	4.8554	5679.7002	210.3566	47.8464	5.2457	44.2	4.6348	5657.3999	208.4350	50.4064	4.4037
10	4	4	2	1000	50	3	45.6	5.6865	5673.2002	227.3200	52.5568	7.0995	50	4.8296	5635.2998	231.2026	56.2176	5.5129
10	4	4	2	1000	50	4	40.8	6.0510	5451.6001	253.6619	46.9312	4.9481	44	6.4795	5409.2002	260.0960	48.5248	5.0105
10	4	4	2	1500	50	1	59.4	8.6604	6736.5000	190.6597	66.5856	7.3593	62.4	10.0074	6691.2002	190.9100	69.0624	7.5700
10	4	4	2	1500	50	2	67.6	5.6059	6996.1001	189.4054	75.3344	8.1912	71.4	6.5338	6941.7998	184.2843	76.9472	7.5924
10	4	4	2	1500	50	3	64	9.2068	6988.3999	186.7989	72.5952	11.0543	70.8	10.6122	6921.3999	180.7079	76.3712	10.7320
10	4	4	2	1500	50	4	65.2	4.4469	6739.1001	192.2471	69.9968	5.9523	70.6	4.7608	6717.7998	195.0143	72.6720	5.0145
10	4	4	2	500	80	1	9.8	1.3826	2474.1001	120.7343	15.7824	3.1448	11.6	2.3418	2440.6001	95.1484	16.3328	2.7663
10	4	4	2	500	80	2	10.6	1.1289	2629.8999	111.4035	18.3744	2.5600	11.2	2.1808	2627.7000	109.1197	18.1888	2.6512
10	4	4	2	500	80	3	9.6	0.9659	2645.0000	118.9032	20.2048	3.3607	11.8	1.9318	2626.2000	115.5271	20.0192	2.9877
10	4	4	2	500	80	4	8.8	2.2828	2424.5000	135.3815	16.1344	3.6203	10	3.2529	2390.1001	116.8786	15.7312	3.4713
10	4	4	2	1000	80	1	16.2	4.2773	3088.8999	150.4832	27.4752	10.7457	18.2	6.0791	3066.8999	144.3909	28.6976	10.5937
10	4	4	2	1000	80	2	21.2	2.2828	3326.5000	131.3881	26.8608	6.9190	22.8	2.4741	3302.0998	135.0978	25.8048	5.2744
10	4	4	2	1000	80	3	18.6	4.6151	3267.2000	178.6052	28.6144	13.0208	21.2	5.7817	3231.8999	159.7525	30.4896	12.6058
10	4	4	2	1000	80	4	15.8	4.5855	3030.6001	164.7505	29.8176	12.1560	18.6	6.4637	3018.0000	158.0499	30.0288	11.3625

C	W	B	E/O	IN	FR	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	1500	80	1	22.6	8.7128	3981.3000	200.0088	23.9744	8.9380	28	11.1108	9577.5996	200.8459	28.1152	9.5448
10	4	4	2	1500	80	2	35.6	6.7816	4254.3999	171.0866	38.1632	5.6956	38.8	6.1257	4221.0000	166.5999	41.1072	6.1712
10	4	4	2	1500	80	3	30	7.7582	4228.3999	162.0611	37.7792	8.4512	35.6	7.6934	4191.7002	159.0929	39.5008	8.2831
10	4	4	2	1500	80	4	32.6	5.4724	4069.0000	152.1695	34.2976	4.8716	37.8	6.7866	4008.6001	132.0136	38.2016	5.7681
10	8	8	2	500	0	1	9.8	0.7390	9617.9004	106.9999	44.0164	3.0940	11	0.9541	9577.5996	129.7586	47.9959	3.9307
10	8	8	2	500	0	2	10.4	0.6913	9951.4004	173.3593	49.0063	3.3197	12	1.0119	9914.2998	162.0523	55.4676	3.9999
10	8	8	2	500	0	3	10.8	1.0560	9775.5996	186.4667	50.6618	3.8685	12.2	1.0006	9710.7002	182.0625	55.9294	2.3194
10	8	8	2	500	0	4	10	0.7543	9434.5996	187.2588	44.8417	3.4999	11.6	1.3577	9399.4004	210.3685	49.4263	5.4369
10	8	8	2	1000	0	1	19.8	1.3826	10228.0996	166.5522	62.4379	3.2701	22	2.0518	10177.4004	164.9610	70.2675	7.9032
10	8	8	2	1000	0	2	21.2	1.7133	10657.0996	173.6246	72.0726	7.0842	23.8	2.3564	10548.4004	192.7795	79.9506	8.7028
10	8	8	2	1000	0	3	18.4	1.6594	10417.0996	142.9026	66.4928	2.5505	21.6	3.0208	10335.4004	171.5283	77.4606	8.1955
10	8	8	2	1000	0	4	19.4	1.6247	10218.7998	225.7649	63.1032	5.4882	22.4	1.6594	10131.0000	208.6502	72.1844	7.6652
10	8	8	2	1500	0	1	31.2	2.5645	10831.5000	281.6946	84.6708	9.5306	33.4	2.3174	10770.2998	271.8616	91.4076	10.3944
10	8	8	2	1500	0	2	30.8	1.5749	11179.5996	285.6039	86.0076	5.5481	33	3.0170	11112.9004	239.9741	94.7056	8.1029
10	8	8	2	1500	0	3	30	2.8019	10966.2002	211.5280	86.9920	3.2147	32.6	2.6816	10915.0996	207.4948	93.4772	6.3550
10	8	8	2	1500	0	4	30	2.4557	10853.9004	221.4689	82.5872	8.0411	35	3.3050	10744.4004	199.8082	98.8576	12.4921
10	8	8	2	500	20	1	9.8	0.7390	8108.8999	203.3944	39.2472	4.4081	10.4	0.9659	8093.1001	199.5941	40.8136	4.5488
10	8	8	2	500	20	2	9	0.6746	8262.7002	204.9071	37.3248	4.0325	10	1.0119	8230.9004	181.5550	40.8888	4.9132
10	8	8	2	500	20	3	9.4	1.3151	8179.2002	208.3705	40.6032	5.0286	10.2	1.2068	8112.3999	194.9788	43.4248	3.8382
10	8	8	2	500	20	4	8.8	0.8124	7972.3999	213.1021	35.6064	4.4183	10.2	1.5384	7913.6001	171.6119	39.5832	6.2558
10	8	8	2	1000	20	1	17	1.6525	8543.5000	221.6242	50.7152	5.6947	17.6	1.7912	8524.2998	220.6094	51.7144	7.2253
10	8	8	2	1000	20	2	17.2	1.5749	8922.9004	238.7599	54.6576	5.7063	18.4	2.0295	8885.7998	262.1292	58.1528	6.1655
10	8	8	2	1000	20	3	16.4	1.7912	8787.7002	230.0385	51.9256	4.6356	19.4	2.4136	8721.2002	205.3491	61.9568	6.6724
10	8	8	2	1000	20	4	17.2	1.4231	8597.0000	251.7847	51.3446	4.9005	20.2	2.2577	8532.4004	240.6698	60.8080	7.0397
10	8	8	2	1500	20	1	24.4	3.0952	9071.0000	189.2662	68.0168	6.7296	25.4	3.4267	9063.0996	184.7553	68.9096	7.3686
10	8	8	2	1500	20	2	25.6	3.2389	9492.7002	202.4284	73.8824	7.1411	28.4	3.6361	9432.7998	182.2557	83.9112	10.0603
10	8	8	2	1500	20	3	23.2	3.8430	9256.0996	166.1008	68.5728	13.7373	24.8	4.6958	9247.2002	165.7659	74.3472	15.8452
10	8	8	2	1500	20	4	26.2	2.9561	9168.2002	152.0329	73.5376	8.4676	29.2	3.4033	9090.0996	135.1398	81.8576	10.3086
10	8	8	2	500	50	1	6	0.7543	5459.3999	233.0627	22.0368	3.5758	7	1.1685	5432.2002	244.0447	24.6328	4.6797
10	8	8	2	500	50	2	6	0.7543	5697.8999	244.3514	22.1072	1.9188	6.8	0.8124	5678.1001	243.3614	23.1368	2.5109
10	8	8	2	500	50	3	6.4	0.6913	5726.2998	297.4656	24.0024	1.1987	6.8	1.0560	5703.7002	277.8680	25.4376	2.8813
10	8	8	2	500	50	4	6	0.7543	5376.8999	205.7423	20.0272	1.7587	6.6	0.9051	5362.7998	208.7979	21.0808	3.1969
10	8	8	2	1000	50	1	11.4	1.3151	5850.2998	226.2527	33.8856	3.7425	11.8	1.5384	5841.6001	222.2982	34.7880	3.9496
10	8	8	2	1000	50	2	11.8	1.2068	6119.8999	206.3577	36.7360	4.2509	13.4	1.1289	6111.0000	213.9139	39.1536	4.1269
10	8	8	2	1000	50	3	10.8	1.2531	6081.2002	222.9028	35.2848	3.7063	12.4	1.5160	6037.0000	220.1034	38.3952	2.7739
10	8	8	2	1000	50	4	10	1.0119	5878.2998	188.4142	30.7232	6.4825	11.4	1.6247	5829.8999	177.2719	33.3328	6.5465
10	8	8	2	1500	50	1	17	1.3492	6455.1001	189.9869	46.1040	3.9496	17.6	1.782	6432.0000	208.7311	47.7424	3.5229
10	8	8	2	1500	50	2	15.2	1.4231	6763.5000	169.7722	46.4048	4.5595	17	2.3370	6738.2998	190.2358	50.4688	6.6619
10	8	8	2	1500	50	3	16	1.5458	6755.1001	238.4609	47.7056	6.2998	19.2	2.3804	6724.0000	245.7091	55.3664	7.7336
10	8	8	2	1500	50	4	15.2	1.9611	6517.7002	203.1387	42.8528	5.0195	17.8	2.1546	6465.5000	193.4474	48.2368	7.4199
10	8	8	2	500	80	1	3.4	0.6034	2812.8999	121.4680	13.4896	2.0574	3.6	0.6913	2805.3999	119.2936	13.8576	1.8543
10	8	8	2	500	80	2	3	0.6746	3013.3999	174.7640	13.6048	2.3224	3.2	0.8124	3012.3999	174.1800	13.6800	2.4592
10	8	8	2	500	80	3	3.2	0.4526	3022.2000	182.0643	16.6000	1.9690	3.8	0.7390	3015.3999	176.4660	17.2816	1.6735
10	8	8	2	500	80	4	3.2	0.4526	2884.0000	170.0369	13.9600	2.0557	3.6	0.6913	2854.1001	154.4094	14.4304	1.8733
10	8	8	2	1000	80	1	6.2	0.7390	3308.6001	136.4763	19.6992	3.7345	6.6	1.1289	3299.0000	133.3811	21.0320	4.4054
10	8	8	2	1000	80	2	5.6	0.6913	3538.8000	140.9256	19.8336	2.8768	6	1.0119	3527.7000	140.6991	20.4192	3.3132

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	8	8	2	1000	80	3	5.6	0.9659	3477.7000	184.5333	21.3984	6.1596	6.6	1.4780	3457.3999	179.6242	24.3456
10	8	8	2	1000	80	4	5.6	0.9659	3257.8999	172.0939	21.3216	5.1438	6.4	1.6594	3239.7000	164.6876	23.0480
10	8	8	2	1500	80	1	8.2	1.0006	3875.1001	174.4989	24.6512	3.9152	10.2	1.5384	3828.8999	173.4001	29.3680
10	8	8	2	1500	80	2	9	1.6525	4080.1001	165.6123	28.3008	5.6477	9.8	1.8102	4064.8999	170.3917	30.6288
10	8	8	2	1500	80	3	8	1.9377	4007.0000	230.4363	26.1776	6.7301	8.8	2.2828	3983.5000	229.8168	28.8672
10	8	8	2	1500	80	4	7.4	1.3151	3871.8999	175.4999	22.9712	4.3865	9.2	1.5749	3825.2000	166.6999	27.9424
40	8	8	5	500	0	1	3.4	0.6034	8877.0996	186.4552	34.6766	3.9392	4.6	0.6034	8859.4004	181.4158	35.8672
40	8	8	5	500	0	2	3	0.0000	9164.5996	144.5408	34.0733	1.8084	3.8	0.7390	9138.0000	127.0788	35.8125
40	8	8	5	500	0	3	3.2	0.4526	9077.5996	193.9737	35.9343	1.2270	4	0.7543	9068.0996	189.6585	37.0716
40	8	8	5	500	0	4	3.2	0.4526	8748.0996	154.9945	32.8781	2.3566	4	0.7543	8731.0996	154.0073	34.2298
40	8	8	5	1000	0	1	5.6	0.6913	11086.0996	139.4361	40.3969	2.3636	6.4	0.6913	11037.5000	128.3409	41.9922
40	8	8	5	1000	0	2	5.6	0.6913	11402.0000	161.3884	40.6982	2.5606	6.6	0.9051	11386.7998	172.2916	44.1655
40	8	8	5	1000	0	3	6.2	0.7390	11274.7002	208.2200	44.5437	2.5643	6.4	0.6913	11269.7002	207.2506	45.0437
40	8	8	5	1000	0	4	6.2	0.7390	11003.2002	181.3225	41.3156	3.4475	6.4	0.6913	10999.0000	184.1351	41.6798
40	8	8	5	1500	0	1	8.2	1.0006	12559.2998	287.4492	47.9602	6.1913	9.6	1.1782	12495.4004	318.1457	56.0716
40	8	8	5	1500	0	2	8.4	1.1782	12914.2998	270.9130	52.5100	7.2804	8.6	1.3151	12912.5000	271.5337	53.2832
40	8	8	5	1500	0	3	8.6	0.6034	12903.5996	255.6586	55.8394	3.7117	10.6	0.6034	12824.0996	246.3246	65.3690
40	8	8	5	1500	0	4	8	0.7543	12549.5996	278.2109	48.8976	4.3229	9	0.9541	12514.5000	268.0460	54.5420
40	8	8	5	500	20	1	3	0.0000	7260.7002	169.1160	27.0108	2.8012	3	0.0000	7260.7002	169.1160	27.0108
40	8	8	5	500	20	2	2.8	0.4526	7652.8999	256.4400	28.3076	3.6959	3.2	0.8124	7650.8999	254.1318	28.6488
40	8	8	5	500	20	3	3	0.0000	7659.1001	184.4727	30.3080	2.2284	3.2	0.4526	7654.0000	176.3357	30.4828
40	8	8	5	500	20	4	3	0.0000	7169.7002	168.4764	26.3464	2.9188	3	0.0000	7169.7002	168.4764	26.3464
40	8	8	5	1000	20	1	4.8	0.4526	9081.4004	240.6537	31.8084	1.8662	5	0.6746	9078.7002	237.8646	31.9052
40	8	8	5	1000	20	2	5.2	0.4526	9511.7998	340.3780	34.2500	2.2793	5.8	0.7390	9495.0996	210.3396	35.2868
40	8	8	5	1000	20	3	5	0.6746	9472.0000	204.8366	36.3308	5.1333	5.6	0.9659	9441.5000	196.0415	37.7284
40	8	8	5	1000	20	4	5	0.0000	9133.2002	262.1435	31.4612	3.0665	6.2	0.7390	9111.7002	266.8381	33.9276
40	8	8	5	1500	20	1	7.4	0.6034	10423.2998	148.1628	40.2208	4.3734	8.4	0.9659	10393.0996	148.7994	44.7184
40	8	8	5	1500	20	2	7.2	0.4526	10751.2002	224.2702	40.3956	3.8044	8.4	0.9659	10699.2002	214.7913	47.4128
40	8	8	5	1500	20	3	7.8	0.7390	10710.5000	189.4858	43.5232	4.8017	8.4	0.6913	10697.9004	201.6635	47.3464
40	8	8	5	1500	20	4	7.6	0.6913	10383.0000	178.7122	40.7212	4.5665	8	0.7543	10358.2998	175.2704	42.9460
40	8	8	5	500	50	1	2.8	0.4526	4900.2002	171.4924	17.7752	2.3063	2.8	0.4526	4900.2002	171.4924	17.7752
40	8	8	5	500	50	2	3	0.0000	5275.0000	219.5034	20.2568	1.9547	3	0.0000	5275.0000	219.5034	20.2568
40	8	8	5	500	50	3	2.8	0.4526	5401.1001	194.6147	22.1872	2.5828	2.8	0.4526	5401.1001	194.6147	22.1872
40	8	8	5	500	50	4	2.8	0.4526	4841.2998	147.7256	18.0496	1.8356	2.8	0.4526	4841.2998	147.7256	18.0496
40	8	8	5	1000	50	1	3.4	0.6034	6279.2002	201.9125	21.9312	1.8050	4.2	0.7390	6256.2998	203.8516	22.1992
40	8	8	5	1000	50	2	3.4	0.6034	6554.5000	233.0346	22.0736	1.9765	3.8	0.7390	6527.6001	227.4102	23.0168
40	8	8	5	1000	50	3	3.2	0.4526	6619.2002	226.7056	25.7536	1.4327	4	0.7543	6603.2002	220.2038	26.6880
40	8	8	5	1000	50	4	3.2	0.4526	6218.0000	190.1338	21.3864	1.7695	4.2	0.7390	6169.2998	194.4672	22.3376
40	8	8	5	1500	50	1	4.6	0.6034	7018.7998	240.0278	23.6912	1.9984	5.4	1.1289	6997.7002	246.1736	24.7056
40	8	8	5	1500	50	2	5	0.0000	7365.5000	241.8218	25.8904	3.1209	5.6	0.6913	7358.6001	232.7315	26.4096
40	8	8	5	1500	50	3	5.4	0.9051	7419.7998	212.7886	28.7352	1.5859	5.4	0.9051	7419.7998	212.7886	28.7352
40	8	8	5	1500	50	4	5	0.0000	7043.7998	231.0694	23.9552	2.3560	5.8	0.7390	7021.3999	240.1587	25.0896
40	8	8	5	500	80	1	1	0.0000	2582.5000	131.7608	11.5592	1.7931	1.6	0.6913	2569.8000	124.2356	11.5144
40	8	8	5	500	80	2	1	0.0000	2779.3000	151.3331	13.2808	1.9491	1.2	0.4526	2775.1001	146.5232	13.4032
40	8	8	5	500	80	3	1	0.0000	3073.5000	138.4496	16.7648	1.7175	2	0.7543	3063.0000	142.7096	16.6248
40	8	8	5	500	80	4	1.2	0.4526	2553.0000	158.9694	10.8664	1.0612	1.2	0.4526	2553.0000	158.9694	10.8664

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
40	8	8	5	1000	80	1	2.8	0.4526	3297.3999	150.7747	16.5192	2.9233	0.0000	3281.6001	154.4557	15.9184	2.7337
40	8	8	5	1000	80	2	2.8	0.4526	3516.8000	239.8673	16.9088	2.7015	2.8	3516.8000	239.8673	16.9088	2.7015
40	8	8	5	1000	80	3	3	0.0000	3679.3999	202.2662	20.0064	1.8780	3	3679.3999	202.2662	20.0064	1.8780
40	8	8	5	1000	80	4	2.6	0.6034	3223.5000	148.0957	16.1728	2.6695	2.6	3223.5000	148.0957	16.1728	2.6695
40	8	8	5	1500	80	1	3	0.0000	3713.3000	209.9597	14.9944	2.0887	3.4	3710.3999	206.7911	15.3088	2.2954
40	8	8	5	1500	80	2	3.2	0.4526	4013.5000	191.1431	16.5208	1.6990	3.4	4009.5000	186.2774	16.7200	1.6737
40	8	8	5	1500	80	3	3	0.0000	4087.0000	185.4399	19.0024	1.2195	3.2	4081.1001	180.4783	19.1360	1.3931
40	8	8	5	1500	80	4	3	0.0000	3729.8999	145.9061	16.6976	1.6263	3.2	3728.8999	144.6389	16.8488	1.5557

Table A.9: Comparison of all-bifurcation-based heuristics without the color conversion and signal regeneration capabilities for the EON network.

C	W	B	E/O	cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @ F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @ F _{opt}	±CI	Solve time [sec]		
10	4	4	2	500	0	1		40.4	4.4264	9872.4004	250.9856	107.1625	8.6685	50.4	6.1849	9710.7998	208.2279	133.3089	19.2143
10	4	4	2	500	0	2		43.2	5.0236	9838.5996	249.6778	115.2880	10.8211	52.4	5.0507	9694.0000	208.6212	134.4214	15.2944
10	4	4	2	500	0	3		41	6.0716	10076.5996	161.4939	111.1772	12.7299	53.4	5.1731	9905.5996	218.8515	147.9152	15.0215
10	4	4	2	500	0	4		42.6	3.5570	9780.2002	226.1385	113.2104	13.6930	51.2	5.9371	9621.2998	199.8945	134.2516	15.0211
10	4	4	2	1000	0	1		72.2	9.0811	11909.9004	244.8322	167.5808	12.7918	80.8	12.2077	11735.0996	264.8798	177.9216	22.0379
10	4	4	2	1000	0	2		82	7.0513	11823.7998	217.0026	171.0176	15.4566	91.2	7.0578	11667.9004	223.0002	184.1376	14.3401
10	4	4	2	1000	0	3		74.4	11.8789	12038.5996	193.9323	179.2560	11.9651	85.8	10.1238	11971.0000	206.9795	190.8368	14.3956
10	4	4	2	1000	0	4		81.6	9.8238	11839.5000	241.6537	173.7440	18.7761	92.8	10.1070	11699.0000	244.2610	193.3984	20.6730
10	4	4	2	1500	0	1		107.8	13.1716	13763.0000	285.8560	212.0240	24.5996	122.4	15.7210	13639.0000	270.2636	234.5136	40.2451
10	4	4	2	1500	0	2		121.4	15.0820	13666.5000	248.1449	226.5376	18.5066	138.4	10.7739	13535.4004	224.7459	257.9744	32.4687
10	4	4	2	1500	0	3		99.2	14.6480	13958.5000	225.3940	217.1424	12.4239	108.8	20.0291	13843.4004	218.9585	240.1920	30.5965
10	4	4	2	1500	0	4		120.4	12.7118	13769.2002	250.4659	229.6416	15.4910	136.8	12.7368	13659.5000	225.3561	264.0128	30.5006
10	4	4	2	500	20	1		32	1.5458	8437.2002	285.9554	83.7824	10.6016	39.8	2.7153	8252.7998	247.1434	91.2128	8.4132
10	4	4	2	500	20	2		36.2	2.8780	8297.7002	325.7227	85.5552	8.6219	41.4	4.6151	8176.1001	304.1238	95.5264	10.9089
10	4	4	2	500	20	3		32.6	3.4267	8682.2002	295.3353	83.7760	8.5400	45.6	5.1841	8503.5000	248.1453	114.0928	15.1442
10	4	4	2	500	20	4		32.2	2.4510	8331.4004	290.3406	76.9280	7.1334	43.6	3.7592	8182.0000	260.3523	102.2848	10.2943
10	4	4	2	1000	20	1		68.2	6.7192	10369.2002	344.0309	127.8336	16.9383	76	10.3693	10260.0000	350.6023	142.4320	19.3219
10	4	4	2	1000	20	2		66.2	6.8533	10244.0000	261.5074	125.5488	12.8740	77.2	9.8331	10089.4004	252.5337	140.4416	20.6173
10	4	4	2	1000	20	3		66.6	8.2844	10534.2002	277.2048	137.8496	13.0622	81.6	10.0528	10394.7998	300.4043	160.6016	21.9862
10	4	4	2	1000	20	4		72.4	7.3298	10239.7998	333.4604	135.8080	14.6516	80.6	7.1650	10113.0996	322.2105	150.8224	21.8114
10	4	4	2	1500	20	1		96.8	10.5692	11969.7998	227.2585	183.2768	32.4556	117	14.3268	11831.0996	178.5796	218.0352	33.7718
10	4	4	2	1500	20	2		100.6	4.2560	11680.0000	249.8629	174.0480	18.5810	109.4	6.7056	11583.2998	213.4432	187.4176	23.4718
10	4	4	2	1500	20	3		99.8	5.7323	12078.5996	183.0121	188.8768	17.3653	104.8	6.4160	11963.7998	193.4526	197.2032	20.1561
10	4	4	2	1500	20	4		112	10.0799	11906.7002	175.4466	202.5984	30.0826	123.8	11.8242	11758.7998	195.7878	234.8992	31.3678
10	4	4	2	500	50	1		23	3.3731	6089.7002	172.6796	48.7680	8.8814	26.6	3.6827	6020.3999	175.5351	51.6480	8.7855
10	4	4	2	500	50	2		22.6	2.4136	5953.2998	177.2181	48.3392	10.5274	26.4	2.7856	5848.5000	201.6005	49.9968	10.2969
10	4	4	2	500	50	3		25	2.6128	6387.8999	193.1847	52.6912	8.2196	30.4	3.2389	6054.40	201.4642	60.5440	9.6959
10	4	4	2	500	50	4		23.2	3.0508	5997.0000	165.7760	48.5440	7.5007	27.8	4.4851	5912.3999	184.9912	53.3952	7.7959
10	4	4	2	1000	50	1		44.4	2.8662	7854.3999	203.2972	88.4608	11.4965	52.4	4.3747	7787.2998	219.2784	101.0368	12.8415
10	4	4	2	1000	50	2		47.2	5.9753	7773.6001	256.1154	90.3744	14.2004	54	7.1793	7686.8999	246.1388	100.0064	16.0270
10	4	4	2	1000	50	3		47.8	5.1907	8128.3999	273.5811	95.6736	13.3616	56.6	7.3840	7992.7998	258.7240	117.5168	19.5470
10	4	4	2	1000	50	4		42.2	6.7866	7774.6001	199.7342	81.8368	12.3368	49.6	5.1841	7700.2002	212.4351	94.0800	11.6078
10	4	4	2	1500	50	1		63.6	7.0125	8911.0000	339.2027	109.8624	9.2515	72.2	7.6682	8804.7998	267.6417	119.5136	11.2198
10	4	4	2	1500	50	2		68.8	5.8599	8720.5996	226.6317	122.4256	15.0063	73.4	5.2603	8634.5000	218.9738	127.1744	13.6340
10	4	4	2	1500	50	3		70.8	5.8210	9204.2998	235.1561	130.7008	17.5346	81.2	7.0255	9057.0000	210.8571	145.4016	16.7753
10	4	4	2	1500	50	4		65.8	4.3302	8892.9004	247.3732	117.7856	10.3987	73.8	3.5184	8785.7002	228.2467	128.8064	12.3639
10	4	4	2	500	80	1		11.2	1.2531	3872.8000	173.9367	34.2016	10.1417	16	2.6345	3744.7000	138.3443	37.6960	8.0184
10	4	4	2	500	80	2		11	1.1685	3800.6001	136.7412	31.9296	9.0668	14	2.8019	3703.8999	115.9796	33.9456	8.9171
10	4	4	2	500	80	3		11.4	1.3151	4216.2002	178.0907	45.5040	9.9259	15.4	2.9251	4088.1001	136.0423	42.2976	7.6781
10	4	4	2	500	80	4		11.4	1.1289	3852.8000	177.2797	35.7056	8.5216	14	1.8165	3796.1001	144.7843	38.6752	8.7936
10	4	4	2	1000	80	1		20.8	4.9321	5500.3999	268.6915	49.6384	13.3024	26.8	3.6610	5289.8999	177.3411	56.2816	13.7368
10	4	4	2	1000	80	2		23	2.5242	5247.6001	227.9884	45.6896	9.0769	30	4.9229	5137.5000	174.7621	59.5712	14.6246
10	4	4	2	1000	80	3		22	3.8311	5573.7998	135.3561	58.2720	11.2470	28.6	3.2912	5442.5000	145.0947	62.5088	7.6245
10	4	4	2	1000	80	4		22	2.7195	5262.7002	214.0176	49.3056	9.1161	26.6	5.8735	5166.5000	188.0531	60.6336	12.7286

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	4	4	2	1500	80	1	29.2	7.3259	6120.2002	222.6766	50.9096	12.0365	45.6	5.6463	5978.1001	247.5387	82.8288	14.1289
10	4	4	2	1500	80	2	36.4	7.2361	5965.0000	272.2714	62.5920	12.4755	42.8	5.2884	5863.1001	229.8701	73.8176	13.4220
10	4	4	2	1500	80	3	33.8	5.8112	6399.7998	267.2567	69.3632	11.9210	40.2	4.8741	6248.2002	248.4449	78.4256	14.0362
10	4	4	2	1500	80	4	33.2	5.7025	6061.7002	241.8147	61.7600	11.9305	44.8	6.8616	5890.2998	226.0709	80.9984	13.7330
10	8	8	2	500	0	1	11.4	1.3151	12203.2002	375.1959	246.9059	52.9187	13.6	1.3577	12057.7998	260.4330	262.5094	47.4526
10	8	8	2	500	0	2	11.6	1.5160	12201.0996	312.2741	227.9908	25.7501	13.6	1.3577	12116.5000	307.3986	256.2116	24.2002
10	8	8	2	500	0	3	12	1.0119	12278.0000	263.3703	237.5624	23.5789	14.6	1.1289	12148.7998	260.0540	277.6104	21.8087
10	8	8	2	500	0	4	11.4	1.3151	12093.2002	266.3109	215.1892	34.9259	14.4	0.6913	11937.2002	292.6912	271.3056	20.4569
10	8	8	2	1000	0	1	20.4	2.9445	12702.0000	235.0470	288.4336	28.3982	24.6	3.0019	12672.4004	248.2872	371.5688	91.8114
10	8	8	2	1000	0	2	20.4	1.6594	12873.7002	346.2513	277.8536	24.5745	24.4	2.8662	12756.5996	300.7307	346.9384	53.5906
10	8	8	2	1000	0	3	20.6	2.5953	12979.4004	313.3944	311.3840	19.5670	24.6	3.2213	12804.7002	276.3636	356.8320	40.2118
10	8	8	2	1000	0	4	19.8	2.0462	12726.2002	251.0061	270.7792	30.5271	26.4	2.3418	12489.4004	237.2842	383.6720	39.3542
10	8	8	2	1500	0	1	30.4	3.3084	13193.4004	278.9793	406.6944	76.2195	33.8	5.0122	13124.5000	271.9547	420.1264	76.7220
10	8	8	2	1500	0	2	27.4	3.5570	13361.0000	289.4365	357.6304	48.8852	34.4	2.4371	13252.4004	262.4373	402.7856	44.8741
10	8	8	2	1500	0	3	31.8	3.1786	13438.7002	241.2697	401.1232	28.3022	37.2	3.2669	13317.2002	192.5382	474.2304	57.4487
10	8	8	2	1500	0	4	29.4	2.7651	13364.5996	254.1481	370.3712	61.4393	39.2	3.1965	13109.0996	230.9890	498.2592	56.7673
10	8	8	2	500	20	1	8.8	1.0560	10354.0000	366.4143	144.8032	21.4034	11.4	1.3151	10229.9004	342.1488	185.5360	23.3074
10	8	8	2	500	20	2	10.2	1.3826	10205.0996	322.2652	169.3440	26.5991	11.8	0.7390	10091.7002	309.3094	191.1584	19.2738
10	8	8	2	500	20	3	11	0.6746	10577.2998	363.1367	195.580	14.2008	12.6	0.9051	10420.0000	319.8808	212.1408	19.4154
10	8	8	2	500	20	4	10	0.7543	10285.2998	303.7073	181.1968	27.8689	11.8	0.7390	10106.5996	319.9185	204.5152	29.9831
10	8	8	2	1000	20	1	18.6	1.8841	11056.5996	392.0203	224.4032	28.2129	20	2.1598	10991.9004	384.7557	243.0880	27.8410
10	8	8	2	1000	20	2	18	1.3908	11064.4004	267.4089	223.9552	26.0814	21	2.1333	10910.0996	325.7839	262.1152	31.5580
10	8	8	2	1000	20	3	17	1.7849	11312.2002	303.5759	218.8352	22.6310	23.8	2.1546	11117.7002	339.6648	373.3152	57.7139
10	8	8	2	1000	20	4	18	1.9377	10975.2002	344.0765	221.0080	26.5972	22.2	2.4510	10781.7002	364.8864	278.2944	38.5435
10	8	8	2	1500	20	1	24.6	1.7592	11403.5996	251.0445	268.5504	25.8151	27.2	3.3358	11339.5996	235.1714	305.0752	50.2854
10	8	8	2	1500	20	2	24.2	2.9561	11435.2002	234.1699	263.1744	33.6412	27	3.5698	11306.7002	206.6791	284.0640	45.5227
10	8	8	2	1500	20	3	24.8	3.1965	11665.2998	281.3018	284.9792	48.2193	29	5.0031	11551.4004	229.6410	340.6592	73.7362
10	8	8	2	1500	20	4	25.4	3.1498	11465.0996	270.1925	289.2160	50.0619	29.8	4.0590	11291.7998	244.5026	336.0576	71.3253
10	8	8	2	500	50	1	7	0.9541	7241.5000	326.2461	95.4432	12.9501	7.4	1.1289	7230.1001	323.5937	103.0976	19.3523
10	8	8	2	500	50	2	6.6	0.9051	7111.6001	339.7264	84.5440	12.8791	7.6	0.9659	7086.6001	316.6963	94.0544	16.0788
10	8	8	2	500	50	3	7.4	0.9051	7477.5000	312.9223	101.0560	13.7713	8.4	0.9659	7443.2998	335.8839	112.3456	18.2849
10	8	8	2	500	50	4	7	0.9541	7178.2002	297.1699	88.9152	12.9501	8.2	0.7390	7141.7998	293.2516	102.6880	14.3816
10	8	8	2	1000	50	1	12.4	0.9659	8288.2998	203.9682	142.1760	16.8362	14.8	1.4231	8238.9004	223.2090	163.9680	22.7423
10	8	8	2	1000	50	2	12	1.5458	8178.7998	280.3834	135.5200	15.7384	14.8	1.8414	8115.7998	240.8535	163.0656	23.0874
10	8	8	2	1000	50	3	12.2	0.7390	8482.5996	196.0917	149.3632	14.5844	16	1.2162	8326.7002	226.2372	189.5872	19.0905
10	8	8	2	1000	50	4	11	1.5085	8215.5996	238.3081	137.9904	24.2950	14	2.0518	8139.0000	243.1288	164.9600	24.9421
10	8	8	2	1500	50	1	18	2.1598	8611.0996	307.1707	192.8576	28.0610	19.8	2.8780	8551.0000	269.5847	212.9920	35.0707
10	8	8	2	1500	50	2	16.8	1.0560	8625.0996	291.5292	174.2592	15.8540	20.8	2.7362	8529.7002	213.8206	216.0896	32.5067
10	8	8	2	1500	50	3	18	1.6866	8932.7998	230.7330	199.6224	26.7134	21.8	1.9318	8844.5000	203.1085	253.5680	37.4387
10	8	8	2	1500	50	4	15.8	1.5384	8695.7998	210.9849	163.6800	29.0722	19.6	3.2389	8502.2002	205.0433	199.9808	41.2562
10	8	8	2	500	80	1	3.6	0.6913	4120.3999	194.1420	51.5328	13.0897	4.2	0.7390	4113.5000	196.1169	54.1376	12.5649
10	8	8	2	500	80	2	3.6	0.6913	4096.7002	147.5414	47.5200	13.5897	4.6	0.9051	4053.3000	158.7764	50.4640	13.2271
10	8	8	2	500	80	3	3.2	0.4526	4465.3999	190.8622	56.8256	12.8369	4.4	0.6913	4404.2002	188.7264	58.8544	11.9598
10	8	8	2	500	80	4	3.8	0.7390	4169.3999	200.6104	55.3280	11.8481	4.2	0.7390	4142.2002	196.0239	56.8576	11.7062
10	8	8	2	1000	80	1	6.2	0.7390	5518.6001	192.1840	72.6912	14.4876	8	1.5458	5452.0000	166.9584	94.9056	26.0519
10	8	8	2	1000	80	2	6.6	0.6034	5415.5000	182.2340	70.1568	12.2414	7.4	0.6034	5324.7998	123.5555	78.6112	17.2133

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	8	8	2	1000	80	3	6.8	0.4526	5666.1001	148.0174	78.9568	11.9511	8.4	1.1782	5590.6001	128.3338	103.9680	19.2164
10	8	8	2	1000	80	4	6.4	0.6913	5426.6001	178.7788	71.7120	12.8155	7.4	0.6034	5349.2998	138.6319	85.0560	17.3056
10	8	8	2	1500	80	1	8.6	1.3151	5845.7002	292.8486	91.7888	11.0625	11	1.5085	5710.1001	228.2269	117.7792	23.2920
10	8	8	2	1500	80	2	9.4	1.4780	5716.0000	235.4091	91.0784	17.5421	11	1.5085	5662.6001	229.1152	106.6816	20.6296
10	8	8	2	1500	80	3	9.6	1.1782	6115.1001	202.8345	101.2672	13.1766	11.8	1.2068	6016.7002	209.6571	128.8064	20.4664
10	8	8	2	1500	80	4	9	1.3492	5835.1001	260.7537	90.8487	15.5535	11.8	1.0006	5690.2002	210.7356	116.5376	17.2247
40	8	8	5	500	0	1	7.8	0.7390	25229.1992	1252.7560	297.8357	45.5293	8.8	0.4526	25020.8008	1135.6046	339.6013	45.3617
40	8	8	5	500	0	2	7.2	0.4526	23476.3008	1054.9910	238.4912	42.9302	8.6	0.6034	23211.8008	1007.4545	299.1380	55.3134
40	8	8	5	500	0	3	8.2	0.7390	26237.6992	952.4725	339.0892	46.5447	9.4	0.6034	25912.3008	965.6241	381.9476	43.7133
40	8	8	5	500	0	4	7	0.0000	24630.9004	1007.5797	239.6192	38.2721	8.4	0.6913	24496.5906	950.5577	306.8128	54.4099
40	8	8	5	1000	0	1	9.2	0.8124	28209.0996	521.2170	334.4032	51.2412	12.2	0.7390	27431.9004	758.8647	431.7112	36.9225
40	8	8	5	1000	0	2	8.8	0.8124	27130.6992	645.6486	304.5656	44.0799	12	0.7543	26302.6992	925.3536	386.6976	47.2602
40	8	8	5	1000	0	3	10.2	1.0006	29460.9004	674.2443	399.9568	50.9542	12.6	0.6034	28773.0996	737.8069	465.0688	27.4813
40	8	8	5	1000	0	4	9.6	0.6913	27921.5996	699.1748	353.7504	38.0945	12	0.7543	27620.4004	754.9116	423.4448	25.3216
40	8	8	5	1500	0	1	11.6	1.1782	29298.5996	842.7746	346.8176	42.5225	15.2	0.8124	28351.1992	836.6642	456.7456	28.8841
40	8	8	5	1500	0	2	11.6	1.3577	28357.4004	1003.1945	343.7984	37.7885	14.8	0.8124	27574.3008	695.8568	438.4416	33.1367
40	8	8	5	1500	0	3	12	1.3908	30832.6992	784.0573	402.3872	70.6968	16	1.0119	29704.1992	631.6826	509.1136	45.4827
40	8	8	5	1500	0	4	12	0.7543	29044.1992	610.5510	374.0224	40.6564	14.8	0.8124	28685.4004	615.2513	449.2672	31.5021
40	8	8	5	500	20	1	6.4	0.6913	20346.8008	1258.6256	192.8896	31.0081	8	0.7543	20073.4004	1244.1320	241.2096	48.4125
40	8	8	5	500	20	2	5.8	0.7390	19160.1992	1063.8958	156.1536	16.6580	6.8	0.4526	18803.8008	1091.0439	182.4480	32.2448
40	8	8	5	500	20	3	7	0.6746	21620.9004	1151.1851	223.4688	37.5560	8.4	0.6913	21371.3008	1173.8027	273.8240	26.7766
40	8	8	5	500	20	4	6	0.7543	20096.0996	1039.9731	183.6224	29.8376	7.2	0.4526	19990.9004	1038.7354	204.8224	30.6807
40	8	8	5	1000	20	1	8.6	1.1289	22773.9004	1119.6523	240.5472	58.5877	10.6	0.9051	22376.4004	1197.7722	298.9440	36.7580
40	8	8	5	1000	20	2	7.6	0.9659	22190.9004	1041.0894	201.7536	23.5218	10.6	0.6034	21683.3008	957.8926	288.7680	32.2363
40	8	8	5	1000	20	3	9	0.9541	24420.4004	1140.1846	290.8992	50.0821	11.2	0.8124	23830.0996	1007.3392	336.8320	37.6311
40	8	8	5	1000	20	4	8.2	1.0006	22478.1992	1040.9451	223.0752	48.4625	10.2	0.7390	22277.6992	1056.6237	280.7200	39.0382
40	8	8	5	1500	20	1	11	1.1685	24276.9004	747.3290	331.7952	54.9545	13.6	0.6913	23706.5000	757.9635	385.7344	42.9842
40	8	8	5	1500	20	2	10	1.0119	23234.5996	1227.0850	271.7440	33.4806	12.4	0.6913	22723.9004	875.4724	349.6960	39.8258
40	8	8	5	1500	20	3	11.2	1.0560	25686.5000	775.8592	362.2336	45.6231	14	1.0119	25195.5000	705.9385	416.2304	45.9427
40	8	8	5	1500	20	4	9.8	1.0006	24176.4004	982.8033	290.0480	46.1267	13.2	0.8124	23819.0996	776.5543	377.8368	42.9015
40	8	8	5	500	50	1	4.6	0.6034	12675.2002	719.7911	84.1216	12.7627	5.4	0.6034	12551.4004	703.8565	87.1040	13.2457
40	8	8	5	500	50	2	4.2	0.7390	11378.5000	839.7443	71.8208	10.6402	5.2	0.4526	11315.2998	852.5167	76.1600	12.2175
40	8	8	5	500	50	3	5	0.6746	13996.5000	711.9977	99.9168	11.7822	5.8	0.7390	13852.7002	652.0752	102.9376	13.3517
40	8	8	5	500	50	4	4.4	0.6913	12563.7998	620.4268	86.2976	11.6315	5	0.0000	12512.7998	631.3163	88.3584	10.3155
40	8	8	5	1000	50	1	6.2	0.7390	16007.2002	623.5781	124.5120	28.0042	7.2	0.8124	15887.2998	694.7527	137.3952	32.3208
40	8	8	5	1000	50	2	5.8	0.7390	14708.5996	844.7947	120.5376	25.3824	7.2	0.8124	14424.0000	761.5750	135.8848	34.1834
40	8	8	5	1000	50	3	6.6	0.6034	17711.4004	624.9744	152.8576	22.9631	8.4	0.6913	17235.9004	598.4227	189.4656	33.5110
40	8	8	5	1000	50	4	6.2	0.7390	15868.7998	514.1260	129.6320	24.9956	7.6	0.6913	15669.2002	403.0538	148.9856	29.3043
40	8	8	5	1500	50	1	7.6	0.9659	17882.8008	945.0057	161.8496	26.1002	9.6	0.6913	17492.0000	908.6528	214.7072	21.9983
40	8	8	5	1500	50	2	6.2	0.7390	16479.5000	996.4451	128.1728	24.6014	8.2	1.3826	16071.9004	881.2400	164.8640	36.9214
40	8	8	5	1500	50	3	7.8	0.7390	16992.9004	768.9159	192.5440	27.1525	10.4	0.9659	169132.1992	695.5367	252.6976	15.7161
40	8	8	5	1500	50	4	7.6	0.6913	17703.6992	763.3042	160.8192	16.3805	8.6	0.9051	17581.6992	829.7666	187.3216	21.8639
40	8	8	5	500	80	1	2.4	0.5003	6876.8999	760.1240	62.6077	13.4886	2.9	0.4062	6779.7998	758.8542	63.8470	13.0868
40	8	8	5	500	80	2	2	0.4770	5749.6001	798.2537	55.4812	15.9931	2.6	0.3695	5735.2998	784.7341	57.3109	15.0631
40	8	8	5	500	80	3	2.7	0.3456	7908.7002	664.9586	78.0546	12.1252	3	0.3373	7851.3999	701.5540	77.2920	12.3135
40	8	8	5	500	80	4	2.2	0.4526	6373.0000	729.4047	57.9204	14.6944	2.5	0.5060	6364.8999	733.8329	58.4001	14.6901

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	Solve time [sec]	$\pm CI$
40	8	8	5	1000	80	1	3.3	0.3456	8879.9004	747.6505	32.1929	3.7	0.4830	8828.0996	92.9735	30.9256
40	8	8	5	1000	80	2	2.9	0.4062	7816.2002	647.9973	11.6357	3.4	0.5003	7652.7998	84.3297	29.2907
40	8	8	5	1000	80	3	3.6	0.5003	10330.7002	680.1112	116.6363	4.2	0.3017	10170.0000	116.4426	29.3204
40	8	8	5	1000	80	4	3.1	0.2263	8897.9004	758.4520	15.3613	3.6	0.5003	8863.9004	93.9108	18.0199
40	8	8	5	1500	80	1	4	0.3373	11854.0996	748.8965	95.6138	5.4	0.6913	11569.0996	106.2546	22.1793
40	8	8	5	1500	80	2	3.8	0.4526	10393.4004	738.1559	94.0670	5.1	0.4062	10186.2998	98.1226	24.4483
40	8	8	5	1500	80	3	4.4	0.5003	13553.9004	654.6456	166.6658	5.9	0.6265	13123.5996	139.7144	18.0631
40	8	8	5	1500	80	4	3.9	0.5280	11701.4004	743.4407	108.5056	5.2	0.5644	11497.2998	117.0968	19.1267

Appendix B

Results of Heuristics Comparison with Color Conversion Capability

In this appendix, we present the detailed results with 95% confidence intervals of the heuristics comparison with the consideration of the color conversion capability and without the consideration of the optical signal regeneration capability. Tables B.1-B.2, B.3-B.4, and B.5-B.6 show the results for the 8-node network, 14-node NSF network, and 11-node EON network respectively.

Table B.1: Comparison of no-bifurcation-based heuristics with the color conversion capability for the 8-node network.

E/O				Weighted				# of				Solve				Weighted				# of				Solve			
C	W	B	cost	IN	FR	Policy	F _{min}	±CI	port count @ F _{min}	OEOs	±CI	time [sec]	±CI	F _{opt}	±CI	port count @ F _{opt}	±CI	time [sec]	±CI	OEOs	±CI	time [sec]	±CI				
[Gb/s]			ratio	[Gb/s]	[%]				@ F _{min}			[sec]				@ F _{opt}		[sec]				[sec]					
10	4	4	2	500	0	1	8.6	0.6913	3044.3000	102.8204	1.8000	2.4042	0.4077	0.0807	10.4	0.9051	2983.5000	98.1138	0.0000	0.0000	0.0000	0.6421	0.0976				
10	4	4	2	500	0	2	8.6	0.6913	3105.1001	112.2800	1.0000	1.5821	0.4546	0.0815	10.8	1.0006	3070.0000	109.1791	0.0000	0.0000	0.0000	0.7439	0.0898				
10	4	4	2	500	0	3	8.6	0.6913	3148.3999	119.9043	3.8000	5.5405	0.4157	0.0848	11	1.2162	3082.1001	96.4779	0.0000	0.0000	0.0000	0.7485	0.1295				
10	4	4	2	500	0	4	8.2	0.4526	3004.7000	87.7206	1.9000	1.7348	0.4220	0.0660	9.4	1.3577	2981.1001	93.0213	0.9000	1.1414	0.5641	0.1426					
10	4	4	2	1000	0	1	15.8	1.0560	3075.1001	176.1518	7.1000	6.5533	0.5828	0.1347	20.2	2.0739	3860.6001	161.3596	0.2000	0.3017	1.3373	0.3525					
10	4	4	2	1000	0	2	15.8	1.0560	4062.3999	169.7235	9.5000	7.3225	0.6437	0.1186	19.8	1.9611	3942.3000	162.1516	0.2000	0.3017	1.3860	0.2656					
10	4	4	2	1000	0	3	16.2	1.2531	4025.8999	174.4530	1.5000	1.9741	0.6032	0.0950	21.4	2.4371	3935.8999	172.8430	0.0000	0.0000	1.6907	0.5141					
10	4	4	2	1000	0	4	15.4	0.9659	3980.3000	122.7685	11.7000	7.0598	0.6341	0.1033	20	1.9081	3848.3000	164.1707	0.6000	1.1289	1.3594	0.2853					
10	4	4	2	1500	0	1	23.4	1.3577	4816.7998	148.9081	12.6000	16.1846	0.9659	0.1938	30.2	4.0167	4633.3999	175.4002	0.0000	0.0000	3.0654	0.8756					
10	4	4	2	1500	0	2	24.4	1.3151	4818.7998	191.8968	9.0000	8.3651	1.6608	0.4687	30.4	2.5953	4716.0000	163.8787	0.3000	0.6788	4.1719	1.4353					
10	4	4	2	1500	0	3	24.4	1.4780	4899.7002	225.4654	9.3000	15.1154	1.6470	0.7472	32.4	2.5061	4728.8999	167.7065	0.0000	0.0000	4.9203	1.7537					
10	4	4	2	1500	0	4	22.8	1.3826	4793.0000	158.0103	16.9000	13.8768	1.1595	0.3304	27.4	2.2426	4613.2998	153.5843	1.0000	1.2162	3.7094	1.7056					
10	4	4	2	500	20	1	7.4	0.6913	2480.3999	57.6835	1.9000	2.3235	0.3172	0.0688	8.4	0.6034	2451.7000	77.4371	0.2000	0.3017	0.4251	0.0808					
10	4	4	2	500	20	2	7	0.7543	2571.5000	96.5968	4.6000	5.1067	0.3562	0.1014	9.6	1.4780	2509.6001	78.1423	0.0000	0.0000	0.5734	0.1051					
10	4	4	2	500	20	3	7.4	0.6913	2558.1001	89.7180	1.2000	1.8414	0.3484	0.0558	9.4	1.3577	2520.5000	79.8633	0.0000	0.0000	0.5624	0.1118					
10	4	4	2	500	20	4	7	0.7543	2510.0000	79.2115	4.6000	5.1950	0.3107	0.0767	9.8	1.0560	2419.2000	73.4293	0.0000	0.0000	0.5736	0.0742					
10	4	4	2	1000	20	1	13	0.7543	3197.8999	126.6764	2.5000	3.4441	0.4767	0.1090	18.6	2.3418	3093.0000	131.0130	0.3000	0.4830	1.1235	0.3389					
10	4	4	2	1000	20	2	13.6	0.6034	3217.0000	148.3152	4.4000	3.8043	0.6406	0.0763	17.6	1.7592	3151.8999	130.7354	0.1000	0.2263	0.9955	0.1394					
10	4	4	2	1000	20	3	13.4	0.6913	3267.8999	138.9362	1.0000	1.5085	0.5453	0.0790	18.8	1.8102	3177.5000	131.4357	0.0000	0.0000	1.1062	0.1438					
10	4	4	2	1000	20	4	13	0.7543	3200.8000	138.6104	9.2000	8.7688	0.5407	0.1085	17.6	1.7592	3094.7000	124.1362	0.3000	0.4830	1.0217	0.1309					
10	4	4	2	1500	20	1	18.4	0.9051	3909.7000	161.0243	12.0000	10.1362	0.6500	0.1317	24.2	2.9752	3740.5000	138.8263	0.7000	1.5839	1.7344	0.6256					
10	4	4	2	1500	20	2	20	0.6746	3916.8999	124.1011	5.1000	4.5562	0.9468	0.0920	24.6	2.0295	3846.8999	118.3207	0.6000	0.9659	2.6609	1.4640					
10	4	4	2	1500	20	3	19.2	0.7390	3932.0000	149.9653	2.3000	1.9392	0.7845	0.1073	25.6	3.4267	3859.0000	130.3853	0.0000	0.0000	2.8297	1.6449					
10	4	4	2	1500	20	4	18.8	1.2068	3899.1001	210.2877	16.4000	27.2497	0.7841	0.1616	26.2	2.8181	3723.6001	127.7798	0.7000	1.0693	2.4484	0.7488					
10	4	4	2	500	50	1	5.8	0.4526	1833.8000	72.0702	0.0000	0.0000	0.2498	0.0366	7.6	0.9051	1796.8000	85.2657	0.0000	0.0000	0.3737	0.0612					
10	4	4	2	500	50	2	5.6	0.6034	1897.9000	68.5137	2.5000	3.7599	0.2404	0.0555	8	0.9541	1859.7000	75.3037	0.0000	0.0000	0.4127	0.0662					
10	4	4	2	500	50	3	5.8	0.4526	1920.1000	69.6403	0.2000	0.3017	0.2657	0.0427	8.2	1.0560	1886.6000	79.8355	0.0000	0.0000	0.4452	0.0665					
10	4	4	2	500	50	4	5.4	0.6913	1813.0000	78.5654	2.1000	2.4429	0.2139	0.0468	7.6	0.9051	1751.9000	77.5835	0.3000	0.6788	0.3734	0.0536					
10	4	4	2	1000	50	1	9.6	0.9051	2376.0000	156.7843	6.4000	7.5666	0.3109	0.0573	12.8	1.9318	2261.3000	126.4299	0.3000	0.3456	0.6408	0.1216					
10	4	4	2	1000	50	2	10.4	0.9051	2391.8999	161.8799	4.9000	6.4747	0.4392	0.0590	13.8	1.5749	2323.7000	128.5955	0.0000	0.0000	0.7299	0.0906					
10	4	4	2	1000	50	3	10.6	0.9659	2395.8000	131.4195	4.7000	8.2628	0.4471	0.0936	14.4	2.1119	2318.7000	128.2344	0.0000	0.0000	0.7846	0.1228					
10	4	4	2	1000	50	4	10.4	0.9051	2316.2000	143.2411	3.3000	3.7417	0.4248	0.0858	13.2	1.9318	2237.8999	125.0924	0.0000	0.0000	0.6674	0.1205					
10	4	4	2	1500	50	1	15.2	1.5384	2876.3999	149.7585	1.4000	1.1289	0.5344	0.0964	19.8	2.9752	2775.5000	142.4787	0.3000	0.3456	1.2235	0.5137					
10	4	4	2	1500	50	2	16.4	1.8841	2907.2000	135.8168	2.4000	3.2036	0.7562	0.1662	19.6	1.8841	2844.2000	148.5064	0.2000	0.4526	1.1968	0.1806					
10	4	4	2	1500	50	3	15.8	1.5749	2970.8000	164.9347	6.7000	8.6857	0.6562	0.1223	19.8	1.5749	2886.3999	164.9045	0.0000	0.0000	1.1907	0.2056					
10	4	4	2	1500	50	4	16	1.9081	2836.6001	147.2292	1.6000	1.1782	0.6828	0.1606	19.6	1.8841	2762.7000	142.2340	0.0000	0.0000	1.1438	0.1832					
10	4	4	2	500	80	1	3.4	0.6913	1010.3000	80.0432	0.0000	0.0000	0.1281	0.0339	5	1.0119	979.9000	91.6697	0.0000	0.0000	0.2018	0.0418					
10	4	4	2	500	80	2	3.4	0.6913	1095.8000	96.4416	0.0000	0.0000	0.1312	0.0346	4.4	0.6034	1067.8000	97.4112	0.0000	0.0000	0.1830	0.0343					
10	4	4	2	500	80	3	3.4	0.6913	1120.5000	98.4692	0.0000	0.0000	0.1342	0.0350	5	1.2162	1086.5000	91.6155	0.0000	0.0000	0.2220	0.0597					
10	4	4	2	500	80	4	3.4	0.6913	998.8000	89.3754	0.0000	0.0000	0.1280	0.0357	5	0.7543	975.8000	92.9034	0.0000	0.0000	0.2031	0.0292					
10	4	4	2	1000	80	1	5.8	0.4526	1301.1000	116.3092	0.0000	0.0000	0.1968	0.0322	7.8	1.7133	1258.1000	92.6991	0.0000	0.0000	0.3092	0.0695					
10	4	4	2	1000	80	2	6	0.6746	1353.8000	109.6765	1.1000	2.0365	0.2186	0.0468	8.4	1.4780	1319.2000	106.7632	0.0000	0.0000	0.3717	0.0671					
10	4	4	2	1000	80	3	5.8	0.4526	1393.8000	116.6693	0.0000	0.0000	0.1968	0.0428	9.2	1.6798	1324.8000	96.5901	0.0000	0.0000	0.4124	0.0754					

E/O				Weighted				# of				Solve				Weighted				# of				Solve			
C	W	B	cost ratio	IN	FR	Policy	F_{min}	$\pm CI$	port count @ F_{min}	$\pm CI$	OEOs @ F_{min}	$\pm CI$	time [sec]	$\pm CI$	F_{opt}	$\pm CI$	port count @ F_{opt}	$\pm CI$	OEOs @ F_{opt}	$\pm CI$	time [sec]	$\pm CI$	F_{opt}	$\pm CI$	time [sec]		
10	4	4	2	1000	80	4	6	0.6746	1266.9000	104.2438	0.1000	0.2263	0.2063	0.0463	8.8	1.2068	1224.8000	106.4654	0.0000	0.0000	0.3641	0.0500					
10	4	4	2	1500	80	1	8.8	1.0006	1656.6000	137.3618	0.0000	0.0000	0.3579	0.0790	13	2.5466	1593.4000	116.9024	0.0000	0.0000	0.6201	0.1344					
10	4	4	2	1500	80	2	8.8	1.0006	1722.5000	138.7050	0.1000	0.2263	0.3595	0.0775	12.4	2.0013	1660.9000	126.8245	0.0000	0.0000	0.6267	0.0946					
10	4	4	2	1500	80	3	8.8	1.0006	1749.1000	142.7169	0.0000	0.0000	0.3626	0.0754	13	2.2628	1689.3000	130.1399	0.0000	0.0000	0.6703	0.1236					
10	4	4	2	1500	80	4	9.2	1.2068	1624.2000	128.2711	0.0000	0.0000	0.3998	0.0864	12.6	2.7856	1573.7000	122.7542	0.0000	0.0000	0.6187	0.1375					
10	8	8	2	500	0	1	2.4	0.6034	4071.8999	198.8739	0.7000	1.1213	0.6612	0.2711	4	0.0000	4023.3000	186.4156	0.0000	0.0000	1.2876	0.0491					
10	8	8	2	500	0	2	2.8	0.7390	4111.0000	204.8838	1.0000	1.4311	0.8953	0.2659	3.4	0.6913	4083.3000	189.2427	0.1000	0.2263	1.1531	0.2138					
10	8	8	2	500	0	3	3	0.7543	4130.2998	187.9014	0.3000	0.4830	0.9546	0.3189	3.6	0.6034	4115.7998	193.5872	0.1000	0.2263	1.2172	0.2098					
10	8	8	2	500	0	4	2.2	0.4526	4081.6001	208.4655	5.2000	9.0309	0.6188	0.1980	3.4	0.6913	4024.8000	196.7363	0.3000	0.4830	1.0998	0.2294					
10	8	8	2	1000	0	1	4.4	0.6034	4387.7998	199.9669	1.9000	4.0541	1.1313	0.4487	5.2	0.7390	4353.7998	186.2324	0.0000	0.0000	1.6939	0.4793					
10	8	8	2	1000	0	2	4.6	0.6913	4451.2998	203.6869	0.0000	0.0000	1.3189	0.4107	5.8	0.4526	4429.0000	195.4471	0.0000	0.0000	2.1141	0.2134					
10	8	8	2	1000	0	3	4.8	0.7390	4457.6001	205.4176	1.8000	2.9561	1.4221	0.4229	6.2	1.0560	4423.7998	193.0348	0.0000	0.0000	3.8452	2.4073					
10	8	8	2	1000	0	4	4.4	0.6034	4384.5000	216.9741	0.5000	0.7729	1.1031	0.4249	5.6	0.6034	4345.7002	204.3825	0.0000	0.0000	1.9547	0.3733					
10	8	8	2	1500	0	1	6.6	0.6913	4828.3999	225.5857	7.4000	14.2799	2.5266	1.6884	8.6	0.9659	4726.7002	152.5798	0.0000	0.0000	6.4312	2.6456					
10	8	8	2	1500	0	2	6.4	0.6034	4912.5000	187.7243	5.3000	6.4800	2.6891	1.6749	8	0.6746	4828.5000	154.6254	0.0000	0.0000	7.3046	2.3767					
10	8	8	2	1500	0	3	6.6	0.6913	4847.5000	174.6748	2.2000	4.4978	3.3452	2.4560	8	1.1685	4793.7998	150.4379	0.0000	0.0000	5.7592	3.0542					
10	8	8	2	1500	0	4	6.2	0.4526	4822.5000	163.2238	7.0000	10.0063	2.1734	1.5369	8	0.9541	4717.8999	139.1694	0.0000	0.0000	6.9767	2.2867					
10	8	8	2	500	20	1	2	0.0000	3224.6001	147.5130	0.0000	0.0000	0.4983	0.0603	2.8	0.7390	3216.7000	141.0548	0.0000	0.0000	0.7438	0.2405					
10	8	8	2	500	20	2	2	0.0000	3268.3000	136.9914	0.5000	0.3771	0.5811	0.0000	3	0.7543	3260.3999	136.6422	0.3000	0.3456	0.8643	0.2241					
10	8	8	2	500	20	3	2	0.0000	3315.3000	152.3149	0.0000	0.0000	0.5497	0.0417	3.6	0.6034	3278.3000	140.6570	0.0000	0.0000	1.0422	0.1756					
10	8	8	2	500	20	4	2	0.0000	3212.5000	143.4722	0.0000	0.0000	0.6171	0.0367	2.8	0.7390	3197.3999	129.9185	0.0000	0.0000	0.8279	0.1671					
10	8	8	2	1000	20	1	4	0.0000	3541.5000	167.6586	0.7000	1.1213	0.9049	0.0666	5.2	0.7390	3520.1001	159.2613	0.1000	0.2263	1.5062	0.3589					
10	8	8	2	1000	20	2	4	0.0000	3569.8000	145.1451	0.0000	0.0000	1.0749	0.0909	4.4	0.6034	3566.1001	142.9643	0.0000	0.0000	1.2452	0.2864					
10	8	8	2	1000	20	3	4	0.0000	3612.3000	165.2945	0.0000	0.0000	0.9453	0.0915	5.6	0.6034	3580.6001	156.1281	0.0000	0.0000	1.7751	0.2987					
10	8	8	2	1000	20	4	4	0.0000	3499.6001	164.2342	0.1000	0.2263	1.0108	0.0780	4.8	0.7390	3487.8999	163.7403	0.1000	0.2263	1.3811	0.3274					
10	8	8	2	1500	20	1	5.8	0.4526	3854.3999	146.9960	2.6000	5.3991	1.6000	0.3126	7.4	0.9659	3799.5000	146.7036	0.1000	0.2263	3.7484	2.1383					
10	8	8	2	1500	20	2	5.8	0.4526	3915.7000	147.9915	3.1000	7.0145	1.7720	0.3472	7	0.7543	3870.8999	128.7941	0.0000	0.0000	3.5313	1.7089					
10	8	8	2	1500	20	3	6	0.0000	3917.2000	125.6919	0.1000	0.2263	1.7344	0.1857	7.6	0.6034	3876.2000	118.7394	0.1000	0.2263	5.2640	2.2525					
10	8	8	2	1500	20	4	5.8	0.4526	3823.6001	141.0266	3.1000	7.0145	1.5782	0.2753	7.2	1.0006	3776.8000	134.3025	0.0000	0.0000	4.5297	2.6365					
10	8	8	2	500	50	1	1.9	0.2263	2279.7000	144.8019	0.0000	0.0000	0.4764	0.0734	2.1	0.5280	2276.7000	146.5499	0.0000	0.0000	0.5170	0.1098					
10	8	8	2	500	50	2	1.9	0.2263	2336.8999	151.0918	0.3000	0.4830	0.5076	0.0838	2.7	0.6788	2329.7000	147.5083	0.0000	0.0000	0.6781	0.1351					
10	8	8	2	500	50	3	1.9	0.2263	2354.3000	149.5399	0.0000	0.0000	0.5080	0.0793	2.3	0.4830	2349.1001	153.0475	0.0000	0.0000	0.6017	0.0901					
10	8	8	2	500	50	4	1.9	0.2263	2239.7000	171.8894	0.0000	0.0000	0.4796	0.0736	2.5	0.6081	2236.2000	169.4429	0.0000	0.0000	0.6141	0.1252					
10	8	8	2	1000	50	1	3.4	0.6913	2846.1001	184.0590	2.0000	4.5255	0.7015	0.2344	4.2	0.4526	2506.6001	173.6704	0.0000	0.0000	0.9998	0.1824					
10	8	8	2	1000	50	2	3.6	0.6034	2562.8999	176.1851	0.2000	0.4526	0.8311	0.1994	4.2	0.4526	2548.3000	165.0761	0.0000	0.0000	1.0420	0.1984					
10	8	8	2	1000	50	3	3.4	0.6913	2595.8000	184.2472	1.7000	3.3740	0.7579	0.2293	4	0.6746	2574.0000	181.3084	0.2000	0.4526	0.9907	0.2606					
10	8	8	2	1000	50	4	3.4	0.6913	2521.7000	179.3963	2.0000	4.5255	0.7265	0.2217	4.2	0.4526	2489.5000	173.9974	0.0000	0.0000	1.0046	0.1853					
10	8	8	2	1500	50	1	4.4	0.6034	2786.1001	165.4690	0.8000	1.1587	0.9423	0.2962	5.6	0.6034	2746.1001	169.2591	0.0000	0.0000	1.5923	0.2527					
10	8	8	2	1500	50	2	4.4	0.6034	2839.1001	166.4973	0.0000	0.0000	1.0407	0.3004	5.4	0.9659	2805.5000	160.8303	0.0000	0.0000	1.6828	0.6035					
10	8	8	2	1500	50	3	4.4	0.6034	2858.3000	183.3109	0.0000	0.0000	1.0142	0.3320	5.4	0.9659	2802.3999	169.5683	0.0000	0.0000	1.7079	0.5996					
10	8	8	2	1500	50	4	4.4	0.6034	2763.0000	184.9995	0.6000	1.1289	0.9982	0.2772	5.6	0.9051	2730.8000	174.6832	0.0000	0.0000	1.7185	0.5114					
10	8	8	2	500	80	1	1	0.0000	1151.0000	111.3910	0.0000	0.0000	0.1985	0.0129	2	0.7543	1139.0000	108.7782	0.0000	0.0000	0.3423	0.1040					
10	8	8	2	500	80	2	1	0.0000	1220.8000	118.7284	0.0000	0.0000	0.2109	0.0231	1.8	0.7390	1205.8000	114.3192	0.0000	0.0000	0.3483	0.1112					
10	8	8	2	500	80	3	1	0.0000	1255.8000	128.4754	0.3000	0.6788	0.2126	0.0225	2	0.7543	1230.4000	114.7213	0.0000	0.0000	0.3939	0.1284					
10	8	8	2	500	80	4	1	0.0000	1136.2000	111.0928	0.1000	0.2263	0.2032	0.0222	1.8	0.7390	1127.2000	110.6942	0.0000	0.0000	0.3297	0.1135					

E/O				IN	FR	Policy	Weighted			# of			Solve			Weighted			# of			Solve		
C	W	B	cost				ratio	[Gb/s]	%	F _{min}	±CI	port count @F _{min}	±CI	OEOs @F _{min}	±CI	time [sec]	±CI	F _{opr}	±CI	port count @F _{opr}	±CI	OEOs @F _{opr}	±CI	time [sec]
10	8	8	2	1000	80	1	1.8	0.3017	1355.0000	114.3626	0.0000	0.0000	0.0000	0.3188	0.0701	3	0.6746	1333.5000	112.2155	0.0000	0.0000	0.0000	0.5390	0.1120
10	8	8	2	1000	80	2	1.8	0.3017	1402.1000	109.3715	0.0000	0.0000	0.0000	0.3252	0.0661	3	0.6746	1391.1000	107.8082	0.0000	0.0000	0.0000	0.5735	0.1298
10	8	8	2	1000	80	3	1.8	0.3017	1409.2000	110.2781	0.0000	0.0000	0.0000	0.3358	0.0689	2.6	0.7692	1396.8000	111.6501	0.0000	0.0000	0.0000	0.4984	0.1495
10	8	8	2	1000	80	4	1.8	0.3017	1335.3000	112.4236	0.0000	0.0000	0.0000	0.3140	0.0651	3.4	0.6034	1307.2000	118.6541	0.0000	0.0000	0.0000	0.6094	0.1014
10	8	8	2	1500	80	1	2.4	0.6034	1621.1000	123.3005	0.0000	0.0000	0.0000	0.3783	0.1562	3.8	0.8124	1550.7000	114.1720	0.0000	0.0000	0.0000	0.7937	0.2173
10	8	8	2	1500	80	2	2.6	0.6913	1661.4000	127.8439	0.4000	0.0000	0.6034	0.4624	0.2023	3.8	1.0560	1623.1000	119.5286	0.0000	0.0000	0.0000	0.8704	0.3121
10	8	8	2	1500	80	3	2.6	0.6913	1661.0000	110.2432	0.2000	0.4526	0.4875	0.1860	0.38	1.0560	1645.4000	113.9775	0.0000	0.0000	0.0000	0.8814	0.3121	
10	8	8	2	1500	80	4	2.6	0.6913	1579.6000	95.3938	0.0000	0.0000	0.0000	0.4594	0.1760	3.8	1.0560	1541.2000	112.4239	0.0000	0.0000	0.0000	0.8266	0.2973
40	8	8	5	500	0	1	1	0.0000	3846.2000	142.0594	0.0000	0.0000	0.0000	0.4655	0.0217	1.2	0.4526	3845.8999	141.9435	0.0000	0.0000	0.0000	0.5203	0.1265
40	8	8	5	500	0	2	1	0.0000	3921.7000	158.6886	0.0000	0.0000	0.0000	0.4827	0.0271	1	0.0000	3921.7000	158.6886	0.0000	0.0000	0.0000	0.4827	0.1271
40	8	8	5	500	0	3	1	0.0000	3958.2000	151.3244	0.0000	0.0000	0.0000	0.4952	0.0279	1.2	0.4526	3956.8000	153.0956	0.0000	0.0000	0.0000	0.5515	0.1063
40	8	8	5	500	0	4	1	0.0000	3798.0000	149.8090	0.0000	0.0000	0.0000	0.4829	0.0172	1	0.0000	3798.0000	149.8090	0.0000	0.0000	0.0000	0.4829	0.0172
40	8	8	5	1000	0	1	1.5	0.3771	4937.6001	164.1125	0.7000	1.5839	0.5110	0.1879	2.5	0.3771	4895.7998	167.0462	0.0000	0.0000	0.0000	0.8827	0.0966	
40	8	8	5	1000	0	2	1.5	0.3771	4948.0000	179.0385	0.3000	0.6788	0.5875	0.1493	2.1	0.5280	4937.5000	178.1681	0.0000	0.0000	0.0000	0.7859	0.1700	
40	8	8	5	1000	0	3	1.8	0.3017	5005.5000	166.0572	0.3000	0.6788	0.6827	0.1569	2.4	0.5003	4988.0000	168.4750	0.0000	0.0000	0.0000	0.9000	0.1322	
40	8	8	5	1000	0	4	1.5	0.3771	4894.7998	137.6124	1.0000	2.2628	0.5549	0.1742	2.3	0.4830	4849.8999	158.0418	0.0000	0.0000	0.0000	0.8313	0.1267	
40	8	8	5	1500	0	1	2	0.0000	5517.2002	182.5214	0.0000	0.0000	0.0000	0.7452	0.0268	2.2	0.4526	5517.0000	182.1890	0.0000	0.0000	0.0000	0.8062	0.1378
40	8	8	5	1500	0	2	2	0.0000	5633.7998	207.6191	0.0000	0.0000	0.0000	0.7516	0.0477	2.2	0.4526	5631.0000	203.2804	0.0000	0.0000	0.0000	0.8203	0.1546
40	8	8	5	1500	0	3	2	0.0000	5657.7002	187.2952	0.0000	0.0000	0.0000	0.7405	0.0525	2.6	0.6913	5651.3999	188.8395	0.0000	0.0000	0.0000	0.9455	0.2150
40	8	8	5	1500	0	4	2	0.0000	5496.1001	175.8088	0.0000	0.0000	0.0000	0.7236	0.0456	2.4	0.6034	5488.3999	179.8144	0.0000	0.0000	0.0000	0.8517	0.1656
40	8	8	5	500	20	1	1	0.0000	3135.8999	136.2516	0.0000	0.0000	0.0000	0.3921	0.0172	1	0.0000	3135.8999	136.2516	0.0000	0.0000	0.0000	0.3921	0.0172
40	8	8	5	500	20	2	1	0.0000	3233.2000	128.0061	0.0000	0.0000	0.0000	0.4079	0.0132	1	0.0000	3233.2000	128.0061	0.0000	0.0000	0.0000	0.4079	0.0132
40	8	8	5	500	20	3	1	0.0000	3259.3000	117.4746	0.0000	0.0000	0.0000	0.4173	0.0092	1	0.0000	3259.3000	117.4746	0.0000	0.0000	0.0000	0.4173	0.0092
40	8	8	5	500	20	4	1	0.0000	3082.8000	123.3352	0.0000	0.0000	0.0000	0.3906	0.0149	1	0.0000	3082.8000	123.3352	0.0000	0.0000	0.0000	0.3906	0.0149
40	8	8	5	1000	20	1	1	0.0000	3906.1001	142.6803	0.0000	0.0000	0.0000	0.2985	0.0389	2	0.7543	3875.3999	115.3129	0.0000	0.0000	0.0000	0.5750	0.2150
40	8	8	5	1000	20	2	1	0.0000	3996.8000	137.8895	0.0000	0.0000	0.0000	0.3436	0.0413	2	0.7543	3984.6001	142.0944	0.0000	0.0000	0.0000	0.6325	0.1922
40	8	8	5	1000	20	3	1	0.0000	4053.8999	132.4886	0.0000	0.0000	0.0000	0.2970	0.0368	2.8	0.4526	4004.8999	141.4718	0.0000	0.0000	0.0000	0.8639	0.1409
40	8	8	5	1000	20	4	1	0.0000	3868.1001	136.4260	0.0000	0.0000	0.0000	0.3189	0.0352	2.4	0.6913	3831.1001	136.9961	0.0000	0.0000	0.0000	0.7111	0.1862
40	8	8	5	1500	20	1	1.9	0.2263	4390.1001	177.0448	2.6000	5.8832	0.6047	0.1113	2.3	0.4830	4349.7002	165.8422	0.0000	0.0000	0.0000	0.7297	0.1133	
40	8	8	5	1500	20	2	2	0.0000	4475.2002	182.0689	0.0000	0.0000	0.0000	0.6984	0.0206	2	0.0000	4475.2002	182.0689	0.0000	0.0000	0.0000	0.6984	0.0206
40	8	8	5	1500	20	3	2	0.0000	4507.2002	168.8096	0.0000	0.0000	0.0000	0.7015	0.0313	2.2	0.4526	4507.0000	168.6768	0.0000	0.0000	0.0000	0.7655	0.1188
40	8	8	5	1500	20	4	2	0.0000	4292.3999	176.0400	0.0000	0.0000	0.0000	0.6594	0.0147	2	0.0000	4292.3999	176.0400	0.0000	0.0000	0.0000	0.6594	0.0147
40	8	8	5	500	50	1	1	0.0000	2190.0000	114.4417	0.0000	0.0000	0.0000	0.2969	0.0105	1	0.0000	2190.0000	114.4417	0.0000	0.0000	0.0000	0.2969	0.0105
40	8	8	5	500	50	2	1	0.0000	2353.3999	102.7003	0.0000	0.0000	0.0000	0.3266	0.0133	1	0.0000	2353.3999	102.7003	0.0000	0.0000	0.0000	0.3266	0.0133
40	8	8	5	500	50	3	1	0.0000	2388.3999	106.9141	0.0000	0.0000	0.0000	0.3328	0.0106	1	0.0000	2388.3999	106.9141	0.0000	0.0000	0.0000	0.3328	0.0106
40	8	8	5	500	50	4	1	0.0000	2124.8999	109.7982	0.0000	0.0000	0.0000	0.2859	0.0129	1	0.0000	2124.8999	109.7982	0.0000	0.0000	0.0000	0.2859	0.0129
40	8	8	5	1000	50	1	1	0.0000	2748.3000	158.4964	0.0000	0.0000	0.0000	0.2986	0.0228	2	0.7543	2735.3000	153.4112	0.0000	0.0000	0.0000	0.5078	0.1540
40	8	8	5	1000	50	2	1	0.0000	2880.5000	141.8805	0.0000	0.0000	0.0000	0.3500	0.0229	1.4	0.6034	2873.1001	139.9155	0.0000	0.0000	0.0000	0.4405	0.1208
40	8	8	5	1000	50	3	1	0.0000	2906.7000	137.5236	0.0000	0.0000	0.0000	0.3501	0.0377	1.4	0.6034	2903.1001	137.3731	0.0000	0.0000	0.0000	0.4329	0.1339
40	8	8	5	1000	50	4	1	0.0000	2716.6001	152.0491	0.0000	0.0000	0.0000	0.3252	0.0157	1.4	0.6034	2713.2000	148.9176					

Table B.2: Comparison of fiber-bifurcation-based heuristics with the color conversion capability for the 8-node network.

C	W	B	E/O cost	IN	FR	Policy	F_{min}	$\pm CI$	Weighted port count $@F_{min}$	$\pm CI$	# of OEOs $@F_{min}$	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count $@F_{opt}$	$\pm CI$	# of OEOs $@F_{opt}$	Solve time [sec]	$\pm CI$
10	4	4	2	500	0	1	8.6	0.6913	3036.3000	96.6744	1.4000	2.2170	0.4189	0.0927	10.4	0.9051	2983.5000	98.1138	0.0000	0.6594
10	4	4	2	500	0	2	8.4	0.6034	3120.0000	114.3979	3.8000	4.3564	0.4345	0.0945	10.8	1.0006	3070.0000	109.1791	0.0000	0.7547
10	4	4	2	500	0	3	8.6	0.6913	3130.5000	105.3122	1.1000	2.2489	0.4202	0.0851	11.2	1.2068	3090.0000	93.2611	0.0000	0.7954
10	4	4	2	500	0	4	8.2	0.4526	3028.3000	93.2556	3.8000	4.2103	0.4189	0.0759	10.2	1.4231	2988.6001	95.6826	1.0000	0.1378
10	4	4	2	1000	0	1	15.8	1.0560	3977.3999	170.9323	8.2000	7.8370	0.6267	0.1269	21	2.2628	3860.2000	165.4925	0.3000	0.3687
10	4	4	2	1000	0	2	15.8	1.0560	4097.7002	172.0872	14.8000	10.7982	0.6656	0.0861	20	1.5085	3941.8999	161.9906	0.2000	0.2491
10	4	4	2	1000	0	3	16	1.1685	4046.6001	149.2296	3.6000	4.7006	0.6047	0.1018	21	1.8165	3929.8999	175.8011	0.0000	0.4066
10	4	4	2	1000	0	4	15.8	0.8124	3963.1001	130.7110	9.6000	6.2671	0.6829	0.0920	21.2	2.2577	3841.1001	157.0524	0.2000	0.4377
10	4	4	2	1500	0	1	23.4	1.3577	4789.7002	164.8261	5.2000	5.4474	1.0127	0.1984	30.6	3.9940	4636.0000	168.0415	0.0000	0.9204
10	4	4	2	1500	0	2	23.2	1.6798	5006.7002	260.6541	29.4000	24.3431	1.1765	0.3043	30.6	2.4371	4720.1001	166.2227	0.2000	2.2309
10	4	4	2	1500	0	3	24.2	1.2531	4925.8999	253.2415	12.3000	18.1994	1.1218	0.1757	32.4	2.5061	4733.0000	172.6114	0.0000	1.3704
10	4	4	2	1500	0	4	22.4	1.4780	4981.8999	199.0087	39.7000	26.1652	1.1062	0.3807	30.2	2.8977	4623.7002	160.7442	0.5000	1.4044
10	4	4	2	500	20	1	7.4	0.6913	2480.3999	57.6835	1.9000	2.3235	0.3266	0.0705	8.4	0.6034	2451.7000	77.4371	0.2000	0.0780
10	4	4	2	500	20	2	7.2	0.7390	2559.0000	89.8928	4.1000	6.7416	0.3452	0.0836	9.6	1.4780	2509.0000	77.6294	0.1000	0.1109
10	4	4	2	500	20	3	7.4	0.6913	2562.0000	77.4871	1.2000	2.2324	0.3455	0.0644	9.4	1.3577	2520.5000	79.8633	0.0000	0.1130
10	4	4	2	500	20	4	6.6	0.6913	2542.8000	104.0462	10.6000	9.8064	0.2625	0.0600	9.6	1.1289	2417.2000	75.3292	0.1000	0.0984
10	4	4	2	1000	20	1	13	0.7543	3196.5000	130.3583	2.6000	2.4833	0.4828	0.0811	18.2	2.5645	3089.3999	131.7401	0.3000	0.3581
10	4	4	2	1000	20	2	12.6	0.6913	3319.5000	159.8965	13.4000	10.4958	0.5095	0.0807	17.6	1.6247	3157.2000	127.0693	0.1000	0.1330
10	4	4	2	1000	20	3	13.2	0.7390	3299.5000	153.1612	8.5000	13.7855	0.5313	0.0739	18	2.3370	3180.1001	126.5497	0.0000	0.2623
10	4	4	2	1000	20	4	12.8	0.7390	3236.6001	143.5436	13.1000	9.8945	0.4892	0.0908	17	1.6866	3097.8000	126.1568	0.4000	0.1522
10	4	4	2	1500	20	1	18.6	0.6913	3931.0000	170.7874	14.1000	14.8779	0.6890	0.1130	25	2.6345	3739.3000	126.9059	0.0000	0.6867
10	4	4	2	1500	20	2	18.4	0.6034	4003.6001	178.7342	18.4000	14.2400	0.7266	0.1106	24.4	2.0013	3851.5000	122.0622	0.8000	1.4025
10	4	4	2	1500	20	3	18.6	0.6913	4037.7000	139.8169	10.4000	13.2894	0.6515	0.0742	25.8	2.7362	3860.3000	128.8915	0.0000	1.5423
10	4	4	2	1500	20	4	18	0.9541	4011.3000	231.0431	28.4000	32.0006	0.6813	0.1228	25	1.6866	3722.8000	115.0781	0.5000	1.6828
10	4	4	2	500	50	1	5.8	0.4526	1831.0000	70.8764	0.0000	0.0000	0.2469	0.0434	7.4	0.9659	1797.6000	84.9866	0.0000	0.0734
10	4	4	2	500	50	2	5.8	0.4526	1890.8000	76.4261	0.6000	0.5003	0.2656	0.0428	7.8	1.0560	1861.2000	74.8033	0.3000	0.0821
10	4	4	2	500	50	3	5.8	0.4526	1923.7000	66.2739	0.2000	0.3017	0.2704	0.0393	8.2	1.0560	1886.8000	79.7646	0.0000	0.0660
10	4	4	2	500	50	4	5.6	0.6034	1789.8000	97.3270	2.0000	2.4089	0.2360	0.0429	7	0.7543	1750.4000	78.6611	0.4000	0.0613
10	4	4	2	1000	50	1	9.6	0.9051	2403.8000	148.0095	7.5000	7.7893	0.3109	0.0563	14	1.6525	2266.0000	124.1504	0.2000	0.1038
10	4	4	2	1000	50	2	9.6	0.9051	2450.5000	178.1710	12.3000	14.2633	0.3455	0.0659	13	1.8165	2320.8000	127.5354	0.7000	0.1353
10	4	4	2	1000	50	3	9.6	0.9051	2486.6001	166.7853	12.1000	16.6874	0.3218	0.0696	14.2	2.1808	2323.0000	126.0138	0.0000	0.1445
10	4	4	2	1000	50	4	9.6	0.9051	2407.8999	151.2457	11.6000	9.3064	0.3311	0.0756	14.4	1.4780	2238.0000	125.3412	0.0000	0.0961
10	4	4	2	1500	50	1	14.8	1.6798	2977.8000	219.5321	14.7000	26.4979	0.5142	0.1159	21.8	3.3358	2789.5000	142.4643	0.2000	0.5606
10	4	4	2	1500	50	2	14.8	1.6798	3013.8000	199.3945	14.0000	17.0868	0.5453	0.1193	19.2	2.1546	2855.1001	154.6469	0.1000	0.1906
10	4	4	2	1500	50	3	14.6	1.7912	3082.3000	202.0675	19.0000	22.2600	0.5000	0.1363	20.4	2.4136	2885.1001	157.3488	0.1000	0.2429
10	4	4	2	1500	50	4	14.6	1.7912	2978.7000	227.3639	18.8000	26.1820	0.5326	0.1312	19.2	1.6798	2772.8000	146.6029	0.2000	0.1007
10	4	4	2	500	80	1	3.4	0.6913	1009.3000	79.3063	0.0000	0.0000	0.1234	0.0329	4.6	0.6913	979.1000	91.0095	0.0000	0.0339
10	4	4	2	500	80	2	3.4	0.6913	1102.5000	103.6186	0.0000	0.0000	0.1313	0.0361	4.8	1.0006	1069.2000	98.9726	0.0000	0.0502
10	4	4	2	500	80	3	3.4	0.6913	1122.3000	100.3399	0.0000	0.0000	0.1344	0.0365	5	1.2162	1086.5000	91.6155	0.0000	0.0586
10	4	4	2	500	80	4	3.4	0.6913	1002.1000	91.6374	0.0000	0.0000	0.1281	0.0348	5	0.7543	975.8000	92.9034	0.0000	0.0309
10	4	4	2	1000	80	1	5.6	0.6034	1312.1000	116.1712	0.0000	0.0000	0.1750	0.0337	8.8	1.9318	1259.7000	93.7029	0.0000	0.0935
10	4	4	2	1000	80	2	5.6	0.6034	1387.2000	116.9421	0.2000	0.4526	0.1843	0.0311	8.4	1.4780	1329.0000	110.7184	0.0000	0.0804
10	4	4	2	1000	80	3	5.6	0.6034	1378.2000	111.6042	0.0000	0.0000	0.1889	0.0378	9.4	1.3577	1324.0000	95.7425	0.0000	0.0633

C	W	B	E/O cost ratio	IN	FR	Policy	F _{min}	Weighted port count			# of OEOs			Solve time			Weighted port count			# of OEOs			Solve time		
								±CI	@F _{min}	±CI	@F _{min}	±CI	@F _{min}	±CI	[sec]	±CI	@F _{min}	±CI	[sec]	±CI	@F _{min}	±CI	[sec]		
10	4	4	2	1000	80	4	5.6	0.6034	1290.3000	116.9816	0.1000	0.2263	0.1784	0.0303	9	1.2162	1227.2000	108.2964	0.1000	0.2263	0.3751	0.0567			
10	4	4	2	1500	80	1	7.6	1.6247	1725.6000	133.0460	0.2000	0.3017	0.2312	0.0777	14	2.5242	1593.6000	117.0633	0.0000	0.0000	0.7014	0.1326			
10	4	4	2	1500	80	2	7.6	1.4780	1760.7000	123.7567	0.7000	1.0693	0.2485	0.0702	13.6	1.8841	1667.4000	129.8923	0.1000	0.2263	0.6955	0.1012			
10	4	4	2	1500	80	3	7.6	1.3151	1790.2000	130.6271	1.7000	3.6023	0.2437	0.0748	13.4	2.5287	1691.8000	131.5282	0.0000	0.0000	0.7095	0.1566			
10	4	4	2	1500	80	4	7.8	1.4231	1676.7000	130.2841	1.4000	1.5531	0.2593	0.0704	12.2	1.8414	1583.5000	125.5594	0.0000	0.0000	0.5720	0.1241			
10	8	8	2	500	0	1	2.4	0.6034	4071.8999	198.8739	0.7000	1.1213	0.6422	0.2519	4	0.0000	4023.3000	186.4156	0.0000	0.0000	1.2689	0.0351			
10	8	8	2	500	0	2	2.8	0.7390	4111.0000	204.8838	1.0000	1.4311	0.8968	0.2658	3.4	0.6913	4083.3000	189.2427	0.1000	0.2263	1.1545	0.2165			
10	8	8	2	500	0	3	3	0.7543	4130.2998	187.9014	0.3000	0.4830	0.9534	0.3180	3.6	0.6034	4115.7998	193.5872	0.1000	0.2263	1.2172	0.2061			
10	8	8	2	500	0	4	2.2	0.4526	4081.6001	208.4655	5.2000	9.0309	0.6171	0.1985	3.4	0.6913	4024.8000	196.7363	0.3000	0.4830	1.1015	0.2305			
10	8	8	2	1000	0	1	4.4	0.6034	4387.7998	199.9669	1.9000	4.0541	1.1280	0.4464	5.2	0.7390	4353.7998	186.2324	0.0000	0.0000	1.6907	0.4793			
10	8	8	2	1000	0	2	4.6	0.6913	4451.2998	203.6869	0.0000	0.0000	1.3202	0.4098	5.8	0.4526	4429.0000	195.4471	0.0000	0.0000	2.1139	0.2115			
10	8	8	2	1000	0	3	4.8	0.7390	4457.6001	205.4176	1.8000	2.9561	1.4235	0.4213	6.2	1.0560	4423.7998	193.0348	0.0000	0.0000	3.8219	2.3736			
10	8	8	2	1000	0	4	4.4	0.6034	4384.5000	216.9741	0.5000	0.7729	1.0985	0.4240	5.6	0.6034	4345.7002	204.3825	0.0000	0.0000	1.9469	0.3726			
10	8	8	2	1500	0	1	6.6	0.6913	4828.3999	225.5857	7.4000	14.2799	2.5124	1.6485	8.6	0.9659	4726.7002	152.5798	0.0000	0.0000	6.3638	2.6006			
10	8	8	2	1500	0	2	6.4	0.6034	4895.5000	169.6763	2.6000	3.0952	3.4593	2.7903	8	0.6746	4829.2002	154.5730	0.0000	0.0000	7.7108	2.4020			
10	8	8	2	1500	0	3	6.6	0.6913	4851.2002	174.8573	2.2000	4.4978	3.2924	2.4269	8.2	1.0560	4797.0000	151.2417	0.0000	0.0000	5.9780	2.8799			
10	8	8	2	1500	0	4	6.4	0.6034	4788.7998	153.3826	5.1000	9.6264	3.0358	2.3066	8	0.9541	4717.8999	139.1694	0.0000	0.0000	6.8579	2.2148			
10	8	8	2	500	20	1	2	0.0000	3224.6001	147.5130	0.0000	0.0000	0.4952	0.0597	2.8	0.7390	3216.7000	141.0548	0.0000	0.0000	0.7421	0.2410			
10	8	8	2	500	20	2	2	0.0000	3268.3000	136.9914	0.5000	0.3771	0.5796	0.0590	3	0.7543	3260.3999	136.6422	0.3000	0.3456	0.8593	0.2248			
10	8	8	2	500	20	3	2	0.0000	3315.3000	152.3149	0.0000	0.0000	0.5483	0.0424	3.6	0.6034	3278.3000	140.6570	0.0000	0.0000	1.0389	0.1777			
10	8	8	2	500	20	4	2	0.0000	3212.5000	143.4722	0.0000	0.0000	0.6141	0.0374	2.8	0.7390	3197.3999	129.9185	0.0000	0.0000	0.8279	0.1697			
10	8	8	2	1000	20	1	4	0.0000	3541.5000	167.6586	0.7000	1.1213	0.9063	0.0631	5.2	0.7390	3520.1001	159.2613	0.1000	0.2263	1.5047	0.3517			
10	8	8	2	1000	20	2	4	0.0000	3569.8000	145.1451	0.0000	0.0000	1.0748	0.0945	4.4	0.6034	3566.1001	142.9643	0.0000	0.0000	1.2390	0.2817			
10	8	8	2	1000	20	3	4	0.0000	3612.3000	165.2945	0.0000	0.0000	0.9455	0.0920	5.6	0.6034	3580.6001	156.1281	0.0000	0.0000	1.7752	0.2925			
10	8	8	2	1000	20	4	4	0.0000	3499.6001	164.2342	0.1000	0.2263	1.0061	0.0757	4.8	0.7390	3487.8999	163.7403	0.1000	0.2263	1.3765	0.3272			
10	8	8	2	1500	20	1	5.8	0.4526	3854.3999	146.9960	2.6000	5.3991	1.5983	0.3138	7.4	0.9659	3799.5000	146.7036	0.1000	0.2263	3.7204	2.0911			
10	8	8	2	1500	20	2	6	0.0000	3888.2000	142.3347	0.0000	0.0000	1.9313	0.1142	7	0.7543	3870.8999	128.7941	0.0000	0.0000	3.5094	1.6599			
10	8	8	2	1500	20	3	6	0.0000	3917.2000	125.6919	0.1000	0.2263	1.7391	0.1806	7.6	0.6034	3876.2000	118.7394	0.1000	0.2263	5.1812	2.1651			
10	8	8	2	1500	20	4	5.8	0.4526	3827.0000	141.7613	3.1000	7.0145	1.5811	0.2773	7.2	1.0006	3776.8000	134.3025	0.0000	0.0000	4.4922	2.5807			
10	8	8	2	500	50	1	1.9	0.2263	2279.7000	144.8019	0.0000	0.0000	0.4750	0.0740	2.1	0.5280	2276.7000	146.5499	0.0000	0.0000	0.5187	0.1124			
10	8	8	2	500	50	2	1.9	0.2263	2336.8999	151.0918	0.3000	0.4830	0.5062	0.0833	2.7	0.6788	2329.7000	147.5083	0.0000	0.0000	0.6797	0.1369			
10	8	8	2	500	50	3	1.9	0.2263	2354.3000	149.5399	0.0000	0.0000	0.5033	0.0784	2.3	0.4830	2349.1001	153.0475	0.0000	0.0000	0.5984	0.0905			
10	8	8	2	500	50	4	1.9	0.2263	2239.7000	171.8894	0.0000	0.0000	0.4782	0.0728	2.5	0.6081	2236.2000	169.4429	0.0000	0.0000	0.6094	0.1225			
10	8	8	2	1000	50	1	3.4	0.6913	2546.1001	184.0590	2.0000	4.5255	0.7139	0.2327	4.2	0.4526	2506.6001	173.6704	0.0000	0.0000	1.0013	0.1779			
10	8	8	2	1000	50	2	3.6	0.6034	2562.8999	176.1851	0.2000	0.4526	0.8343	0.2009	4.2	0.4526	2548.3000	165.0761	0.0000	0.0000	1.0452	0.1981			
10	8	8	2	1000	50	3	3.4	0.6913	2595.8000	184.2472	1.7000	3.3740	0.7625	0.2316	4	0.6746	2574.0000	181.3084	0.2000	0.4526	0.9955	0.2605			
10	8	8	2	1000	50	4	3.4	0.6913	2521.7000	179.3963	2.0000	4.5255	0.7313	0.2245	4.2	0.4526	2489.5000	173.9974	0.0000	0.0000	1.0109	0.1880			
10	8	8	2	1500	50	1	4.4	0.6034	2786.1001	165.4690	0.8000	1.1587	0.9471	0.3056	5.6	0.6034	2746.1001	169.2591	0.0000	0.0000	1.5968	0.2522			
10	8	8	2	1500	50	2	4.4	0.6034	2845.8999	169.0223	0.0000	0.0000	1.0548	0.2903	5.6	0.9051	2805.8999	160.9919	0.0000	0.0000	1.7938	0.5441			
10	8	8	2	1500	50	3	4.4	0.6034	2856.7000	182.0628	0.0000	0.0000	1.0235	0.3266	5.4	0.9659	2802.3999	169.5683	0.0000	0.0000	1.7032	0.5877			
10	8	8	2	1500	50	4	4.4	0.6034	2763.0000	184.9995	0.6000	1.1289	0.9970	0.2771	5.6	0.9051	2730.8000	174.6832	0.0000	0.0000	1.7328	0.5182			
10	8	8	2	500	80	1	1	0.0000	1151.0000	111.3910	0.0000	0.0000	0.1938	0.0152	2	0.7543	1139.0000	108.7782	0.0000	0.0000	0.3420	0.1063			
10	8	8	2	500	80	2	1	0.0000	1220.8000	118.7284	0.0000	0.0000	0.2139	0.0212	1.8	0.7390	1205.8000	114.3192	0.0000	0.0000	0.3500	0.1102			
10	8	8	2	500	80	3	1	0.0000	1255.8000	128.4754	0.3000	0.6788	0.2122	0.0255	2	0.7543	1230.4000	114.7213	0.0000	0.0000	0.3968	0.1289			
10	8	8	2	500	80	4	1	0.0000	1136.2000	111.0928	0.1000	0.2263	0.2046	0.0207	1.8	0.7390	1127.2000	110.6942	0.0000	0.0000	0.3343	0.1130			

C	W	B	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs	±CI	Solve time [sec]	
																					[Gb/s]
10	8	8	2	1000	80	1	1.8	0.3017	1355.0000	114.3626	0.0000	0.0000	0.3188	0.0701	3	0.6746	1333.5000	112.2155	0.0000	0.5405	0.1118
10	8	8	2	1000	80	2	1.8	0.3017	1402.1000	109.3715	0.0000	0.0000	0.3265	0.0670	3	0.6746	1391.1000	107.8082	0.0000	0.5702	0.1263
10	8	8	2	1000	80	3	1.8	0.3017	1409.2000	110.2781	0.0000	0.0000	0.3373	0.0713	2.6	0.7692	1396.8000	111.6501	0.0000	0.4983	0.1476
10	8	8	2	1000	80	4	1.8	0.3017	1335.3000	112.4236	0.0000	0.0000	0.3155	0.0677	3.4	0.6034	1307.2000	118.6541	0.0000	0.6141	0.0995
10	8	8	2	1500	80	1	2.4	0.6034	1621.1000	123.3005	0.0000	0.0000	0.3751	0.1568	3.8	0.8124	1550.7000	114.1720	0.0000	0.7952	0.2221
10	8	8	2	1500	80	2	2.5	0.7729	1680.0000	153.2090	3.0000	6.5407	0.4500	0.2081	3.9	0.9805	1623.1000	119.5286	0.0000	0.8984	0.2900
10	8	8	2	1500	80	3	2.6	0.6913	1661.0000	110.2432	0.2000	0.4526	0.4859	0.1872	3.8	1.0560	1645.4000	113.9775	0.0000	0.8829	0.3125
10	8	8	2	1500	80	4	2.3	0.6788	1600.6000	87.0553	0.0000	0.0000	0.3687	0.1683	3.7	1.0693	1540.6000	112.2839	0.0000	0.7999	0.3039
40	8	8	5	500	0	1	1	0.0000	3846.2000	142.0594	0.0000	0.0000	0.4609	0.0211	1.2	0.4526	3845.9999	141.9435	0.0000	0.5218	0.1336
40	8	8	5	500	0	2	1	0.0000	3921.7000	158.6886	0.0000	0.0000	0.4844	0.0256	1	0.0000	3921.7000	158.6886	0.0000	0.4844	0.0256
40	8	8	5	500	0	3	1	0.0000	3958.2000	151.3244	0.0000	0.0000	0.4906	0.0311	1.2	0.4526	3956.8000	153.0956	0.0000	0.5484	0.1073
40	8	8	5	500	0	4	1	0.0000	3798.0000	149.8090	0.0000	0.0000	0.4814	0.0157	1	0.0000	3798.0000	149.8090	0.0000	0.4814	0.0157
40	8	8	5	1000	0	1	1.5	0.3771	4937.6001	164.1125	0.7000	1.5839	0.5092	0.1891	2.5	0.3771	4895.7998	167.0462	0.0000	0.8826	0.0968
40	8	8	5	1000	0	2	1.5	0.3771	4948.0000	179.0385	0.3000	0.6788	0.5874	0.1491	2.1	0.5280	4937.5000	178.1681	0.0000	0.7842	0.1725
40	8	8	5	1000	0	3	1.8	0.3017	5005.5000	166.0572	0.3000	0.6788	0.6875	0.1527	2.4	0.5003	4988.0000	168.4750	0.0000	0.9015	0.1329
40	8	8	5	1000	0	4	1.5	0.3771	4894.7998	137.6124	1.0000	2.2628	0.5501	0.1707	2.3	0.4830	4849.8999	158.0418	0.0000	0.8250	0.1309
40	8	8	5	1500	0	1	2	0.0000	5517.2002	182.5214	0.0000	0.0000	0.7406	0.0255	2.2	0.4526	5517.0000	182.1890	0.0000	0.7999	0.1389
40	8	8	5	1500	0	2	2	0.0000	5633.7998	207.6191	0.0000	0.0000	0.7530	0.0490	2.2	0.4526	5631.0000	203.2804	0.0000	0.8249	0.1574
40	8	8	5	1500	0	3	2	0.0000	5657.7002	187.2952	0.0000	0.0000	0.7422	0.0516	2.6	0.6913	5651.3999	188.8395	0.0000	0.9436	0.2130
40	8	8	5	1500	0	4	2	0.0000	5496.1001	175.8088	0.0000	0.0000	0.7234	0.0459	2.4	0.6034	5488.3999	179.8144	0.0000	0.8484	0.1644
40	8	8	5	500	20	1	1	0.0000	3135.8999	136.2516	0.0000	0.0000	0.3907	0.0189	1	0.0000	3135.8999	136.2516	0.0000	0.3907	0.0189
40	8	8	5	500	20	2	1	0.0000	3233.2000	128.0061	0.0000	0.0000	0.4065	0.0117	1	0.0000	3233.2000	128.0061	0.0000	0.4065	0.0117
40	8	8	5	500	20	3	1	0.0000	3259.3000	117.4746	0.0000	0.0000	0.4205	0.0099	1	0.0000	3259.3000	117.4746	0.0000	0.4205	0.0099
40	8	8	5	500	20	4	1	0.0000	3082.8000	123.3352	0.0000	0.0000	0.3861	0.0129	1	0.0000	3082.8000	123.3352	0.0000	0.3861	0.0129
40	8	8	5	1000	20	1	1	0.0000	3906.1001	142.6803	0.0000	0.0000	0.3000	0.0380	2	0.7543	3875.3999	115.3129	0.0000	0.5764	0.2162
40	8	8	5	1000	20	2	1	0.0000	3996.8000	137.8895	0.0000	0.0000	0.3392	0.0422	2	0.7543	3984.6001	142.0944	0.0000	0.6344	0.1957
40	8	8	5	1000	20	3	1	0.0000	4053.8999	132.4886	0.0000	0.0000	0.2969	0.0383	2.8	0.4526	4004.8999	141.4718	0.0000	0.8531	0.1377
40	8	8	5	1000	20	4	1	0.0000	3868.1001	136.4260	0.0000	0.0000	0.3093	0.0283	2.4	0.6913	3831.1001	136.9961	0.0000	0.6859	0.1816
40	8	8	5	1500	20	1	1.9	0.2263	4390.1001	177.0448	2.6000	5.8832	0.5843	0.1101	2.3	0.4830	4349.7002	165.8422	0.0000	0.7061	0.1085
40	8	8	5	1500	20	2	2	0.0000	4475.2002	182.0689	0.0000	0.0000	0.6782	0.0200	2	0.0000	4475.2002	182.0689	0.0000	0.6782	0.0200
40	8	8	5	1500	20	3	2	0.0000	4507.2002	168.8096	0.0000	0.0000	0.6829	0.0297	2.2	0.4526	4507.0000	168.6768	0.0000	0.7421	0.1088
40	8	8	5	1500	20	4	2	0.0000	4292.3999	176.0400	0.0000	0.0000	0.6361	0.0168	2	0.0000	4292.3999	176.0400	0.0000	0.6361	0.0168
40	8	8	5	500	50	1	1	0.0000	2190.0000	114.4417	0.0000	0.0000	0.2875	0.0142	1	0.0000	2190.0000	114.4417	0.0000	0.2875	0.0142
40	8	8	5	500	50	2	1	0.0000	2353.3999	102.7003	0.0000	0.0000	0.3141	0.0134	1	0.0000	2353.3999	102.7003	0.0000	0.3141	0.0134
40	8	8	5	500	50	3	1	0.0000	2388.3999	106.9141	0.0000	0.0000	0.3269	0.0110	1	0.0000	2388.3999	106.9141	0.0000	0.3269	0.0110
40	8	8	5	500	50	4	1	0.0000	2124.8999	109.7982	0.0000	0.0000	0.2844	0.0138	1	0.0000	2124.8999	109.7982	0.0000	0.2844	0.0138
40	8	8	5	1000	50	1	1	0.0000	2748.3000	158.4964	0.0000	0.0000	0.2843	0.0234	2	0.7543	2735.3000	153.4112	0.0000	0.4923	0.1520
40	8	8	5	1000	50	2	1	0.0000	2880.5000	141.8805	0.0000	0.0000	0.3422	0.0233	1.4	0.6034	2873.1001	139.9155	0.0000	0.4282	0.1171
40	8	8	5	1000	50	3	1	0.0000	2906.7000	137.5236	0.0000	0.0000	0.3406	0.0387	1.4	0.6034	2903.1001	137.3731	0.0000	0.4201	0.1304
40	8	8	5	1000	50	4	1	0.0000	2716.6001	152.0491	0.0000	0.0000	0.3111	0.0143	1.4	0.6034	2713.2000	148.9176	0.0000	0.3909	0.1273
40	8	8	5	1500	50	1	1.2	0.3017	3113.2000	173.4717	0.2000	0.4526	0.2921	0.0979	2.4	0.6034	3061.8000	182.9259	0.0000	0.5702	0.1299
40	8	8	5	1500	50	2	1.3	0.3456	3219.2000	175.3544	0.1000	0.2263	0.3360	0.1111	2.1	0.6265	3199.8000	168.1552	0.0000	0.5421	0.1448
40	8	8	5	1500	50	3	1.2	0.3017	3267.8999	174.9554	0.0000	0.0000	0.3001	0.1124	2.8	0.3017	3237.3999	171.9143	0.0000	0.7201	0.0562
40	8	8	5	1500	50	4	1.2	0.3017	3055.0000	188.0161	0.1000	0.2263	0.2937	0.0945	2	0.6746	3030.7000	175.4521	0.0000	0.4845	0.1527
40	8	8	5	500	80	1	1	0.0000	1121.6000	136.0798	0.0000	0.0000	0.1734	0.0193	1	0.0000	1121.6000	136.0798	0.0000	0.1734	0.0193

C	W	B	E/O cost	IN	FR	Policy	F _{min}	Weighted			# of OEOs	Solve			# of OEOs	Weighted			±CI	±CI	Solve time	±CI	±CI
								±CI	port	count		±CI	time	count		±CI	port	count					
[Gb/s]								ratio	[Gb/s]	[%]	[sec]								@F _{opt}				
																			@F _{min}				
40	8	8	5	500	80	2	1	0.0000	1268.4000	89.2769	0.0000	0.0000	0.1952	0.0080	1	0.0000	1268.4000	89.2769	0.0000	0.0000	0.1952	0.0080	0.0080
40	8	8	5	500	80	3	1	0.0000	1376.2000	100.0593	0.0000	0.0000	0.2204	0.0134	1	0.0000	1376.2000	100.0593	0.0000	0.0000	0.2204	0.0134	0.0134
40	8	8	5	500	80	4	1	0.0000	1069.8000	118.8515	0.0000	0.0000	0.1687	0.0146	1	0.0000	1069.8000	118.8515	0.0000	0.0000	0.1687	0.0146	0.0146
40	8	8	5	1000	80	1	1	0.0000	1402.9000	157.6089	0.0000	0.0000	0.2018	0.0154	1	0.0000	1402.9000	157.6089	0.0000	0.0000	0.2018	0.0154	0.0154
40	8	8	5	1000	80	2	1	0.0000	1530.5000	122.1792	0.0000	0.0000	0.2201	0.0123	1	0.0000	1530.5000	122.1792	0.0000	0.0000	0.2201	0.0123	0.0123
40	8	8	5	1000	80	3	1	0.0000	1594.8000	125.1098	0.0000	0.0000	0.2344	0.0118	1	0.0000	1594.8000	125.1098	0.0000	0.0000	0.2344	0.0118	0.0118
40	8	8	5	1000	80	4	1	0.0000	1337.5000	134.8746	0.0000	0.0000	0.1985	0.0167	1	0.0000	1337.5000	134.8746	0.0000	0.0000	0.1985	0.0167	0.0167
40	8	8	5	1500	80	1	1	0.0000	1605.6000	166.4418	0.0000	0.0000	0.1999	0.0202	1.6	0.6913	1591.3000	157.8381	0.0000	0.0000	0.2906	0.0916	0.0916
40	8	8	5	1500	80	2	1	0.0000	1712.7000	127.2582	0.0000	0.0000	0.2266	0.0153	1.4	0.6034	1710.7000	126.0481	0.0000	0.0000	0.2939	0.0902	0.0902
40	8	8	5	1500	80	3	1	0.0000	1782.4000	139.1476	0.0000	0.0000	0.2328	0.0212	1.4	0.6034	1780.0000	138.7549	0.0000	0.0000	0.3061	0.1043	0.1043
40	8	8	5	1500	80	4	1	0.0000	1558.4000	150.4389	0.0000	0.0000	0.2094	0.0177	1.2	0.4526	1557.4000	150.1735	0.0000	0.0000	0.2345	0.0538	0.0538

Table B.3: Comparison of no-bifurcation-based heuristics with the color conversion capability for the NSF network.

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs F _{opt}	±CI	Solve time [sec]	±CI		
10	8	8	2	500	0	1	7	0.0000	14743.5000	314.6993	0.0000	58.4401	3.6448	7.6	0.6913	14723.0996	296.5961	0.0000	124.7294	132.4034	
10	8	8	2	500	0	2	7	0.0000	14989.4004	285.8683	0.0000	61.0887	2.8040	7.4	0.6034	14974.9004	278.3620	0.2000	67.5450	7.9669	
10	8	8	2	500	0	3	7	0.0000	14965.0000	209.6883	0.0000	61.5636	3.1259	7.4	0.6034	14961.2002	210.3389	0.0000	124.8366	135.0671	
10	8	8	2	500	0	4	7	0.0000	14709.5000	227.9767	2.8000	60.0172	2.2342	7.6	0.6913	14673.2998	213.0171	0.1000	68.4014	8.1778	
10	8	8	2	1000	0	1	11.8	0.7390	16324.2002	552.5656	31.7000	313.3392	258.3515	14.2	1.0006	15878.0996	241.1134	0.0000	737.5974	310.3591	
10	8	8	2	1000	0	2	12.4	0.6913	16303.0000	343.2831	2.2000	372.7000	270.2145	14	0.7543	16154.0996	330.3344	0.0000	761.0228	325.8001	
10	8	8	2	1000	0	3	12	0.7543	16541.1992	809.0183	38.7000	138.3060	151.0750	13.8	0.7390	16143.2998	270.6714	0.1000	582.7468	369.1721	
10	8	8	2	1000	0	4	12.2	0.7390	16233.4004	622.1727	40.7000	58.4388	255.4923	14	1.2162	15889.5996	258.3654	1.0000	635.5024	332.1391	
10	8	8	2	1500	0	1	17.6	0.6913	17441.5000	355.7338	29.5000	96.3424	19.5325	20.8	1.2531	17026.9004	317.9652	0.0000	194.8192	14.7266	
10	8	8	2	1500	0	2	17.6	0.6913	17762.1992	364.6206	16.5000	119.4656	15.1738	20.8	1.0560	17371.8008	312.1145	0.0000	204.2424	16.2048	
10	8	8	2	1500	0	3	17.6	0.6913	17686.5996	328.8090	18.3000	27.8585	91.2168	21.2	1.5749	17261.4004	291.2869	0.0000	203.5136	18.5921	
10	8	8	2	1500	0	4	17.6	0.6913	17325.3008	311.2646	14.1000	8.2241	20.0567	20.4	1.1782	16974.0996	286.7058	0.0000	185.9144	12.8986	
10	8	8	2	500	20	1	5.2	0.4526	12338.9004	167.8228	15.6000	20.8676	7.6672	6.4	0.6913	12192.0996	166.6253	0.0000	50.0824	6.0318	
10	8	8	2	500	20	2	5.4	0.6034	12625.4004	251.4349	15.0000	18.4815	8.2574	6.6	0.6034	12467.4004	176.0354	0.2000	52.9760	5.1958	
10	8	8	2	500	20	3	5.6	0.6913	12528.5000	199.1035	3.0000	38.6608	10.5172	6.8	0.4526	12393.7002	150.9477	0.0000	56.1664	2.1929	
10	8	8	2	500	20	4	5.4	0.6034	12458.2002	317.7263	21.1000	37.4656	8.3720	6.6	0.6034	12234.0000	199.7749	0.6000	52.1328	3.9662	
10	8	8	2	1000	20	1	10.4	0.6913	13440.9004	254.9667	13.2000	28.3759	173.0758	12.4	0.6913	13216.7998	203.3394	0.0000	372.7472	256.2681	
10	8	8	2	1000	20	2	10.2	0.7390	13789.4004	380.7288	30.6000	61.7024	165.6309	12.2	1.0006	13487.5000	242.8505	0.0000	436.3744	264.8321	
10	8	8	2	1000	20	3	10.4	0.6913	13639.2998	299.7172	11.6000	22.5802	169.1953	12.4	0.9659	13432.5996	243.9959	0.0000	680.8976	228.9691	
10	8	8	2	1000	20	4	10.4	0.6913	13360.0996	642.9929	7.0000	366.0384	204.2604	12.4	0.9659	13240.4004	272.7943	0.4000	577.9008	244.3461	
10	8	8	2	1500	20	1	14.4	0.9659	15205.0000	636.9515	126.1000	108.1238	305.3632	17.2	0.8124	14274.0996	253.4950	0.0000	234.5440	203.1411	
10	8	8	2	1500	20	2	14.6	0.9051	15465.5996	706.2394	102.8000	98.9220	287.7907	17.2	1.0560	14615.5996	270.4814	0.0000	306.7264	231.6281	
10	8	8	2	1500	20	3	15	0.9541	15147.5000	718.9116	61.1000	111.6626	465.4384	17.6	1.1782	14575.0000	242.2058	0.0000	335.1104	261.1891	
10	8	8	2	1500	20	4	14.4	0.9659	15437.9004	892.2865	156.0000	119.0854	427.2304	190.0035	17	0.6746	14304.0996	263.7058	1.4000	225.2624	198.0991
10	8	8	2	500	50	1	4.8	0.4526	8523.0996	199.4498	9.1000	31.9808	6.5206	5.2	0.4526	8453.7002	149.8120	0.0000	36.2720	2.4887	
10	8	8	2	500	50	2	4.8	0.4526	8704.0000	185.7731	10.5000	34.2880	5.4061	5.6	0.6913	8621.7002	134.6005	0.0000	39.8144	4.0705	
10	8	8	2	500	50	3	5	0.0000	8643.4004	156.8896	0.0000	37.6928	0.8475	5	0.0000	8643.4004	156.8896	0.0000	37.6928	0.8475	
10	8	8	2	500	50	4	4.8	0.4526	8498.4004	162.6823	17.7000	40.0508	33.0176	5.8925	5	0.0000	8422.2998	139.4241	0.0000	35.6512	0.9111
10	8	8	2	1000	50	1	7	0.0000	9483.7998	326.4632	6.5000	28.6016	5.5279	9.6	0.6913	9287.0996	281.5386	0.1000	300.3296	178.9891	
10	8	8	2	1000	50	2	7.2	0.4526	9611.7002	304.1557	8.5000	38.0352	8.1618	9.4	0.9051	9459.0996	258.7220	0.0000	155.9968	134.2051	
10	8	8	2	1000	50	3	7.2	0.4526	9748.2002	345.2482	15.2000	21.0105	115.7975	9.6	0.6913	9465.2998	276.7826	0.0000	250.2272	165.2554	
10	8	8	2	1000	50	4	7.2	0.4526	9606.0000	484.4619	21.6000	38.6162	103.5070	9	0.6746	9311.9004	251.3800	0.2000	228.2912	156.3651	
10	8	8	2	1500	50	1	10.4	0.9659	10827.2002	917.4956	69.9000	126.2003	252.5824	13.8	1.3826	10162.5000	213.2574	0.0000	586.6176	255.6331	
10	8	8	2	1500	50	2	10.4	0.9659	10735.7002	296.7577	18.1000	17.7224	186.6853	13.4	1.3151	10398.0996	192.4009	0.4000	384.2848	272.9961	
10	8	8	2	1500	50	3	10.4	0.9659	10821.2002	381.2560	33.8000	43.1480	325.4720	13.4	1.1289	10391.0996	174.9518	0.0000	533.0272	281.7151	
10	8	8	2	1500	50	4	10.4	0.9659	10733.5996	498.8187	62.6000	71.1234	257.2544	12.6	0.9051	10205.2002	186.1288	0.8000	454.1696	240.4061	
10	8	8	2	500	80	1	3	0.0000	4465.8999	188.4820	0.0000	14.1088	0.5303	3	0.0000	4465.8999	188.4820	0.0000	14.1088	0.5303	
10	8	8	2	500	80	2	3	0.0000	4628.2998	184.5043	0.0000	14.7008	0.5138	3	0.0000	4628.2998	184.5043	0.0000	14.7008	0.5138	
10	8	8	2	500	80	3	3	0.0000	4723.0000	191.7928	0.0000	15.1616	0.5804	3	0.0000	4723.0000	191.7928	0.0000	15.1616	0.5804	
10	8	8	2	500	80	4	3	0.0000	4482.2002	179.9503	0.0000	14.0448	0.5402	3	0.0000	4482.2002	179.9503	0.0000	14.0448	0.5402	
10	8	8	2	1000	80	1	4.6	0.6034	5137.6001	245.2816	1.7000	21.7504	5.2944	5.4	0.9051	5089.8999	217.0466	1.7000	27.9904	6.3442	
10	8	8	2	1000	80	2	4.6	0.6034	5309.6001	225.9466	0.6000	1.3577	22.3040	6.4	0.6913	5247.8999	213.9183	0.0000	35.3088	2.9071	
10	8	8	2	1000	80	3	4.6	0.6034	5325.6001	206.3957	1.8000	3.1965	23.0720	6	0.7543	5277.6001	211.4744	0.0000	33.8368	3.7247	
10	8	8	2	1000	80	4	4.4	0.6913	5116.8999	170.5679	3.9000	6.1687	19.9712	5.4	0.9051	5061.2002	224.0900	0.0000	28.0160	5.8908	

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	# of OEOs @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	Weighted port count @ F_{opt}	$\pm CI$	# of OEOs F_{opt}	$\pm CI$	Solve time [sec]
10	8	8	2	1500	80	1	5.2	0.4526	6080.7002	235.3170	235.3170	21.8208	5.6757	7	1.1685	5934.2002	1.8000	3.0321	81.6928
10	8	8	2	1500	80	2	5.2	0.4526	6231.6001	201.9107	201.9107	27.6096	6.8240	7.2	0.8124	6115.6001	0.5000	0.7729	90.5632
10	8	8	2	1500	80	3	5.4	0.6034	6358.2998	261.5287	261.5287	26.1440	6.8808	8	0.7543	6185.5000	0.0000	0.0000	146.7264
10	8	8	2	1500	80	4	5.4	0.6034	6003.2998	233.8833	233.8833	26.6528	7.0150	7.2	0.8124	5880.7998	0.1000	0.2263	43.5264

Table B.4: Comparison of fiber-bifurcation-based heuristics with the color conversion capability for the NSF network.

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	# of OEOs @ F_{min}	Solve time [sec]	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	# of OEOs @ F_{opt}	$\pm CI$	Solve time [sec]
10	8	8	2	500	0	1	7	0.0000	14743.5000	314.6993	0.0000	0.0000	14723.0996	296.5961	0.0000	0.0000	123.4775
10	8	8	2	500	0	2	7	0.0000	14989.4004	285.8683	0.0000	0.4526	14974.9004	278.3620	0.2000	0.4526	66.4967
10	8	8	2	500	0	3	7	0.0000	14965.0000	209.6883	0.0000	0.0000	14961.2002	210.3389	0.0000	0.0000	123.0428
10	8	8	2	500	0	4	7	0.0000	14709.5000	227.9767	2.8000	4.2507	14673.2998	213.0171	0.1000	0.2263	67.3378
10	8	8	2	1000	0	1	11.8	0.7390	16324.2002	552.5656	31.7000	52.0030	15878.0996	241.1134	0.0000	0.0000	724.3052
10	8	8	2	1000	0	2	12.4	0.6913	16303.0000	343.2831	2.2000	4.2773	16154.0996	330.3344	0.0000	0.0000	746.5209
10	8	8	2	1000	0	3	12	0.7543	16541.1992	899.0183	38.7000	78.2222	16143.2998	270.6714	0.1000	0.2263	571.6608
10	8	8	2	1000	0	4	12.2	0.7390	16233.4004	622.1727	40.7000	58.4388	15889.5996	258.3654	1.0000	2.0239	624.1000
10	8	8	2	1500	0	1	17.6	0.6913	17441.5000	355.7338	29.5000	39.5709	17026.9004	317.9652	0.0000	0.0000	192.1256
10	8	8	2	1500	0	2	17.6	0.6913	17744.9004	375.1061	15.2000	16.5104	17371.8008	312.1145	0.0000	0.0000	198.7376
10	8	8	2	1500	0	3	17.6	0.6913	17674.0996	321.8768	19.2000	28.5976	17261.4004	291.2869	0.0000	0.0000	198.9976
10	8	8	2	1500	0	4	17.6	0.6913	17341.0996	310.7964	12.5000	6.1020	16974.0996	286.7058	0.0000	0.0000	182.8696
10	8	8	2	500	20	1	5.2	0.4526	12338.9004	167.8228	15.6000	20.8676	12192.0996	166.6253	0.0000	0.0000	49.1648
10	8	8	2	500	20	2	5.4	0.6034	12625.4004	251.4349	15.0000	18.4815	12467.4004	176.0354	0.2000	0.4526	52.1792
10	8	8	2	500	20	3	5.6	0.6913	12528.5000	199.1035	3.0000	3.5054	12393.7002	150.9477	0.0000	0.0000	55.3904
10	8	8	2	500	20	4	5.4	0.6034	12458.2002	317.7263	21.1000	40.5300	12234.0000	199.7749	0.6000	1.3577	51.4288
10	8	8	2	1000	20	1	10.4	0.6913	13440.9004	254.9667	13.2000	28.3759	13216.7998	203.3394	0.0000	0.0000	365.3392
10	8	8	2	1000	20	2	10.2	0.7390	13789.4004	380.7288	30.6000	61.7024	13487.5000	242.8505	0.0000	0.0000	427.1152
10	8	8	2	1000	20	3	10.4	0.6913	13639.2998	299.7172	11.6000	22.5802	13432.5996	243.9959	0.0000	0.0000	668.1520
10	8	8	2	1000	20	4	10.4	0.6913	13360.0996	246.9929	7.0000	6.9784	13240.4004	272.7943	0.4000	0.9051	566.5663
10	8	8	2	1500	20	1	14.4	0.9659	15205.0000	636.9515	126.1000	108.1238	14274.0996	253.4950	0.0000	0.0000	199.3666
10	8	8	2	1500	20	2	14.6	0.9051	15575.7998	671.4085	122.1000	104.8543	14615.5996	270.4814	0.0000	0.0000	301.4336
10	8	8	2	1500	20	3	15	0.9541	15147.5000	718.9116	61.1000	111.6626	14575.0000	242.2058	0.0000	0.0000	330.1616
10	8	8	2	1500	20	4	14.4	0.9659	15451.0000	881.1508	162.3000	116.2635	14304.0996	263.7058	1.4000	3.1679	221.5728
10	8	8	2	500	50	1	4.8	0.4526	8523.0996	199.4498	9.1000	20.5911	8453.7002	149.8120	0.0000	0.0000	35.8592
10	8	8	2	500	50	2	4.8	0.4526	8704.0000	185.7731	10.5000	23.7589	8621.7002	134.6005	0.0000	0.0000	39.4656
10	8	8	2	500	50	3	5	0.0000	8643.4004	156.8896	0.0000	0.0000	8643.4004	156.8896	0.0000	0.0000	37.2096
10	8	8	2	500	50	4	4.8	0.4526	8498.4004	162.6823	17.7000	40.0508	8422.2998	139.4241	0.0000	0.0000	35.2768
10	8	8	2	1000	50	1	7	0.0000	9483.7998	326.4632	6.5000	6.3845	9287.0996	281.5386	0.1000	0.2263	294.6848
10	8	8	2	1000	50	2	7.2	0.4526	9611.7002	304.1557	8.5000	9.9678	9459.0996	258.7820	0.0000	0.0000	152.3296
10	8	8	2	1000	50	3	7.2	0.4526	9748.2002	345.2482	15.2000	21.0105	9465.2998	276.7826	0.0000	0.0000	245.0560
10	8	8	2	1000	50	4	7.2	0.4526	9606.0000	484.4619	21.6000	38.6162	9311.9004	251.3800	0.2000	0.4526	223.8976
10	8	8	2	1500	50	1	10.4	0.9659	10827.2002	917.4956	69.9000	126.2003	10162.5000	213.2574	0.0000	0.0000	575.7184
10	8	8	2	1500	50	2	10.4	0.9659	10748.7998	285.7385	31.3000	27.5195	10398.0996	192.4009	0.4000	0.9051	376.3488
10	8	8	2	1500	50	3	10.4	0.9659	10786.2998	324.2530	33.3000	41.8322	10391.0996	174.9518	0.0000	0.0000	523.1937
10	8	8	2	1500	50	4	10.4	0.9659	10724.5996	495.9373	63.2000	71.7403	10205.2002	186.1288	0.8000	1.2531	445.6512
10	8	8	2	500	80	1	3	0.0000	4465.8999	188.4820	0.0000	0.0000	4465.8999	188.4820	0.0000	0.0000	13.7536
10	8	8	2	500	80	2	3	0.0000	4628.2998	184.5043	0.0000	0.0000	4628.2998	184.5043	0.0000	0.0000	14.4768
10	8	8	2	500	80	3	3	0.0000	4723.0000	191.7928	0.0000	0.0000	4723.0000	191.7928	0.0000	0.0000	14.9504
10	8	8	2	500	80	4	3	0.0000	4482.2002	179.9503	0.0000	0.0000	4482.2002	179.9503	0.0000	0.0000	13.8720
10	8	8	2	1000	80	1	4.6	0.6034	5137.6001	245.2816	1.7000	3.3740	5089.8999	217.0466	1.7000	3.3740	27.4848
10	8	8	2	1000	80	2	4.6	0.6034	5309.6001	225.9466	0.6000	1.3577	5247.8999	213.9183	0.0000	0.0000	34.7456
10	8	8	2	1000	80	3	4.6	0.6034	5325.6001	206.3957	1.8000	3.1965	5277.6001	211.4744	0.0000	0.0000	33.3376
10	8	8	2	1000	80	4	4.4	0.6913	5116.8999	170.5679	3.9000	6.1687	5061.2002	224.9000	0.0000	0.0000	27.5200

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	Weighted port count @ F_{min}	$\pm CI$	# of OEOs @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	Weighted port count @ F_{opt}	$\pm CI$	# of OEOs F_{opt}	Solve time [sec]	$\pm CI$
10	8	8	2	1500	80	1	5.2	0.4526	6086.0000	233.5827	21.4528	5.6780	7.6	1.3577	5935.8999	213.0196	130.7392	134.7800
10	8	8	2	1500	80	2	5.2	0.4526	6252.5000	184.1689	26.6560	7.0066	7.2	0.8124	6111.2998	207.4489	88.1664	99.0177
10	8	8	2	1500	80	3	5.4	0.6034	6358.2998	261.5287	25.7280	6.7514	8.4	0.9659	6186.3999	230.1594	195.5232	162.724
10	8	8	2	1500	80	4	5.4	0.6034	6003.2998	233.8833	26.4320	6.9111	7.2	0.8124	5880.7998	234.1560	43.3728	7.2263

Table B.5: Comparison of no-bifurcation-based heuristics with the color conversion capability for the EON network.

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @ F _{min}	# of OEOs @ F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	Weighted port count @ F _{opt}	# of OEOs @ F _{opt}	±CI	Solve Time [sec]	±CI			
10	8	8	2	500	0	1	4.2	0.7390	9691.0996	352.2847	80.2000	28.4020	22.6455	8	2.9599	9409.2002	239.2948	15.3300	264.6251	261.811		
10	8	8	2	500	0	2	4	0.7543	10437.5996	418.4820	151.9000	42.1835	20.1670	10	2.5466	9845.2998	149.4577	13.7000	506.1212	343.544		
10	8	8	2	500	0	3	4	0.7543	9626.7002	274.3591	71.2000	26.0491	23.3364	5.2	2.0739	9463.4004	127.0753	40.3000	21.3656	75.3028	41.7104	
10	8	8	2	500	0	4	4.6	0.6034	10229.2998	380.2973	121.3000	40.5968	15.3452	11	1.7849	9375.4004	191.5578	1.2000	2.7153	492.3288	319.501	
10	8	8	2	1000	0	1	7.4	0.6034	10244.9004	485.9798	89.4000	46.1072	13.8410	9.8	2.7153	9925.9004	274.5934	33.6000	17.4628	219.3432	196.882	
10	8	8	2	1000	0	2	7.4	0.6034	10703.0000	532.5524	126.4000	49.9258	12.2193	14	5.6140	10364.7002	251.6097	39.4000	33.5302	278.4528	217.487	
10	8	8	2	1000	0	3	7.6	0.6913	10188.7998	381.2680	69.0000	28.5482	18.6881	10	3.7104	10074.0000	284.9598	43.9000	27.5946	182.6352	178.973	
10	8	8	2	1000	0	4	7.6	0.6913	10329.2002	467.1634	87.5000	39.6442	18.3770	16.4	5.9981	10020.0996	224.5396	19.3000	18.6166	226.9872	114.933	
10	8	8	2	1500	0	1	10.8	0.8124	10796.0996	470.9218	84.1000	33.7471	80.5984	20.2619	14.8	4.0167	10476.0996	260.0533	33.3000	10.5328	262.4352	136.701
10	8	8	2	1500	0	2	11	0.9541	11682.7998	460.5589	184.5000	44.2653	116.9197	25.6	4.2694	11011.7002	237.3980	9.4000	10.7369	343.0304	66.7762	
10	8	8	2	1500	0	3	9.8	1.0006	10968.7002	370.8081	97.4000	27.8220	17.4725	14	4.7822	10640.9004	303.5518	33.0000	21.3361	219.1840	149.141	
10	8	8	2	1500	0	4	11.2	1.4231	10955.7002	588.5367	92.9000	43.4693	157.5718	24.6	10.0471	10546.0000	336.0159	18.2000	17.5168	336.8192	188.744	
10	8	8	2	500	20	1	3.2	0.4526	8095.2002	316.4604	77.9000	25.2949	30.5527	8.0040	5.2	1.7133	7892.7002	182.6399	24.7000	15.1867	88.4931	41.9842
10	8	8	2	500	20	2	3.6	0.6913	8774.2002	316.5857	137.1000	31.1561	57.5646	28.9705	9.2	1.8414	8218.5996	178.1285	9.0000	20.3648	176.1746	42.7071
10	8	8	2	500	20	3	3.6	0.6913	8090.8999	365.8417	66.3000	32.2623	56.6328	29.6041	5.8	2.4510	7931.0000	243.8349	28.7000	19.4622	97.7452	60.0688
10	8	8	2	500	20	4	4.2	0.7390	8525.5996	450.5752	104.2000	37.8794	36.6831	10	1.6866	7933.5000	204.1768	1.6000	3.6204	182.5126	37.0534	
10	8	8	2	1000	20	1	6.2	1.0006	8551.0996	402.6213	74.1000	29.0117	58.7420	19.5076	9.2	3.0508	8315.5000	310.6305	28.6000	16.7512	267.6688	234.571
10	8	8	2	1000	20	2	6	0.7543	8873.5996	454.7487	100.6000	33.9986	69.1152	16.0428	12.6	4.7127	8648.5000	343.4661	20.9000	18.8697	314.4336	200.853
10	8	8	2	1000	20	3	6.2	0.7390	8723.2998	408.6274	85.8000	28.1707	64.8440	14.8030	12.2	4.7320	8531.5000	309.0356	23.1000	18.5535	291.7040	195.251
10	8	8	2	1000	20	4	6.2	1.0006	8854.0996	462.9841	111.6000	39.3156	59.4384	19.3373	14	5.0145	8421.7998	231.3403	18.1000	19.8683	325.6288	193.049
10	8	8	2	1500	20	1	9.4	1.1289	9223.4004	432.8550	99.9000	38.2019	18.4231	17.4	5.2603	8883.2998	213.4016	20.9000	20.8737	285.0288	125.101	
10	8	8	2	1500	20	2	8.8	0.8124	9598.2998	273.5938	115.9000	35.5931	91.6352	20.6393	16.8	5.9753	9307.2002	145.2137	31.5000	23.2605	315.3968	167.253
10	8	8	2	1500	20	3	8.6	1.3151	9203.2002	471.8150	74.4000	34.6894	76.3072	29.0792	14.6	5.9505	8931.7998	255.7228	18.0000	13.9689	203.5296	128.853
10	8	8	2	1500	20	4	9.2	1.5749	9405.0996	391.4013	105.9000	37.7404	82.9056	28.5761	19.2	6.3087	8905.2998	240.1295	11.3000	8.8672	298.5440	144.584
10	8	8	2	500	50	1	3	0.0000	5716.0000	340.4930	61.6000	25.7888	31.4528	8.5550	5.6	0.9659	5372.5000	250.4258	1.3000	2.2890	87.3056	20.3353
10	8	8	2	500	50	2	3	0.0000	6131.1001	300.4619	90.3000	27.2828	37.1552	5.8554	6.2	1.2068	5631.6001	231.0037	6.5000	9.1339	105.9296	26.2347
10	8	8	2	500	50	3	3	0.0000	5796.6001	310.5087	52.7000	31.2137	38.0896	9.9438	5	1.5085	5601.5000	237.0501	11.2000	10.2855	84.1920	33.0231
10	8	8	2	500	50	4	3	0.0000	5744.5000	220.5001	55.9000	20.1046	6.0798	5.8	1.0006	5361.1001	226.8389	1.3000	2.9416	90.9568	21.0366	
10	8	8	2	1000	50	1	4.2	0.7390	5785.1001	210.7366	37.7000	8.4735	33.3920	12.5543	5.4	2.1119	5741.7998	197.4634	25.7000	10.0915	107.6576	151.583
10	8	8	2	1000	50	2	4.4	0.6913	6574.5000	512.8026	118.2000	46.8169	49.4656	16.9098	9.6	2.4371	6049.1001	274.5170	8.6000	7.9336	255.8048	207.561
10	8	8	2	1000	50	3	4.4	0.6913	5974.0000	202.0585	50.4000	10.6838	45.1776	16.4134	6.2	2.6302	5917.6001	197.2317	34.8000	19.3765	171.3344	196.781
10	8	8	2	1000	50	4	4.2	0.7390	6196.1001	440.3948	80.3000	27.8564	39.3568	15.7863	9.4	3.9797	5782.2002	175.0030	16.5000	22.0707	312.0992	263.571
10	8	8	2	1500	50	1	6.2	1.2068	6495.2002	248.2445	57.5000	17.8210	53.9488	27.2578	10.4	3.8784	6291.2998	197.1950	16.1000	10.8856	128.1248	74.3971
10	8	8	2	1500	50	2	6.2	0.7390	7047.7998	412.8470	103.6000	31.8598	66.5600	12.0727	13	4.0477	6665.7998	226.1025	18.5000	20.3348	374.9696	241.353
10	8	8	2	1500	50	3	5.8	0.7390	6533.5000	274.4037	45.1000	17.5611	47.7888	10.8955	10.2	5.1022	6495.8999	263.5902	25.7000	18.6532	146.5472	115.353
10	8	8	2	1500	50	4	6.4	0.6913	6771.2998	350.5887	75.6000	27.8669	63.5712	12.2268	17.2	3.7227	6412.0000	226.6574	2.0000	4.5255	372.8000	148.721
10	8	8	2	500	80	1	1	0.0000	2824.7000	184.8946	21.4000	7.9049	14.7072	5.1677	2.6	1.1289	2759.1001	138.1745	5.8000	5.6624	31.3344	14.5441
10	8	8	2	500	80	2	1	0.0000	2950.6001	143.4623	31.1000	17.3427	14.7456	2.3424	1.8	0.7390	2914.0000	146.6329	10.8000	8.3091	20.7104	6.6747
10	8	8	2	500	80	3	1	0.0000	2934.0000	180.0171	23.1000	8.7014	17.7984	5.2742	2	1.2162	2915.8999	174.9567	12.4000	8.1529	31.7312	19.2742
10	8	8	2	500	80	4	1	0.0000	2818.6001	166.2811	20.3000	7.1399	18.2656	3.9846	2.2	1.0006	2777.6001	154.3308	8.5000	7.4990	28.2816	11.4381
10	8	8	2	1000	80	1	3	0.0000	3464.1001	235.9962	33.8000	17.3077	28.4800	9.1410	6	1.6866	3275.3000	132.8143	4.8000	6.0416	82.1184	24.1971
10	8	8	2	1000	80	2	2.8	0.4526	3643.7000	283.5785	46.9000	26.8824	31.0976	10.1247	5.6	1.7912	3466.6001	170.0256	1.7000	3.8467	89.6704	26.5991
10	8	8	2	1000	80	3	3	0.0000	3608.3000	271.0545	46.4000	23.4770	35.0784	8.9444	5.2	1.5749	3406.6001	180.4940	7.7000	8.7509	88.9536	26.5422
10	8	8	2	1000	80	4	3	0.0000	3547.2000	231.2209	49.6000	21.6910	31.2256	6.9392	6	1.8165	3244.0000	171.1401	1.9000	2.9493	85.3504	23.9061

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	# of OEOs @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	$\pm CI$	Weighted port count @ F_{opt}	$\pm CI$	# of OEOs F_{opt}	$\pm CI$	Solve Time [sec]
10	8	8	2	1500	80	1	3.2	0.4526	3865.3999	29.7000	23.0480	7.9687	6.6	2.7651	3744.1001	204.5018	5.1000	7.6952	113.1776
10	8	8	2	1500	80	2	3	0.0000	4100.6001	48.3000	23.9744	4.6945	7	3.6951	3936.7000	188.1384	7.3000	6.4005	151.9296
10	8	8	2	1500	80	3	3	0.0000	3959.1001	34.0000	21.5680	3.8774	4.6	1.6247	3900.3999	203.0595	16.3000	14.1914	58.4704
10	8	8	2	1500	80	4	3	0.0000	3878.5000	30.1000	25.5232	6.3960	6.6	2.5953	3720.0000	192.4183	2.1000	3.0066	92.1472
																			47.1711

Table B.6: Comparison of fiber-bifurcation-based heuristics with the color conversion capability for the EON network.

C	W	B	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	Weighted			# of OEOs @ F_{min}	Solve			# of OEOs @ F_{opt}	Weighted			# of OEOs @ F_{opt}	Solve		
								$\pm CI$	port count @ F_{min}	$\pm CI$		$\pm CI$	time [sec]	$\pm CI$		$\pm CI$	port count @ F_{opt}	$\pm CI$		$\pm CI$	time [sec]	$\pm CI$
10	8	8	2	500	0	1	4.2	0.7390	9691.0996	352.2847	80.2000	28.4020	71.6139	30.3619	8	2.9599	9409.2002	239.2948	15.3000	15.2353	271.5090	293.701
10	8	8	2	500	0	2	4	0.7543	10437.5996	418.4820	151.9000	42.1835	72.4772	27.0956	10	2.5466	9845.2998	149.4577	13.7000	27.2160	608.5092	394.049
10	8	8	2	500	0	3	4	0.7543	9626.7002	274.3591	71.2000	26.0491	66.9236	29.2112	5.2	2.0739	9463.4004	127.0753	40.3000	21.3656	95.1436	60.0894
10	8	8	2	500	0	4	4.6	0.6034	10229.2998	380.2973	121.3000	40.5968	82.5136	19.8361	11	1.7849	9375.4004	191.5578	1.2000	2.7153	603.6104	372.008
10	8	8	2	1000	0	1	7.4	0.6034	10244.9004	485.9798	89.4000	46.1072	82.8608	20.2845	9.8	2.7153	9925.9004	274.5934	33.6000	17.4628	201.9776	157.063
10	8	8	2	1000	0	2	7.4	0.6034	10703.0000	532.5524	126.4000	49.9258	102.6032	16.5905	14	5.6140	10364.7002	251.6097	39.4000	33.5302	369.0928	275.191
10	8	8	2	1000	0	3	7.6	0.6913	10188.7998	381.2680	69.0000	26.3859	93.9520	26.0707	10	3.7104	10074.0000	284.9598	43.9000	27.5946	236.3056	225.685
10	8	8	2	1000	0	4	7.6	0.6913	10329.2002	467.1634	87.5000	39.6442	93.8944	24.1950	16.4	5.9981	10020.0996	224.5396	19.3000	18.6166	317.1136	166.805
10	8	8	2	1500	0	1	11.6	0.9659	10689.4004	458.1900	71.7000	31.5743	201.1744	108.5305	15	3.8754	10451.0996	259.7030	32.9000	10.4373	335.0944	158.658
10	8	8	2	1500	0	2	11.2	1.0560	11503.0996	371.5197	158.4000	34.3482	261.6128	166.1116	20.8	6.5564	10968.2998	260.1758	36.0000	25.9730	422.0512	191.986
10	8	8	2	1500	0	3	10.2	0.7390	10739.5996	393.2401	69.0000	26.3859	103.7248	16.3098	15	6.4000	10630.0000	304.0349	35.7000	22.2371	229.2864	166.420
10	8	8	2	1500	0	4	11	1.1685	11060.5996	569.4850	112.0000	46.9651	212.6208	132.3076	23.2	9.0372	10574.5000	281.7854	20.0000	15.3653	465.2160	233.636
10	8	8	2	500	20	1	3.2	0.4526	8095.2002	316.4604	77.9000	25.2949	30.7532	7.9999	5.2	1.7133	7892.7002	182.6399	24.7000	15.1867	88.7867	41.0305
10	8	8	2	500	20	2	3.6	0.6913	8774.2002	316.5857	137.1000	31.1561	58.6531	29.6418	9.2	1.8414	8218.5996	178.1285	9.0000	20.3648	189.7517	46.9112
10	8	8	2	500	20	3	3.6	0.6913	8090.8999	365.8417	66.3000	32.2623	57.9002	30.4898	5.8	2.4510	7931.0000	243.8349	28.7000	19.4622	107.4636	65.0647
10	8	8	2	500	20	4	4.2	0.7390	8525.5996	450.5752	104.2000	37.8794	87.6024	38.6390	10	1.6866	7933.5000	204.1768	1.6000	3.6204	199.0564	41.1355
10	8	8	2	1000	20	1	6.2	1.0006	8551.0996	402.6213	74.1000	29.0117	65.8836	20.4280	9.2	3.0508	8315.5000	310.6305	28.6000	16.7512	316.4376	279.924
10	8	8	2	1000	20	2	6	0.7543	8873.5996	454.7487	101.6000	33.9986	82.2488	12.7180	12.6	4.7127	8648.5000	343.4661	20.9000	18.8697	364.6232	233.504
10	8	8	2	1000	20	3	6.2	0.7390	8723.2998	408.6274	85.8000	28.1707	73.7096	13.0873	12.2	4.7320	8531.5000	309.0356	23.1000	18.5535	334.7336	227.899
10	8	8	2	1000	20	4	6.2	1.0006	8854.0996	462.9841	111.6000	39.3156	69.8624	17.9325	14	5.0145	8421.7998	231.3403	18.1000	19.8683	375.3952	230.833
10	8	8	2	1500	20	1	9	0.9541	8986.0000	357.4041	67.5000	34.1290	83.4880	16.2647	12.8	4.3433	8818.4004	224.2951	24.7000	19.1584	173.9824	117.420
10	8	8	2	1500	20	2	9	0.6746	9431.7998	276.1899	95.9000	29.1447	97.1008	18.0597	16.2	5.9275	9225.5996	169.5914	30.5000	15.3174	274.4064	166.625
10	8	8	2	1500	20	3	8.8	1.2531	9170.7002	416.5757	70.2000	31.1220	86.9600	32.8853	14.6	5.9505	8946.7002	281.1981	20.2000	15.4052	222.1440	144.878
10	8	8	2	1500	20	4	9.4	1.3151	9205.5000	355.6561	80.4000	28.2582	90.3136	24.0616	19.4	7.9193	8939.7002	231.9391	18.2000	13.9600	346.9792	206.882
10	8	8	2	500	50	1	3	0.0000	5716.0000	340.4930	61.6000	25.7888	31.7600	8.5612	5.6	0.9659	5372.5000	250.4258	1.3000	2.2890	93.0912	22.1607
10	8	8	2	500	50	2	3	0.0000	6131.1001	300.4619	90.3000	27.2828	37.4880	5.8418	6.2	1.2068	5631.6001	231.0037	6.5000	9.1339	113.8752	28.7136
10	8	8	2	500	50	3	3	0.0000	5796.6001	310.5087	52.7000	31.2137	38.3712	9.9083	5	1.5085	5601.5000	237.0501	11.2000	10.2855	89.3920	36.8969
10	8	8	2	500	50	4	3	0.0000	5744.5000	220.5001	55.9000	20.1046	34.1728	6.0750	5.8	1.0006	5361.1001	226.8389	1.3000	2.9416	97.6256	23.1299
10	8	8	2	1000	50	1	4.2	0.7390	5785.1001	210.7366	37.7000	8.4735	39.2288	15.5181	5.4	2.1119	5741.7998	197.4634	25.7000	10.0915	64.5152	41.5307
10	8	8	2	1000	50	2	4.4	0.6913	6574.5000	512.8026	118.2000	46.8169	62.3456	23.7990	9.6	2.4371	6049.1001	274.5170	8.6000	7.9336	234.1376	212.641
10	8	8	2	1000	50	3	4.4	0.6913	5974.0000	202.0585	50.4000	10.6838	54.3840	20.5187	6.2	2.6302	5917.6001	197.2317	34.8000	19.3765	104.4480	221.159
10	8	8	2	1000	50	4	4.2	0.7390	6196.1001	440.3948	80.3000	27.8564	44.6400	19.2475	9.4	3.9797	5782.2002	175.0030	16.5000	22.0707	300.0128	285.934
10	8	8	2	1500	50	1	6.4	1.1782	6501.7002	246.4348	49.5000	18.5038	61.2736	28.9027	10.8	3.5983	6301.6001	204.7689	12.3000	8.7314	150.1760	77.0728
10	8	8	2	1500	50	2	5.8	0.7390	6789.8999	480.3475	70.5000	44.1031	60.5120	12.6737	9.6	4.3223	6532.6001	237.6586	24.4000	20.1632	279.5328	264.480
10	8	8	2	1500	50	3	5.8	1.0006	6523.7998	309.6095	44.0000	21.7298	58.6816	26.5618	9.8	5.2776	6461.7002	273.0743	22.6000	16.5839	156.4672	130.337
10	8	8	2	1500	50	4	6.2	0.7390	6730.8999	333.3629	78.7000	30.1871	61.7664	12.6941	13.2	4.2906	6470.7998	221.9480	15.8000	19.9978	267.9680	178.205
10	8	8	2	500	80	1	1	0.0000	2824.7000	184.8946	21.4000	7.9049	14.7648	5.1417	2.6	1.1289	2759.1001	138.1745	5.8000	5.6624	32.2112	15.5635
10	8	8	2	500	80	2	1	0.0000	2950.6001	143.4623	31.1000	17.3427	14.7968	2.3157	1.8	0.7390	2914.0000	146.6329	10.8000	8.3091	20.8064	6.7077
10	8	8	2	500	80	3	1	0.0000	2934.0000	180.0171	23.1000	8.7014	17.8688	5.2653	2	1.2162	2915.8999	174.9569	12.4000	8.1529	32.6400	20.4329
10	8	8	2	500	80	4	1	0.0000	2818.6001	166.2811	20.3000	7.1399	18.2784	3.9455	2.2	1.0006	2777.6001	154.3308	8.5000	7.4990	28.7616	12.1860
10	8	8	2	1000	80	1	3	0.0000	3464.1001	235.9962	33.8000	17.3077	28.6656	9.1760	6	1.6866	3275.3000	132.8143	4.8000	6.0416	88.3584	27.6212
10	8	8	2	1000	80	2	2.8	0.4526	3643.7000	283.5785	46.9000	26.8824	31.2704	10.1226	5.6	1.7912	3466.6001	170.0256	1.7000	3.8467	95.9616	28.9553
10	8	8	2	1000	80	3	3	0.0000	3608.3000	271.0545	46.4000	23.4770	35.2576	8.9014	5.2	1.5749	3406.6001	180.4940	7.7000	8.7509	94.2144	27.784
10	8	8	2	1000	80	4	3	0.0000	3547.2000	231.2209	49.6000	21.6910	31.4304	6.9433	6	1.8165	3244.0000	171.1401	1.9000	2.9493	91.3920	26.6680

C [Gb/s]	W	B	E/O cost ratio	IN [Gb/s]	FR Policy [%]	F_{min}	Weighted port count @ F_{min}	$\pm CI$	# of OEOs @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	Weighted port count @ F_{opt}	$\pm CI$	# of OEOs F_{opt}	Solve time [sec]	$\pm CI$
10	8	8	2	1500	80	3	3719.1001	0.0000	17.5000	18.7264	1.9301	5.2	3691.0000	2.5645	9.0000	68.4672	57.9810
10	8	8	2	1500	80	3	4016.0000	0.0000	42.1000	23.9808	5.1132	4.6	3897.5000	2.1119	17.4000	64.8256	52.5543
10	8	8	2	1500	80	3	3939.2000	0.0000	33.6000	24.1664	4.6706	5	3875.3000	1.9081	13.7000	74.1952	47.7280
10	8	8	2	1500	80	3	3818.6001	0.0000	29.8000	23.2896	5.4479	6.2	3747.8999	2.3564	7.4000	94.4576	51.7207

Appendix C

Results of Heuristics Comparison with Signal Regeneration Capability

In this appendix, we present the detailed results with 95% confidence intervals of the heuristics comparison with the consideration of the optical signal regeneration capability and without/with customizing the optical reach. Tables C.1-C.4, C.5-C.8, and C.9-C.12 show the results for the 8-node network, 14-node NSF network, and 11-node EON network respectively.

Table C.1: Comparison of no-bifurcation-based heuristics without the optical-reach customization for the 8-node network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	4	4	1000	2	500	0	1	26.6	1.6247	5909.2002	366.0000	17.1830	0.5110	0.0459	5909.2002	214.6959	366.0000	17.1830	0.5110	0.0459
10	4	4	1000	2	500	0	2	26.6	1.6247	5957.2002	370.7000	18.4169	0.5124	0.0484	5957.2002	219.3763	370.7000	18.4169	0.5124	0.0484
10	4	4	1000	2	500	0	3	26.6	1.6247	6010.7998	371.8000	17.0694	0.5171	0.0491	6010.7998	226.4085	371.8000	17.0694	0.5171	0.0491
10	4	4	1000	2	500	0	4	26.6	1.6247	5982.7998	379.6000	23.4479	0.5266	0.0439	5982.7998	201.1693	379.6000	23.4479	0.5266	0.0439
10	4	4	1000	2	500	0	5	26.8	1.7133	6030.0000	373.0000	17.3740	0.5283	0.0529	6030.0000	225.2728	373.0000	17.3740	0.5283	0.0529
10	4	4	1000	2	500	0	6	26.8	1.7133	5986.7998	377.2000	24.4471	0.5329	0.0507	5986.7998	200.2578	377.2000	24.4471	0.5329	0.0507
10	4	4	2000	2.5	500	0	1	9.4	0.6034	4247.7998	135.5000	19.6866	0.3564	0.0484	4068.5000	123.2196	110.8000	6.1443	0.3526	0.0428
10	4	4	2000	2.5	500	0	2	9.2	0.4526	4302.7998	138.9000	19.4663	0.3547	0.0478	4116.8999	126.0438	114.7000	7.5354	0.5311	0.0517
10	4	4	2000	2.5	500	0	3	9.4	0.6034	4305.6001	136.6000	16.8899	0.3672	0.0508	4105.0000	122.9773	112.9000	6.3773	0.5533	0.0436
10	4	4	2000	2.5	500	0	4	9.6	0.6913	4265.8999	200.4090	20.4991	0.3953	0.0644	4106.2002	127.1651	110.5000	6.0740	0.5640	0.0442
10	4	4	2000	2.5	500	0	5	9.2	0.4526	4360.7002	251.4032	18.1436	0.3515	0.0423	4104.7998	130.2529	112.8000	6.0885	0.5546	0.0451
10	4	4	2000	2.5	500	0	6	9.4	0.6034	4246.7998	133.7000	15.1605	0.3828	0.0507	4089.1001	122.5962	110.4000	7.4224	0.5529	0.0546
10	4	4	3000	2.849	500	0	1	8.0	0.7543	3809.9082	185.1444	19.0574	0.3705	0.0873	3560.2813	115.9427	17.9000	1.9509	0.7968	0.0962
10	4	4	3000	2.849	500	0	2	8.2	0.7390	3886.4507	191.7316	21.8031	0.4358	0.0982	3651.8184	131.7117	18.4000	2.6603	0.7953	0.0731
10	4	4	3000	2.849	500	0	3	8.4	0.6913	3864.1960	188.9725	29.8974	0.4624	0.1220	3644.9487	115.3811	18.4000	2.0013	0.8219	0.1033
10	4	4	3000	2.849	500	0	4	8.0	0.7543	3862.9185	187.4363	19.8998	0.4078	0.0941	3566.7329	124.7498	17.4000	2.0848	0.7875	0.0752
10	4	4	3000	2.849	500	0	5	8.2	0.7390	3888.0508	219.1722	51.6000	0.4312	0.1034	3628.6421	121.4969	18.6000	2.0573	0.7859	0.1057
10	4	4	3000	2.849	500	0	6	8.2	0.7390	3800.7441	155.9151	49.6000	0.4455	0.1060	3587.8391	107.7349	17.8000	2.0739	0.8156	0.0989
10	4	4	4000	3.125	500	0	1	8.0	0.7543	3712.3000	184.9900	17.2000	0.4691	0.0901	3572.4751	110.8722	0.9000	1.3681	0.6750	0.0663
10	4	4	4000	3.125	500	0	2	8.2	0.7390	3784.0000	176.7124	15.3000	0.4970	0.0968	3649.1499	126.5284	0.1000	0.2263	0.7266	0.0560
10	4	4	4000	3.125	500	0	3	8.4	0.6913	3778.8999	171.2292	23.4984	0.5091	0.1263	3675.5249	112.6021	0.2000	1.3514	0.7736	0.1062
10	4	4	4000	3.125	500	0	4	8.0	0.7543	3766.7500	181.5265	21.7000	0.4375	0.1002	3566.8000	113.1627	0.1000	0.2263	0.7346	0.0839
10	4	4	4000	3.125	500	0	5	8.4	0.6913	3771.3000	152.0439	11.9000	0.5725	0.1197	3668.2251	117.4501	0.3000	0.6788	0.7188	0.0633
10	4	4	4000	3.125	500	0	6	8.2	0.7390	3714.3750	173.0439	17.0000	0.4750	0.1129	3580.3000	102.2484	0.4000	0.9051	0.7173	0.0789
10	4	4	5000	3.358	500	0	1	8.4	0.6913	3829.5396	96.6362	6.5000	0.6552	0.3860	3707.1016	123.9263	0.0000	0.0000	0.6814	0.0668
10	4	4	5000	3.358	500	0	2	8.2	0.7390	3922.5469	120.4298	8.1000	0.4250	0.0947	3788.7363	132.5327	0.0000	0.0000	0.7595	0.1062
10	4	4	5000	3.358	500	0	3	8.6	0.6034	3901.6440	110.2056	6.0000	0.4141	0.0612	3808.3523	127.0848	0.1000	0.4526	0.7141	0.1145
10	4	4	5000	3.358	500	0	4	8.4	0.6913	3749.0781	119.2039	4.0000	0.4285	0.4498	3691.9297	127.0848	0.1000	0.2263	0.7065	0.0952
10	4	4	5000	3.358	500	0	5	8.8	0.4526	3897.6433	153.6331	5.1000	0.4537	0.4484	3808.3091	127.0677	0.3000	0.4830	0.6972	0.1060
10	4	4	5000	3.358	500	0	6	8.6	0.6034	3764.5632	129.6862	3.6000	0.4924	0.0804	3710.0161	118.8739	0.0000	0.0000	0.7547	0.0727
10	4	4	6000	3.561	500	0	1	8.4	0.6913	3866.3130	104.7823	3.3000	0.4295	0.0737	3796.1758	127.4639	0.0000	0.0000	0.6767	0.0702
10	4	4	6000	3.561	500	0	2	8.6	0.6034	3930.1406	139.7167	0.5000	0.9082	0.0869	3895.5554	134.8195	0.0000	0.0000	0.6752	0.1291
10	4	4	6000	3.561	500	0	3	8.6	0.6034	3954.9199	140.2055	2.6000	0.4392	0.0811	3911.4407	121.4983	0.0000	0.0000	0.6984	0.1005
10	4	4	6000	3.561	500	0	4	8.4	0.6913	3831.1672	143.1139	2.2000	0.4481	0.0841	3787.8269	134.0903	0.1000	0.2263	0.5956	0.0945
10	4	4	6000	3.561	500	0	5	8.4	0.6913	3950.1836	106.3596	2.8000	0.3833	0.4656	3903.0164	130.0460	0.0000	0.0000	0.6861	0.1116
10	4	4	6000	3.561	500	0	6	8.4	0.6913	3851.3130	119.9738	2.8000	0.4709	0.0820	3803.9363	115.1632	0.1000	0.2263	0.6420	0.1096
10	4	4	7000	3.742	500	0	1	8.4	0.6913	3979.3169	99.9446	2.0000	0.3899	0.3826	3900.8687	129.1690	0.0000	0.0000	0.6584	0.0710
10	4	4	7000	3.742	500	0	2	8.2	0.7390	4076.1133	137.3571	3.5000	0.4186	0.0956	3994.1296	141.8110	0.0000	0.0000	0.6752	0.1116
10	4	4	7000	3.742	500	0	3	8.6	0.6034	4077.5454	124.0684	0.9000	1.5622	0.4092	4019.5684	120.7128	0.0000	0.0000	0.7890	0.1121
10	4	4	7000	3.742	500	0	4	8.4	0.6913	3920.8940	121.5402	2.0000	0.2773	0.4470	3889.0269	129.8449	0.0000	0.0000	0.6814	0.1342
10	4	4	7000	3.742	500	0	5	8.6	0.6034	4086.2329	139.5736	2.4000	0.3631	0.4174	4011.6714	137.7914	0.0000	0.0000	0.7612	0.0815
10	4	4	7000	3.742	500	0	6	8.4	0.6034	3944.2915	139.5736	1.0000	0.2029	0.4718	3904.1140	127.5383	0.0000	0.0000	0.6728	0.1087
10	4	4	8000	3.906	500	0	1	8.4	0.6913	4061.1750	108.5723	1.6000	0.3137	0.3838	3984.6001	131.1523	0.0000	0.0000	0.6608	0.0699
10	4	4	8000	3.906	500	0	2	8.2	0.7390	4170.4814	137.4052	3.6000	0.4168	0.0935	4081.3687	145.2578	0.0000	0.0000	0.6770	0.1128
10	4	4	8000	3.906	500	0	3	8.6	0.6034	4177.1064	125.4789	1.8000	0.3828	0.4112	4107.3374	123.6398	0.0000	0.0000	0.7860	0.1100
10	4	4	8000	3.906	500	0	4	8.4	0.6913	4010.9937	131.5063	1.4000	0.26816	0.4422	3974.5938	133.0222	0.0000	0.0000	0.6798	0.1343
10	4	4	8000	3.906	500	0	5	8.6	0.6034	4172.0625	124.8301	2.0000	0.31822	0.4078	4103.2749	143.2916	0.0000	0.0000	0.7424	0.0836

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	4	4	8000	3.906	500	0	6	8.6	0.6034	4025.4375	137.9830	0.6000	1.1289	0.0805	10.2	3990.2437	130.6834	0.0000	0.0000	0.6728
10	4	4	9000	4.057	500	0	1	8.4	0.6913	4138.9492	111.6470	1.5000	3.1508	0.3859	10.4	4063.3406	133.9608	0.0000	0.0000	0.6642
10	4	4	9000	4.057	500	0	2	8.4	0.6913	4239.2363	144.4476	3.1000	4.2992	0.4532	10.4	4161.9697	148.4672	0.0000	0.0000	0.6907
10	4	4	9000	4.057	500	0	3	8.6	0.6034	4258.0020	126.8448	1.7000	3.8467	0.4092	11.4	4187.9502	126.3311	0.0000	0.0000	0.7858
10	4	4	9000	4.057	500	0	4	8.2	0.7390	4122.2134	250.2815	8.8000	17.1094	0.0873	10.4	4053.1831	135.9421	0.0000	0.0000	0.6795
10	4	4	9000	4.057	500	0	5	8.6	0.6034	4255.3018	127.7249	2.4000	3.9940	0.0773	10.8	4182.3271	146.8926	0.0000	0.0000	0.7454
10	4	4	9000	4.057	500	0	6	8.6	0.6034	4107.3779	138.5648	0.5000	1.1314	0.4736	10.4	4071.3755	133.3660	0.0000	0.0000	0.7061
10	4	4	10000	4.197	500	0	1	8.4	0.6913	4211.6768	115.9212	1.4000	3.1679	0.3797	10.4	4134.3516	136.1533	0.0000	0.0000	0.6591
10	4	4	10000	4.197	500	0	2	8.4	0.6913	4312.8037	146.1902	2.9000	4.2191	0.4564	10.8	4237.8208	152.5681	0.0000	0.0000	0.7421
10	4	4	10000	4.197	500	0	3	8.6	0.6034	4330.0640	131.7884	1.7000	3.8467	0.4315	11.0	4260.8965	133.0726	0.0000	0.0000	0.7514
10	4	4	10000	4.197	500	0	4	8.2	0.7390	4246.8037	256.8947	8.8000	17.1094	0.0878	10.4	4126.0542	138.6511	0.0000	0.0000	0.6844
10	4	4	10000	4.197	500	0	5	8.6	0.6034	4331.8643	131.6172	2.4000	3.9940	0.0796	11.2	4260.8784	143.5654	0.0000	0.0000	0.7828
10	4	4	10000	4.197	500	0	6	8.6	0.6034	4180.7246	141.2167	0.5000	1.1314	0.4736	10.4	4144.4697	135.9130	0.0000	0.0000	0.7064
10	4	4	1000	2	500	80	1	8.0	1.3908	1618.4000	175.6054	94.3000	13.4969	0.1063	8.0	1618.4000	175.6054	94.3000	13.4969	0.1096
10	4	4	1000	2	500	80	2	8.0	1.3908	1663.6000	150.4302	97.7000	14.0827	0.1093	8.0	1663.6000	150.4302	97.7000	14.0827	0.1093
10	4	4	1000	2	500	80	3	8.0	1.3908	1670.0000	160.5391	97.8000	12.5160	0.1078	8.0	1670.0000	160.5391	97.8000	12.5160	0.1078
10	4	4	1000	2	500	80	4	8.0	1.3908	1672.4000	182.2755	93.8000	14.6325	0.1111	8.0	1672.4000	182.2755	93.8000	14.6325	0.1111
10	4	4	1000	2	500	80	5	8.0	1.3908	1683.2000	172.3913	100.0000	15.0699	0.1078	8.0	1683.2000	172.3913	100.0000	15.0699	0.1078
10	4	4	1000	2	500	80	6	8.0	1.3908	1696.0000	193.3335	96.5000	16.0613	0.1093	8.0	1696.0000	193.3335	96.5000	16.0613	0.1093
10	4	4	2000	2.5	500	80	1	3.6	0.6913	1261.1000	168.0156	36.4000	9.6544	0.0875	5.6	1150.1000	124.9122	26.1000	4.2727	0.1453
10	4	4	2000	2.5	500	80	2	3.8	0.7390	1321.1000	179.4221	40.3000	10.7043	0.0905	5.4	1128.3000	131.5481	28.0000	3.9481	0.1483
10	4	4	2000	2.5	500	80	3	3.8	0.7390	1310.9000	182.5475	40.0000	10.4675	0.0967	5.4	1128.3000	131.5481	28.0000	3.9481	0.1483
10	4	4	2000	2.5	500	80	4	3.6	0.6913	1303.5000	163.1813	37.1000	8.7730	0.0937	5.2	1128.3000	122.9977	26.0000	4.2800	0.1502
10	4	4	2000	2.5	500	80	5	3.8	0.7390	1299.1000	161.0382	39.5000	9.8934	0.0939	5.4	1128.3000	122.9977	26.0000	4.2800	0.1502
10	4	4	2000	2.5	500	80	6	3.6	0.6913	1284.4000	174.8786	36.6000	9.6367	0.0890	5.4	1128.3000	122.9977	26.0000	4.2800	0.1502
10	4	4	3000	2.849	500	80	1	3.2	0.4526	1236.1357	151.9062	13.3000	7.2034	0.1065	5.2	1142.8097	104.8850	4.6000	2.2170	0.2079
10	4	4	3000	2.849	500	80	2	3.2	0.4526	1304.6426	168.0048	15.3000	6.1187	0.1077	5.0	1168.5000	127.9263	5.7000	2.2890	0.2095
10	4	4	3000	2.849	500	80	3	3.2	0.4526	1318.5820	158.4990	16.3000	6.2293	0.1093	5.0	1168.5000	127.9263	5.7000	2.2890	0.2095
10	4	4	3000	2.849	500	80	4	3.2	0.4526	1229.9355	162.9713	13.4000	6.1108	0.1064	4.8	1132.8704	104.6502	4.7000	2.5253	0.1954
10	4	4	3000	2.849	500	80	5	3.2	0.4526	1290.8785	150.9536	14.8000	6.0604	0.1124	5.0	1221.8469	122.6913	6.6000	2.0013	0.2139
10	4	4	3000	2.849	500	80	6	3.2	0.4526	1230.0024	176.8434	15.3000	7.4975	0.1110	4.8	1108.7429	105.6982	4.8000	2.1011	0.1938
10	4	4	4000	3.125	500	80	1	3.4	0.6034	1222.7250	139.4927	5.5000	4.6648	0.1145	5.2	1165.7500	111.2026	0.1000	0.2263	0.2109
10	4	4	4000	3.125	500	80	2	3.8	0.7390	1288.6750	141.3209	3.3000	2.9990	0.1516	5.0	1168.5000	116.7434	0.1000	0.2263	0.2204
10	4	4	4000	3.125	500	80	3	3.8	0.7390	1315.2250	126.5800	3.9000	4.0541	0.1562	5.4	1288.0000	114.7817	0.2000	0.3017	0.2422
10	4	4	4000	3.125	500	80	4	3.2	0.4526	1218.5000	160.0528	5.8000	4.8858	0.1077	4.8	1152.0500	113.5403	0.6000	1.3577	0.1953
10	4	4	4000	3.125	500	80	5	3.6	0.6913	1321.1000	130.7563	3.7000	3.0180	0.1423	5.2	1289.7250	119.0781	0.4000	0.3695	0.2342
10	4	4	4000	3.125	500	80	6	3.4	0.6034	1177.3750	160.4792	5.7000	5.1934	0.1187	4.8	1106.0000	112.1620	0.2000	0.3017	0.1890
10	4	4	5000	3.358	500	80	1	3.2	0.4526	1262.2413	135.3515	1.9000	2.3235	0.1048	5.2	1198.4087	111.5291	0.0000	0.0000	0.2142
10	4	4	5000	3.358	500	80	2	3.6	0.6913	1335.1877	134.4360	1.6000	2.2426	0.1389	5.2	1294.0430	118.3883	0.0000	0.0000	0.2252
10	4	4	5000	3.358	500	80	3	3.6	0.6913	1351.6465	122.6720	1.6000	2.8859	0.1407	5.0	1316.3016	116.1258	0.1000	0.2263	0.2172
10	4	4	5000	3.358	500	80	4	3.2	0.4526	1239.4966	150.3267	2.4000	3.3084	0.1081	4.8	1190.0078	116.0864	0.2000	0.4526	0.1938
10	4	4	5000	3.358	500	80	5	3.4	0.6034	1362.2749	126.4844	1.4000	2.4371	0.1266	4.6	1330.9586	118.9099	0.1000	0.2263	0.2017
10	4	4	5000	3.358	500	80	6	3.2	0.4526	1203.0950	146.8498	1.6000	2.2426	0.1109	4.8	1134.5199	115.9759	0.0000	0.0000	0.1954
10	4	4	6000	3.561	500	80	1	3.2	0.4526	1285.1500	131.6406	1.5000	2.6826	0.1156	5.2	1225.9735	117.4605	0.0000	0.0000	0.2090
10	4	4	6000	3.561	500	80	2	3.6	0.6913	1365.7021	133.9247	0.7000	1.1213	0.1378	5.2	1334.8564	123.7574	0.0000	0.0000	0.2296
10	4	4	6000	3.561	500	80	3	3.6	0.6913	1388.8723	120.2807	1.0000	2.0239	0.1372	5.4	1354.3900	115.9966	0.0000	0.0000	0.2440
10	4	4	6000	3.561	500	80	4	3.2	0.4526	1260.1829	145.8597	1.3000	1.6882	0.1098	5.0	1218.4006	119.0262	0.0000	0.0000	0.2098
10	4	4	6000	3.561	500	80	5	3.4	0.6034	1400.3845	133.6053	1.2000	2.4741	0.1316	4.6	1365.5658	122.5662	0.0000	0.0000	0.2042
10	4	4	6000	3.561	500	80	6	3.2	0.4526	1236.2856	155.5149	1.3000	2.1347	0.1094	4.8	1165.9698	119.4110	0.0000	0.0000	0.1938

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	4	4	7000	3.742	500	80	1	3.2	0.4526	1309.8956	135.1962	0.6913	0.1078	0.0209	5.2	1.0560	1253.4346	116.6357	0.0000	0.2124	0.0447
10	4	4	7000	3.742	500	80	2	3.6	0.6913	1388.8956	132.2817	0.0000	0.1422	0.0320	5.0	0.9541	1359.7566	122.8886	0.0000	0.2138	0.0446
10	4	4	7000	3.742	500	80	3	3.6	0.6913	1407.8757	117.8191	0.0000	0.1424	0.0339	5.2	0.8124	1384.8889	118.9617	0.0000	0.2328	0.0378
10	4	4	7000	3.742	500	80	4	3.2	0.4526	1281.2861	140.0225	0.2000	0.3017	0.1108	5.0	1.1685	1245.0442	119.8389	0.0000	0.2062	0.0509
10	4	4	7000	3.742	500	80	5	3.4	0.6034	1421.4791	122.4219	0.0000	0.1264	0.0318	4.6	0.9051	1396.2921	119.3369	0.0000	0.2020	0.0421
10	4	4	7000	3.742	500	80	6	3.2	0.4526	1249.8508	142.4166	0.1000	0.2263	0.1080	4.8	1.0560	1194.7251	123.4791	0.0000	0.1878	0.0431
10	4	4	8000	3.906	500	80	1	3.2	0.4526	1333.9437	135.3510	0.3000	0.1076	0.0174	5.2	1.0560	1279.4750	119.2421	0.0000	0.2125	0.0460
10	4	4	8000	3.906	500	80	2	3.6	0.6913	1417.1438	135.1439	0.0000	0.1423	0.0319	5.0	0.9541	1388.3750	126.1206	0.0000	0.2189	0.0427
10	4	4	8000	3.906	500	80	3	3.6	0.6913	1435.8187	120.5554	0.0000	0.1424	0.0338	5.2	0.8124	1412.6687	121.5939	0.0000	0.2327	0.0379
10	4	4	8000	3.906	500	80	4	3.2	0.4526	1306.1937	142.9954	0.1000	0.2263	0.1031	4.8	1.2531	1272.4250	123.5255	0.0000	0.1953	0.0617
10	4	4	8000	3.906	500	80	5	3.4	0.6034	1447.0563	125.2931	0.0000	0.1282	0.0316	4.6	0.9051	1422.2063	121.7918	0.0000	0.2061	0.0410
10	4	4	8000	3.906	500	80	6	3.2	0.4526	1276.3000	145.6077	0.0000	0.1078	0.0185	4.8	1.0560	1219.5437	125.9728	0.0000	0.1922	0.0435
10	4	4	9000	4.057	500	80	1	3.2	0.4526	1357.8879	137.4033	0.3000	0.1076	0.0185	5.2	1.0560	1303.0247	121.4613	0.0000	0.2126	0.0442
10	4	4	9000	4.057	500	80	2	3.6	0.6913	1443.1541	137.8158	0.0000	0.1422	0.0312	5.0	0.9541	1413.3740	128.3514	0.0000	0.2188	0.0433
10	4	4	9000	4.057	500	80	3	3.6	0.6913	1461.5914	122.6221	0.0000	0.1422	0.0336	5.2	0.8124	1437.9998	123.9826	0.0000	0.2368	0.0368
10	4	4	9000	4.057	500	80	4	3.2	0.4526	1323.7135	139.4565	0.1000	0.2263	0.1109	4.8	1.2531	1295.3333	125.6780	0.0000	0.1969	0.0571
10	4	4	9000	4.057	500	80	5	3.4	0.6034	1471.3685	125.8319	0.0000	0.1282	0.0329	4.4	0.9659	1447.0769	123.4488	0.0000	0.1921	0.0502
10	4	4	9000	4.057	500	80	6	3.2	0.4526	1299.4875	147.9800	0.0000	0.1078	0.0217	4.8	1.0560	1242.3387	128.2645	0.0000	0.1922	0.0442
10	4	4	10000	4.197	500	80	1	3.2	0.4526	1385.8074	138.6127	0.3000	0.1078	0.0201	5.2	1.0560	1324.8608	123.5197	0.0000	0.2093	0.0462
10	4	4	10000	4.197	500	80	2	3.6	0.6913	1466.5297	139.9487	0.0000	0.1392	0.0336	5.0	0.9541	1436.5537	130.4217	0.0000	0.2190	0.0449
10	4	4	10000	4.197	500	80	3	3.6	0.6913	1484.9030	124.9578	0.0000	0.1423	0.0339	5.2	0.8124	1461.4875	126.1976	0.0000	0.2343	0.0380
10	4	4	10000	4.197	500	80	4	3.2	0.4526	1345.3213	141.6189	0.1000	0.2263	0.1094	4.8	1.2531	1316.9453	127.8166	0.0000	0.1969	0.0599
10	4	4	10000	4.197	500	80	5	3.4	0.6034	1495.0242	128.0496	0.0000	0.1250	0.0323	4.4	0.9659	1470.5085	125.6253	0.0000	0.1907	0.0505
10	4	4	10000	4.197	500	80	6	3.2	0.4526	1320.9875	150.1813	0.0000	0.1063	0.0171	4.8	1.0560	1263.4749	130.3904	0.0000	0.1922	0.0468
10	4	4	1000	2	1500	0	1	78.2	4.5356	9305.5996	284.2246	623.2000	1.9123	0.1807	78.2	4.5356	9305.5996	284.2246	623.2000	38.9676	1.9123
10	4	4	1000	2	1500	0	2	78.2	4.5356	9366.7998	314.5629	617.6000	1.9232	0.1853	78.2	4.5356	9366.7998	314.5629	617.6000	28.2904	1.9232
10	4	4	1000	2	1500	0	3	78.2	4.5356	9383.5996	330.2444	616.4000	1.9420	0.1864	78.2	4.5356	9383.5996	330.2444	616.4000	27.5879	1.9420
10	4	4	1000	2	1500	0	4	78.2	4.5356	9338.7998	331.7174	653.1000	1.9813	0.1944	78.2	4.5356	9338.7998	331.7174	653.1000	48.6612	1.9813
10	4	4	1000	2	1500	0	5	78.2	4.5356	9412.7998	320.9104	618.7000	1.9484	0.1837	78.2	4.5356	9412.7998	320.9104	618.7000	27.2389	1.9484
10	4	4	1000	2	1500	0	6	78.2	4.5356	9329.2002	319.8884	647.3000	1.9764	0.1914	78.2	4.5356	9329.2002	319.8884	647.3000	42.7842	1.9764
10	4	4	2000	2.5	1500	0	1	26.6	1.8841	6873.2002	419.4437	252.5000	1.894	0.2832	33.0	2.6128	6403.0000	239.4683	186.5000	2.4326	0.2760
10	4	4	2000	2.5	1500	0	2	26.4	1.6594	6996.2002	402.6219	282.6000	1.857	0.2554	32.2	2.7153	6487.3999	241.2133	188.3000	2.4017	0.2671
10	4	4	2000	2.5	1500	0	3	27.0	1.9081	6829.2998	359.5095	229.9000	1.8408	0.2503	31.8	2.4510	6473.7002	241.4754	189.2000	2.3249	0.2310
10	4	4	2000	2.5	1500	0	4	26.6	1.8841	6794.2998	301.2098	239.7000	1.8402	0.3037	34.2	2.7979	6415.5000	244.2958	185.4000	2.6077	0.3079
10	4	4	2000	2.5	1500	0	5	26.8	1.8414	6918.1001	375.9267	253.1000	1.2361	0.2624	31.4	3.1498	6474.5000	240.7412	189.5000	2.2468	0.3902
10	4	4	2000	2.5	1500	0	6	26.6	1.7592	6831.8999	367.8064	244.9000	1.2859	0.2984	34.0	2.6345	6440.6001	233.9595	185.7000	2.6000	0.2607
10	4	4	3000	2.849	1500	0	1	22.6	1.3151	6407.7734	342.7594	130.1000	0.8889	0.2283	31.0	2.7815	5592.1543	191.4306	30.8000	4.5842	2.0471
10	4	4	3000	2.849	1500	0	2	23.6	1.6594	6131.8799	351.4175	87.6000	1.5748	0.3972	30.6	2.1119	5709.0859	202.2969	32.6000	3.5703	0.3995
10	4	4	3000	2.849	1500	0	3	23.0	1.1685	6236.0850	348.3943	97.3000	1.1296	0.2360	30.4	2.3418	5671.1436	186.0753	32.0000	5.6241	1.4794
10	4	4	3000	2.849	1500	0	4	22.6	1.1289	6069.2803	317.9462	92.2000	1.2126	0.2675	30.8	2.3669	5580.3145	186.2250	30.9000	5.4541	4.2988
10	4	4	3000	2.849	1500	0	5	23.0	1.1685	6168.2012	303.2436	82.8000	1.1485	0.2161	29.2	2.8181	5699.4004	189.7855	33.5000	6.2129	1.3519
10	4	4	3000	2.849	1500	0	6	22.2	1.2068	6187.0791	258.5725	106.8000	1.1376	0.2515	31.0	2.4324	5619.9121	197.2823	30.9000	5.1488	1.6928
10	4	4	4000	3.125	1500	0	1	23.0	1.1685	5880.8501	302.4624	23.6000	1.30387	0.1399	28.2	2.5422	5600.3252	200.6514	0.5000	0.6081	1.4334
10	4	4	4000	3.125	1500	0	2	24.0	1.2162	5975.9502	275.3538	23.0000	1.26211	0.3020	28.8	1.2531	5713.6250	216.1224	0.5000	0.6954	3.8765
10	4	4	4000	3.125	1500	0	3	23.0	1.1685	6072.9502	306.4828	32.2000	1.2781	0.2919	29.2	2.5645	5702.4248	201.7400	0.1000	0.2263	0.5468
10	4	4	4000	3.125	1500	0	4	22.6	1.1289	5955.5498	281.7753	34.6000	1.07528	0.2115	30.0	2.5465	5580.3252	194.1925	1.1000	2.4890	1.8880
10	4	4	4000	3.125	1500	0	5	23.2	1.2531	6035.6499	277.8288	29.8000	1.07454	0.2073	29.0	2.8622	5711.2251	206.9068	0.3000	0.4830	3.7078
10	4	4	4000	3.125	1500	0	6	22.4	1.3577	6058.2749	182.2021	44.7000	1.3656	0.2610	28.8	1.0560	5605.1748	196.5915	0.1000	0.2263	0.8302
10	4	4	5000	3.358	1500	0	1	22.8	1.4231	6251.2104	332.5398	32.6000	0.8984	0.1999	31.6	3.0952	5813.3145	214.1017	0.0000	3.4218	0.6055

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	4	4	5000	3.358	1500	0	2	24.4	1.3577	6064.9453	255.0152	8.5000	5.8546	1.7231	5920.9365	208.6395	0.1000	0.2263	3.8311
10	4	4	5000	3.358	1500	0	3	24.4	1.6594	6241.8481	281.5801	23.0000	13.8913	1.3577	5924.7042	216.1366	0.0000	0.0000	5.1188
10	4	4	5000	3.358	1500	0	4	22.6	1.1289	5995.1152	204.6819	12.4000	5.0054	1.2141	5805.7578	201.3668	0.2000	0.3017	1.9021
10	4	4	5000	3.358	1500	0	5	24.0	1.6866	6334.2832	223.2172	28.0000	13.9200	0.2992	5932.9775	221.6338	0.0000	0.0000	5.0547
10	4	4	5000	3.358	1500	0	6	23.6	1.5160	6012.0732	232.0176	13.4000	9.3430	1.4641	5817.2720	211.1398	0.0000	0.0000	2.8172
10	4	4	6000	3.561	1500	0	1	22.8	1.0560	6305.9902	332.6400	21.0000	19.8155	0.9391	5984.8643	219.7442	0.1000	0.2263	3.7358
10	4	4	6000	3.561	1500	0	2	24.0	1.0119	6271.4858	290.5330	8.7000	8.2490	1.6346	6106.2290	212.7759	0.0000	0.0000	4.4202
10	4	4	6000	3.561	1500	0	3	23.8	1.3826	6345.7476	277.5812	12.7000	9.7415	1.2063	6106.4165	224.3796	0.0000	0.0000	3.7702
10	4	4	6000	3.561	1500	0	4	22.6	1.1289	6139.8418	222.2446	9.2000	6.4778	1.2779	5988.6123	206.2506	0.1000	0.2263	3.4814
10	4	4	6000	3.561	1500	0	5	23.8	1.2068	6507.9258	351.8913	27.2000	16.6408	1.1516	6116.7559	215.9133	0.0000	0.0000	4.4390
10	4	4	6000	3.561	1500	0	6	23.2	1.4231	6191.1553	236.7582	13.0000	11.2482	1.4282	6004.2734	201.8878	0.0000	0.0000	3.1049
10	4	4	7000	3.742	1500	0	1	23.4	1.4780	6384.9800	271.7759	10.3000	12.2089	1.0548	6158.9072	233.2632	0.0000	0.0000	4.1812
10	4	4	7000	3.742	1500	0	2	24.4	1.3577	6363.7158	250.6456	2.7000	3.9489	1.7176	6260.6094	218.1687	0.0000	0.0000	5.3140
10	4	4	7000	3.742	1500	0	3	24.2	1.8102	6523.5825	253.9631	14.9000	13.0747	1.3044	6272.9614	228.1260	0.0000	0.0000	4.9666
10	4	4	7000	3.742	1500	0	4	22.6	1.1289	6280.0518	189.8454	5.8000	4.6837	1.2408	6142.0068	211.6362	0.0000	0.0000	3.2800
10	4	4	7000	3.742	1500	0	5	24.0	1.6866	6563.4502	226.6053	16.7000	14.6296	1.2316	6280.4678	232.7942	0.0000	0.0000	4.0486
10	4	4	7000	3.742	1500	0	6	23.4	1.7592	6374.7119	211.0458	12.3000	10.5974	1.3778	6156.5459	211.5155	0.0000	0.0000	3.0656
10	4	4	8000	3.906	1500	0	1	23.4	1.4780	6514.4248	287.8109	9.2000	12.3375	1.0470	6303.7251	237.2459	0.0000	0.0000	4.1822
10	4	4	8000	3.906	1500	0	2	24.4	1.3577	6510.6123	256.9341	2.6000	3.9797	1.7200	6406.2998	223.4110	0.0000	0.0000	5.3304
10	4	4	8000	3.906	1500	0	3	24.2	1.8102	6676.8750	262.5346	14.9000	13.0747	1.3002	6418.6187	233.4425	0.0000	0.0000	4.8456
10	4	4	8000	3.906	1500	0	4	22.6	1.1289	6425.8062	193.9293	5.8000	4.6837	1.2358	6285.0249	216.3922	0.0000	0.0000	3.2620
10	4	4	8000	3.906	1500	0	5	24.0	1.6866	6708.1563	225.8127	16.4000	14.2639	1.2294	6424.0938	237.0678	0.0000	0.0000	3.9168
10	4	4	8000	3.906	1500	0	6	23.6	1.6594	6517.0874	216.8985	11.5000	10.5015	1.3816	6309.4937	216.5375	0.0000	0.0000	2.6650
10	4	4	9000	4.057	1500	0	1	23.2	1.4231	6611.5107	246.9840	4.8000	5.7224	1.0155	6429.1240	238.6241	0.0000	0.0000	3.3609
10	4	4	9000	4.057	1500	0	2	24.4	1.3577	6641.6313	261.6350	2.7000	4.0765	1.7282	6542.0107	238.4112	0.0000	0.0000	3.9999
10	4	4	9000	4.057	1500	0	3	24.0	1.6866	6803.1104	280.2898	14.1000	13.2304	1.4643	6554.6108	239.0734	0.0000	0.0000	3.9452
10	4	4	9000	4.057	1500	0	4	22.6	1.1289	6651.9251	301.0394	11.6000	15.4104	1.1642	6413.4473	220.0022	0.0000	0.0000	2.7095
10	4	4	9000	4.057	1500	0	5	23.6	1.5160	6871.5962	290.4598	16.3000	14.9679	1.3938	6551.0537	237.2625	0.0000	0.0000	3.9843
10	4	4	9000	4.057	1500	0	6	23.6	1.6594	6645.0913	217.9459	9.8000	10.0957	1.3688	6431.3818	221.5536	0.0000	0.0000	2.7813
10	4	4	10000	4.197	1500	0	1	23.4	1.4780	6785.6436	300.4148	9.0000	12.8356	1.0831	6566.0791	243.6755	0.0000	0.0000	3.2282
10	4	4	10000	4.197	1500	0	2	24.2	1.3826	6779.8701	265.5848	2.6000	3.5730	1.5951	6666.7241	232.0202	0.1000	0.2263	3.8719
10	4	4	10000	4.197	1500	0	3	24.0	1.8165	6946.2930	255.7933	13.4000	12.5949	1.5110	6674.6455	243.1646	0.0000	0.0000	3.3389
10	4	4	10000	4.197	1500	0	4	22.6	1.1289	6677.0483	201.8460	4.9000	4.0681	1.2313	6545.1572	224.9083	0.0000	0.0000	2.6078
10	4	4	10000	4.197	1500	0	5	24.2	1.8102	6893.0791	232.0833	8.4000	9.7774	1.5907	6689.7876	246.4269	0.0000	0.0000	3.8406
10	4	4	10000	4.197	1500	0	6	23.4	1.6247	6769.9624	225.7086	9.6000	9.7366	1.2952	6553.6147	224.0723	0.0000	0.0000	2.9983
10	4	4	1000	2	1500	80	1	23.0	3.3050	2896.3999	296.2126	175.0000	24.5358	0.3501	2896.3999	296.2126	175.0000	24.5358	0.3501
10	4	4	1000	2	1500	80	2	23.0	3.3050	2943.6001	309.6763	177.9000	25.0849	0.3545	2943.6001	309.6763	177.9000	25.0849	0.3545
10	4	4	1000	2	1500	80	3	23.0	3.3050	2946.3999	310.6147	178.0000	24.6791	0.3562	2946.3999	310.6147	178.0000	24.6791	0.3562
10	4	4	1000	2	1500	80	4	23.0	3.3050	2940.8000	299.5535	180.0000	32.8217	0.3641	2940.8000	299.5535	180.0000	32.8217	0.3641
10	4	4	1000	2	1500	80	5	23.0	3.3050	2966.3999	288.6039	184.7000	32.5048	0.3562	2966.3999	288.6039	184.7000	32.5048	0.3562
10	4	4	1000	2	1500	80	6	23.0	3.3050	2947.2000	287.2813	180.4000	32.7630	0.3627	2947.2000	287.2813	180.4000	32.7630	0.3627
10	4	4	2000	2.5	1500	80	1	9.2	1.0560	2250.0000	258.6449	75.5000	19.9706	0.2517	2046.5000	168.5396	54.0000	9.2868	0.4985
10	4	4	2000	2.5	1500	80	2	10.2	1.5384	2265.7000	230.7400	75.1000	18.1568	0.3016	2107.7000	181.2388	55.9000	10.0429	0.5000
10	4	4	2000	2.5	1500	80	3	9.4	1.1289	2350.7000	267.8247	86.3000	20.9841	0.2563	2094.1001	170.9626	56.0000	9.3357	0.4783
10	4	4	2000	2.5	1500	80	4	10.0	1.5458	2220.1001	207.9156	71.6000	16.1565	0.2984	2089.6001	165.7987	56.0000	9.8285	0.4577
10	4	4	2000	2.5	1500	80	5	9.2	1.0560	2352.2000	281.6611	86.1000	24.7768	0.2454	2074.5000	174.4558	55.1000	8.8762	0.5031
10	4	4	2000	2.5	1500	80	6	10.0	1.3908	2238.0000	214.9340	73.4000	16.6968	0.2983	2079.3000	169.0565	54.5000	9.4943	0.4719
10	4	4	3000	2.849	1500	80	1	8.8	0.4526	1988.5508	211.2741	21.0000	11.8801	0.3422	1861.0059	149.9574	8.7000	2.6356	0.6236
10	4	4	3000	2.849	1500	80	2	9.6	1.1782	2042.0117	197.3942	19.2000	6.9686	0.4374	1933.9824	145.7963	8.5000	2.5744	0.7064

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	Weighted port count @F _{min}		# of OEOs @F _{min}	Solve time [sec]	F _{opt}		Weighted port count @F _{opt}	# of OEOs @F _{opt}	Solve time [sec]					
									±CI	±CI			±CI	±CI								
10	4	4	3000	2.849	1500	80	3	8.8	0.4526	2094.8489	211.0311	12.5508	0.3436	0.0820	12.2	2.1546	1953.6008	9.7000	2.7414	0.6264	0.1071	
10	4	4	3000	2.849	1500	80	4	9.2	1.0560	2005.7119	207.4693	9.2253	0.3766	0.0851	11.8	2.3564	1871.9186	10.7000	3.2363	0.5859	0.1271	
10	4	4	3000	2.849	1500	80	5	8.8	0.4526	2068.3455	214.0507	11.8732	0.3532	0.0700	12.4	2.0295	1924.7459	9.5000	2.4148	0.6266	0.0985	
10	4	4	3000	2.849	1500	80	6	9.0	1.1685	2081.8647	184.8039	11.6614	0.3530	0.0976	13.6	2.2426	1870.2883	10.3000	3.3740	0.6811	0.1232	
10	4	4	4000	3.125	1500	80	1	9.0	0.6746	1974.5000	178.3501	3.7833	0.3781	0.0686	13.4	2.6816	1893.1000	137.3745	0.6034	0.6561	0.1397	
10	4	4	4000	3.125	1500	80	2	9.0	0.6746	2097.4751	210.3113	8.5347	0.3874	0.0787	12.6	2.5061	1973.9000	152.4110	0.9207	0.6407	0.1510	
10	4	4	4000	3.125	1500	80	3	9.2	0.8124	2038.1500	171.2325	3.2955	0.4015	0.0862	13.2	2.7362	2001.9750	157.0455	0.4000	0.6825	0.1629	
10	4	4	4000	3.125	1500	80	4	9.0	0.6746	1979.0000	186.7592	4.4238	0.3577	0.0700	12.8	2.5645	1885.3750	148.6247	0.6000	0.6343	0.1340	
10	4	4	4000	3.125	1500	80	5	9.0	0.6746	2078.8999	188.2505	6.1000	0.3688	0.0874	11.4	1.7592	1996.3750	158.4502	0.5003	0.5938	0.1172	
10	4	4	4000	3.125	1500	80	6	8.8	1.0560	2066.6750	198.7420	10.0471	0.3298	0.0911	13.0	2.3370	1865.3750	144.8286	0.4000	0.6455	0.1188	
10	4	4	5000	3.358	1500	80	1	9.0	0.6746	2006.2908	160.8796	0.7000	0.3859	0.0609	13.4	2.5953	1949.8746	146.1154	0.0000	0.6656	0.1450	
10	4	4	5000	3.358	1500	80	2	9.0	0.6746	2126.0159	205.5117	5.5000	0.4075	0.0685	12.8	2.4741	2035.3933	161.9900	0.0000	0.6703	0.1466	
10	4	4	5000	3.358	1500	80	3	9.2	0.8124	2092.0686	168.7052	1.2000	0.4076	0.0804	12.8	2.4741	2059.3813	160.9426	0.0000	0.6767	0.1351	
10	4	4	5000	3.358	1500	80	4	9.0	0.6746	1996.8635	177.6884	2.5000	0.3655	0.0660	12.4	2.7027	1941.1885	157.8817	0.0000	0.6124	0.1424	
10	4	4	5000	3.358	1500	80	5	9.0	0.6746	2112.1555	190.7572	2.1000	0.4890	0.0858	11.8	1.9318	2052.5100	168.0403	0.0000	0.6247	0.1203	
10	4	4	5000	3.358	1500	80	6	9.0	0.6746	2031.0374	203.4006	5.1000	0.3640	0.0652	12.6	2.5061	1928.1160	152.1800	0.0000	0.6125	0.1371	
10	4	4	6000	3.561	1500	80	1	9.0	0.6746	2055.5630	156.9467	0.1000	0.2263	0.0679	12.8	2.4741	2009.1051	153.5170	0.0000	0.6380	0.1301	
10	4	4	6000	3.561	1500	80	2	9.0	0.6746	2168.1860	205.5591	4.0000	0.4076	0.0684	12.8	2.8181	2092.5366	171.6199	0.0000	0.6738	0.1555	
10	4	4	6000	3.561	1500	80	3	9.2	0.8124	2154.9214	172.4470	0.1000	0.2263	0.0748	12.0	2.2628	2123.8853	167.8732	0.0000	0.6372	0.1088	
10	4	4	6000	3.561	1500	80	4	9.0	0.6746	2036.3903	174.7154	0.8000	0.3710	0.0638	11.4	2.2170	1993.5886	158.6998	0.1000	0.2263	0.1036	
10	4	4	6000	3.561	1500	80	5	9.0	0.6746	2158.2822	187.2778	0.7000	0.3864	0.0871	10.8	1.0560	2121.5728	179.4885	0.0000	0.5646	0.0663	
10	4	4	6000	3.561	1500	80	6	9.0	0.6746	2075.9058	203.6896	3.7000	0.3646	0.0651	11.6	1.7912	1983.4713	156.2838	0.0000	0.5372	0.0980	
10	4	4	7000	3.742	1500	80	1	9.0	0.6746	2105.9775	162.8272	0.0000	0.3898	0.0639	12.8	2.4741	2056.0486	157.5701	0.0000	0.6380	0.1290	
10	4	4	7000	3.742	1500	80	2	9.0	0.6746	2214.8191	205.3261	3.1000	0.7045	0.0695	12.2	2.2577	2152.1646	179.1502	0.0000	0.6390	0.1387	
10	4	4	7000	3.742	1500	80	3	9.0	0.6746	2206.4028	181.7097	0.0000	0.4046	0.0661	11.6	2.3418	2170.2576	171.4901	0.0000	0.5864	0.1386	
10	4	4	7000	3.742	1500	80	4	9.0	0.6746	2083.8906	179.7589	0.3000	0.6788	0.3712	0.0604	11.8	2.5422	2039.4553	162.9357	0.0000	0.5812	0.1270
10	4	4	7000	3.742	1500	80	5	8.8	0.4526	2214.4963	192.7817	0.5000	0.1314	0.0784	11.0	1.1685	2169.2095	181.9503	0.0000	0.5828	0.0775	
10	4	4	7000	3.742	1500	80	6	9.0	0.6746	2120.4966	209.1272	3.6000	0.3656	0.0631	12.6	2.3174	2034.1682	163.9519	0.0000	0.6072	0.1332	
10	4	4	8000	3.906	1500	80	1	9.0	0.6746	2151.5938	167.2406	0.0000	0.3844	0.0652	12.8	2.4741	2099.6375	161.4135	0.0000	0.6422	0.1302	
10	4	4	8000	3.906	1500	80	2	9.0	0.6746	2259.6375	209.2803	3.1000	0.7045	0.0684	12.2	2.2577	2194.6626	182.4039	0.0000	0.6390	0.1403	
10	4	4	8000	3.906	1500	80	3	9.0	0.6746	2251.1313	185.4824	0.0000	0.4047	0.0678	11.6	2.3418	2215.6875	175.4098	0.0000	0.5920	0.1416	
10	4	4	8000	3.906	1500	80	4	9.0	0.6746	2129.0437	183.0546	0.3000	0.6788	0.3702	0.0632	11.8	2.5422	2082.9126	166.7650	0.0000	0.5891	0.1276
10	4	4	8000	3.906	1500	80	5	8.8	0.4526	2257.1563	196.4062	0.5000	0.1314	0.0733	11.0	1.1685	2213.7063	185.2346	0.0000	0.5861	0.0770	
10	4	4	8000	3.906	1500	80	6	9.0	0.6746	2162.5938	211.7750	3.3000	0.3672	0.0655	12.6	2.3174	2077.7625	167.9473	0.0000	0.6062	0.1313	
10	4	4	9000	4.057	1500	80	1	9.0	0.6746	2192.0208	170.8410	0.0000	0.3876	0.0634	12.8	2.4741	2139.6724	164.9441	0.0000	0.6360	0.1333	
10	4	4	9000	4.057	1500	80	2	9.0	0.6746	2304.4875	215.2140	3.1000	0.7045	0.0657	12.2	2.2577	2236.2671	186.0768	0.0000	0.6376	0.1418	
10	4	4	9000	4.057	1500	80	3	9.0	0.6746	2294.1472	190.3189	0.0000	0.4079	0.0686	11.6	2.3418	2257.4128	179.0118	0.0000	0.5909	0.1385	
10	4	4	9000	4.057	1500	80	4	9.0	0.6746	2169.7063	186.9151	0.1000	0.2263	0.3688	0.0611	11.8	2.5422	2124.0266	171.3138	0.0000	0.5843	0.1250
10	4	4	9000	4.057	1500	80	5	8.8	0.4526	2299.0930	200.1131	0.5000	0.1314	0.0736	11.0	1.1685	2252.0015	187.8066	0.0000	0.5814	0.0796	
10	4	4	9000	4.057	1500	80	6	9.0	0.6746	2206.8384	219.9970	3.4000	0.3640	0.0659	12.6	2.3174	2116.6350	170.9741	0.0000	0.6063	0.1331	
10	4	4	10000	4.197	1500	80	1	9.0	0.6746	2229.5059	174.1816	0.0000	0.3875	0.0639	12.8	2.4741	2176.7932	168.2182	0.0000	0.6390	0.1314	
10	4	4	10000	4.197	1500	80	2	9.2	0.8124	2314.1834	200.2331	0.0000	0.4359	0.0700	12.2	2.2577	2274.8440	189.4837	0.0000	0.6358	0.1385	
10	4	4	10000	4.197	1500	80	3	9.0	0.6746	2332.9202	193.7137	0.0000	0.4048	0.0681	11.6	2.3418	2296.9019	182.5067	0.0000	0.5889	0.1357	
10	4	4	10000	4.197	1500	80	4	9.0	0.6746	2206.9116	190.2160	0.1000	0.2263	0.3688	0.0632	11.8	2.5422	2161.0354	174.5773	0.0000	0.5846	0.1229
10	4	4	10000	4.197	1500	80	5	8.8	0.4526	2337.9778	203.5513	0.5000	0.1314	0.0771	11.0	1.1685	2290.6626	191.2116	0.0000	0.5812	0.0756	
10	4	4	10000	4.197	1500	80	6	9.0	0.6746	2244.6948	223.9139	3.5000	0.3625	0.0661	12.6	2.3174	2153.4199	174.1920	0.0000	0.6017	0.1307	
10	8	8	1000	2	500	0	1	7.2	0.4526	8164.3999	407.8532	31.6660	0.5267	0.0384	7.2	0.4526	8164.3999	407.8532	539.0000	0.5267	0.0384	
10	8	8	1000	2	500	0	2	7.2	0.4526	8184.0000	395.5											

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	1000	2	500	0	4	7.2	0.4526	8226.7998	388.2153	30.1196	0.5437	7.2	0.4526	8226.7998	388.2153	30.1196	0.5437
10	8	8	1000	2	500	0	5	7.2	0.4526	8250.0000	403.8494	30.6174	0.5359	7.2	0.4526	8250.0000	403.8494	30.6174	0.5359
10	8	8	1000	2	500	0	6	7.2	0.4526	8215.2002	399.8573	31.2559	0.5425	7.2	0.4526	8215.2002	399.8573	31.2559	0.5425
10	8	8	2000	2.5	500	0	1	3.0	0.0000	5570.7002	282.3787	161.6000	0.6219	3.2	0.4526	5566.7998	283.0556	161.0000	0.6225
10	8	8	2000	2.5	500	0	2	3.0	0.0000	5619.0000	295.8691	165.0000	0.6328	3.2	0.4526	5611.2998	294.6028	164.3000	0.6376
10	8	8	2000	2.5	500	0	3	3.0	0.0000	5608.5000	295.9472	164.2000	0.6407	3.2	0.4526	5606.7002	294.7671	164.0000	0.6828
10	8	8	2000	2.5	500	0	4	3.0	0.0000	5601.7998	282.9396	162.4000	0.6483	3.2	0.4526	5598.2002	284.0377	161.0000	0.6873
10	8	8	2000	2.5	500	0	5	3.0	0.0000	5584.1001	296.2823	163.4000	0.6406	3.0	0.0000	5584.1001	296.2823	163.4000	0.6406
10	8	8	2000	2.5	500	0	6	3.0	0.0000	5584.2002	291.9980	162.0000	0.6516	3.2	0.4526	5581.7998	292.4652	160.5000	0.6875
10	8	8	3000	2.849	500	0	1	3.0	0.0000	4878.7456	232.6607	26.3000	0.9751	3.2	0.4526	4869.7695	228.2884	24.7000	1.0486
10	8	8	3000	2.849	500	0	2	3.0	0.0000	4928.4888	237.2675	25.0000	1.0220	3.0	0.0000	4928.4888	237.2675	25.0000	1.0326
10	8	8	3000	2.849	500	0	3	3.0	0.0000	4907.0581	244.4204	25.3000	1.0392	3.0	0.0000	4907.0581	244.4204	25.3000	1.0392
10	8	8	3000	2.849	500	0	4	3.0	0.0000	4865.5576	230.2849	25.8000	1.0017	3.4	0.6034	4853.1118	229.6790	24.3000	1.1188
10	8	8	3000	2.849	500	0	5	3.0	0.0000	4915.1396	248.0545	25.6000	1.0312	3.0	0.0000	4915.1396	248.0545	25.6000	1.0312
10	8	8	3000	2.849	500	0	6	3.0	0.0000	4874.7393	221.3662	24.6000	1.0156	3.0	0.0000	4874.7393	221.3662	24.6000	1.0156
10	8	8	4000	3.125	500	0	1	3.0	0.0000	4880.9248	225.1599	0.4000	0.9951	3.2	0.4526	4875.6250	232.3340	0.0000	1.0659
10	8	8	4000	3.125	500	0	2	3.0	0.0000	4984.9248	227.9534	0.1000	0.2263	3.0	0.0000	4984.9248	227.9534	0.1000	0.2263
10	8	8	4000	3.125	500	0	3	3.0	0.0000	4978.6748	250.8717	0.1000	0.2263	3.2	0.4526	4978.6748	250.8717	0.1000	0.2263
10	8	8	4000	3.125	500	0	4	3.0	0.0000	4864.1499	237.8695	0.1000	0.2263	3.2	0.4526	4861.7500	236.5237	0.1000	0.2263
10	8	8	4000	3.125	500	0	5	3.0	0.0000	4964.2002	250.5839	0.4000	0.3695	3.0	0.0000	4964.2002	250.5839	0.4000	0.3695
10	8	8	4000	3.125	500	0	6	3.0	0.0000	4884.6250	223.8147	0.1000	0.2263	3.0	0.0000	4884.6250	223.8147	0.1000	0.2263
10	8	8	5000	3.358	500	0	1	3.0	0.0000	5068.5322	231.4110	0.0000	0.9952	3.2	0.4526	5059.6323	235.1103	0.0000	1.0688
10	8	8	5000	3.358	500	0	2	3.0	0.0000	5140.5674	233.7802	0.0000	0.0390	3.0	0.0000	5140.5674	233.7802	0.0000	0.0390
10	8	8	5000	3.358	500	0	3	3.0	0.0000	5167.7402	252.0550	0.0000	1.0515	3.2	0.4526	5160.0684	254.4864	0.0000	1.1219
10	8	8	5000	3.358	500	0	4	3.0	0.0000	5060.9326	246.7026	0.0000	1.0172	3.2	0.4526	5059.7324	246.0613	0.0000	1.0782
10	8	8	5000	3.358	500	0	5	3.0	0.0000	5161.2256	243.2348	0.0000	1.0516	3.2	0.4526	5154.5537	245.5810	0.0000	1.1293
10	8	8	5000	3.358	500	0	6	3.0	0.0000	5058.3467	251.8537	0.0000	1.0344	3.0	0.0000	5058.3467	251.8537	0.0000	1.0344
10	8	8	6000	3.561	500	0	1	3.0	0.0000	5223.1621	244.4767	0.0000	1.0028	3.0	0.0000	5223.1621	244.4767	0.0000	1.0028
10	8	8	6000	3.561	500	0	2	3.0	0.0000	5300.5298	243.4752	0.0000	1.0570	3.0	0.0000	5300.5298	243.4752	0.0000	1.0570
10	8	8	6000	3.561	500	0	3	3.0	0.0000	5314.1274	258.1000	0.0000	1.0514	3.2	0.4526	5312.6152	258.6152	0.0000	1.1202
10	8	8	6000	3.561	500	0	4	3.0	0.0000	5218.1626	251.5061	0.0000	1.0116	3.4	0.6034	5213.8623	252.5330	0.0000	1.1332
10	8	8	6000	3.561	500	0	5	3.0	0.0000	5332.0908	255.9296	0.0000	1.0540	3.2	0.4526	5328.7910	254.4488	0.0000	1.1699
10	8	8	6000	3.561	500	0	6	3.0	0.0000	5213.2988	255.1218	0.0000	1.0378	3.0	0.0000	5213.2988	255.1218	0.0000	1.0378
10	8	8	7000	3.742	500	0	1	3.0	0.0000	5349.8706	251.8320	0.0000	1.0110	3.0	0.0000	5349.8706	251.8320	0.0000	1.0110
10	8	8	7000	3.742	500	0	2	3.0	0.0000	5435.0308	246.0604	0.0000	1.0636	3.0	0.0000	5435.0308	246.0604	0.0000	1.0636
10	8	8	7000	3.742	500	0	3	3.0	0.0000	5462.8179	262.0947	0.0000	1.0582	3.2	0.4526	5457.7695	263.9572	0.0000	1.1286
10	8	8	7000	3.742	500	0	4	3.0	0.0000	5357.2705	256.9253	0.0000	1.0214	3.0	0.0000	5357.2705	256.9253	0.0000	1.0214
10	8	8	7000	3.742	500	0	5	3.0	0.0000	5458.9731	270.4988	0.0000	1.0622	3.2	0.4526	5458.8247	270.5689	0.0000	1.1360
10	8	8	7000	3.742	500	0	6	3.0	0.0000	5343.3154	268.1214	0.0000	1.0404	3.0	0.0000	5343.3154	268.1214	0.0000	1.0404
10	8	8	8000	3.906	500	0	1	3.0	0.0000	5475.0811	258.0081	0.0000	1.0080	3.0	0.0000	5475.0811	258.0081	0.0000	1.0080
10	8	8	8000	3.906	500	0	2	3.0	0.0000	5562.4502	252.5097	0.0000	1.0674	3.0	0.0000	5562.4502	252.5097	0.0000	1.0674
10	8	8	8000	3.906	500	0	3	3.0	0.0000	5592.2998	269.5282	0.0000	1.0628	3.2	0.4526	5587.2188	271.4296	0.0000	1.1316
10	8	8	8000	3.906	500	0	4	3.0	0.0000	5482.4814	263.1750	0.0000	1.0216	3.0	0.0000	5482.4814	263.1750	0.0000	1.0216
10	8	8	8000	3.906	500	0	5	3.0	0.0000	5585.5562	276.3837	0.0000	1.0672	3.2	0.4526	5585.3750	276.4691	0.0000	1.1404
10	8	8	8000	3.906	500	0	6	3.0	0.0000	5467.6250	273.5544	0.0000	1.0426	3.0	0.0000	5467.6250	273.5544	0.0000	1.0426
10	8	8	9000	4.057	500	0	1	3.0	0.0000	5590.0825	263.6823	0.0000	1.0204	3.0	0.0000	5590.0825	263.6823	0.0000	1.0204
10	8	8	9000	4.057	500	0	2	3.0	0.0000	5679.1118	258.1750	0.0000	1.0732	3.0	0.0000	5679.1118	258.1750	0.0000	1.0732
10	8	8	9000	4.057	500	0	3	3.0	0.0000	5709.2041	275.1740	0.0000	1.0639	3.4	0.6034	5704.0806	277.0930	0.0000	1.0639
10	8	8	9000	4.057	500	0	4	3.0	0.0000	5597.4824	268.9166	0.0000	1.0219	3.0	0.0000	5597.4824	268.9166	0.0000	1.0219

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	Weighted port count			# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count			# of OEOs @F _{opt}	±CI	Solve time [sec]	
									±CI	@F _{min}	±CI						±CI	@F _{opt}	±CI				
10	8	8	9000	4.057	500	0	5	3.0	0.0000	5702.3687	282.0888	0.0000	1.0706	0.0525	3.2	0.4526	5702.1572	282.1885	0.0000	0.0000	1.1440	0.1239	
10	8	8	9000	4.057	500	0	6	3.0	0.0000	5582.7173	279.1028	0.0000	1.0500	0.0316	3.0	0.0000	5582.7173	279.1028	0.0000	0.0000	1.0500	0.0316	
10	8	8	10000	4.197	500	0	1	3.0	0.0000	5696.7158	268.9454	0.0000	1.0126	0.0479	3.0	0.0000	5696.7158	268.9454	0.0000	0.0000	1.0126	0.0479	
10	8	8	10000	4.197	500	0	2	3.0	0.0000	5783.2842	261.4382	0.0000	1.0623	0.0356	3.0	0.0000	5783.2842	261.4382	0.0000	0.0000	1.0623	0.0356	
10	8	8	10000	4.197	500	0	3	3.0	0.0000	5807.0000	271.1551	0.0000	1.0686	0.0384	3.4	0.6034	5804.7212	278.0822	0.0000	0.0000	1.2060	0.1839	
10	8	8	10000	4.197	500	0	4	3.0	0.0000	5704.1157	274.2418	0.0000	1.0234	0.0297	3.0	0.0000	5704.1157	274.2418	0.0000	0.0000	1.0234	0.0297	
10	8	8	10000	4.197	500	0	5	3.0	0.0000	5810.6821	287.3797	0.0000	1.0686	0.0538	3.2	0.4526	5810.4424	287.4925	0.0000	0.0000	1.1421	0.1250	
10	8	8	10000	4.197	500	0	6	3.0	0.0000	5689.4341	284.2483	0.0000	1.0453	0.0301	3.0	0.0000	5689.4341	284.2483	0.0000	0.0000	1.0453	0.0301	
10	8	8	1000	2	500	80	1	2.8	0.4526	1924.8000	251.3615	120.9000	1.1359	0.0229	2.8	0.4526	1924.8000	251.3615	120.9000	20.5966	0.1359	0.0229	
10	8	8	1000	2	500	80	2	2.8	0.4526	1969.6000	235.3815	124.5000	1.1405	0.0203	2.8	0.4526	1969.6000	235.3815	124.5000	19.2127	0.1405	0.0203	
10	8	8	1000	2	500	80	3	2.8	0.4526	1974.8000	227.5394	123.5000	1.1405	0.0241	2.8	0.4526	1974.8000	227.5394	123.5000	18.3897	0.1405	0.0241	
10	8	8	1000	2	500	80	4	2.8	0.4526	1977.2000	250.0809	118.8000	1.1407	0.0242	2.8	0.4526	1977.2000	250.0809	118.8000	19.6997	0.1407	0.0242	
10	8	8	1000	2	500	80	5	2.8	0.4526	1988.8000	252.1750	125.0000	1.1404	0.0243	2.8	0.4526	1988.8000	252.1750	125.0000	20.4735	0.1404	0.0243	
10	8	8	1000	2	500	80	6	2.8	0.4526	1995.2000	259.3462	121.1000	1.1438	0.0208	2.8	0.4526	1995.2000	259.3462	121.1000	20.8219	0.1438	0.0208	
10	8	8	2000	2.5	500	80	1	1.0	0.0000	1437.2000	171.8033	38.1000	0.87405	0.0075	2.2	0.7390	1378.4000	132.9861	32.0000	4.7822	0.2297	0.0650	
10	8	8	2000	2.5	500	80	2	1.4	0.6034	1497.5000	171.4036	40.2000	0.91746	0.0654	2.4	0.6913	1456.1000	151.7455	34.5000	4.3230	0.2671	0.0714	
10	8	8	2000	2.5	500	80	3	1.2	0.4526	1509.9000	202.1309	42.4000	12.5723	0.1361	2.0	0.7543	1428.2000	133.9144	33.7000	4.3987	0.2170	0.0772	
10	8	8	2000	2.5	500	80	4	1.0	0.0000	1447.3000	155.6843	36.9000	8.7210	0.1266	0.0098	2.2	0.7390	1413.4000	138.3176	31.8000	4.5481	0.0765	
10	8	8	2000	2.5	500	80	5	1.4	0.6034	1479.7000	195.9872	39.3000	9.8980	0.1563	0.0596	2.2	0.7390	1422.8000	138.0602	33.7000	4.4629	0.0748	
10	8	8	2000	2.5	500	80	6	1.0	0.0000	1453.6000	176.9759	38.0000	9.3661	0.1205	0.0129	2.4	0.6913	1398.8000	145.4486	30.5000	4.4526	0.2657	0.0700
10	8	8	3000	2.849	500	80	1	1.0	0.0000	1369.1267	142.6186	8.6000	4.1750	0.1890	0.0220	1.8	0.7390	1339.9353	121.1859	5.6000	3.0768	0.3078	0.1012
10	8	8	3000	2.849	500	80	2	1.0	0.0000	1472.9132	162.1301	13.5000	7.1016	0.2001	0.0218	2.0	0.7543	1403.6121	120.5284	6.5000	2.8070	0.3562	0.1142
10	8	8	3000	2.849	500	80	3	1.0	0.0000	1465.1979	161.0022	12.2000	6.1350	0.1985	0.0274	1.8	0.7390	1420.8817	124.6789	7.2000	2.3804	0.3233	0.1198
10	8	8	3000	2.849	500	80	4	1.0	0.0000	1357.4359	146.4095	9.3000	5.3125	0.1938	0.0206	1.8	0.7390	1324.2170	123.4334	5.6000	2.9056	0.3094	0.1114
10	8	8	3000	2.849	500	80	5	1.0	0.0000	1444.3218	159.7909	11.8000	6.1257	0.1936	0.0249	2.2	0.7390	1400.6754	128.1150	6.9000	2.5567	0.3781	0.1105
10	8	8	3000	2.849	500	80	6	1.0	0.0000	1352.0845	165.5921	10.4000	5.4411	0.1845	0.0217	2.0	0.7543	1307.8896	131.2150	5.5000	2.5964	0.3389	0.1132
10	8	8	4000	3.125	500	80	1	1.0	0.0000	1399.6750	154.4800	1.6000	2.1119	0.1893	0.0213	2.0	0.7543	1373.7500	135.0758	0.1000	0.2263	0.3360	0.1103
10	8	8	4000	3.125	500	80	2	1.0	0.0000	1484.0500	163.1808	3.1000	3.0255	0.2001	0.0217	2.0	0.7543	1441.5500	140.8376	0.2000	0.3017	0.3721	0.1234
10	8	8	4000	3.125	500	80	3	1.0	0.0000	1503.6000	163.0892	2.7000	3.2186	0.2048	0.0201	1.8	0.7390	1468.5750	137.4506	0.1000	0.2263	0.3470	0.1294
10	8	8	4000	3.125	500	80	4	1.0	0.0000	1377.8000	144.6344	1.5000	2.3186	0.1984	0.0218	1.6	0.6913	1356.9000	137.9835	0.0000	0.0000	0.2953	0.1028
10	8	8	4000	3.125	500	80	5	1.0	0.0000	1500.5500	160.7228	3.2000	3.2494	0.2032	0.0231	1.8	0.7390	1464.7000	136.2519	0.5000	0.5060	0.3501	0.1249
10	8	8	4000	3.125	500	80	6	1.0	0.0000	1345.3500	155.7396	2.0000	2.2878	0.1810	0.0212	2.0	0.7543	1321.7000	142.1571	0.1000	0.2263	0.3374	0.1152
10	8	8	5000	3.358	500	80	1	1.0	0.0000	1430.5787	142.3571	0.5000	1.1314	0.1972	0.0167	2.2	0.7390	1410.3347	136.0685	0.0000	0.0000	0.3716	0.1013
10	8	8	5000	3.358	500	80	2	1.0	0.0000	1520.0287	159.2431	1.8000	2.8977	0.2086	0.0217	2.0	0.7543	1490.4977	146.8664	0.0000	0.0000	0.3736	0.1149
10	8	8	5000	3.358	500	80	3	1.0	0.0000	1589.3472	168.0492	0.9000	1.7992	0.2158	0.0227	2.0	0.7543	1561.5137	151.1260	0.0000	0.0000	0.3972	0.1139
10	8	8	5000	3.358	500	80	4	1.0	0.0000	1410.7780	140.2314	0.5000	1.1314	0.2036	0.0244	1.8	0.7390	1397.8772	137.1003	0.0000	0.0000	0.3302	0.1137
10	8	8	5000	3.358	500	80	5	1.0	0.0000	1526.2849	151.4423	0.1000	0.2263	0.2074	0.0206	2.0	0.7543	1510.5417	147.7339	0.0000	0.0000	0.3896	0.1276
10	8	8	5000	3.358	500	80	6	1.0	0.0000	1373.0039	152.6513	0.0000	0.0000	0.1860	0.0223	2.0	0.7543	1360.3745	147.7161	0.0000	0.0000	0.3410	0.1171
10	8	8	6000	3.561	500	80	1	1.0	0.0000	1471.1697	147.5738	0.0000	0.1906	0.0199	2.2	0.7390	1454.2090	141.9571	0.0000	0.0000	0.3764	0.1043	
10	8	8	6000	3.561	500	80	2	1.0	0.0000	1557.2499	154.9883	1.2000	1.8102	0.2064	0.0194	2.0	0.7543	1531.6799	147.7400	0.0000	0.0000	0.3748	0.1139
10	8	8	6000	3.561	500	80	3	1.0	0.0000	1589.3472	168.0492	0.9000	1.7992	0.2158	0.0227	2.0	0.7543	1561.5137	151.1260	0.0000	0.0000	0.3972	0.1139
10	8	8	6000	3.561	500	80	4	1.0	0.0000	1446.2848	144.0384	0.0000	0.0000	0.2062	0.0213	1.8	0.7390	1435.5483	144.2575	0.0000	0.0000	0.3278	0.1146
10	8	8	6000	3.561	500	80	5	1.0	0.0000	1573.6257	154.5298	0.1000	0.2263	0.2172	0.0234	2.2	0.7390	1558.6892	151.8216	0.0000	0.0000	0.4232	0.1152
10	8	8	6000	3.561	500	80	6																

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	7000	3.742	500	80	6	1.0	0.0000	1451.2102	162.7633	0.0000	0.0000	0.1906	0.0237	1.8	0.7390	1433.5748	154.9291	0.0000	0.0000	0.3144	0.1075
10	8	8	8000	3.906	500	80	1	1.0	0.0000	1534.6125	153.9684	0.0000	0.0000	0.1974	0.0180	2.2	0.7390	1518.2875	150.2361	0.0000	0.0000	0.3752	0.1108
10	8	8	8000	3.906	500	80	2	1.0	0.0000	1623.4750	164.2459	0.6000	1.3577	0.2112	0.0232	1.8	0.7390	1603.4250	155.0713	0.0000	0.0000	0.3488	0.1110
10	8	8	8000	3.906	500	80	3	1.0	0.0000	1664.2500	176.0071	0.7000	1.5839	0.2110	0.0238	2.0	0.7543	1632.6188	157.2559	0.0000	0.0000	0.3920	0.1300
10	8	8	8000	3.906	500	80	4	1.0	0.0000	1513.9625	149.1138	0.0000	0.0000	0.2046	0.0212	1.8	0.7390	1502.4000	149.3720	0.0000	0.0000	0.3312	0.1132
10	8	8	8000	3.906	500	80	5	1.0	0.0000	1642.7375	163.3798	0.0000	0.0000	0.2122	0.0211	2.0	0.7543	1621.2562	160.0466	0.0000	0.0000	0.3900	0.1193
10	8	8	8000	3.906	500	80	6	1.0	0.0000	1483.4250	166.5319	0.0000	0.0000	0.1916	0.0201	1.8	0.7390	1465.4938	158.6197	0.0000	0.0000	0.3182	0.1089
10	8	8	9000	4.057	500	80	1	1.0	0.0000	1562.8534	155.5350	0.0000	0.0000	0.1967	0.0132	2.0	0.7543	1549.6190	153.7741	0.0000	0.0000	0.3439	0.1080
10	8	8	9000	4.057	500	80	2	1.0	0.0000	1650.5684	161.8846	0.0000	0.0000	0.2110	0.0231	1.8	0.7390	1635.3455	158.2450	0.0000	0.0000	0.3485	0.1112
10	8	8	9000	4.057	500	80	3	1.0	0.0000	1690.7170	173.7345	0.2000	0.4526	0.2141	0.0242	2.0	0.7543	1664.4713	160.6411	0.0000	0.0000	0.3951	0.1297
10	8	8	9000	4.057	500	80	4	1.0	0.0000	1547.1733	154.5619	0.0000	0.0000	0.2045	0.0232	1.8	0.7390	1535.3505	154.8808	0.0000	0.0000	0.3297	0.1142
10	8	8	9000	4.057	500	80	5	1.0	0.0000	1674.9597	167.0387	0.0000	0.0000	0.2142	0.0230	2.0	0.7543	1654.2484	164.7650	0.0000	0.0000	0.3937	0.1189
10	8	8	9000	4.057	500	80	6	1.0	0.0000	1513.0131	169.9951	0.0000	0.0000	0.1875	0.0241	1.8	0.7390	1494.8102	162.0107	0.0000	0.0000	0.3156	0.1113
10	8	8	10000	4.197	500	80	1	1.0	0.0000	1590.8763	158.5535	0.0000	0.0000	0.1999	0.0148	2.0	0.7543	1577.5581	156.8524	0.0000	0.0000	0.3456	0.1046
10	8	8	10000	4.197	500	80	2	1.0	0.0000	1679.4905	162.4662	0.0000	0.0000	0.2190	0.0247	1.8	0.7390	1663.5720	159.1412	0.0000	0.0000	0.3548	0.1099
10	8	8	10000	4.197	500	80	3	1.0	0.0000	1714.2848	165.9808	0.0000	0.0000	0.2140	0.0243	2.0	0.7543	1696.2061	160.2380	0.0000	0.0000	0.3968	0.1334
10	8	8	10000	4.197	500	80	4	1.0	0.0000	1573.0002	157.5256	0.0000	0.0000	0.2049	0.0219	1.8	0.7390	1563.1213	157.8966	0.0000	0.0000	0.3328	0.1133
10	8	8	10000	4.197	500	80	5	1.0	0.0000	1706.2666	167.7286	0.0000	0.0000	0.2172	0.0242	2.0	0.7543	1685.5271	165.6115	0.0000	0.0000	0.3951	0.1156
10	8	8	10000	4.197	500	80	6	1.0	0.0000	1540.4482	173.2078	0.0000	0.0000	0.1938	0.0206	1.8	0.7390	1521.9933	165.1562	0.0000	0.0000	0.3173	0.1048
10	8	8	1000	2	1500	0	1	20.4	1.1782	9569.2002	348.2026	635.8000	29.3147	1.9094	0.1846	20.4	1.1782	9569.2002	348.2026	635.8000	29.3147	1.9094	0.1846
10	8	8	1000	2	1500	0	2	20.4	1.1782	9623.2002	354.0219	637.3000	29.3675	1.9172	0.1891	20.4	1.1782	9623.2002	354.0219	637.3000	29.3675	1.9172	0.1891
10	8	8	1000	2	1500	0	3	20.4	1.1782	9625.2002	360.6935	638.0000	30.3337	1.9391	0.1881	20.4	1.1782	9625.2002	360.6935	638.0000	30.3337	1.9391	0.1881
10	8	8	1000	2	1500	0	4	20.4	1.1782	9612.7998	373.8798	637.8000	31.7786	1.9827	0.1966	20.4	1.1782	9612.7998	373.8798	637.8000	31.7786	1.9827	0.1966
10	8	8	1000	2	1500	0	5	20.4	1.1782	9655.2002	358.7673	640.3000	30.5096	1.9467	0.1864	20.4	1.1782	9655.2002	358.7673	640.3000	30.5096	1.9467	0.1864
10	8	8	1000	2	1500	0	6	20.4	1.1782	9601.5996	357.2224	636.6000	27.5955	1.9751	0.1935	20.4	1.1782	9601.5996	357.2224	636.6000	27.5955	1.9751	0.1935
10	8	8	2000	2.5	1500	0	1	7.2	0.4526	6801.2998	376.6179	218.4000	27.3268	1.7062	0.2306	8.6	0.9051	6567.8999	251.4750	189.7000	14.6606	2.6251	0.4181
10	8	8	2000	2.5	1500	0	2	7.2	0.4526	6871.7902	379.5919	225.5000	28.4329	2.2078	0.9993	8.8	0.8124	6625.0000	255.2260	190.6000	14.7116	3.2950	1.3184
10	8	8	2000	2.5	1500	0	3	7.2	0.4526	6867.1001	410.3717	225.9000	34.7749	1.7437	0.2622	9.0	0.6746	6581.8999	250.2793	190.7000	14.1673	2.8438	0.2379
10	8	8	2000	2.5	1500	0	4	7.2	0.4526	6822.8999	385.9300	230.9000	30.1502	2.2486	1.2531	8.6	0.6034	6565.3999	259.5482	191.3000	12.6123	3.1514	1.0463
10	8	8	2000	2.5	1500	0	5	7.2	0.4526	6916.2002	446.5615	230.1000	35.9446	1.6986	0.2806	9.0	0.6746	6580.7002	250.9711	190.3000	14.4653	2.8468	0.2645
10	8	8	2000	2.5	1500	0	6	7.2	0.4526	6833.3999	380.2536	228.2000	36.5136	2.2907	1.2609	8.8	0.8124	6585.1001	243.1118	187.9000	14.3762	3.6875	1.5080
10	8	8	3000	2.849	1500	0	1	6.6	0.6034	6010.2539	217.1378	65.2000	16.6203	2.2170	0.6024	9.0	0.9541	5737.7422	172.2255	32.5000	3.3264	6.0858	2.8101
10	8	8	3000	2.849	1500	0	2	6.8	0.4526	5987.2715	213.4741	53.1000	14.4236	2.8249	0.5742	8.2	0.7390	5816.1465	203.7642	33.2000	3.3187	4.2484	0.5243
10	8	8	3000	2.849	1500	0	3	6.8	0.4526	6000.4834	227.1901	57.6000	15.8938	2.5717	0.5342	8.4	0.6913	5795.5010	188.1938	33.3000	3.2538	4.3095	0.4912
10	8	8	3000	2.849	1500	0	4	6.6	0.6034	6006.6880	222.3240	66.7000	15.0210	2.4878	0.6599	8.8	0.8124	5725.9326	185.5993	32.0000	3.5698	5.1749	2.0579
10	8	8	3000	2.849	1500	0	5	6.8	0.4526	5929.9976	259.7710	50.3000	16.0038	2.7485	0.5456	8.4	0.9659	5778.6821	181.1667	33.6000	3.6981	5.0158	2.1578
10	8	8	3000	2.849	1500	0	6	6.6	0.6034	6016.8794	253.1382	67.1000	17.7512	2.3374	0.5633	8.6	0.6034	5737.3784	189.2570	32.6000	3.3765	4.3124	0.3780
10	8	8	4000	3.125	1500	0	1	6.8	0.4526	5798.8501	150.6444	63.0000	6.0721	2.7329	0.5310	8.6	0.9051	5724.2998	193.0716	0.0000	0.0000	5.8451	2.6643
10	8	8	4000	3.125	1500	0	2	6.8	0.4526	6021.8501	290.6217	19.8000	30.2168	2.7796	0.7183	7.8	0.7390	5824.2500	193.2364	0.0000	0.0000	4.0481	0.5496
10	8	8	4000	3.125	1500	0	3	6.6	0.6034	5992.2500	309.7352	17.8000	28.8255	2.6455	0.7597	7.8	0.7390	5825.6001	185.8055	0.1000	0.2263	3.9828	0.5894
10	8	8	4000	3.125	1500	0	4	6.8	0.4526	5830.2749	155.9182	9.2000	9.2487	2.7671	0.5418	8.6	0.9051	5733.2749	183.6284	0.0000	0.0000	4.3173	0.5622
10	8	8	4000	3.125	1500	0	5	7.0	0.0000	5832.6748	189.6035	1.6000	2.0013	3.2560	0.1721	7.8	0.7390	5821.0000	179.5943	0.4000	0.9051	3.9936	0.6286
10	8	8	4000	3.125	1500	0	6	6.6	0.6034	5839.7251	162.4825	10.4000	11.5487	2.6703	0.6788	7.6	0.6913	5742.2749	182.2108	0.0000	0.0000	3.6485	0.4845
10	8	8	5000	3.358	1500	0	1	6.8	0.4526	6026.1221	188.0909	5.0000	6.9211	2.3281	0.5102	8.0	0.7543	5951.1304	199.8925	0.0000	0.0000	3.6251	0.7864
10	8	8	5000	3.358	1500	0	2	6.8	0.4526	6080.1245	196.6454	0.5000	1.1314	2.8624	0.5230	8.0	0.7543	6057.6958	208.2497	0.0000	0.0000	4.0218	0.6419
10	8	8	5000	3.358	1500	0	3	6.8	0.4526	6160.4609	181.8926	6.9000	6.6396	2.4016	0.5366	8.8	1.0560	6042.2520	193.9715	0.0000	0.0000	5.4562	2.4002
10	8	8	5000	3.358	1500	0	4	6.6	0.6034	6156.5552	445.1651	20.2000	39.6263	2.3172	0.5781	7.8	0.7390	5934.4736	180.8218	0.0000	0.0000	3.5484	0.6601
10	8	8	5000	3.358	1500	0	5	7.0	0.0000	6103.8418	185.7330	3.4000	4.0925	2.7779	0.4220	8.0	0.7543	6042.9375	174.5746	0.0000	0.0000	3.9983	0.6923
10	8	8	5000	3.358	1500	0	6	6.8	0.4526	6009.8638	200.9855	2.0000	3.0358	2.5235	0.4332	8.8	0.8124	5942.7314	184.9128	0.0000	0.0000	5.0903	2.0480

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	6000	3.561	1500	0	1	6.8	0.4526	6175.9067	2.3000	2.6582	0.5408	8.2	0.7390	6140.2158	0.0000	198.8462	4.7252	1.9795
10	8	8	6000	3.561	1500	0	2	7.0	0.0000	6237.3813	0.0000	3.3094	0.1387	7.8	0.7390	6218.7568	0.0000	222.4374	4.0502	0.5702
10	8	8	6000	3.561	1500	0	3	7.0	0.0000	6218.2563	0.1000	0.2263	0.2974	8.0	0.7543	6199.7197	0.0000	221.8894	4.0114	0.6387
10	8	8	6000	3.561	1500	0	4	6.6	0.6034	6299.5854	15.4000	32.6465	0.6147	8.0	0.7543	6114.1396	0.0000	196.9979	3.7890	0.6057
10	8	8	6000	3.561	1500	0	5	7.0	0.0000	6232.3198	0.0000	3.0768	0.3259	7.6	0.6913	6228.4077	0.0000	213.9776	3.7236	0.6267
10	8	8	6000	3.561	1500	0	6	6.6	0.6034	6326.3223	15.1000	30.5829	0.6482	8.2	1.0006	6127.8887	0.0000	187.2994	4.7340	2.1255
10	8	8	7000	3.742	1500	0	1	6.8	0.4526	6403.2666	7.5000	2.3824	0.4967	8.4	0.6913	6294.3413	0.0000	203.9012	4.1732	0.5439
10	8	8	7000	3.742	1500	0	2	6.8	0.4526	6444.6309	0.5000	1.1314	0.5397	8.0	0.7543	6421.7920	0.0000	216.9701	4.0658	0.6384
10	8	8	7000	3.742	1500	0	3	6.6	0.6034	6491.7856	3.6000	7.1967	0.1878	9.0	0.9541	6395.3467	0.0000	206.6519	5.6298	2.3074
10	8	8	7000	3.742	1500	0	4	6.8	0.4526	6397.8760	6.9000	15.6130	0.5265	8.2	0.7390	6294.0381	0.0000	186.8538	3.9504	0.6010
10	8	8	7000	3.742	1500	0	5	7.0	0.0000	6412.7471	203.5920	2.8608	0.3194	8.0	0.7543	6394.3501	0.0000	194.8827	4.0188	0.7230
10	8	8	7000	3.742	1500	0	6	6.8	0.4526	6341.1699	0.1000	0.2263	0.24824	8.4	0.6913	6287.2803	0.0000	193.8372	4.1256	0.6241
10	8	8	8000	3.906	1500	0	1	6.8	0.4526	6553.8877	7.5000	2.3880	0.4957	8.6	0.9051	6444.0313	0.0000	210.8758	5.8170	2.6955
10	8	8	8000	3.906	1500	0	2	6.8	0.4526	6596.1563	0.5000	1.1314	0.5351	8.0	0.7543	6574.0874	0.0000	221.6525	4.0624	0.6391
10	8	8	8000	3.906	1500	0	3	6.6	0.6034	6635.7437	3.0000	6.5407	0.6249	9.0	0.9541	6542.6436	0.0000	211.5648	5.6840	2.2917
10	8	8	8000	3.906	1500	0	4	6.8	0.4526	6544.3374	250.2968	15.6130	0.5258	8.2	0.7390	6437.5127	0.0000	192.0690	4.0158	0.5399
10	8	8	8000	3.906	1500	0	5	7.0	0.0000	6562.4438	208.7838	0.0000	0.3207	8.0	0.7543	6543.9814	0.0000	199.7002	4.0078	0.7321
10	8	8	8000	3.906	1500	0	6	6.8	0.4526	6499.8877	203.4768	0.2263	0.4962	8.6	0.6034	6437.1187	0.0000	192.9154	4.3658	0.4302
10	8	8	9000	4.057	1500	0	1	6.8	0.4526	6692.4272	7.5000	2.3906	0.5058	8.6	0.9051	6580.0459	0.0000	215.6027	9.5798	3.2111
10	8	8	9000	4.057	1500	0	2	6.8	0.4526	6732.6240	0.5000	1.1314	0.5387	8.0	0.7543	6710.3438	0.0000	226.8280	7.2625	3.5084
10	8	8	9000	4.057	1500	0	3	6.6	0.6034	6771.0640	2.9000	6.5620	0.6238	9.0	0.9541	6680.4092	0.0000	213.4318	10.3705	3.0663
10	8	8	9000	4.057	1500	0	4	6.8	0.4526	6763.2788	406.2337	29.8684	0.5602	8.2	0.7390	6573.5571	0.0000	196.8193	8.3596	3.2032
10	8	8	9000	4.057	1500	0	5	7.0	0.0000	6699.2095	213.1581	0.0000	0.3101	8.0	0.7543	6680.2866	0.0000	204.1094	7.8847	3.6524
10	8	8	9000	4.057	1500	0	6	6.8	0.4526	6635.2837	207.9590	0.0000	0.4884	8.6	0.6034	6573.3149	0.0000	197.6212	10.1986	2.6232
10	8	8	10000	4.197	1500	0	1	6.8	0.4526	6833.2998	7.5000	2.3251	0.4869	8.8	0.8124	6714.2236	0.0000	219.3710	10.3861	2.7127
10	8	8	10000	4.197	1500	0	2	6.8	0.4526	6860.6445	0.5000	1.1314	0.5379	8.0	0.7543	6838.1689	0.0000	231.3732	7.2407	3.4938
10	8	8	10000	4.197	1500	0	3	6.6	0.6034	6904.1733	2.9000	2.1486	0.6277	9.0	0.9541	6809.0508	0.0000	219.2237	10.2908	3.0180
10	8	8	10000	4.197	1500	0	4	6.8	0.4526	6893.9478	415.7270	29.8684	0.5560	8.2	0.7390	6700.5024	0.0000	201.6666	8.2783	3.1587
10	8	8	10000	4.197	1500	0	5	7.0	0.0000	6827.9507	217.8596	0.0000	0.3251	8.0	0.7543	6808.9717	0.0000	208.9059	7.9173	3.6153
10	8	8	10000	4.197	1500	0	6	6.8	0.4526	6751.2969	208.2453	0.0000	0.5271	8.4	0.6913	6700.6001	0.0000	202.3903	9.3514	3.0202
10	8	8	1000	2	1500	80	1	6.6	0.6034	2838.0000	312.7177	0.0421	0.0421	6.6	0.6034	2838.0000	178.4000	312.7177	0.3812	0.0421
10	8	8	1000	2	1500	80	2	6.6	0.6034	2880.3999	328.4480	0.0450	0.0450	6.6	0.6034	2880.3999	181.3000	328.4480	0.3828	0.0450
10	8	8	1000	2	1500	80	3	6.6	0.6034	2881.2000	314.5773	0.0440	0.0440	6.6	0.6034	2881.2000	181.4000	314.5773	0.3890	0.0440
10	8	8	1000	2	1500	80	4	6.6	0.6034	2899.6001	311.9955	0.0425	0.0425	6.6	0.6034	2899.6001	178.1000	311.9955	0.4002	0.0425
10	8	8	1000	2	1500	80	5	6.6	0.6034	2904.8000	306.1596	0.0460	0.0460	6.6	0.6034	2904.8000	182.7000	306.1596	0.3921	0.0460
10	8	8	1000	2	1500	80	6	6.6	0.6034	2898.0000	310.1779	0.0455	0.0455	6.6	0.6034	2898.0000	178.4000	310.1779	0.4000	0.0455
10	8	8	2000	2.5	1500	80	1	3.2	0.4526	2106.2000	192.1116	0.3985	0.0880	4.2	1.0006	2020.5000	54.1000	167.3278	0.6016	0.2253
10	8	8	2000	2.5	1500	80	2	3.2	0.4526	2173.3999	199.2791	0.4219	0.0903	4.6	0.9051	2070.5000	55.5000	165.6562	0.6954	0.2090
10	8	8	2000	2.5	1500	80	3	3.2	0.4526	2143.5000	187.7022	0.4186	0.0935	4.2	0.7390	2061.1001	55.5000	161.2366	0.5826	0.1192
10	8	8	2000	2.5	1500	80	4	3.2	0.4526	2142.3000	192.7544	0.4219	0.0976	4.0	0.7543	2050.3000	53.2000	164.8585	0.5625	0.1255
10	8	8	2000	2.5	1500	80	5	3.2	0.4526	2135.8000	196.6918	0.4186	0.0931	4.6	0.9051	2050.3999	55.5000	164.5197	0.6842	0.1971
10	8	8	2000	2.5	1500	80	6	3.2	0.4526	2126.7000	190.3380	0.4155	0.0974	4.6	0.9051	2037.9000	52.7000	167.0121	0.7031	0.2124
10	8	8	3000	2.849	1500	80	1	3.0	0.0000	1900.9832	169.5257	0.6993	0.5625	4.2	1.0006	1837.3093	8.2000	131.5798	0.9362	0.3365
10	8	8	3000	2.849	1500	80	2	3.0	0.0000	1945.4993	148.6397	0.5267	0.5999	4.4	0.9659	1896.2949	8.4000	134.4824	1.0390	0.3501
10	8	8	3000	2.849	1500	80	3	3.0	0.0000	1956.3625	145.1762	0.5949	0.6063	4.2	1.0006	1911.2162	8.6000	125.8341	1.0045	0.3524
10	8	8	3000	2.849	1500	80	4	3.0	0.0000	1879.1830	143.4563	0.5349	0.0538	4.2	1.0006	1828.1697	7.6000	126.6074	0.9467	0.3359
10	8	8	3000	2.849	1500	80	5	3.0	0.0000	1947.3324	168.0707	0.6407	0.0582	4.0	1.0119	1883.1309	9.0000	133.0783	0.9221	0.3458
10	8	8	3000	2.849	1500	80	6	3.0	0.0000	1882.2500	141.4884	0.5537	0.0559	4.4	0.9659	1827.8278	8.2000	124.8172	1.0064	0.3344
10	8	8	4000	3.125	1500	80	1	3.0	0.0000	1914.0250	161.2538	0.5751	0.0544	4.2	0.7390	1867.6750	0.3000	134.3015	0.6788	0.1550

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	4000	3.125	1500	80	2	3.0	0.0000	1965.1000	149.3877	1.6000	1.7912	0.0574	4.2	1938.5250	146.0657	0.5000	0.9082	0.9515	0.1677
10	8	8	4000	3.125	1500	80	3	3.0	0.0000	1990.7750	155.0795	1.5000	1.6611	0.0522	4.0	1961.4250	143.5614	0.1000	0.2263	0.9157	0.1801
10	8	8	4000	3.125	1500	80	4	3.0	0.0000	1890.8250	143.9392	1.8000	1.8720	0.0529	0.643	1864.5250	137.5253	0.2000	0.4526	0.9044	0.1650
10	8	8	4000	3.125	1500	80	5	3.0	0.0000	1981.4500	156.6055	1.6000	1.6247	0.0634	3.8	1961.7500	145.3704	0.5000	0.5060	0.8657	0.1951
10	8	8	4000	3.125	1500	80	6	3.0	0.0000	1880.1000	147.2226	2.5000	2.8472	0.0506	4.2	1836.8000	133.7849	0.3000	0.6788	0.8952	0.1576
10	8	8	5000	3.358	1500	80	1	3.0	0.0000	1960.0791	163.4120	0.1000	0.2263	0.0594	3.6	1924.9919	144.1487	0.0000	0.0000	0.7560	0.1561
10	8	8	5000	3.358	1500	80	2	3.0	0.0000	2017.3840	159.1914	0.0000	0.0000	0.6216	4.0	2001.4408	153.4429	0.0000	0.0000	0.8940	0.1852
10	8	8	5000	3.358	1500	80	3	3.0	0.0000	2053.7700	158.2239	0.0000	0.0000	0.6312	4.0	2028.1272	149.7069	0.0000	0.0000	0.9126	0.1900
10	8	8	5000	3.358	1500	80	4	3.0	0.0000	1926.3203	147.4310	0.0000	0.0000	0.5950	4.0	1912.4772	144.3296	0.0000	0.0000	0.8596	0.1829
10	8	8	5000	3.358	1500	80	5	3.0	0.0000	2040.1986	160.2305	0.0000	0.0000	0.6266	3.8	2021.7555	155.7701	0.0000	0.0000	0.8566	0.1899
10	8	8	5000	3.358	1500	80	6	3.0	0.0000	1920.6774	151.2682	0.1000	0.2263	0.5866	4.2	1890.7617	142.0964	0.0000	0.0000	0.8966	0.1559
10	8	8	6000	3.561	1500	80	1	3.0	0.0000	2021.9301	164.0814	0.1000	0.2263	0.5924	4.0	1989.6842	150.7899	0.0000	0.0000	0.8622	0.1627
10	8	8	6000	3.561	1500	80	2	3.0	0.0000	2072.7522	160.8598	0.1000	0.2263	0.6216	3.8	2055.0156	153.1736	0.0000	0.0000	0.8560	0.1882
10	8	8	6000	3.561	1500	80	3	3.0	0.0000	2110.5886	156.6786	0.0000	0.0000	0.6284	4.0	2084.9644	148.4126	0.0000	0.0000	0.9156	0.1889
10	8	8	6000	3.561	1500	80	4	3.0	0.0000	1977.8844	152.2156	0.0000	0.0000	0.6024	4.0	1962.7600	148.0711	0.0000	0.0000	0.8620	0.1790
10	8	8	6000	3.561	1500	80	5	3.0	0.0000	2085.0767	161.8038	0.0000	0.0000	0.6294	3.6	2071.6523	159.4669	0.0000	0.0000	0.8056	0.1874
10	8	8	6000	3.561	1500	80	6	3.0	0.0000	1967.6355	151.9985	0.0000	0.0000	0.5936	4.0	1947.7385	146.4844	0.0000	0.0000	0.8522	0.1631
10	8	8	7000	3.742	1500	80	1	3.0	0.0000	2058.7451	168.2132	0.0000	0.0000	0.5942	4.0	2027.8613	154.6440	0.0000	0.0000	0.8594	0.1630
10	8	8	7000	3.742	1500	80	2	3.0	0.0000	2130.7739	168.4528	0.0000	0.0000	0.6298	3.8	2115.0769	163.1024	0.0000	0.0000	0.8546	0.1846
10	8	8	7000	3.742	1500	80	3	3.0	0.0000	2166.1672	161.0281	0.0000	0.0000	0.6318	4.2	2140.9702	154.8676	0.0000	0.0000	0.9704	0.1767
10	8	8	7000	3.742	1500	80	4	3.0	0.0000	2033.3613	159.1596	0.0000	0.0000	0.5988	3.8	2136.3645	154.4157	0.0000	0.0000	0.8176	0.1772
10	8	8	7000	3.742	1500	80	5	3.0	0.0000	2146.9189	170.5522	0.0000	0.0000	0.6284	3.8	2136.3220	159.3224	0.0000	0.0000	0.8614	0.1933
10	8	8	7000	3.742	1500	80	6	3.0	0.0000	2019.7678	156.4027	0.0000	0.0000	0.5924	4.0	1994.7806	160.8595	0.0000	0.0000	0.8484	0.1661
10	8	8	8000	3.906	1500	80	1	3.0	0.0000	2103.2188	172.2603	0.0000	0.0000	0.5954	4.0	2071.4063	158.5284	0.0000	0.0000	0.8654	0.1654
10	8	8	8000	3.906	1500	80	2	3.0	0.0000	2176.2937	172.8613	0.0000	0.0000	0.6280	3.8	2161.1313	167.3211	0.0000	0.0000	0.8580	0.1826
10	8	8	8000	3.906	1500	80	3	3.0	0.0000	2217.4187	164.1651	0.0000	0.0000	0.6338	4.2	2187.5562	159.0085	0.0000	0.0000	0.9736	0.1754
10	8	8	8000	3.906	1500	80	4	3.0	0.0000	2078.1062	163.2155	0.0000	0.0000	0.6064	3.8	2062.0437	158.3523	0.0000	0.0000	0.8186	0.1735
10	8	8	8000	3.906	1500	80	5	3.0	0.0000	2193.3374	174.6932	0.0000	0.0000	0.6364	3.8	2182.6750	173.4937	0.0000	0.0000	0.8664	0.1909
10	8	8	8000	3.906	1500	80	6	3.0	0.0000	2060.7813	160.2532	0.0000	0.0000	0.5920	4.0	2038.7312	154.6844	0.0000	0.0000	0.8542	0.1674
10	8	8	9000	4.057	1500	80	1	3.0	0.0000	2146.0496	177.0622	0.0000	0.0000	0.5970	4.0	2112.1353	162.1134	0.0000	0.0000	0.8626	0.1648
10	8	8	9000	4.057	1500	80	2	3.0	0.0000	2224.8530	181.1135	0.0000	0.0000	0.6235	3.8	2204.0303	171.0794	0.0000	0.0000	0.8547	0.1852
10	8	8	9000	4.057	1500	80	3	3.0	0.0000	2259.8989	167.8289	0.0000	0.0000	0.6358	4.2	2229.9761	162.6777	0.0000	0.0000	0.9764	0.1733
10	8	8	9000	4.057	1500	80	4	3.0	0.0000	2118.4353	166.1321	0.0000	0.0000	0.6016	3.8	2104.3125	163.2282	0.0000	0.0000	0.8219	0.1743
10	8	8	9000	4.057	1500	80	5	3.0	0.0000	2234.5874	179.2305	0.0000	0.0000	0.6311	3.6	2222.9644	176.6478	0.0000	0.0000	0.8093	0.1864
10	8	8	9000	4.057	1500	80	6	3.0	0.0000	2101.3896	163.7759	0.0000	0.0000	0.5938	4.0	2079.0979	158.2012	0.0000	0.0000	0.8532	0.1667
10	8	8	10000	4.197	1500	80	1	3.0	0.0000	2183.8950	179.6987	0.0000	0.0000	0.5969	4.0	2150.3005	165.4641	0.0000	0.0000	0.8593	0.1582
10	8	8	10000	4.197	1500	80	2	3.0	0.0000	2258.3301	179.3756	0.0000	0.0000	0.6327	3.8	2242.6511	173.6424	0.0000	0.0000	0.8580	0.1811
10	8	8	10000	4.197	1500	80	3	3.0	0.0000	2298.4878	171.1731	0.0000	0.0000	0.6328	4.2	2268.7090	165.7562	0.0000	0.0000	0.9688	0.1759
10	8	8	10000	4.197	1500	80	4	3.0	0.0000	2157.0005	170.5847	0.0000	0.0000	0.6047	3.8	2142.8215	167.7624	0.0000	0.0000	0.8173	0.1726
10	8	8	10000	4.197	1500	80	5	3.0	0.0000	2271.9482	182.1199	0.0000	0.0000	0.6328	3.6	2261.2695	180.5903	0.0000	0.0000	0.8095	0.1886
10	8	8	10000	4.197	1500	80	6	3.0	0.0000	2139.4429	167.3778	0.0000	0.0000	0.5937	4.0	2116.5271	161.4650	0.0000	0.0000	0.8533	0.1635
40	8	8	1000	5	500	0	1	3.0	0.0000	8023.2002	355.1719	314.9000	17.8184	0.0054	3.0	8023.2002	355.1719	314.9000	17.8184	0.1873	0.0054
40	8	8	1000	5	500	0	2	3.0	0.0000	8093.2002	369.6716	317.8000	18.6372	0.0079	3.0	8093.2002	369.6716	317.8000	18.6372	0.1952	0.0079
40	8	8	1000	5	500	0	3	3.0	0.0000	8170.0000	381.7559	321.3000	18.9017	0.0057	3.0	8170.0000	381.7559	321.3000	18.9017	0.1938	0.0057
40	8	8	1000	5	500	0	4	3.0	0.0000	8185.6001	392.4371	317.8000	19.5548	0.0056	3.0	8185.6001	392.4371	317.8000	19.5548	0.1969	0.0056
40	8	8	1000	5	500	0	5	3.0	0.0000	8167.3999	378.7860	320.6000	18.6660	0.0057	3.0	8167.3999	378.7860	320.6000	18.6660	0.1970	0.0057
40	8	8	1000	5	500	0	6	3.0	0.0000	8139.6001	404.5795	316.2000	20.4117	0.0058	3.0	8139.6001	404.5795	316.2000	20.4117	0.1969	0.0058
40	8	8	2000	6.25	500	0	1	1.0	0.0000	5706.7998	247.9070	95.6000	6.5771	0.0092	1.0	5706.7998	247.9070	95.6000	6.5771	0.2703	0.0092
40	8	8	2000	6.25	500	0	2	1.0	0.0000	5803.4502	228.0810	97.7000	6.5498	0.0092	1.0	5803.4502	228.0810	97.7000	6.5498	0.2767	0.0092

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
40	8	8	2000	6.25	500	0	3	1.0	0.0000	5772.3501	98.1000	246.1892	0.0098	1.0	0.0000	5772.3501	98.1000	246.1892	0.2830
40	8	8	2000	6.25	500	0	4	1.0	0.0000	5764.6001	95.2000	247.4877	0.0098	1.0	0.0000	5764.6001	95.2000	247.4877	0.2797
40	8	8	2000	6.25	500	0	5	1.0	0.0000	5733.3999	96.4000	244.8804	0.0088	1.0	0.0000	5733.3999	96.4000	244.8804	0.2781
40	8	8	2000	6.25	500	0	6	1.0	0.0000	5749.2998	94.9000	246.0443	0.0103	1.0	0.0000	5749.2998	94.9000	246.0443	0.2781
40	8	8	3000	7.121	500	0	1	1.0	0.0000	5005.3604	188.1789	186.1789	0.4781	1.0	0.0000	5005.3604	15.7000	202.53	0.4422
40	8	8	3000	7.121	500	0	2	1.0	0.0000	5121.6982	15.6000	199.0846	0.0124	1.0	0.0000	5121.6982	15.6000	199.0846	0.4562
40	8	8	3000	7.121	500	0	3	1.0	0.0000	5127.7959	16.0000	202.7059	0.0177	1.0	0.0000	5127.7959	16.0000	202.7059	0.4687
40	8	8	3000	7.121	500	0	4	1.0	0.0000	4987.3115	15.7000	190.9410	0.0118	1.0	0.0000	4987.3115	15.7000	190.9410	0.4486
40	8	8	3000	7.121	500	0	5	1.0	0.0000	5074.9346	16.0000	190.5707	0.0141	1.0	0.0000	5074.9346	16.0000	190.5707	0.4591
40	8	8	3000	7.121	500	0	6	1.0	0.0000	5003.3359	15.5000	188.5156	0.0143	1.0	0.0000	5003.3359	15.5000	188.5156	0.4514
40	8	8	4000	7.813	500	0	1	1.0	0.0000	5117.9375	0.0000	197.7970	0.0121	1.0	0.0000	5117.9375	0.0000	197.7970	0.4609
40	8	8	4000	7.813	500	0	2	1.0	0.0000	5210.0625	0.0000	221.4392	0.0141	1.0	0.0000	5210.0625	0.0000	221.4392	0.4750
40	8	8	4000	7.813	500	0	3	1.0	0.0000	5252.7998	0.0000	202.2196	0.0143	1.0	0.0000	5252.7998	0.0000	202.2196	0.4921
40	8	8	4000	7.813	500	0	4	1.0	0.0000	5062.7876	0.0000	203.8344	0.0151	1.0	0.0000	5062.7876	0.0000	203.8344	0.4624
40	8	8	4000	7.813	500	0	5	1.0	0.0000	5242.2876	0.0000	203.3231	0.0175	1.0	0.0000	5242.2876	0.0000	203.3231	0.4921
40	8	8	4000	7.813	500	0	6	1.0	0.0000	5066.5625	0.1000	207.7852	0.0183	1.2	0.4526	5060.0752	0.0000	208.1137	0.5095
40	8	8	5000	8.394	500	0	1	1.0	0.0000	5390.0845	0.0000	201.5959	0.0246	1.0	0.0000	5390.0845	0.0000	201.5959	0.4656
40	8	8	5000	8.394	500	0	2	1.0	0.0000	5496.3975	0.0000	227.3974	0.0223	1.0	0.0000	5496.3975	0.0000	227.3974	0.4844
40	8	8	5000	8.394	500	0	3	1.0	0.0000	5542.7803	0.0000	218.0763	0.0223	1.0	0.0000	5542.7803	0.0000	218.0763	0.4874
40	8	8	5000	8.394	500	0	4	1.0	0.0000	5328.6069	0.0000	215.7604	0.0129	1.0	0.0000	5328.6069	0.0000	215.7604	0.4687
40	8	8	5000	8.394	500	0	5	1.0	0.0000	5530.5649	0.0000	215.1744	0.0235	1.2	0.4526	5529.2861	0.0000	216.7547	0.5515
40	8	8	5000	8.394	500	0	6	1.0	0.0000	5330.5913	0.0000	218.9845	0.0210	1.2	0.4526	5328.1123	0.0000	217.8715	0.5205
40	8	8	6000	8.902	500	0	1	1.0	0.0000	5633.9922	0.0000	208.2061	0.0228	1.0	0.0000	5633.9922	0.0000	208.2061	0.4687
40	8	8	6000	8.902	500	0	2	1.0	0.0000	5738.0669	0.0000	233.1963	0.0261	1.0	0.0000	5738.0669	0.0000	233.1963	0.4826
40	8	8	6000	8.902	500	0	3	1.0	0.0000	5790.7725	0.0000	229.7962	0.0272	1.2	0.4526	5789.3726	0.0000	231.5457	0.5517
40	8	8	6000	8.902	500	0	4	1.0	0.0000	5562.6846	0.0000	226.0036	0.0168	1.0	0.0000	5562.6846	0.0000	226.0036	0.4794
40	8	8	6000	8.902	500	0	5	1.0	0.0000	5779.7510	0.0000	222.0027	0.0329	1.0	0.0000	5779.7510	0.0000	222.0027	0.4953
40	8	8	6000	8.902	500	0	6	1.0	0.0000	5564.8633	0.0000	229.1845	0.0200	1.2	0.4526	5561.8833	0.0000	232.6846	0.5205
40	8	8	7000	9.355	500	0	1	1.0	0.0000	5839.9492	0.0000	228.7385	0.0244	1.0	0.0000	5839.9492	0.0000	228.7385	0.4766
40	8	8	7000	9.355	500	0	2	1.0	0.0000	5946.8999	0.0000	244.7236	0.0233	1.2	0.4526	5943.8291	0.0000	243.0404	0.5423
40	8	8	7000	9.355	500	0	3	1.0	0.0000	5986.8925	0.0000	234.5014	0.0280	1.2	0.4526	5985.8926	0.0000	235.0033	0.5639
40	8	8	7000	9.355	500	0	4	1.0	0.0000	5770.4302	0.0000	234.0707	0.0166	1.0	0.0000	5770.4302	0.0000	234.0707	0.4812
40	8	8	7000	9.355	500	0	5	1.0	0.0000	5977.0088	0.0000	236.5902	0.0205	1.2	0.4526	5974.7378	0.0000	236.7263	0.5580
40	8	8	7000	9.355	500	0	6	1.0	0.0000	5762.0459	0.0000	238.9684	0.0176	1.2	0.4526	5759.5757	0.0000	241.8396	0.5283
40	8	8	8000	9.766	500	0	1	1.0	0.0000	6025.9971	0.0000	229.8232	0.0202	1.2	0.4526	6025.6968	0.0000	229.7070	0.5235
40	8	8	8000	9.766	500	0	2	1.0	0.0000	6141.7280	0.0000	254.2360	0.0238	1.0	0.0000	6141.7280	0.0000	254.2360	0.4813
40	8	8	8000	9.766	500	0	3	1.0	0.0000	6192.5249	0.0000	245.3487	0.0281	1.2	0.4526	6191.1250	0.0000	247.1347	0.5484
40	8	8	8000	9.766	500	0	4	1.0	0.0000	5957.1343	0.0000	242.3271	0.0130	1.0	0.0000	5957.1343	0.0000	242.3271	0.4797
40	8	8	8000	9.766	500	0	5	1.0	0.0000	6184.0127	0.0000	247.0547	0.0261	1.0	0.0000	6184.0127	0.0000	247.0547	0.5016
40	8	8	8000	9.766	500	0	6	1.0	0.0000	5950.1221	0.0000	243.5495	0.0191	1.2	0.4526	5946.9688	0.0000	247.3271	0.5283
40	8	8	9000	10.14	500	0	1	1.0	0.0000	6198.6191	0.0000	236.7806	0.0223	1.2	0.4526	6198.3193	0.0000	236.6643	0.1322
40	8	8	9000	10.14	500	0	2	1.0	0.0000	6317.3208	0.0000	261.7968	0.0239	1.0	0.0000	6317.3208	0.0000	261.7968	0.4860
40	8	8	9000	10.14	500	0	3	1.0	0.0000	6369.2495	0.0000	252.7289	0.0284	1.2	0.4526	6367.8496	0.0000	254.5155	0.5547
40	8	8	9000	10.14	500	0	4	1.0	0.0000	6129.8477	0.0000	250.0816	0.0140	1.0	0.0000	6129.8477	0.0000	250.0816	0.4841
40	8	8	9000	10.14	500	0	5	1.0	0.0000	6360.8354	0.0000	254.4188	0.0259	1.0	0.0000	6360.8354	0.0000	254.4188	0.5079
40	8	8	9000	10.14	500	0	6	1.0	0.0000	6121.3330	0.0000	250.8089	0.0203	1.2	0.4526	6118.1045	0.0000	254.6818	0.5332
40	8	8	10000	10.49	500	0	1	1.0	0.0000	6359.6802	0.0000	243.6332	0.0230	1.0	0.0000	6359.6802	0.0000	243.6332	0.4717
40	8	8	10000	10.49	500	0	2	1.0	0.0000	6480.3213	0.0000	268.8258	0.0251	1.0	0.0000	6480.3213	0.0000	268.8258	0.4876
40	8	8	10000	10.49	500	0	3	1.0	0.0000	6533.2998	0.0000	259.6338	0.0319	1.2	0.4526	6531.8999	0.0000	261.4209	0.5500

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	10000	10.49	500	0	4	1.0	0.0000	6288.5088	256.9073	0.0000	0.0000	1.0	0.0144	6288.5088	256.9073	0.0000	0.4875	0.0144
40	8	8	10000	10.49	500	0	5	1.0	0.0000	6522.6064	263.7808	0.0000	0.0000	1.0	0.0274	6522.6064	263.7808	0.0000	0.5108	0.0274
40	8	8	10000	10.49	500	0	6	1.0	0.0000	6277.9146	256.6729	0.0000	0.0000	1.2	0.0202	6274.6157	260.6317	0.0000	0.5328	0.1025
40	8	8	1000	5	500	80	1	1.0	0.0000	1780.2000	266.0143	67.4000	13.6983	1.0	0.0000	1780.2000	266.0143	67.4000	0.0485	0.0037
40	8	8	1000	5	500	80	2	1.0	0.0000	1898.6000	259.3566	73.2000	13.7174	1.0	0.0000	1898.6000	259.3566	73.2000	0.0500	0.0047
40	8	8	1000	5	500	80	3	1.0	0.0000	1902.6000	267.3127	74.1000	13.7243	1.0	0.0000	1902.6000	267.3127	74.1000	0.0546	0.0059
40	8	8	1000	5	500	80	4	1.0	0.0000	1877.6000	296.0973	64.7000	14.7612	1.0	0.0000	1877.6000	296.0973	64.7000	0.0562	0.0058
40	8	8	1000	5	500	80	5	1.0	0.0000	1954.8000	302.3766	75.8000	15.4089	1.0	0.0000	1954.8000	302.3766	75.8000	0.0532	0.0057
40	8	8	1000	5	500	80	6	1.0	0.0000	1912.8000	293.2007	67.0000	14.8685	1.0	0.0000	1912.8000	293.2007	67.0000	0.0499	0.0046
40	8	8	2000	6.25	500	80	1	1.0	0.0000	1354.3000	166.3115	17.6000	4.7368	1.0	0.0000	1354.3000	166.3115	17.6000	0.0983	0.0053
40	8	8	2000	6.25	500	80	2	1.0	0.0000	1422.9000	161.8140	19.5000	4.5287	1.0	0.0000	1422.9000	161.8140	19.5000	0.1030	0.0095
40	8	8	2000	6.25	500	80	3	1.0	0.0000	1483.6500	130.6554	21.3000	3.3401	1.0	0.0000	1483.6500	130.6554	21.3000	0.1092	0.0052
40	8	8	2000	6.25	500	80	4	1.0	0.0000	1356.6500	156.1066	14.7000	4.6624	1.0	0.0000	1356.6500	156.1066	14.7000	0.1050	0.0056
40	8	8	2000	6.25	500	80	5	1.0	0.0000	1457.5000	167.9693	21.2000	3.9018	1.0	0.0000	1457.5000	167.9693	21.2000	0.1062	0.0046
40	8	8	2000	6.25	500	80	6	1.0	0.0000	1351.8000	179.9412	14.3000	4.8537	1.0	0.0000	1351.8000	179.9412	14.3000	0.1078	0.0064
40	8	8	3000	7.121	500	80	1	1.0	0.0000	1401.6733	142.0283	3.8000	2.5197	1.0	0.0000	1401.6733	142.0283	3.8000	0.1591	0.0127
40	8	8	3000	7.121	500	80	2	1.0	0.0000	1536.8552	117.9686	4.6000	2.5953	1.0	0.0000	1536.8552	117.9686	4.6000	0.1767	0.0107
40	8	8	3000	7.121	500	80	3	1.0	0.0000	1665.0455	129.4569	5.6000	2.2678	1.0	0.0000	1665.0455	129.4569	5.6000	0.1969	0.0141
40	8	8	3000	7.121	500	80	4	1.0	0.0000	1370.0847	151.1110	3.1000	2.5788	1.0	0.0000	1370.0847	151.1110	3.1000	0.1593	0.0165
40	8	8	3000	7.121	500	80	5	1.0	0.0000	1569.0767	120.3933	5.6000	2.2678	1.0	0.0000	1569.0767	120.3933	5.6000	0.1782	0.0121
40	8	8	3000	7.121	500	80	6	1.0	0.0000	1351.7876	137.9342	3.7000	2.5253	1.0	0.0000	1351.7876	137.9342	3.7000	0.1595	0.0101
40	8	8	4000	7.813	500	80	1	1.0	0.0000	1478.4375	177.0557	0.0000	0.0000	1.0	0.0000	1478.4375	177.0557	0.0000	0.1688	0.0149
40	8	8	4000	7.813	500	80	2	1.0	0.0000	1660.2625	123.4262	0.0000	0.0000	1.0	0.0000	1660.2625	123.4262	0.0000	0.1938	0.0108
40	8	8	4000	7.813	500	80	3	1.0	0.0000	1792.8750	140.9682	0.0000	0.0000	1.0	0.0000	1792.8750	140.9682	0.0000	0.2123	0.0106
40	8	8	4000	7.813	500	80	4	1.0	0.0000	1410.2875	155.3777	0.0000	0.0000	1.0	0.0000	1410.2875	155.3777	0.0000	0.1687	0.0154
40	8	8	4000	7.813	500	80	5	1.0	0.0000	1763.5250	141.2237	0.0000	0.0000	1.0	0.0000	1763.5250	141.2237	0.0000	0.2142	0.0120
40	8	8	4000	7.813	500	80	6	1.0	0.0000	1370.0500	156.4766	0.0000	0.0000	1.0	0.0000	1370.0500	156.4766	0.0000	0.1578	0.0123
40	8	8	5000	8.394	500	80	1	1.0	0.0000	1546.9384	186.6260	0.0000	0.0000	1.0	0.0000	1546.9384	186.6260	0.0000	0.1720	0.0183
40	8	8	5000	8.394	500	80	2	1.0	0.0000	1738.9749	128.6526	0.0000	0.0000	1.0	0.0000	1738.9749	128.6526	0.0000	0.1970	0.0077
40	8	8	5000	8.394	500	80	3	1.0	0.0000	1884.3555	143.3694	0.0000	0.0000	1.0	0.0000	1884.3555	143.3694	0.0000	0.2171	0.0134
40	8	8	5000	8.394	500	80	4	1.0	0.0000	1475.3298	163.9697	0.0000	0.0000	1.0	0.0000	1475.3298	163.9697	0.0000	0.1657	0.0159
40	8	8	5000	8.394	500	80	5	1.0	0.0000	1851.2090	143.4885	0.0000	0.0000	1.0	0.0000	1851.2090	143.4885	0.0000	0.2139	0.0092
40	8	8	5000	8.394	500	80	6	1.0	0.0000	1440.1469	162.0190	0.0000	0.0000	1.0	0.0000	1440.1469	162.0190	0.0000	0.1623	0.0142
40	8	8	6000	8.902	500	80	1	1.0	0.0000	1608.1667	195.0030	0.0000	0.0000	1.0	0.0000	1608.1667	195.0030	0.0000	0.1782	0.0159
40	8	8	6000	8.902	500	80	2	1.0	0.0000	1809.7136	132.0591	0.0000	0.0000	1.0	0.0000	1809.7136	132.0591	0.0000	0.1999	0.0129
40	8	8	6000	8.902	500	80	3	1.0	0.0000	1959.6729	146.4626	0.0000	0.0000	1.0	0.0000	1959.6729	146.4626	0.0000	0.2189	0.0105
40	8	8	6000	8.902	500	80	4	1.0	0.0000	1534.1165	170.6196	0.0000	0.0000	1.0	0.0000	1534.1165	170.6196	0.0000	0.1671	0.0174
40	8	8	6000	8.902	500	80	5	1.0	0.0000	1924.9086	147.7676	0.0000	0.0000	1.0	0.0000	1924.9086	147.7676	0.0000	0.2156	0.0102
40	8	8	6000	8.902	500	80	6	1.0	0.0000	1499.0110	168.8480	0.0000	0.0000	1.0	0.0000	1499.0110	168.8480	0.0000	0.1611	0.0140
40	8	8	7000	9.355	500	80	1	1.0	0.0000	1662.8981	200.8653	0.0000	0.0000	1.0	0.0000	1662.8981	200.8653	0.0000	0.1734	0.0163
40	8	8	7000	9.355	500	80	2	1.0	0.0000	1873.2480	133.9642	0.0000	0.0000	1.0	0.0000	1873.2480	133.9642	0.0000	0.1954	0.0108
40	8	8	7000	9.355	500	80	3	1.0	0.0000	2029.4080	153.0668	0.0000	0.0000	1.0	0.0000	2029.4080	153.0668	0.0000	0.2217	0.0116
40	8	8	7000	9.355	500	80	4	1.0	0.0000	1586.0116	175.0309	0.0000	0.0000	1.0	0.0000	1586.0116	175.0309	0.0000	0.1674	0.0167
40	8	8	7000	9.355	500	80	5	1.0	0.0000	1993.7566	154.2231	0.0000	0.0000	1.0	0.0000	1993.7566	154.2231	0.0000	0.2142	0.0118
40	8	8	7000	9.355	500	80	6	1.0	0.0000	1551.3474	175.0287	0.0000	0.0000	1.0	0.0000	1551.3474	175.0287	0.0000	0.1639	0.0109
40	8	8	8000	9.766	500	80	1	1.0	0.0000	1715.3969	208.5004	0.0000	0.0000	1.0	0.0000	1715.3969	208.5004	0.0000	0.1767	0.0158
40	8	8	8000	9.766	500	80	2	1.0	0.0000	1932.7281	141.1826	0.0000	0.0000	1.0	0.0000	1932.7281	141.1826	0.0000	0.1983	0.0106
40	8	8	8000	9.766	500	80	3	1.0	0.0000	2090.2437	156.3160	0.0000	0.0000	1.0	0.0000	2090.2437	156.3160	0.0000	0.2186	0.0129
40	8	8	8000	9.766	500	80	4	1.0	0.0000	1637.3093	182.6250	0.0000	0.0000	1.0	0.0000	1637.3093	182.6250	0.0000	0.1703	0.0154

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	8000	9.766	500	80	5	1.0	0.0000	2053.0063	160.1324	0.2169	0.0000	1.0	0.0000	2053.0063	160.1324	0.0000	0.2169	0.0123
40	8	8	8000	9.766	500	80	6	1.0	0.0000	1599.6125	180.2401	0.1640	0.0000	1.0	0.0000	1599.6125	180.2401	0.0000	0.1640	0.0169
40	8	8	9000	10.14	500	80	1	1.0	0.0000	1762.4207	214.2471	0.1766	0.0000	1.0	0.0000	1762.4207	214.2471	0.0000	0.1766	0.0174
40	8	8	9000	10.14	500	80	2	1.0	0.0000	1985.3376	145.3125	0.2031	0.0000	1.0	0.0000	1985.3376	145.3125	0.0000	0.2031	0.0116
40	8	8	9000	10.14	500	80	3	1.0	0.0000	2147.2534	160.8218	0.2203	0.0000	1.0	0.0000	2147.2534	160.8218	0.0000	0.2203	0.0112
40	8	8	9000	10.14	500	80	4	1.0	0.0000	1681.8199	187.3842	0.1704	0.0000	1.0	0.0000	1681.8199	187.3842	0.0000	0.1704	0.0160
40	8	8	9000	10.14	500	80	5	1.0	0.0000	2106.5103	163.5278	0.2188	0.0000	1.0	0.0000	2106.5103	163.5278	0.0000	0.2188	0.0104
40	8	8	9000	10.14	500	80	6	1.0	0.0000	1643.3909	185.3222	0.1687	0.0000	1.0	0.0000	1643.3909	185.3222	0.0000	0.1687	0.0147
40	8	8	10000	10.49	500	80	1	1.0	0.0000	1806.0231	219.5766	0.1719	0.0000	1.0	0.0000	1806.0231	219.5766	0.0000	0.1719	0.0175
40	8	8	10000	10.49	500	80	2	1.0	0.0000	2036.3190	149.5271	0.2016	0.0000	1.0	0.0000	2036.3190	149.5271	0.0000	0.2016	0.0123
40	8	8	10000	10.49	500	80	3	1.0	0.0000	2197.7441	165.6165	0.2219	0.0000	1.0	0.0000	2197.7441	165.6165	0.0000	0.2219	0.0126
40	8	8	10000	10.49	500	80	4	1.0	0.0000	1723.8625	191.9445	0.1675	0.0000	1.0	0.0000	1723.8625	191.9445	0.0000	0.1675	0.0158
40	8	8	10000	10.49	500	80	5	1.0	0.0000	2159.1611	167.2299	0.2156	0.0000	1.0	0.0000	2159.1611	167.2299	0.0000	0.2156	0.0128
40	8	8	10000	10.49	500	80	6	1.0	0.0000	1684.3835	190.1619	0.1640	0.0000	1.0	0.0000	1684.3835	190.1619	0.0000	0.1640	0.0152
40	8	8	1000	5	1500	0	1	6.0	0.7543	11739.5996	465.8766	0.4218	0.0000	6.0	0.7543	11739.5996	465.8766	0.0000	0.4218	0.0664
40	8	8	1000	5	1500	0	2	6.0	0.7543	11798.5996	475.1937	0.4282	0.0000	6.0	0.7543	11798.5996	475.1937	0.0000	0.4282	0.0685
40	8	8	1000	5	1500	0	3	6.0	0.7543	11859.5996	471.5565	0.4313	0.0000	6.0	0.7543	11859.5996	471.5565	0.0000	0.4313	0.0686
40	8	8	1000	5	1500	0	4	6.0	0.7543	11891.0000	466.7280	0.4423	0.0000	6.0	0.7543	11891.0000	466.7280	0.0000	0.4423	0.0721
40	8	8	1000	5	1500	0	5	6.0	0.7543	11857.5996	487.4485	0.4359	0.0000	6.0	0.7543	11857.5996	487.4485	0.0000	0.4359	0.0696
40	8	8	1000	5	1500	0	6	6.0	0.7543	11849.7998	460.5399	0.4391	0.0000	6.0	0.7543	11849.7998	460.5399	0.0000	0.4391	0.0676
40	8	8	2000	6.25	1500	0	1	3.0	0.0000	8301.0498	330.6989	0.6250	0.0000	3.0	0.0000	8301.0498	330.6989	0.0000	0.6250	0.0105
40	8	8	2000	6.25	1500	0	2	3.0	0.0000	8426.0996	349.4461	0.6148	0.0000	3.0	0.0000	8426.0996	349.4461	0.0000	0.6148	0.0148
40	8	8	2000	6.25	1500	0	3	3.0	0.0000	8380.5498	335.3871	0.6517	0.0000	3.0	0.0000	8380.5498	335.3871	0.0000	0.6517	0.0117
40	8	8	2000	6.25	1500	0	4	3.0	0.0000	8390.3496	333.1093	0.6590	0.0000	3.0	0.0000	8390.3496	333.1093	0.0000	0.6590	0.0146
40	8	8	2000	6.25	1500	0	5	3.0	0.0000	8360.2002	326.2195	0.6501	0.0000	3.0	0.0000	8360.2002	326.2195	0.0000	0.6501	0.0142
40	8	8	2000	6.25	1500	0	6	3.0	0.0000	8361.0996	326.2651	0.6527	0.0000	3.0	0.0000	8361.0996	326.2651	0.0000	0.6527	0.0115
40	8	8	3000	7.121	1500	0	1	3.0	0.0000	7257.5718	265.3273	0.9969	0.0000	3.0	0.0000	7257.5718	265.3273	0.0000	0.9969	0.0229
40	8	8	3000	7.121	1500	0	2	3.0	0.0000	7416.6772	270.7134	1.0391	0.0000	3.0	0.0000	7416.6772	270.7134	0.0000	1.0391	0.0272
40	8	8	3000	7.121	1500	0	3	3.0	0.0000	7408.0562	264.5889	1.0454	0.0000	3.0	0.0000	7408.0562	264.5889	0.0000	1.0454	0.0219
40	8	8	3000	7.121	1500	0	4	3.0	0.0000	7268.9990	267.1461	1.0063	0.0000	3.0	0.0000	7268.9990	267.1461	0.0000	1.0063	0.0151
40	8	8	3000	7.121	1500	0	5	3.0	0.0000	7360.2710	255.6342	1.0266	0.0000	3.0	0.0000	7360.2710	255.6342	0.0000	1.0266	0.0190
40	8	8	3000	7.121	1500	0	6	3.0	0.0000	7266.7446	248.4810	1.0157	0.0000	3.0	0.0000	7266.7446	248.4810	0.0000	1.0157	0.0225
40	8	8	4000	7.813	1500	0	1	3.0	0.0000	7377.1001	258.8651	1.0108	0.0000	3.0	0.0000	7377.1001	258.8651	0.0000	1.0108	0.0177
40	8	8	4000	7.813	1500	0	2	3.0	0.0000	7542.9873	265.8221	1.0640	0.0000	3.0	0.0000	7542.9873	265.8221	0.0000	1.0640	0.0266
40	8	8	4000	7.813	1500	0	3	3.0	0.0000	7538.5625	268.5494	1.0844	0.0000	3.0	0.0000	7538.5625	268.5494	0.0000	1.0844	0.0232
40	8	8	4000	7.813	1500	0	4	3.0	0.0000	7367.5874	261.5657	1.0235	0.0000	3.0	0.0000	7367.5874	261.5657	0.0000	1.0235	0.0175
40	8	8	4000	7.813	1500	0	5	3.0	0.0000	7536.9375	270.1491	1.0734	0.0000	3.0	0.0000	7536.9375	270.1491	0.0000	1.0734	0.0247
40	8	8	4000	7.813	1500	0	6	3.0	0.0000	7357.1499	248.0522	1.0264	0.0000	3.0	0.0000	7357.1499	248.0522	0.0000	1.0264	0.0184
40	8	8	5000	8.394	1500	0	1	3.0	0.0000	7753.2305	267.9608	1.0202	0.0000	3.0	0.0000	7753.2305	267.9608	0.0000	1.0202	0.0225
40	8	8	5000	8.394	1500	0	2	3.0	0.0000	7924.1143	289.9634	1.0750	0.0000	3.0	0.0000	7924.1143	289.9634	0.0000	1.0750	0.0257
40	8	8	5000	8.394	1500	0	3	3.0	0.0000	7943.6572	278.9193	1.0827	0.0000	3.0	0.0000	7943.6572	278.9193	0.0000	1.0827	0.0223
40	8	8	5000	8.394	1500	0	4	3.0	0.0000	7744.1357	261.8168	1.0298	0.0000	3.0	0.0000	7744.1357	261.8168	0.0000	1.0298	0.0178
40	8	8	5000	8.394	1500	0	5	3.0	0.0000	7952.0986	288.9843	1.0875	0.0000	3.0	0.0000	7952.0986	288.9843	0.0000	1.0875	0.0244
40	8	8	5000	8.394	1500	0	6	3.0	0.0000	7734.7148	279.2997	1.0313	0.0000	3.0	0.0000	7734.7148	279.2997	0.0000	1.0313	0.0216
40	8	8	6000	8.902	1500	0	1	3.0	0.0000	8101.1650	279.3567	1.0268	0.0000	3.0	0.0000	8101.1650	279.3567	0.0000	1.0268	0.0230
40	8	8	6000	8.902	1500	0	2	3.0	0.0000	8275.6494	305.4762	1.0751	0.0000	3.0	0.0000	8275.6494	305.4762	0.0000	1.0751	0.0256
40	8	8	6000	8.902	1500	0	3	3.0	0.0000	8289.9893	291.2242	1.0907	0.0000	3.0	0.0000	8289.9893	291.2242	0.0000	1.0907	0.0246
40	8	8	6000	8.902	1500	0	4	3.0	0.0000	8077.5635	275.9550	1.0327	0.0000	3.0	0.0000	8077.5635	275.9550	0.0000	1.0327	0.0200
40	8	8	6000	8.902	1500	0	5	3.0	0.0000	8296.3271	298.2678	1.0859	0.0000	3.0	0.0000	8296.3271	298.2678	0.0000	1.0859	0.0199

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	±CI	Solve time	±CI	Weighted port count	# of OEOs	±CI	Solve time
[Gb/s]			[km]	[ratio]	[Gb/s]	[%]				@F _{min}	@F _{min}		[sec]		@F _{opt}	@F _{opt}		[sec]
40	8	8	6000	8.902	1500	0	6	3.0	0.0000	8083.4438	289.7347	0.0000	1.0376	0.0192	8083.4438	289.7347	0.0000	1.0376
40	8	8	7000	9.355	1500	0	1	3.0	0.0000	8404.8662	290.6331	0.0000	1.0280	0.0203	8404.8662	290.6331	0.0000	1.0280
40	8	8	7000	9.355	1500	0	2	3.0	0.0000	8581.5195	315.1805	0.0000	1.0828	0.0274	8581.5195	315.1805	0.0000	1.0828
40	8	8	7000	9.355	1500	0	3	3.0	0.0000	8579.6777	306.8347	0.0000	1.0359	0.0238	8579.6777	306.8347	0.0000	1.0359
40	8	8	7000	9.355	1500	0	4	3.0	0.0000	8377.1123	282.9493	0.0000	1.0359	0.0191	8377.1123	282.9493	0.0000	1.0359
40	8	8	7000	9.355	1500	0	5	3.0	0.0000	8599.4365	307.5804	0.0000	1.0954	0.0266	8599.4365	307.5804	0.0000	1.0954
40	8	8	7000	9.355	1500	0	6	3.0	0.0000	8383.9824	288.4592	0.0000	1.0344	0.0189	8383.9824	288.4592	0.0000	1.0344
40	8	8	8000	9.766	1500	0	1	3.0	0.0000	8676.1504	299.0470	0.0000	1.0311	0.0204	8676.1504	299.0470	0.0000	1.0311
40	8	8	8000	9.766	1500	0	2	3.0	0.0000	8857.9092	325.5041	0.0000	1.0813	0.0272	8857.9092	325.5041	0.0000	1.0813
40	8	8	8000	9.766	1500	0	3	3.0	0.0000	8872.9033	308.1967	0.0000	1.0968	0.0195	8872.9033	308.1967	0.0000	1.0968
40	8	8	8000	9.766	1500	0	4	3.0	0.0000	8644.7842	297.2658	0.0000	1.0405	0.0182	8644.7842	297.2658	0.0000	1.0405
40	8	8	8000	9.766	1500	0	5	3.0	0.0000	8881.7969	305.0956	0.0000	1.0969	0.0252	8881.7969	305.0956	0.0000	1.0969
40	8	8	8000	9.766	1500	0	6	3.0	0.0000	8655.6377	298.2193	0.0000	1.0359	0.0191	8655.6377	298.2193	0.0000	1.0359
40	8	8	9000	10.14	1500	0	1	3.0	0.0000	8926.1387	308.1341	0.0000	1.0281	0.0234	8926.1387	308.1341	0.0000	1.0281
40	8	8	9000	10.14	1500	0	2	3.0	0.0000	9112.3564	335.2980	0.0000	1.0842	0.0260	9112.3564	335.2980	0.0000	1.0842
40	8	8	9000	10.14	1500	0	3	3.0	0.0000	9127.7988	317.6373	0.0000	1.1031	0.0243	9127.7988	317.6373	0.0000	1.1031
40	8	8	9000	10.14	1500	0	4	3.0	0.0000	8893.3965	304.5991	0.0000	1.0405	0.0205	8893.3965	304.5991	0.0000	1.0405
40	8	8	9000	10.14	1500	0	5	3.0	0.0000	9135.5410	315.1808	0.0000	1.1018	0.0244	9135.5410	315.1808	0.0000	1.1018
40	8	8	9000	10.14	1500	0	6	3.0	0.0000	8905.3262	307.2119	0.0000	1.0407	0.0192	8905.3262	307.2119	0.0000	1.0407
40	8	8	10000	10.49	1500	0	1	3.0	0.0000	9157.9375	316.5612	0.0000	1.0342	0.0189	9157.9375	316.5612	0.0000	1.0342
40	8	8	10000	10.49	1500	0	2	3.0	0.0000	9349.4434	344.1668	0.0000	1.0875	0.0237	9349.4434	344.1668	0.0000	1.0875
40	8	8	10000	10.49	1500	0	3	3.0	0.0000	9369.4473	330.8804	0.0000	1.1000	0.0255	9369.4473	330.8804	0.0000	1.1000
40	8	8	10000	10.49	1500	0	4	3.0	0.0000	9121.5449	314.4198	0.0000	1.0454	0.0179	9121.5449	314.4198	0.0000	1.0454
40	8	8	10000	10.49	1500	0	5	3.0	0.0000	9375.7500	320.9715	0.0000	1.1061	0.0283	9375.7500	320.9715	0.0000	1.1061
40	8	8	10000	10.49	1500	0	6	3.0	0.0000	9143.5449	319.1400	0.0000	1.0407	0.0177	9143.5449	319.1400	0.0000	1.0407
40	8	8	1000	5	1500	80	1	2.8	0.4526	2840.6001	343.7424	16.2408	0.1389	0.0238	2840.6001	343.7424	16.2408	0.0238
40	8	8	1000	5	1500	80	2	2.8	0.4526	2924.6001	362.5554	114.5000	0.1421	0.0244	2924.6001	362.5554	114.5000	0.1421
40	8	8	1000	5	1500	80	3	2.8	0.4526	2957.2000	357.1150	116.3000	0.1421	0.0208	2957.2000	357.1150	116.3000	0.1421
40	8	8	1000	5	1500	80	4	2.8	0.4526	3000.2000	362.2587	111.3000	0.1453	0.0210	3000.2000	362.2587	111.3000	0.1453
40	8	8	1000	5	1500	80	5	2.8	0.4526	3023.2000	389.7054	118.6000	0.1406	0.0241	3023.2000	389.7054	118.6000	0.1406
40	8	8	1000	5	1500	80	6	2.8	0.4526	2959.5000	370.4637	109.5000	0.1453	0.0210	2959.5000	370.4637	109.5000	0.1453
40	8	8	2000	6.25	1500	80	1	1.0	0.0000	2216.8000	266.2616	37.9000	0.8951	0.0077	2169.8501	238.4486	35.1000	0.7913
40	8	8	2000	6.25	1500	80	2	1.0	0.0000	2327.7000	254.0040	40.8000	0.8226	0.0094	2286.3501	226.4780	37.8000	0.7950
40	8	8	2000	6.25	1500	80	3	1.0	0.0000	2298.2500	280.6139	41.8000	0.9640	0.0070	2239.0500	235.5626	38.2000	0.7199
40	8	8	2000	6.25	1500	80	4	1.0	0.0000	2247.6001	257.3464	36.7000	0.8286	0.0075	2200.4500	224.8216	33.8000	0.7546
40	8	8	2000	6.25	1500	80	5	1.0	0.0000	2270.9500	254.4534	39.7000	0.8912	0.0070	2235.8000	230.6973	37.3000	0.7588
40	8	8	2000	6.25	1500	80	6	1.0	0.0000	2252.8999	251.4944	36.6000	0.9349	0.0088	2210.6001	225.5869	33.9000	0.8028
40	8	8	3000	7.121	1500	80	1	1.0	0.0000	2004.7936	188.0942	4.9000	2.5788	0.0183	1995.8962	183.8867	4.7000	2.4336
40	8	8	3000	7.121	1500	80	2	1.0	0.0000	2160.1209	165.6905	5.8000	2.0182	0.0137	2149.3511	168.0198	5.2000	2.1546
40	8	8	3000	7.121	1500	80	3	1.0	0.0000	2203.9126	189.4731	7.0000	2.1860	0.0144	2199.8154	186.5971	6.7000	2.0532
40	8	8	3000	7.121	1500	80	4	1.0	0.0000	1986.5505	193.5479	4.7000	2.1873	0.0200	1984.3264	194.0164	4.5000	2.3911
40	8	8	3000	7.121	1500	80	5	1.0	0.0000	2164.9482	148.0281	6.8000	2.2324	0.0157	2159.8511	146.2591	6.3000	2.2132
40	8	8	3000	7.121	1500	80	6	1.0	0.0000	2001.1449	169.1441	4.9000	2.0642	0.0133	1979.6777	170.8063	4.6000	2.1387
40	8	8	4000	7.813	1500	80	1	1.0	0.0000	2102.7749	224.7299	0.4000	0.6913	0.0199	2082.8750	208.1634	0.0000	0.2595
40	8	8	4000	7.813	1500	80	2	1.0	0.0000	2254.3875	174.2255	0.4000	0.5003	0.0219	2247.3750	175.2031	0.0000	0.3217
40	8	8	4000	7.813	1500	80	3	1.0	0.0000	2317.1875	194.0488	0.5000	0.6954	0.0296	2315.0249	192.9810	0.4000	0.6913
40	8	8	4000	7.813	1500	80	4	1.0	0.0000	2064.3000	210.5592	0.0000	0.0000	0.0238	2061.6626	209.5059	0.0000	0.2642
40	8	8	4000	7.813	1500	80	5	1.0	0.0000	2314.2124	189.1724	0.3000	0.4830	0.0233	2313.0500	189.4879	0.2000	0.4526
40	8	8	4000	7.813	1500	80	6	1.0	0.0000	2052.1125	190.2920	0.1000	0.2263	0.0157	2032.2500	191.4475	0.0000	0.2813

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
40	8	8	5000	8.394	1500	80	1	1.0	0.0000	2211.0652	236.3358	0.0000	0.1954	0.0208	0.0140	2194.4131	0.0000	0.0000	0.2594
40	8	8	5000	8.394	1500	80	2	1.0	0.0000	2362.3765	185.9134	0.0000	0.2249	0.0140	0.0140	2358.8611	0.0000	0.0000	0.2921
40	8	8	5000	8.394	1500	80	3	1.0	0.0000	2445.7063	203.9977	0.0000	0.2330	0.0201	0.0201	2443.2273	0.0000	0.0000	0.2674
40	8	8	5000	8.394	1500	80	4	1.0	0.0000	2157.8091	216.2965	0.0000	0.2092	0.0151	0.0151	2156.8091	0.0000	0.0000	0.2326
40	8	8	5000	8.394	1500	80	5	1.0	0.0000	2427.8540	204.3064	0.0000	0.2344	0.0231	0.0231	2423.8962	0.0000	0.0000	0.2734
40	8	8	5000	8.394	1500	80	6	1.0	0.0000	2146.4934	200.8479	0.0000	0.1999	0.0156	0.0156	2126.4624	0.0000	0.0000	0.2842
40	8	8	6000	8.902	1500	80	1	1.0	0.0000	2303.7075	246.9336	0.0000	0.1983	0.0198	0.0198	2286.5454	0.0000	0.0000	0.2625
40	8	8	6000	8.902	1500	80	2	1.0	0.0000	2461.4102	198.5265	0.0000	0.2233	0.0182	0.0182	2456.2886	0.0000	0.0000	0.2921
40	8	8	6000	8.902	1500	80	3	1.0	0.0000	2547.8799	211.4266	0.0000	0.2343	0.0216	0.0216	2546.6997	0.0000	0.0000	0.1026
40	8	8	6000	8.902	1500	80	4	1.0	0.0000	2244.1201	226.3302	0.0000	0.2093	0.0192	0.0192	2243.1201	0.0000	0.0000	0.2358
40	8	8	6000	8.902	1500	80	5	1.0	0.0000	2530.7173	212.9008	0.0000	0.2409	0.0231	0.0231	2526.1567	0.0000	0.0000	0.3143
40	8	8	6000	8.902	1500	80	6	1.0	0.0000	2236.5986	209.2103	0.0000	0.2031	0.0129	0.0129	2215.1558	0.0000	0.0000	0.2828
40	8	8	7000	9.355	1500	80	1	1.0	0.0000	2391.5208	253.9213	0.0000	0.2081	0.0191	0.0191	2370.3240	0.0000	0.0000	0.2955
40	8	8	7000	9.355	1500	80	2	1.0	0.0000	2549.3481	205.6550	0.0000	0.2250	0.0143	0.0143	2538.6646	0.0000	0.0000	0.2924
40	8	8	7000	9.355	1500	80	3	1.0	0.0000	2638.4639	217.9940	0.0000	0.2376	0.0164	0.0164	2636.1929	0.0000	0.0000	0.3047
40	8	8	7000	9.355	1500	80	4	1.0	0.0000	2326.4309	233.6986	0.0000	0.2109	0.0176	0.0176	2325.4309	0.0000	0.0000	0.2376
40	8	8	7000	9.355	1500	80	5	1.0	0.0000	2621.0671	224.1398	0.0000	0.2405	0.0212	0.0212	2615.5254	0.0000	0.0000	0.2781
40	8	8	7000	9.355	1500	80	6	1.0	0.0000	2314.7468	217.9692	0.0000	0.2047	0.0170	0.0170	2293.1792	0.0000	0.0000	0.2874
40	8	8	8000	9.766	1500	80	1	1.0	0.0000	2464.3657	264.1413	0.0000	0.2001	0.0211	0.0211	2443.3938	0.0000	0.0000	0.2925
40	8	8	8000	9.766	1500	80	2	1.0	0.0000	2629.4063	211.2630	0.0000	0.2233	0.0130	0.0130	2623.1938	0.0000	0.0000	0.2906
40	8	8	8000	9.766	1500	80	3	1.0	0.0000	2724.2407	226.8967	0.0000	0.2359	0.0163	0.0163	2721.6875	0.0000	0.0000	0.3047
40	8	8	8000	9.766	1500	80	4	1.0	0.0000	2397.3501	242.8248	0.0000	0.2078	0.0183	0.0183	2396.3501	0.0000	0.0000	0.2312
40	8	8	8000	9.766	1500	80	5	1.0	0.0000	2703.5688	231.7588	0.0000	0.2404	0.0230	0.0230	2696.0625	0.0000	0.0000	0.3169
40	8	8	8000	9.766	1500	80	6	1.0	0.0000	2387.5376	224.7539	0.0000	0.2063	0.0180	0.0180	2365.1125	0.0000	0.0000	0.2876
40	8	8	9000	10.14	1500	80	1	1.0	0.0000	2532.3730	271.9010	0.0000	0.2014	0.0207	0.0207	2510.8726	0.0000	0.0000	0.2982
40	8	8	9000	10.14	1500	80	2	1.0	0.0000	2702.2178	217.6539	0.0000	0.2235	0.0158	0.0158	2695.7034	0.0000	0.0000	0.2938
40	8	8	9000	10.14	1500	80	3	1.0	0.0000	2799.6902	234.2962	0.0000	0.2391	0.0198	0.0198	2796.2617	0.0000	0.0000	0.3108
40	8	8	9000	10.14	1500	80	4	1.0	0.0000	2463.5723	250.0175	0.0000	0.2094	0.0185	0.0185	2462.5723	0.0000	0.0000	0.2359
40	8	8	9000	10.14	1500	80	5	1.0	0.0000	2778.8899	240.6214	0.0000	0.2407	0.0238	0.0238	2770.2329	0.0000	0.0000	0.3157
40	8	8	9000	10.14	1500	80	6	1.0	0.0000	2452.8579	231.1331	0.0000	0.2077	0.0190	0.0190	2430.4290	0.0000	0.0000	0.2921
40	8	8	10000	10.49	1500	80	1	1.0	0.0000	2595.4316	279.0978	0.0000	0.2080	0.0183	0.0183	2573.4414	0.0000	0.0000	0.2955
40	8	8	10000	10.49	1500	80	2	1.0	0.0000	2769.5457	223.8104	0.0000	0.2297	0.0151	0.0151	2763.1514	0.0000	0.0000	0.2954
40	8	8	10000	10.49	1500	80	3	1.0	0.0000	2868.9080	240.7764	0.0000	0.2374	0.0217	0.0217	2865.4094	0.0000	0.0000	0.3079
40	8	8	10000	10.49	1500	80	4	1.0	0.0000	2525.1614	256.8072	0.0000	0.2110	0.0218	0.0218	2524.1614	0.0000	0.0000	0.2375
40	8	8	10000	10.49	1500	80	5	1.0	0.0000	2847.6177	247.1346	0.0000	0.2377	0.0222	0.0222	2838.8206	0.0000	0.0000	0.3143
40	8	8	10000	10.49	1500	80	6	1.0	0.0000	2514.1670	237.5431	0.0000	0.2081	0.0175	0.0175	2491.1782	0.0000	0.0000	0.2894

Table C.2: Comparison of no-bifurcation-based heuristics with the optical-reach customization for the 8-node network.

C	W	B	R _{max} [km]	E/O cost	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	4	4	1000	2	500	0	1	26.6	1.6247	5909.2002	214.6959	0.5187	0.0444	26.6	1.6247	5909.2002	366.0000	214.6959	0.5187	0.0444
10	4	4	1000	2	500	0	2	26.6	1.6247	5957.2002	219.3763	0.5172	0.0478	26.6	1.6247	5957.2002	370.7000	219.3763	0.5172	0.0478
10	4	4	1000	2	500	0	3	26.6	1.6247	6010.7998	226.4085	0.5282	0.0475	26.6	1.6247	6010.7998	371.8000	226.4085	0.5282	0.0475
10	4	4	1000	2	500	0	4	26.6	1.6247	5982.7998	201.1693	0.5345	0.0464	26.6	1.6247	5982.7998	379.6000	201.1693	0.5345	0.0464
10	4	4	1000	2	500	0	5	26.8	1.7133	6030.0000	225.2728	0.5391	0.0473	26.8	1.7133	6030.0000	373.0000	225.2728	0.5391	0.0473
10	4	4	1000	2	500	0	6	26.8	1.7133	5986.7998	200.2578	0.5422	0.0504	26.8	1.7133	5986.7998	377.2000	200.2578	0.5422	0.0504
10	4	4	2000	2.5	500	0	1	9.4	0.6034	4093.2000	183.9005	0.3610	0.0485	11.8	1.0066	3921.3999	110.8000	183.9005	0.3610	0.0485
10	4	4	2000	2.5	500	0	2	9.2	0.4526	4147.1001	195.3424	0.3595	0.0459	11.6	1.1782	3967.8000	114.7000	195.3424	0.3595	0.0459
10	4	4	2000	2.5	500	0	3	9.4	0.6034	4154.6001	210.6507	0.3721	0.0538	12.0	1.0119	3957.6001	112.9000	210.6507	0.3721	0.0538
10	4	4	2000	2.5	500	0	4	9.6	0.6913	4108.2002	187.7493	0.4030	0.0657	12.0	1.0119	3958.3999	112.4364	187.7493	0.4030	0.0657
10	4	4	2000	2.5	500	0	5	9.2	0.4526	4208.2998	241.0116	0.3518	0.0381	12.0	1.0119	3957.3999	112.8000	241.0116	0.3518	0.0381
10	4	4	2000	2.5	500	0	6	9.4	0.6034	4091.3999	163.2353	0.3844	0.0531	11.8	1.2068	3939.6001	116.8955	163.2353	0.3844	0.0531
10	4	4	3000	2.849	500	0	1	8.0	0.7543	3595.1204	164.3361	0.3719	0.0951	11.6	1.3577	3369.2251	104.3868	164.3361	0.3719	0.0951
10	4	4	3000	2.849	500	0	2	8.2	0.7390	3674.0422	174.7960	0.4005	0.0961	11.4	1.1289	3458.4285	119.5704	174.7960	0.4005	0.0961
10	4	4	3000	2.849	500	0	3	8.4	0.6913	3657.3633	166.1575	0.4673	0.1202	11.4	1.4780	3453.8586	104.3037	166.1575	0.4673	0.1202
10	4	4	3000	2.849	500	0	4	8.0	0.7543	3639.0808	161.3807	0.4141	0.0946	11.4	1.1289	3375.3433	112.3056	161.3807	0.4141	0.0946
10	4	4	3000	2.849	500	0	5	8.2	0.7390	3683.8914	200.2061	0.4392	0.1078	11.2	1.4231	3437.5405	109.5679	200.2061	0.4392	0.1078
10	4	4	3000	2.849	500	0	6	8.2	0.7390	3585.6199	135.9797	0.4468	0.1085	11.6	1.3577	3395.0945	96.0650	135.9797	0.4468	0.1085
10	4	4	4000	3.125	500	0	1	8.0	0.7543	3409.0208	166.8781	0.3719	0.0951	10.2	0.7390	3281.2422	97.7162	166.8781	0.3719	0.0951
10	4	4	4000	3.125	500	0	2	8.2	0.7390	3476.8716	151.5697	0.5017	0.0967	10.4	0.6913	3352.1577	100.4510	151.5697	0.5017	0.0967
10	4	4	4000	3.125	500	0	3	8.4	0.6913	3477.7988	143.1313	0.4984	0.1246	10.8	0.8124	3383.6851	110.3790	143.1313	0.4984	0.1246
10	4	4	4000	3.125	500	0	4	8.0	0.7543	3452.9370	147.5587	0.4469	0.0971	10.6	0.9051	3280.6660	98.7138	147.5587	0.4469	0.0971
10	4	4	4000	3.125	500	0	5	8.4	0.6913	3474.8528	131.7902	0.5156	0.1226	10.2	0.7390	3377.2903	102.5314	131.7902	0.5156	0.1226
10	4	4	4000	3.125	500	0	6	8.2	0.7390	3408.3022	144.4427	0.4783	0.1120	10.4	0.9659	3287.9038	88.8089	144.4427	0.4783	0.1120
10	4	4	5000	3.358	500	0	1	8.4	0.6913	3441.7700	67.6297	0.3889	0.0640	10.8	0.8124	3316.5854	107.5265	67.6297	0.3889	0.0640
10	4	4	5000	3.358	500	0	2	8.2	0.7390	3523.0437	104.3533	0.4247	0.0958	10.8	1.2531	3391.6353	114.2304	104.3533	0.4247	0.0958
10	4	4	5000	3.358	500	0	3	8.6	0.6034	3514.9895	99.2844	0.4220	0.0617	11.6	1.3577	3414.9226	101.2450	99.2844	0.4220	0.0617
10	4	4	5000	3.358	500	0	4	8.4	0.6913	3358.8833	99.7045	0.4530	0.0730	10.8	1.2531	3305.6453	110.7897	99.7045	0.4530	0.0730
10	4	4	5000	3.358	500	0	5	8.8	0.4526	3510.4897	145.6385	0.4500	0.0794	10.4	0.9659	3413.3020	112.4805	145.6385	0.4500	0.0794
10	4	4	5000	3.358	500	0	6	8.6	0.6034	3376.3477	113.7749	0.4704	0.0809	10.8	1.0560	3318.9343	102.6486	113.7749	0.4704	0.0809
10	4	4	6000	3.561	500	0	1	8.4	0.6913	3368.4761	84.0532	0.4314	0.0761	10.6	0.6034	3301.3530	106.3865	84.0532	0.4314	0.0761
10	4	4	6000	3.561	500	0	2	8.6	0.6034	3433.4575	117.4959	0.4908	0.0872	10.2	1.2068	3392.4246	110.8913	117.4959	0.4908	0.0872
10	4	4	6000	3.561	500	0	3	8.6	0.6034	3461.2410	121.9162	0.4908	0.0837	10.4	0.9659	3410.5640	99.8422	121.9162	0.4908	0.0837
10	4	4	6000	3.561	500	0	4	8.4	0.6913	3339.9478	119.4065	0.4851	0.0818	9.4	0.9051	3301.2202	113.0167	119.4065	0.4851	0.0818
10	4	4	6000	3.561	500	0	5	8.4	0.6913	3458.4148	85.4403	0.4702	0.1025	10.0	1.0119	3404.3306	110.5558	85.4403	0.4702	0.1025
10	4	4	6000	3.561	500	0	6	8.4	0.6913	3352.5188	98.4677	0.4813	0.0841	9.8	1.0066	3308.0066	97.5640	98.4677	0.4813	0.0841
10	4	4	7000	3.742	500	0	1	8.4	0.6913	3403.3364	73.5013	0.3899	0.0678	11.0	0.6746	3312.5483	105.6048	73.5013	0.3899	0.0678
10	4	4	7000	3.742	500	0	2	8.2	0.7390	3490.1121	114.7876	0.4224	0.0983	10.8	1.4231	3398.9341	115.9224	114.7876	0.4224	0.0983
10	4	4	7000	3.742	500	0	3	8.6	0.6034	3503.0161	104.6099	0.4138	0.0728	11.4	1.1289	3424.8953	99.9775	104.6099	0.4138	0.0728
10	4	4	7000	3.742	500	0	4	8.4	0.6913	3341.8894	94.6078	0.4448	0.0775	10.8	1.5749	3306.4751	105.2301	94.6078	0.4448	0.0775
10	4	4	7000	3.742	500	0	5	8.6	0.6034	3512.1985	107.5012	0.4580	0.0813	11.0	0.6746	3419.6558	117.2072	107.5012	0.4580	0.0813
10	4	4	7000	3.742	500	0	6	8.6	0.6034	3364.3945	118.8501	0.4740	0.0779	10.4	0.9659	3315.0398	103.9661	118.8501	0.4740	0.0779
10	4	4	8000	3.906	500	0	1	8.4	0.6913	3399.6790	77.8259	0.3870	0.0690	10.8	0.8124	3311.0168	104.7059	77.8259	0.3870	0.0690
10	4	4	8000	3.906	500	0	2	8.2	0.7390	3493.5906	108.2453	0.4198	0.0933	10.8	1.4231	3397.7739	116.4727	108.2453	0.4198	0.0933
10	4	4	8000	3.906	500	0	3	8.6	0.6034	3512.5430	102.5658	0.4112	0.0702	11.4	1.1289	3424.8953	99.9775	102.5658	0.4112	0.0702
10	4	4	8000	3.906	500	0	4	8.4	0.6913	3349.4819	100.0366	0.4442	0.0730	10.8	1.5749	3306.9302	107.9778	100.0366	0.4442	0.0730
10	4	4	8000	3.906	500	0	5	8.6	0.6034	3509.5051	106.2903	0.4112	0.0769	10.8	0.8124	3424.0444	119.8553	106.2903	0.4112	0.0769

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	Solve time [sec]	±CI
10	4	4	7000	3.742	500	80	1	3.2	0.4526	1138.0728	125.2894	0.4000	0.6913	0.1096	1073.4611	97.9125	0.0000	0.2142	0.0458
10	4	4	7000	3.742	500	80	2	3.6	0.6913	1211.0129	119.7792	0.0000	0.0000	0.0348	1171.7322	105.1107	0.0000	0.2316	0.0464
10	4	4	7000	3.742	500	80	3	3.6	0.6913	1234.5507	102.3825	0.0000	0.0000	0.1454	1201.3937	100.4301	0.0000	0.2468	0.0424
10	4	4	7000	3.742	500	80	4	3.2	0.4526	1117.0836	130.9139	0.2000	0.3017	0.1070	1071.8339	103.0278	0.0000	0.2126	0.0525
10	4	4	7000	3.742	500	80	5	3.4	0.6034	1251.7770	108.7472	0.0000	0.0000	0.1268	1216.2527	102.5671	0.0000	0.2236	0.0476
10	4	4	7000	3.742	500	80	6	3.2	0.4526	1079.6304	133.4541	0.1000	0.2263	0.1078	1015.7084	106.7589	0.0000	0.1954	0.0423
10	4	4	8000	3.906	500	80	1	3.2	0.4526	1136.4055	123.2318	0.3000	0.6788	0.1093	1073.9302	98.1616	0.0000	0.2142	0.0463
10	4	4	8000	3.906	500	80	2	3.6	0.6913	1212.4235	120.3967	0.0000	0.0000	0.1406	1173.2737	106.1587	0.0000	0.2282	0.0460
10	4	4	8000	3.906	500	80	3	3.6	0.6913	1235.2926	102.5634	0.0000	0.0000	0.1421	1201.6628	100.4578	0.0000	0.2422	0.0436
10	4	4	8000	3.906	500	80	4	3.2	0.4526	1116.4213	131.3363	0.1000	0.2263	0.1046	1074.5559	104.5563	0.0000	0.2093	0.0515
10	4	4	8000	3.906	500	80	5	3.4	0.6034	1250.2776	109.0446	0.0000	0.0000	0.1297	1215.0720	102.5619	0.0000	0.2218	0.0439
10	4	4	8000	3.906	500	80	6	3.2	0.4526	1081.4176	134.4958	0.0000	0.0000	0.1094	1015.7084	106.7589	0.0000	0.1922	0.0434
10	4	4	9000	4.057	500	80	1	3.2	0.4526	1136.3713	123.1439	0.3000	0.6788	0.1094	1073.9302	98.1616	0.0000	0.2142	0.0458
10	4	4	9000	4.057	500	80	2	3.6	0.6913	1213.6292	120.8155	0.0000	0.0000	0.1390	1173.2737	106.1587	0.0000	0.2281	0.0490
10	4	4	9000	4.057	500	80	3	3.6	0.6913	1235.9558	102.5914	0.0000	0.0000	0.1451	1201.6628	100.4578	0.0000	0.2486	0.0430
10	4	4	9000	4.057	500	80	4	3.2	0.4526	1110.2178	124.5692	0.1000	0.2263	0.1047	1073.3014	103.9451	0.0000	0.2107	0.0529
10	4	4	9000	4.057	500	80	5	3.4	0.6034	1249.6814	107.0675	0.0000	0.0000	0.1313	1215.2422	102.3257	0.0000	0.2219	0.0403
10	4	4	9000	4.057	500	80	6	3.2	0.4526	1081.4176	134.4958	0.0000	0.0000	0.1092	1015.7084	106.7589	0.0000	0.1923	0.0442
10	4	4	10000	4.197	500	80	1	78.2	4.5356	9305.5996	284.2246	623.2000	38.9676	1.9406	9305.5996	284.2246	623.2000	1.9406	0.1837
10	4	4	10000	4.197	500	80	2	78.2	4.5356	9366.7998	314.5629	617.6000	28.2904	1.9468	9366.7998	314.5629	617.6000	1.9468	0.1867
10	4	4	10000	4.197	500	80	3	78.2	4.5356	9383.5996	320.2444	616.4000	27.5879	1.9645	9383.5996	320.2444	616.4000	1.9645	0.1886
10	4	4	10000	4.197	500	80	4	78.2	4.5356	9338.7998	331.7174	653.1000	48.6612	1.9969	9338.7998	331.7174	653.1000	1.9969	0.1923
10	4	4	10000	4.197	500	80	5	78.2	4.5356	9412.7998	320.9104	618.7000	27.2389	1.9733	9412.7998	320.9104	618.7000	1.9733	0.1859
10	4	4	10000	4.197	500	80	6	78.2	4.5356	9329.2002	319.8884	647.3000	42.7842	1.9953	9329.2002	319.8884	647.3000	1.9953	0.1911
10	4	4	2000	2.5	1500	0	1	26.6	1.8841	6000.3999	395.7383	252.5000	46.1295	1.1935	6150.8999	228.7903	186.5000	2.4359	0.2733
10	4	4	2000	2.5	1500	0	2	26.4	1.6594	6727.5000	387.3138	282.6000	50.8102	1.2000	6240.2002	229.5237	188.3000	2.4123	0.2618
10	4	4	2000	2.5	1500	0	3	27.0	1.9081	6574.8999	344.1988	229.9000	28.0972	1.3514	6227.1001	230.0606	189.2000	2.3360	0.2280
10	4	4	2000	2.5	1500	0	4	26.6	1.8841	6527.6001	283.3333	239.7000	20.4012	1.2890	6169.0000	233.1669	185.4000	2.6125	0.3049
10	4	4	2000	2.5	1500	0	5	26.8	1.8414	6657.5000	361.2504	253.1000	38.6755	1.2469	6228.3999	229.3435	189.5000	2.2454	0.3881
10	4	4	2000	2.5	1500	0	6	26.6	1.7592	6566.8999	350.3780	244.9000	50.4407	1.2967	6190.7998	222.9531	187.1000	2.5721	0.2948
10	4	4	3000	2.849	1500	0	1	22.6	1.3151	6026.5381	309.3759	130.1000	47.0722	0.8954	5267.2969	179.9197	31.3000	3.7689	1.2484
10	4	4	3000	2.849	1500	0	2	23.6	1.6594	5756.6235	323.8669	87.6000	29.6301	1.5749	5379.8325	189.3677	34.9000	7.4625	0.6127
10	4	4	3000	2.849	1500	0	3	23.0	1.1685	5886.2080	312.7827	97.3000	34.2734	1.1343	5346.8965	171.8279	32.0000	5.6241	1.5060
10	4	4	3000	2.849	1500	0	4	22.6	1.1289	5693.6211	294.2639	92.2000	23.6450	1.2219	5256.5425	172.3257	30.9000	5.4541	1.5692
10	4	4	3000	2.849	1500	0	5	23.0	1.1685	5832.3604	283.8212	82.8000	17.4550	1.1624	5371.3936	176.8222	33.5000	6.2129	4.2189
10	4	4	3000	2.849	1500	0	6	22.2	1.2068	5792.8555	231.2211	106.8000	18.7437	1.1376	5294.4204	183.6546	30.9000	5.1648	1.6900
10	4	4	4000	3.125	1500	0	1	23.0	1.1685	5378.9165	281.5021	23.0000	13.0387	1.1766	5112.7603	184.9181	0.5000	0.6081	3.4562
10	4	4	4000	3.125	1500	0	2	24.0	1.2162	5477.2710	257.8762	23.0000	12.6211	1.5924	5223.5581	198.8706	0.5000	0.6954	1.4045
10	4	4	4000	3.125	1500	0	3	23.0	1.1685	5570.8228	281.6715	32.0000	16.6954	1.2874	5208.0903	183.9635	0.1000	0.2263	0.5499
10	4	4	4000	3.125	1500	0	4	22.6	1.1289	5427.8892	252.5512	34.6000	10.7528	1.2563	5094.0098	175.4433	2.3000	2.9026	1.9959
10	4	4	4000	3.125	1500	0	5	23.2	1.2531	5551.8892	261.1694	29.8000	10.7454	1.1888	5216.4209	190.7258	0.1000	0.2263	1.4061
10	4	4	4000	3.125	1500	0	6	22.4	1.3577	5506.0898	153.0972	44.7000	13.3656	1.2266	5116.6851	179.8982	0.1000	0.2263	1.3668
10	4	4	5000	3.358	1500	0	1	22.8	1.4231	5559.8115	282.7021	32.6000	20.8703	0.9063	5156.6177	192.5463	0.7000	1.5839	4.5094

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI		
10	4	4	5000	3.358	1500	0	2	24.4	1.3577	5404.9824	229.8779	8.5000	5.8546	1.7250	0.4235	30.0	2.5466	5260.4395	186.2241	0.1000	0.2263	4.1078	1.6107
10	4	4	5000	3.358	1500	0	3	24.4	1.6594	5566.0454	245.7799	23.0000	13.8913	1.3594	0.3404	32.6	2.5061	5259.5806	192.9708	0.0000	0.0000	5.3205	1.7360
10	4	4	5000	3.358	1500	0	4	22.6	1.1289	5328.0947	187.7534	12.4000	5.0054	1.2202	0.2466	27.6	1.9141	5151.2275	176.8953	0.2000	0.3017	2.6689	0.5617
10	4	4	5000	3.358	1500	0	5	24.0	1.6866	5666.3818	187.5396	28.0000	13.9200	1.1937	0.2922	32.2	3.1786	5267.2310	204.0072	0.0000	0.0000	5.0360	2.1630
10	4	4	5000	3.358	1500	0	6	23.6	1.5160	5338.8271	204.2135	13.4000	9.3430	1.4765	0.3840	28.0	2.3612	5159.5732	193.7066	0.0000	0.0000	2.6109	0.4942
10	4	4	6000	3.361	1500	0	1	22.8	1.0560	5449.6147	268.3396	21.0000	19.8155	0.9421	0.1560	30.4	3.1679	5151.0503	192.4704	0.1000	0.2263	3.7467	1.6050
10	4	4	6000	3.361	1500	0	2	24.0	1.0119	5433.2861	254.6492	8.7000	8.2490	1.6310	0.3053	30.0	2.9599	5264.0493	180.1104	0.0000	0.0000	3.9670	1.5035
10	4	4	6000	3.361	1500	0	3	23.8	1.3826	5522.1948	238.3413	12.7000	9.7415	1.2093	0.2744	30.2	2.5422	5264.5752	196.2252	0.0000	0.0000	4.3139	1.6713
10	4	4	6000	3.361	1500	0	4	22.6	1.1289	5296.9868	187.6463	9.2000	6.4778	1.2782	0.2562	28.2	1.3826	5160.4546	175.5250	0.0000	0.0000	3.4311	1.3064
10	4	4	6000	3.361	1500	0	5	23.8	1.2068	5656.8164	299.6382	27.2000	16.6408	1.1593	0.2312	30.4	2.7027	5280.7964	186.7018	0.0000	0.0000	3.9471	1.3868
10	4	4	6000	3.361	1500	0	6	23.2	1.4231	5345.9712	199.1283	13.0000	11.2482	1.1248	0.3337	29.6	2.3418	5173.6704	172.0905	0.0000	0.0000	3.1076	0.5669
10	4	4	7000	3.742	1500	0	1	23.4	1.4780	5411.6611	212.7381	10.3000	12.2089	1.0530	0.2419	30.0	3.3221	5172.1636	201.7898	0.0000	0.0000	4.1410	1.6420
10	4	4	7000	3.742	1500	0	2	24.4	1.3577	5385.5571	216.0219	2.7000	3.9489	1.7142	0.4329	31.4	2.5061	5264.4087	182.4386	0.0000	0.0000	5.4398	2.2593
10	4	4	7000	3.742	1500	0	3	24.2	1.8102	5529.2275	195.4415	14.9000	13.0747	1.3090	0.3555	32.4	2.1387	5276.9976	192.7358	0.0000	0.0000	4.2294	1.1340
10	4	4	7000	3.742	1500	0	4	22.6	1.1289	5295.4189	162.5100	5.8000	4.6837	1.2312	0.2025	28.4	1.6594	5161.0991	177.7855	0.0000	0.0000	3.2750	1.2848
10	4	4	7000	3.742	1500	0	5	24.0	1.6866	5569.1118	173.8447	16.7000	14.6296	1.2390	0.3042	31.0	3.0170	5285.3545	200.6591	0.0000	0.0000	4.1810	2.0426
10	4	4	7000	3.742	1500	0	6	23.4	1.7592	5376.4307	166.4839	12.3000	10.5974	1.3894	0.3761	28.6	2.4136	5166.0625	182.8450	0.0000	0.0000	3.2422	1.0543
10	4	4	8000	3.906	1500	0	1	23.4	1.4780	5397.4937	219.7247	9.2000	12.3375	1.0514	0.2410	30.0	3.3221	5173.2896	200.4756	0.0000	0.0000	4.1440	1.6278
10	4	4	8000	3.906	1500	0	2	24.4	1.3577	5387.3232	216.7208	2.6000	3.9797	1.7106	0.4246	31.4	2.5061	5264.4087	182.4386	0.0000	0.0000	5.4584	2.2612
10	4	4	8000	3.906	1500	0	3	24.2	1.8102	5532.8213	197.5988	14.9000	13.0747	1.3060	0.3587	32.4	2.1387	5276.9976	192.7358	0.0000	0.0000	4.2938	1.4881
10	4	4	8000	3.906	1500	0	4	22.6	1.1289	5296.0098	161.5802	5.8000	4.6837	1.2362	0.1975	28.4	1.6594	5160.1084	177.2624	0.0000	0.0000	3.2778	1.2753
10	4	4	8000	3.906	1500	0	5	24.0	1.6866	5564.0229	167.8588	16.4000	14.2639	1.2346	0.2992	31.0	3.0170	5283.3896	200.0227	0.0000	0.0000	4.1814	2.0476
10	4	4	8000	3.906	1500	0	6	23.6	1.6594	5369.9536	173.9538	11.5000	10.5015	1.3796	0.3842	28.6	2.4136	5166.0625	182.8450	0.0000	0.0000	3.2532	1.0616
10	4	4	9000	4.057	1500	0	1	23.2	1.4231	5373.5542	184.8280	4.8000	5.7224	1.0141	0.1892	30.2	2.7979	5168.2021	196.3124	0.0000	0.0000	3.3750	0.9174
10	4	4	9000	4.057	1500	0	2	24.4	1.3577	5386.6128	217.7924	2.7000	4.0765	1.7235	0.4489	30.8	2.6517	5267.2861	182.5830	0.0000	0.0000	4.8062	2.2401
10	4	4	9000	4.057	1500	0	3	24.0	1.6866	5525.8301	206.1663	14.1000	13.2304	1.4580	0.5819	31.0	2.9406	5278.7568	196.4508	0.0000	0.0000	3.9345	1.6162
10	4	4	9000	4.057	1500	0	4	22.6	1.1289	5369.5571	225.9959	11.6000	15.4104	1.1718	0.2442	28.8	1.9611	5153.0498	178.1711	0.0000	0.0000	2.8970	0.4125
10	4	4	9000	4.057	1500	0	5	23.6	1.5160	5594.7539	213.5437	16.3000	14.9679	1.5906	0.7554	31.0	2.7815	5276.5889	194.7318	0.0000	0.0000	3.4750	0.6654
10	4	4	9000	4.057	1500	0	6	23.6	1.6594	5376.3096	173.9249	9.8000	10.0957	1.3627	0.3961	29.2	2.5645	5166.2480	183.0907	0.0000	0.0000	3.5249	1.4966
10	4	4	10000	4.197	1500	0	1	23.4	1.4780	5409.4878	215.7950	9.0000	12.8356	1.0815	0.2278	30.4	3.5087	5180.8501	196.3590	0.0000	0.0000	3.1609	0.7343
10	4	4	10000	4.197	1500	0	2	24.2	1.3826	5403.5654	217.2694	2.6000	3.5730	1.5875	0.3838	30.0	2.2628	5273.1055	184.9201	0.1000	0.2263	3.8187	1.4644
10	4	4	10000	4.197	1500	0	3	24.0	1.8165	5545.8638	188.7659	13.4000	12.5949	1.5000	0.6433	30.6	2.7651	5275.3643	193.4575	0.0000	0.0000	3.4842	0.5706
10	4	4	10000	4.197	1500	0	4	22.6	1.1289	5294.6226	161.8140	4.9000	4.0681	1.2296	0.2033	28.6	1.6247	5164.5186	179.5446	0.0000	0.0000	2.8172	0.3552
10	4	4	10000	4.197	1500	0	5	24.2	1.8102	5510.4893	186.0377	8.4000	9.7774	1.8095	0.7556	30.6	3.3596	5294.0518	200.0183	0.0000	0.0000	4.6048	1.9420
10	4	4	10000	4.197	1500	0	6	23.4	1.6247	5377.4326	176.5332	9.6000	9.7366	1.2936	0.3440	29.0	2.6128	5166.5605	180.6456	0.0000	0.0000	3.4797	1.4152
10	4	4	1000	2	1500	80	1	23.0	3.3050	2896.3999	296.2126	175.0000	24.5358	0.3532	0.0585	23.0	3.3050	2896.3999	296.2126	175.0000	24.5358	0.3532	0.0585
10	4	4	1000	2	1500	80	2	23.0	3.3050	2943.6001	309.6763	177.0000	25.0849	0.3608	0.0621	23.0	3.3050	2943.6001	309.6763	177.0000	25.0849	0.3608	0.0621
10	4	4	1000	2	1500	80	3	23.0	3.3050	2946.3999	310.6147	178.0000	24.6791	0.3594	0.0612	23.0	3.3050	2946.3999	310.6147	178.0000	24.6791	0.3594	0.0612
10	4	4	1000	2	1500	80	4	23.0	3.3050	2940.8000	299.5535	180.0000	32.8217	0.3672	0.0621	23.0	3.3050	2940.8000	299.5535	180.0000	32.8217	0.3672	0.0621
10	4	4	1000	2	1500	80	5	23.0	3.3050	2966.3999	288.6039	184.7000	32.5048	0.3610	0.0582	23.0	3.3050	2966.3999	288.6039	184.7000	32.5048	0.3610	0.0582
10	4	4	1000	2	1500	80	6	23.0	3.3050	2947.2000	287.2813	180.4000	32.7630	0.3673	0.0621	23.0	3.3050	2947.2000	287.2813	180.4000	32.7630	0.3673	0.0621
10	4	4	2000	2.5	1500	80	1	9.2	1.0560	2169.6001	252.4711	75.5000	19.9706	0.2578	0.0519	15.0	3.1643	1972.0000	166.4472	54.0000	9.2868	0.5031	0.1130
10	4	4	2000	2.5	1500	80	2	10.2	1.5384	2186.6001	227.9015	75.1000	18.1568	0.2999	0.0552	14.6	3.0019	2032.3000	179.9504	55.9000	10.0429	0.5030	0.1050
10	4	4	2000	2.5	1500	80	3	9.4	1.1289	2266.5000	262.9187	86.3000	20.9841	0.2625	0.0544	14.8	3.0508	2012.4000	166.4500	55.2000	8.7623	0.5077	0.1080
10	4	4	2000	2.5	1500	80	4	10.0	1.5458	2139.7000	204.2121	71.6000	16.1565	0.3045	0.0646	13.2	2.1808	2012.1000	164.2422	56.0000	9.8285	0.4625	0.0838
10	4	4	2000	2.5	1500	80	5	9.2	1.0560	2265.8000	273.6415	86.1000	24.7768	0.2500	0.0558	14.8	2.9752	1999.4000	172.7274	55.1000	8.8762	0.5078	0.1096
10	4	4	2000	2.5	1500	80	6	10.0	1.3908	2155.1001	220.4416	73.4000	16.6980	0.3013	0.0649	13.6	2.6172	1999.7000	167.3029	54.5000	9.4943	0.4766	0.0977
10	4	4	3000	2.849	1500	80	1	8.8	0.4526	1886.3871	198.3788	21.0000	11.8801	0.3469	0.0643	12.4	2.7027	1764.9371	139.7575	9.3000	2.9990	0.6046	0.1353
10	4	4	3000	2.849	1500	80	2	9.6	1.1782	1938.6631	187.1795	19.2000	6.9886	0.4392	0.0801	13.4	2.5061	1835.0950	133.3296	8.9000	2.8512	0.6843	0.1455

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	4	4	3000	2.849	1500	80	3	8.8	0.4526	1990.5911	199.4525	26.1000	12.5508	0.3485	12.0	2.2628	1855.2496	140.0946	10.3000	2.9026	0.6094
10	4	4	3000	2.849	1500	80	4	9.2	1.0560	1899.0264	195.8862	23.0000	9.2253	0.3717	11.8	2.3564	1772.2582	134.5574	10.7000	3.2363	0.5828
10	4	4	3000	2.849	1500	80	5	8.8	0.4526	1968.7791	206.2829	24.0000	11.8732	0.3578	12.2	2.2577	1827.3167	137.6004	10.0000	2.7195	0.6092
10	4	4	3000	2.849	1500	80	6	9.0	1.1685	1968.5328	178.2884	29.6000	11.6614	0.3552	13.4	2.2537	1867.2795	132.1397	10.3000	3.3740	0.1358
10	4	4	4000	3.125	1500	80	1	9.0	0.6746	1830.4666	165.7656	4.8000	3.7833	0.3845	13.6	2.6172	1746.3734	132.9252	0.5000	0.5060	0.6752
10	4	4	4000	3.125	1500	80	2	9.0	0.6746	1937.1731	187.5493	10.6000	8.5347	0.3938	12.6	2.5061	1819.7494	135.5493	0.9000	0.9207	0.6453
10	4	4	4000	3.125	1500	80	3	9.2	0.8124	1893.1189	156.0710	4.1000	3.2955	0.4063	13.2	2.7362	1853.0466	142.3713	0.4000	0.5003	0.6921
10	4	4	4000	3.125	1500	80	4	9.0	0.6746	1828.5723	171.1205	8.0000	4.4238	0.3656	12.8	2.5645	1739.5830	134.1412	0.6000	0.7692	0.6390
10	4	4	4000	3.125	1500	80	5	9.0	0.6746	1931.3597	174.1330	6.1000	4.9059	0.3719	11.8	1.9318	1848.5006	143.7478	0.6000	0.5003	0.6171
10	4	4	4000	3.125	1500	80	6	8.8	1.0560	1902.3723	181.8462	16.6000	10.0471	0.3360	13.0	2.3370	1718.8959	130.2066	0.4000	0.5003	0.6468
10	4	4	5000	3.358	1500	80	1	9.0	0.6746	1816.8516	142.7645	0.7000	0.9570	0.3923	13.4	2.5953	1749.5648	124.8905	0.0000	0.0000	0.6687
10	4	4	5000	3.358	1500	80	2	9.0	0.6746	1919.3694	178.9639	5.5000	7.1016	0.4049	12.8	2.4741	1826.3125	138.5367	0.0000	0.0000	0.6704
10	4	4	5000	3.358	1500	80	3	9.2	0.8124	1895.7006	148.2392	1.2000	1.6456	0.4140	12.8	2.4741	1856.2172	137.8366	0.0000	0.0000	0.6858
10	4	4	5000	3.358	1500	80	4	9.0	0.6746	1802.0442	158.2441	2.5000	2.3911	0.3704	12.4	2.7027	1744.0520	137.5040	0.0000	0.0000	0.6189
10	4	4	5000	3.358	1500	80	5	9.0	0.6746	1914.9441	169.5520	2.1000	2.4890	0.3844	12.2	1.9318	1848.9564	145.4654	0.0000	0.0000	0.6453
10	4	4	5000	3.358	1500	80	6	9.0	0.6746	1830.2090	179.9631	5.1000	7.0872	0.3672	12.6	2.5061	1728.3489	131.5950	0.0000	0.0000	0.6125
10	4	4	6000	3.561	1500	80	1	9.0	0.6746	1815.7578	135.1043	0.1000	0.2263	0.3844	12.8	2.4741	1757.1334	128.4324	0.0000	0.0000	0.6394
10	4	4	6000	3.561	1500	80	2	9.0	0.6746	1908.9717	176.3527	4.0000	7.2659	0.4092	12.6	2.5953	1829.0114	144.4020	0.0000	0.0000	0.6646
10	4	4	6000	3.561	1500	80	3	9.2	0.8124	1909.3955	149.6054	0.1000	0.2263	0.4220	12.0	2.2628	1869.3551	141.6053	0.0000	0.0000	0.6372
10	4	4	6000	3.561	1500	80	4	9.0	0.6746	1794.5482	154.0412	0.8000	1.1587	0.3688	11.8	2.5422	1744.3467	133.6489	0.1000	0.2263	0.5856
10	4	4	6000	3.561	1500	80	5	9.0	0.6746	1911.8552	163.0595	0.7000	1.3514	0.3844	10.8	1.0560	1867.2429	154.5911	0.0000	0.0000	0.5670
10	4	4	6000	3.561	1500	80	6	9.0	0.6746	1824.4385	177.5364	3.7000	6.7128	0.3686	12.8	2.4741	1731.6370	132.6261	0.0000	0.0000	0.6140
10	4	4	7000	3.742	1500	80	1	9.0	0.6746	1819.9641	137.3289	0.0000	0.0000	0.3864	12.2	2.2577	1757.5680	128.2897	0.0000	0.0000	0.6008
10	4	4	7000	3.742	1500	80	2	9.0	0.6746	1909.0183	171.7941	3.1000	7.0145	0.4066	12.8	2.4741	1829.3574	143.6754	0.0000	0.0000	0.6658
10	4	4	7000	3.742	1500	80	3	9.0	0.6746	1914.8289	157.2937	0.0000	0.0000	0.4096	12.2	2.2577	1866.4379	141.7852	0.0000	0.0000	0.6442
10	4	4	7000	3.742	1500	80	4	9.0	0.6746	1801.2615	156.3021	0.3000	0.6788	0.3734	12.0	2.4557	1745.8646	134.6077	0.0000	0.0000	0.6026
10	4	4	7000	3.742	1500	80	5	8.8	0.4526	1923.6125	167.5145	0.5000	1.1314	0.3754	11.0	1.1685	1867.1344	153.3298	0.0000	0.0000	0.5862
10	4	4	7000	3.742	1500	80	6	9.0	0.6746	1821.5720	177.5601	3.6000	6.7056	0.3672	13.2	2.6517	1733.3180	134.4316	0.0000	0.0000	0.6598
10	4	4	8000	3.906	1500	80	1	9.0	0.6746	1821.7057	137.8469	0.0000	0.0000	0.3875	12.2	2.2577	1757.5680	128.2897	0.0000	0.0000	0.6047
10	4	4	8000	3.906	1500	80	2	9.0	0.6746	1907.6781	170.9991	3.1000	7.0145	0.4079	12.8	2.4741	1826.5984	142.8708	0.0000	0.0000	0.6720
10	4	4	8000	3.906	1500	80	3	9.0	0.6746	1913.9172	157.0445	0.0000	0.0000	0.4093	12.2	2.2577	1866.4379	141.7852	0.0000	0.0000	0.6482
10	4	4	8000	3.906	1500	80	4	9.0	0.6746	1800.8177	155.9588	0.3000	0.6788	0.3703	12.0	2.4557	1745.8646	134.6077	0.0000	0.0000	0.6016
10	4	4	8000	3.906	1500	80	5	8.8	0.4526	1920.4514	166.8558	0.5000	1.1314	0.3750	11.0	1.1685	1866.0765	152.5234	0.0000	0.0000	0.5875
10	4	4	8000	3.906	1500	80	6	9.0	0.6746	1820.4773	176.2583	3.3000	6.7298	0.3689	13.2	2.6517	1734.8584	135.3356	0.0000	0.0000	0.6611
10	4	4	9000	4.057	1500	80	1	9.0	0.6746	1821.7057	137.8469	0.0000	0.0000	0.3875	12.2	2.2577	1757.5680	128.2897	0.0000	0.0000	0.6031
10	4	4	9000	4.057	1500	80	2	9.0	0.6746	1910.2477	172.7240	3.1000	7.0145	0.4078	12.8	2.4741	1826.5984	142.8708	0.0000	0.0000	0.6704
10	4	4	9000	4.057	1500	80	3	9.0	0.6746	1915.6008	158.6628	0.0000	0.0000	0.4096	12.2	2.2577	1866.4379	141.7852	0.0000	0.0000	0.6451
10	4	4	9000	4.057	1500	80	4	9.0	0.6746	1801.8621	156.7478	0.1000	0.2263	0.3687	11.8	2.5422	1746.2582	134.9656	0.0000	0.0000	0.6164
10	4	4	9000	4.057	1500	80	5	8.8	0.4526	1920.4514	166.8558	0.5000	1.1314	0.3749	11.0	1.1685	1863.4908	151.9083	0.0000	0.0000	0.5858
10	4	4	9000	4.057	1500	80	6	9.0	0.6746	1823.1692	178.4783	3.4000	7.2046	0.3688	13.0	2.5242	1735.1970	135.5104	0.0000	0.0000	0.6547
10	4	4	10000	4.197	1500	80	1	9.0	0.6746	1821.7057	137.8469	0.0000	0.0000	0.3861	12.2	2.2577	1757.5680	128.2897	0.0000	0.0000	0.6049
10	4	4	10000	4.197	1500	80	2	9.2	0.8124	1893.0740	163.6905	0.0000	0.0000	0.4375	12.8	2.4741	1826.5984	142.8708	0.0000	0.0000	0.6718
10	4	4	10000	4.197	1500	80	3	9.0	0.6746	1915.6008	158.6628	0.0000	0.0000	0.4093	12.2	2.2577	1867.5267	141.9605	0.0000	0.0000	0.6467
10	4	4	10000	4.197	1500	80	4	9.0	0.6746	1801.8621	156.7478	0.1000	0.2263	0.3705	11.8	2.5422	1746.2582	134.9656	0.0000	0.0000	0.5876
10	4	4	10000	4.197	1500	80	5	8.8	0.4526	1920.4514	166.8558	0.5000	1.1314	0.3705	11.0	1.1685	1863.4908	151.9083	0.0000	0.0000	0.5890
10	4	4	10000	4.197	1500	80	6	9.0	0.6746	1822.8873	178.2286	3.5000	7.4304	0.3705	13.0	2.5242	1735.1970	135.5104	0.0000	0.0000	0.6501
10	8	8	1000	2	500	0	1	7.2	0.4526	8164.3999	407.8532	539.0000	31.6660	0.5424	7.2	0.4526	8164.3999	407.8532	539.0000	31.6660	0.5424
10	8	8	1000	2	500	0	2	7.2	0.4526	8184.0000	395.5964	542.5000	31.3105	0.5453	7.2	0.4526	8184.0000	395.5964	542.5000	31.3105	0.5453
10	8	8	1000	2	500	0	3	7.2	0.4526	8226.4004	413.7070	544.8000	30.9387	0.5499	7.2	0.4526	8226.4004	413.7070	544.8000	30.9387	0.5499

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	1000	2	500	0	4	7.2	0.4526	8226.7998	388.2153	30.1196	0.5580	0.0415	7.2	0.4526	8226.7998	388.2153	30.1196	0.5580	0.0415
10	8	8	1000	2	500	0	5	7.2	0.4526	8250.0000	403.8494	30.6174	0.5516	0.0429	7.2	0.4526	8250.0000	403.8494	30.6174	0.5516	0.0429
10	8	8	1000	2	500	0	6	7.2	0.4526	8215.2002	399.8573	31.2559	0.5594	0.0412	7.2	0.4526	8215.2002	399.8573	31.2559	0.5594	0.0412
10	8	8	2000	2.5	500	0	1	3.0	0.0000	5350.2998	271.0803	161.0000	0.6205	0.0218	3.2	0.4526	5352.3999	271.5616	161.0000	0.6655	0.0738
10	8	8	2000	2.5	500	0	2	3.0	0.0000	5402.3999	284.5736	165.0000	0.6390	0.0186	3.2	0.4526	5394.7002	283.3712	164.3000	0.6813	0.0898
10	8	8	2000	2.5	500	0	3	3.0	0.0000	5393.1001	284.3677	164.2000	0.6467	0.0176	3.2	0.4526	5391.2998	283.1993	164.0000	0.872	0.0958
10	8	8	2000	2.5	500	0	4	3.0	0.0000	5386.6001	272.0332	162.4000	0.6548	0.0194	3.2	0.4526	5382.8999	273.1162	161.0000	0.8836	0.0936
10	8	8	2000	2.5	500	0	5	3.0	0.0000	5369.2002	284.3158	163.4000	0.6454	0.0199	3.0	0.0000	5369.2002	284.3158	163.4000	0.6454	0.0199
10	8	8	2000	2.5	500	0	6	3.0	0.0000	5365.7998	281.0019	162.0000	0.6532	0.0165	3.2	0.4526	5364.7998	281.1968	160.5000	0.6939	0.0863
10	8	8	3000	2.849	500	0	1	3.0	0.0000	4603.8110	219.0775	26.3000	0.9796	0.0427	3.2	0.4526	4595.9443	215.3986	24.7000	1.0546	0.1380
10	8	8	3000	2.849	500	0	2	3.0	0.0000	4652.0635	223.8340	25.0000	1.0264	0.0337	3.0	0.0000	4632.0635	223.8340	25.0000	1.0264	0.0337
10	8	8	3000	2.849	500	0	3	3.0	0.0000	4630.3994	230.7430	25.3000	1.0469	0.0352	3.0	0.0000	4630.3994	230.7430	25.3000	1.0469	0.0352
10	8	8	3000	2.849	500	0	4	3.0	0.0000	4588.4351	214.9018	25.8000	1.0093	0.0307	3.4	0.6034	4579.0537	214.3637	24.3000	1.1280	0.1729
10	8	8	3000	2.849	500	0	5	3.0	0.0000	4640.1689	232.5601	25.6000	1.0343	0.0387	3.0	0.0000	4640.1689	232.5601	25.6000	1.0343	0.0387
10	8	8	3000	2.849	500	0	6	3.0	0.0000	4598.6045	207.7833	24.6000	1.0218	0.0300	3.0	0.0000	4598.6045	207.7833	24.6000	1.0218	0.0300
10	8	8	4000	3.125	500	0	1	3.0	0.0000	4456.1309	204.1934	0.4000	0.9970	0.0544	3.2	0.4526	4451.0811	211.4364	0.0000	1.0658	0.1127
10	8	8	4000	3.125	500	0	2	3.0	0.0000	4559.1670	205.5716	0.1000	1.0513	0.0327	3.0	0.0000	4559.1670	205.5716	0.1000	1.0513	0.0327
10	8	8	4000	3.125	500	0	3	3.0	0.0000	4549.4131	229.7742	0.1000	1.0591	0.0387	3.2	0.4526	4549.0132	229.3126	0.0000	1.1263	0.1499
10	8	8	4000	3.125	500	0	4	3.0	0.0000	4439.4736	214.0372	0.1000	1.0219	0.0248	3.2	0.4526	4437.6367	213.0759	0.0000	1.0829	0.1425
10	8	8	4000	3.125	500	0	5	3.0	0.0000	4537.2422	229.6355	0.4000	1.0690	0.0325	3.0	0.0000	4537.2422	229.6355	0.4000	1.0690	0.0325
10	8	8	4000	3.125	500	0	6	3.0	0.0000	4459.1655	202.2081	0.1000	1.0188	0.0353	3.0	0.0000	4459.1655	202.2081	0.1000	1.0188	0.0353
10	8	8	5000	3.358	500	0	1	3.0	0.0000	4497.1182	202.6338	0.0000	0.9969	0.0586	3.2	0.4526	4486.4712	206.3331	0.0000	1.0719	0.1232
10	8	8	5000	3.358	500	0	2	3.0	0.0000	4560.9731	205.4091	0.0000	1.0641	0.0376	3.0	0.0000	4560.9731	205.4091	0.0000	1.0641	0.0376
10	8	8	5000	3.358	500	0	3	3.0	0.0000	4588.6455	227.9397	0.0000	1.0533	0.0421	3.2	0.4526	4581.1763	229.1390	0.0000	1.1236	0.1380
10	8	8	5000	3.358	500	0	4	3.0	0.0000	4486.4033	214.9123	0.0000	1.0251	0.0313	3.2	0.4526	4484.2896	213.7444	0.0000	1.1454	0.1749
10	8	8	5000	3.358	500	0	5	3.0	0.0000	4586.6445	217.8181	0.0000	1.0608	0.0567	3.2	0.4526	4579.5259	219.6554	0.0000	1.1374	0.1306
10	8	8	5000	3.358	500	0	6	3.0	0.0000	4484.5068	226.4216	0.0000	1.0391	0.0286	3.0	0.0000	4484.5068	226.4216	0.0000	1.0391	0.0286
10	8	8	6000	3.561	500	0	1	3.0	0.0000	4495.1406	208.6924	0.0000	1.0044	0.0503	3.0	0.0000	4495.1406	208.6924	0.0000	1.0044	0.0503
10	8	8	6000	3.561	500	0	2	3.0	0.0000	4568.9644	211.2178	0.0000	1.0656	0.0338	3.0	0.0000	4568.9644	211.2178	0.0000	1.0656	0.0338
10	8	8	6000	3.561	500	0	3	3.0	0.0000	4584.5659	228.4538	0.0000	1.0574	0.0489	3.2	0.4526	4583.4150	228.6836	0.0000	1.1262	0.1401
10	8	8	6000	3.561	500	0	4	3.0	0.0000	4492.4575	212.7571	0.0000	1.0204	0.0321	3.4	0.6034	4486.8052	212.5678	0.0000	1.1454	0.1749
10	8	8	6000	3.561	500	0	5	3.0	0.0000	4599.1167	219.2316	0.0000	1.0640	0.0496	3.2	0.4526	4597.0977	218.0855	0.0000	1.1282	0.1672
10	8	8	6000	3.561	500	0	6	3.0	0.0000	4483.6592	221.4389	0.0000	1.0422	0.0310	3.0	0.0000	4483.6592	221.4389	0.0000	1.0422	0.0310
10	8	8	7000	3.742	500	0	1	3.0	0.0000	4489.2759	207.6716	0.0000	1.0174	0.0467	3.0	0.0000	4489.2759	207.6716	0.0000	1.0174	0.0467
10	8	8	7000	3.742	500	0	2	3.0	0.0000	4564.9834	205.0791	0.0000	1.0672	0.0348	3.0	0.0000	4564.9834	205.0791	0.0000	1.0672	0.0348
10	8	8	7000	3.742	500	0	3	3.0	0.0000	4590.6201	223.6292	0.0000	1.0604	0.0467	3.2	0.4526	4586.7007	224.4326	0.0000	1.1324	0.1409
10	8	8	7000	3.742	500	0	4	3.0	0.0000	4495.6406	211.3233	0.0000	1.0268	0.0304	3.2	0.4526	4494.6606	211.5790	0.0000	1.0832	0.1203
10	8	8	7000	3.742	500	0	5	3.0	0.0000	4591.9395	231.4318	0.0000	1.0658	0.0533	3.0	0.0000	4591.9395	231.4318	0.0000	1.0658	0.0533
10	8	8	7000	3.742	500	0	6	3.0	0.0000	4479.6997	227.8283	0.0000	1.0452	0.0296	3.0	0.0000	4479.6997	227.8283	0.0000	1.0452	0.0296
10	8	8	8000	3.906	500	0	1	3.0	0.0000	4489.2759	207.6716	0.0000	1.0154	0.0467	3.0	0.0000	4489.2759	207.6716	0.0000	1.0154	0.0467
10	8	8	8000	3.906	500	0	2	3.0	0.0000	4565.7891	205.5574	0.0000	1.0720	0.0332	3.0	0.0000	4565.7891	205.5574	0.0000	1.0720	0.0332
10	8	8	8000	3.906	500	0	3	3.0	0.0000	4593.5327	225.2720	0.0000	1.0638	0.0443	3.2	0.4526	4589.6143	226.0984	0.0000	1.1358	0.1437
10	8	8	8000	3.906	500	0	4	3.0	0.0000	4495.6406	211.3233	0.0000	1.0280	0.0256	3.2	0.4526	4494.6606	211.5790	0.0000	1.0812	0.1160
10	8	8	8000	3.906	500	0	5	3.0	0.0000	4590.7666	230.8201	0.0000	1.0690	0.0539	3.0	0.0000	4590.7666	230.8201	0.0000	1.0690	0.0539
10	8	8	8000	3.906	500	0	6	3.0	0.0000	4479.1777	226.8283	0.0000	1.0484	0.0251	3.0	0.0000	4479.1777	226.8283	0.0000	1.0484	0.0251
10	8	8	9000	4.057	500	0	1	3.0	0.0000	4489.2759	207.6716	0.0000	1.0156	0.0525	3.0	0.0000	4489.2759	207.6716	0.0000	1.0156	0.0525
10	8	8	9000	4.057	500	0	2	3.0	0.0000	4565.7891	205.5574	0.0000	1.0733	0.0350	3.0	0.0000	4565.7891	205.5574	0.0000	1.0733	0.0350
10	8	8	9000	4.057	500	0	3	3.0	0.0000	4593.5327	225.2720	0.0000	1.0655	0.0420	3.2	0.4526	4589.6143	226.0984	0.0000	1.1358	0.1437
10	8	8	9000	4.057	500	0	4	3.0	0.0000	4495.6406	211.3233	0.0000	1.0344	0.0283	3.2	0.4526	4494.6606	211.5790	0.0000	1.0875	0.1147

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI	
10	8	8	9000	4.057	500	0	5	3.0	0.0000	4590.7666	230.8201	0.0000	1.0701	0.0544	3.0	0.0000	4590.7666	230.8201	0.0000	1.0701	0.0544	
10	8	8	9000	4.057	500	0	6	3.0	0.0000	4479.1777	226.8283	0.0000	1.0485	0.0313	3.0	0.0000	4479.1777	226.8283	0.0000	1.0485	0.0313	
10	8	8	10000	4.197	500	0	1	3.0	0.0000	4489.2759	207.6716	0.0000	1.0157	0.0478	3.0	0.0000	4489.2759	207.6716	0.0000	1.0157	0.0478	
10	8	8	10000	4.197	500	0	2	3.0	0.0000	4559.5596	200.9624	0.0000	1.0704	0.0363	3.0	0.0000	4559.5596	200.9624	0.0000	1.0704	0.0363	
10	8	8	10000	4.197	500	0	3	3.0	0.0000	4582.1250	222.0419	0.0000	1.0750	0.0387	3.2	0.4526	4581.0273	222.3362	0.0000	1.1422	0.1374	
10	8	8	10000	4.197	500	0	4	3.0	0.0000	4495.6406	211.3233	0.0000	1.0280	0.0288	3.2	0.4526	4494.6606	211.5790	0.0000	1.0827	0.1158	
10	8	8	10000	4.197	500	0	5	3.0	0.0000	4590.7666	230.8201	0.0000	1.0749	0.0556	3.0	0.0000	4590.7666	230.8201	0.0000	1.0749	0.0556	
10	8	8	10000	4.197	500	0	6	3.0	0.0000	4479.1777	226.8283	0.0000	1.0515	0.0324	3.0	0.0000	4479.1777	226.8283	0.0000	1.0515	0.0324	
10	8	8	1000	2	500	80	1	2.8	0.4526	1924.8000	251.3615	120.9000	0.1436	0.0210	2.8	0.4526	1924.8000	251.3615	120.9000	0.1436	0.0210	
10	8	8	1000	2	500	80	2	2.8	0.4526	1969.6000	235.3815	124.5000	0.1423	0.0244	2.8	0.4526	1969.6000	235.3815	124.5000	0.1423	0.0244	
10	8	8	1000	2	500	80	3	2.8	0.4526	1974.8000	227.5394	123.5000	0.1437	0.0251	2.8	0.4526	1974.8000	227.5394	123.5000	0.1437	0.0251	
10	8	8	1000	2	500	80	4	2.8	0.4526	1977.2000	250.0809	118.8000	0.1498	0.0225	2.8	0.4526	1977.2000	250.0809	118.8000	0.1498	0.0225	
10	8	8	1000	2	500	80	5	2.8	0.4526	1988.8000	252.1750	125.0000	0.1501	0.0226	2.8	0.4526	1988.8000	252.1750	125.0000	0.1501	0.0226	
10	8	8	1000	2	500	80	6	2.8	0.4526	1995.2000	259.3462	121.1000	0.1515	0.0231	2.8	0.4526	1995.2000	259.3462	121.1000	0.1515	0.0231	
10	8	8	2000	2.5	500	80	1	1.0	0.0000	1386.5000	165.0617	38.1000	0.1173	0.0058	2.2	0.7390	1329.8000	127.2845	32.0000	0.2343	0.0699	
10	8	8	2000	2.5	500	80	2	1.4	0.6034	1446.3000	165.3956	40.2000	0.1641	0.0684	2.4	0.6913	1405.2000	145.9698	34.5000	0.2720	0.0732	
10	8	8	2000	2.5	500	80	3	1.2	0.4526	1460.4000	195.7949	42.4000	0.1408	0.0479	2.0	0.7543	1379.1000	128.1254	33.7000	0.2266	0.0792	
10	8	8	2000	2.5	500	80	4	1.0	0.0000	1396.6000	149.2825	36.9000	0.1282	0.0127	2.2	0.7390	1364.1000	133.3949	31.8000	0.2469	0.0781	
10	8	8	2000	2.5	500	80	5	1.4	0.6034	1430.7000	191.1252	39.3000	0.1579	0.0620	2.2	0.7390	1374.0000	133.0848	33.7000	0.2454	0.0806	
10	8	8	2000	2.5	500	80	6	1.0	0.0000	1399.8000	170.9381	38.0000	0.1251	0.0107	2.4	0.6913	1346.0000	140.1180	30.5000	0.2767	0.0704	
10	8	8	3000	2.849	500	80	1	1.0	0.0000	1289.0396	134.3399	8.6000	0.1843	0.0189	1.8	0.7390	1259.7664	111.5840	5.6000	0.3081	0.1078	
10	8	8	3000	2.849	500	80	2	1.0	0.0000	1389.2345	153.8573	13.5000	0.1986	0.0213	2.0	0.7543	1321.0031	110.9856	6.5000	0.3609	0.1176	
10	8	8	3000	2.849	500	80	3	1.0	0.0000	1386.3105	153.5311	12.2000	0.2015	0.0255	1.8	0.7390	1340.0367	115.3320	7.2000	0.3281	0.1196	
10	8	8	3000	2.849	500	80	4	1.0	0.0000	1276.2544	137.4540	9.3000	0.1953	0.0218	1.8	0.7390	1244.3629	114.0615	5.6000	0.29056	0.1117	
10	8	8	3000	2.849	500	80	5	1.0	0.0000	1365.0253	153.9935	11.8000	0.1625	0.0231	2.2	0.7390	1318.6029	118.8184	6.9000	0.3826	0.1134	
10	8	8	3000	2.849	500	80	6	1.0	0.0000	1265.8514	153.9474	10.4000	0.1810	0.0192	2.0	0.7543	1226.7271	121.9447	5.5000	0.3389	0.1155	
10	8	8	4000	3.125	500	80	1	1.0	0.0000	1282.4125	141.1616	1.6000	0.1937	0.0177	2.0	0.7543	1255.8932	119.5907	0.1000	0.2263	0.1123	
10	8	8	4000	3.125	500	80	2	1.0	0.0000	1364.7053	152.4052	3.1000	0.2031	0.0241	2.0	0.7543	1320.0664	125.9894	0.2000	0.3017	0.1239	
10	8	8	4000	3.125	500	80	3	1.0	0.0000	1389.0657	151.9905	2.7000	0.2186	0.0207	1.8	0.7390	1351.7242	123.3935	0.1000	0.2263	0.1282	
10	8	8	4000	3.125	500	80	4	1.0	0.0000	1261.0590	131.8920	1.5000	0.2386	0.0240	1.6	0.6913	1242.8855	124.9156	0.0000	0.2998	0.0982	
10	8	8	4000	3.125	500	80	5	1.0	0.0000	1386.0654	151.2219	3.2000	0.2032	0.0183	2.0	0.7543	1347.7292	122.9952	0.4000	0.3846	0.1284	
10	8	8	4000	3.125	500	80	6	1.0	0.0000	1225.3132	142.1328	2.0000	0.1814	0.0220	2.0	0.7543	1204.1538	127.6612	0.1000	0.2263	0.1161	
10	8	8	5000	3.358	500	80	1	1.0	0.0000	1275.5507	126.7965	0.5000	0.1946	0.0178	2.2	0.7390	1253.1271	116.9522	0.0000	0.3766	0.1047	
10	8	8	5000	3.358	500	80	2	1.0	0.0000	1364.3890	143.5882	1.8000	0.2877	0.0228	2.0	0.7543	1330.6584	126.9420	0.0000	0.3828	0.1171	
10	8	8	5000	3.358	500	80	3	1.0	0.0000	1392.2598	153.9945	1.5000	0.2094	0.0228	2.0	0.7543	1352.2063	124.5037	0.0000	0.3912	0.1287	
10	8	8	5000	3.358	500	80	4	1.0	0.0000	1259.0798	124.5155	0.5000	0.1314	0.0244	2.0	0.7543	1244.6925	119.3781	0.0000	0.3630	0.1185	
10	8	8	5000	3.358	500	80	5	1.0	0.0000	1377.1727	138.7965	0.1000	0.2263	0.0204	0.0211	2.0	0.7543	1354.5518	129.4215	0.0000	0.3954	0.1296
10	8	8	5000	3.358	500	80	6	1.0	0.0000	1216.4812	136.1942	0.0000	0.1968	0.0183	2.0	0.7543	1200.7177	128.3292	0.0000	0.3466	0.1123	
10	8	8	6000	3.561	500	80	1	1.0	0.0000	1277.6604	128.4372	0.0000	0.1956	0.0199	2.2	0.7390	1257.3021	118.7626	0.0000	0.3784	0.1052	
10	8	8	6000	3.561	500	80	2	1.0	0.0000	1362.7754	137.6264	1.2000	0.2108	0.0211	2.0	0.7543	1330.3176	123.7059	0.0000	0.3806	0.1112	
10	8	8	6000	3.561	500	80	3	1.0	0.0000	1398.8174	147.5344	0.9000	0.17992	0.0234	2.2	0.7390	1364.3021	126.4108	0.0000	0.4250	0.1189	
10	8	8	6000	3.561	500	80	4	1.0	0.0000	1259.0392	125.1822	0.0000	0.2110	0.0206	2.0	0.7543	1246.1202	122.4511	0.0000	0.3608	0.1183	
10	8	8	6000	3.561	500	80	5	1.0	0.0000	1387.3102	135.3470	0.1000	0.2263	0.0203	2.0	0.7543	1364.9729	127.7173	0.0000	0.3918	0.1251	
10	8	8	6000	3.561	500	80	6	1.0	0.0000	1215.5081	134.9731	0.0000	0.1908	0.0223	2.0	0.7543	1200.1311	127.5383	0.0000	0.3470	0.1172	
10	8	8	7000	3.742	500	80	1	1.0	0.0000	1278.0796	128.4441	0.0000	0.2000	0.0204	2.4	0.6913	1256.5912	118.8768	0.0000	0.4124	0.1062	
10	8	8	7000	3.742	500	80	2	1.0	0.0000	1359.1342	137.8223	0.6000	0.13577	0.0214	2.0	0.7543	1332.9210	123.9400	0.0000	0.3846	0.1140	
10	8	8	7000	3.742	500	80	3	1.0	0.0000	1401.5789	149.3251	0.8000	0.18102	0.0260	2.0	0.7543	1363.9222	125.9508	0.0000	0.3968	0.1333	
10	8	8	7000	3.742	500	80	4	1.0	0.0000	1258.3673	121.9585	0.0000	0.2122	0.0180	2.0	0.7543	1245.1100	119.6184	0.0000	0.3636	0.1182	
10	8	8	7000	3.742	500	80	5	1.0	0.0000	1382.4642	136.8035	0.0000	0.2126	0.0222	2.0	0.7543	1359.7727	128.3704</				

C [Gb/s]	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	Weighted port count @ F _{min}		# of OEOs @ F _{min}	Solve time [sec]		F _{opt}	Weighted port count @ F _{opt}		# of OEOs @ F _{opt}	Solve time [sec]				
									±CI	@ F _{min}		±CI	@ F _{min}		±CI	@ F _{opt}		±CI	@ F _{opt}			
10	8	8	7000	3.742	500	80	6	1.0	0.0000	1221.5873	139.1302	0.0000	0.1906	0.0221	2.0	0.7543	1200.6459	127.9306	0.0000	0.3532	0.1170	
10	8	8	8000	3.906	500	80	1	1.0	0.0000	1276.1733	127.2932	0.0000	0.2020	0.0171	2.4	0.6913	1256.5912	118.8768	0.0000	0.4140	0.1059	
10	8	8	8000	3.906	500	80	2	1.0	0.0000	1359.0205	137.2541	0.6000	1.3577	0.0228	2.0	0.7543	1332.9540	123.9380	0.0000	0.3842	0.1158	
10	8	8	8000	3.906	500	80	3	1.0	0.0000	1402.5575	149.7602	0.7000	1.5839	0.2110	0.0264	2.0	0.7543	1364.4727	126.5334	0.0000	0.3964	0.1331
10	8	8	8000	3.906	500	80	4	1.0	0.0000	1259.3542	122.5979	0.0000	0.0000	0.2042	0.0198	2.0	0.7543	1245.0500	119.4978	0.0000	0.3606	0.1203
10	8	8	8000	3.906	500	80	5	1.0	0.0000	1384.7593	139.1168	0.0000	0.0000	0.2154	0.0224	2.0	0.7543	1357.4147	128.7047	0.0000	0.3986	0.1318
10	8	8	8000	3.906	500	80	6	1.0	0.0000	1221.5873	139.1302	0.0000	0.1924	0.0212	2.0	0.7543	1200.6459	127.9306	0.0000	0.3502	0.1171	
10	8	8	9000	4.057	500	80	1	1.0	0.0000	1275.3563	126.6654	0.0000	0.2001	0.0172	2.2	0.7390	1258.6189	119.5642	0.0000	0.3780	0.1050	
10	8	8	9000	4.057	500	80	2	1.0	0.0000	1357.5598	134.2457	0.0000	0.0000	0.0259	2.0	0.7543	1333.5958	123.9063	0.0000	0.3860	0.1156	
10	8	8	9000	4.057	500	80	3	1.0	0.0000	1398.8093	145.7379	0.2000	0.4526	0.0242	2.0	0.7543	1364.4727	126.5334	0.0000	0.3969	0.1332	
10	8	8	9000	4.057	500	80	4	1.0	0.0000	1262.6945	124.8422	0.0000	0.0000	0.0223	1.8	0.7390	1248.6885	122.1431	0.0000	0.3326	0.1139	
10	8	8	9000	4.057	500	80	5	1.0	0.0000	1384.9801	139.3367	0.0000	0.0000	0.2157	0.0246	2.0	0.7543	1358.8074	129.9655	0.0000	0.3953	0.1297
10	8	8	9000	4.057	500	80	6	1.0	0.0000	1221.7272	139.0211	0.0000	0.1924	0.0212	2.0	0.7543	1200.7859	127.8250	0.0000	0.3486	0.1161	
10	8	8	10000	4.197	500	80	1	1.0	0.0000	1275.3563	126.6654	0.0000	0.2017	0.0185	2.2	0.7390	1258.6189	119.5642	0.0000	0.3827	0.1056	
10	8	8	10000	4.197	500	80	2	1.0	0.0000	1354.5491	129.3946	0.0000	0.0000	0.0223	2.0	0.7543	1333.7156	122.7721	0.0000	0.3830	0.1155	
10	8	8	10000	4.197	500	80	3	1.0	0.0000	1391.4511	132.4752	0.0000	0.2173	0.0243	2.0	0.7543	1367.1680	122.8346	0.0000	0.4014	0.1318	
10	8	8	10000	4.197	500	80	4	1.0	0.0000	1262.6945	124.8422	0.0000	0.2093	0.0218	1.8	0.7390	1248.6885	122.1431	0.0000	0.3358	0.1121	
10	8	8	10000	4.197	500	80	5	1.0	0.0000	1386.6368	137.1107	0.0000	0.2154	0.0258	2.0	0.7543	1360.4641	127.7693	0.0000	0.3970	0.1312	
10	8	8	10000	4.197	500	80	6	1.0	0.0000	1221.7272	139.0211	0.0000	0.1937	0.0224	2.0	0.7543	1200.7859	127.8250	0.0000	0.3499	0.1176	
10	8	8	1000	2	1500	0	1	20.4	1.1782	9569.2002	348.2026	635.8000	1.9501	0.1829	20.4	1.1782	9569.2002	348.2026	635.8000	29.3147	1.9501	0.1829
10	8	8	1000	2	1500	0	2	20.4	1.1782	9623.2002	354.0219	637.3000	29.3675	0.1892	20.4	1.1782	9623.2002	354.0219	637.3000	29.3675	1.9596	0.1892
10	8	8	1000	2	1500	0	3	20.4	1.1782	9625.2002	360.6935	638.0000	30.3337	0.1907	20.4	1.1782	9625.2002	360.6935	638.0000	30.3337	1.9799	0.1907
10	8	8	1000	2	1500	0	4	20.4	1.1782	9612.7998	373.8798	637.8000	31.7786	0.1995	20.4	1.1782	9612.7998	373.8798	637.8000	31.7786	2.0219	0.1995
10	8	8	1000	2	1500	0	5	20.4	1.1782	9655.2002	358.7673	640.3000	30.5096	0.1868	20.4	1.1782	9655.2002	358.7673	640.3000	30.5096	1.9827	0.1868
10	8	8	1000	2	1500	0	6	20.4	1.1782	9601.5996	357.2224	636.6000	20.126	0.1941	20.4	1.1782	9601.5996	357.2224	636.6000	30.5955	2.0126	0.1941
10	8	8	2000	2.5	1500	0	1	7.2	0.4526	6539.6001	359.0316	218.4000	2.7328	0.2368	8.6	0.9051	6316.2998	239.7331	189.7000	14.6606	2.6326	0.4207
10	8	8	2000	2.5	1500	0	2	7.2	0.4526	6610.7998	361.6405	225.5000	2.8439	0.2419	8.8	0.8124	6372.6001	243.3702	190.6000	14.7116	2.3300	1.3090
10	8	8	2000	2.5	1500	0	3	7.2	0.4526	6605.2002	390.5910	225.9000	3.4749	0.2625	9.0	0.6746	6330.6001	239.1629	190.7000	14.1673	2.8596	0.2463
10	8	8	2000	2.5	1500	0	4	7.2	0.4526	6552.2002	364.1787	230.9000	3.01502	0.2655	8.6	0.6034	6314.2002	248.6484	191.3000	12.6123	3.1814	1.0545
10	8	8	2000	2.5	1500	0	5	7.2	0.4526	6653.7998	427.7709	230.1000	3.5946	0.2816	9.0	0.6746	6329.5000	239.2059	190.3000	14.4653	2.8673	0.2711
10	8	8	2000	2.5	1500	0	6	7.2	0.4526	6557.3999	354.9126	228.2000	3.65136	0.2477	8.8	0.8124	6331.2998	232.2852	187.9000	14.3762	3.7016	1.5167
10	8	8	3000	2.849	1500	0	1	6.6	0.6034	5662.6938	205.8414	65.2000	16.6203	0.2327	9.0	0.9541	5406.7568	160.4668	32.5000	3.3264	6.1470	2.8664
10	8	8	3000	2.849	1500	0	2	6.8	0.4526	5635.3838	210.3053	53.1000	14.4236	0.2819	8.2	0.7390	5478.9404	191.0805	33.2000	3.3187	4.2592	0.5376
10	8	8	3000	2.849	1500	0	3	6.8	0.4526	5654.0088	220.6591	57.6000	15.8938	0.5422	8.4	0.6913	5461.4155	174.8448	33.3000	3.2538	4.3219	0.4884
10	8	8	3000	2.849	1500	0	4	6.6	0.6034	5641.5801	212.7838	66.7000	15.0210	0.2498	8.8	0.8124	5392.5146	172.8873	32.0000	3.5698	5.2064	2.0824
10	8	8	3000	2.849	1500	0	5	6.8	0.4526	5590.4321	243.1959	50.3000	16.0038	0.2764	8.6	0.9051	5445.6514	168.6174	33.3000	3.2538	5.2032	2.1448
10	8	8	3000	2.849	1500	0	6	6.6	0.6034	5649.3765	238.8198	67.1000	17.7512	0.23579	8.6	0.6034	5401.2725	178.2242	32.6000	3.3765	4.3375	0.3852
10	8	8	4000	3.125	1500	0	1	6.8	0.4526	5297.5913	128.4045	63.0000	6.0721	0.5256	8.2	0.7390	5225.3062	170.5132	0.0000	0.0000	4.7973	1.9448
10	8	8	4000	3.125	1500	0	2	6.6	0.6034	5488.4043	235.8723	19.8000	30.2168	0.7228	7.8	0.7390	5313.4014	171.2406	0.0000	0.0000	4.0610	0.5482
10	8	8	4000	3.125	1500	0	3	6.6	0.6034	5474.3740	263.7778	17.8000	28.8255	0.6672	7.8	0.7390	5319.3525	165.1876	0.1000	0.2263	4.0127	0.5929
10	8	8	4000	3.125	1500	0	4	6.8	0.4526	5320.0869	141.5911	9.2000	9.2487	0.5400	8.4	0.9659	5230.6548	163.1349	0.3000	0.6788	4.1531	0.6574
10	8	8	4000	3.125	1500	0	5	7.0	0.0000	5325.2539	172.5033	1.6000	2.0013	0.3207	7.4	0.6034	5314.5400	161.3788	0.4000	0.9051	3.6378	0.5098
10	8	8	4000	3.125	1500	0	6	6.6	0.6034	5325.2227	142.9477	10.4000	11.5487	0.6837	7.6	0.6913	5239.0337	164.7117	0.0000	0.0000	3.6766	0.4897
10	8	8	5000	3.358	1500	0	1	6.8	0.4526	5354.9033	163.4053	5.0000	6.9211	0.5038	8.0	0.7543	5276.5815	171.9850	0.0000	0.0000	3.6376	0.7837
10	8	8	5000	3.358	1500	0	2	6.8	0.4526	5404.1919	180.6429	0.5000	1.1314	0.2870	8.2	0.7390	5371.9434	185.4074	0.0000	0.0000	4.2548	0.6180
10	8	8	5000	3.358	1500	0	3	6.8	0.4526	5488.0972	169.5549	6.9000	6.6396	0.4110	8.8	1.0560						

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	Weighted port count @F _{min}		# of OEOs @F _{min}	Solve time [sec]		F _{opt}	Weighted port count @F _{opt}		# of OEOs @F _{opt}	Solve time [sec]				
									±CI	±CI		±CI	±CI		±CI	±CI						
10	8	8	6000	3.561	1500	0	1	6.8	0.4526	5327.2573	161.5035	2.3000	4.4756	0.5340	8.4	5286.1011	161.7656	0.0000	5.5914	2.9138		
10	8	8	6000	3.561	1500	0	2	7.0	0.0000	5370.4277	204.4790	0.0000	0.0000	0.1401	7.8	5348.5156	187.5699	0.0000	4.0638	0.5721		
10	8	8	6000	3.561	1500	0	3	7.0	0.0000	5361.7549	197.8739	0.1000	0.2263	0.3551	8.0	5334.6255	189.2807	0.0000	4.0404	0.6433		
10	8	8	6000	3.561	1500	0	4	6.6	0.6034	5406.5649	328.5009	15.4000	32.0465	0.2532	8.0	5249.4014	165.6519	0.0000	3.8094	0.6048		
10	8	8	6000	3.561	1500	0	5	7.0	0.0000	5369.3325	179.8256	0.0000	0.3716	0.3229	7.6	5367.3564	179.6322	0.0000	3.7376	0.6505		
10	8	8	6000	3.561	1500	0	6	6.6	0.6034	5433.8843	333.5196	15.1000	30.5829	0.2503	8.2	5266.8350	158.5919	0.0000	4.7764	2.1661		
10	8	8	7000	3.742	1500	0	1	6.8	0.4526	5374.9829	183.4415	7.5000	16.9707	0.2396	8.2	5279.0117	161.3212	0.0000	4.0402	0.6985		
10	8	8	7000	3.742	1500	0	2	6.8	0.4526	5427.2544	185.2082	0.5000	1.1314	0.2872	8.2	5383.5557	182.8948	0.0000	4.2388	0.6434		
10	8	8	7000	3.742	1500	0	3	6.6	0.6034	5487.1211	162.1799	3.6000	7.1967	0.2028	8.8	5372.3857	161.8513	0.0000	5.4864	2.4242		
10	8	8	7000	3.742	1500	0	4	6.8	0.4526	5362.8032	185.8153	6.9000	15.6130	0.2528	8.4	0.9659	5273.7881	147.9266	0.0000	4.9240	2.2801	
10	8	8	7000	3.742	1500	0	5	7.0	0.0000	5397.1279	171.2026	0.0000	0.2850	0.3175	8.0	0.7543	5370.1538	151.6597	0.0000	4.0172	0.7268	
10	8	8	7000	3.742	1500	0	6	6.8	0.4526	5328.2314	178.5773	0.1000	0.2263	0.2484	8.4	0.6913	5265.5713	162.3396	0.0000	4.1270	0.6251	
10	8	8	8000	3.906	1500	0	1	6.8	0.4526	5374.9829	183.4415	7.5000	16.9707	0.2392	8.4	0.9659	5281.8447	164.8172	0.0000	5.6220	2.7941	
10	8	8	8000	3.906	1500	0	2	6.8	0.4526	5429.1577	182.8787	0.5000	1.1314	0.2860	8.2	0.7390	5386.5151	181.3841	0.0000	4.2468	0.6406	
10	8	8	8000	3.906	1500	0	3	6.6	0.6034	5480.7236	166.5955	3.0000	6.5407	0.2712	8.8	1.0560	5369.3691	162.9390	0.0000	5.5060	2.3502	
10	8	8	8000	3.906	1500	0	4	6.8	0.4526	5358.9800	181.8685	6.9000	15.6130	0.2516	8.4	0.9659	5268.6436	148.8327	0.0000	4.9608	2.2495	
10	8	8	8000	3.906	1500	0	5	7.0	0.0000	5395.5518	171.1144	0.0000	0.0000	0.2846	8.0	0.7543	5368.5776	151.4005	0.0000	4.0676	0.7457	
10	8	8	8000	3.906	1500	0	6	6.8	0.4526	5340.1782	167.3416	0.1000	0.2263	0.2582	8.6	0.6034	5267.9238	155.1141	0.0000	4.4880	0.4417	
10	8	8	9000	4.057	1500	0	1	6.8	0.4526	5375.8740	185.7406	7.5000	16.9707	0.2382	8.4	0.9659	5281.8447	164.8172	0.0000	8.6312	3.5097	
10	8	8	9000	4.057	1500	0	2	6.8	0.4526	5428.0181	183.4536	0.5000	1.1314	0.2860	8.2	0.7390	5385.3755	181.8118	0.0000	8.2266	3.5542	
10	8	8	9000	4.057	1500	0	3	6.6	0.6034	5478.9219	166.3205	2.9000	6.5620	0.2140	8.8	1.0560	5369.3691	162.9390	0.0000	9.4032	3.3723	
10	8	8	9000	4.057	1500	0	4	6.8	0.4526	5424.6904	300.0201	13.2000	29.8684	0.2511	8.4	0.9659	5268.6436	148.8327	0.0000	7.8327	3.1638	
10	8	8	9000	4.057	1500	0	5	7.0	0.0000	5393.7939	170.1486	0.0000	0.0000	0.2860	8.0	0.7543	5367.3174	150.9747	0.0000	7.9079	3.6428	
10	8	8	9000	4.057	1500	0	6	6.8	0.4526	5339.5078	167.2441	0.0000	0.0000	0.2505	8.6	0.6034	5267.9238	155.1141	0.0000	10.2092	2.6293	
10	8	8	10000	4.197	1500	0	1	6.8	0.4526	5391.3335	183.4449	7.5000	16.9707	0.2378	8.6	0.9051	5289.6963	165.1316	0.0000	9.4563	3.2053	
10	8	8	10000	4.197	1500	0	2	6.8	0.4526	5428.0181	183.4536	0.5000	1.1314	0.2877	8.2	0.7390	5385.3755	181.8118	0.0000	8.2045	3.5544	
10	8	8	10000	4.197	1500	0	3	6.6	0.6034	5481.1221	168.0695	2.9000	6.5620	0.2145	8.8	1.0560	5367.1479	161.2627	0.0000	9.3798	3.3604	
10	8	8	10000	4.197	1500	0	4	6.8	0.4526	5425.4609	300.0048	13.2000	29.8684	0.2512	8.4	0.9659	5269.4136	149.2608	0.0000	7.8546	3.1683	
10	8	8	10000	4.197	1500	0	5	7.0	0.0000	5395.1743	170.2302	0.0000	0.0000	0.2878	8.0	0.7543	5368.6978	151.2043	0.0000	7.9280	3.6184	
10	8	8	10000	4.197	1500	0	6	6.8	0.4526	5327.7988	165.0856	0.0000	0.0000	0.2567	8.4	0.6913	5267.1621	154.8638	0.0000	9.3751	3.0263	
10	8	8	1000	2	1500	80	1	6.6	0.6034	2838.0000	312.7177	178.4000	26.5647	0.3952	6.6	0.6034	2838.0000	312.7177	178.4000	26.5647	0.3952	0.0435
10	8	8	1000	2	1500	80	2	6.6	0.6034	2880.3999	328.4480	181.3000	27.6185	0.3935	6.6	0.6034	2880.3999	328.4480	181.3000	27.6185	0.3935	0.0460
10	8	8	1000	2	1500	80	3	6.6	0.6034	2881.2000	314.5773	181.4000	26.9305	0.4045	6.6	0.6034	2881.2000	314.5773	181.4000	26.9305	0.4045	0.0444
10	8	8	1000	2	1500	80	4	6.6	0.6034	2899.6001	311.9955	178.1000	26.4321	0.4091	6.6	0.6034	2899.6001	311.9955	178.1000	26.4321	0.4091	0.0458
10	8	8	1000	2	1500	80	5	6.6	0.6034	2904.8000	306.1596	182.7000	26.1804	0.4032	6.6	0.6034	2904.8000	306.1596	182.7000	26.1804	0.4032	0.0438
10	8	8	1000	2	1500	80	6	6.6	0.6034	2898.0000	310.1779	178.4000	26.4423	0.4107	6.6	0.6034	2898.0000	310.1779	178.4000	26.4423	0.4107	0.0440
10	8	8	2000	2.5	1500	80	1	3.2	0.4526	2031.0000	190.0021	63.2000	12.3973	0.4093	4.2	1.0006	1946.1000	165.0918	54.1000	9.9804	0.6094	0.2238
10	8	8	2000	2.5	1500	80	2	3.2	0.4526	2096.3999	197.3733	66.6000	14.4581	0.4296	4.6	0.9051	1994.7000	163.6397	55.5000	9.9792	0.7077	0.2128
10	8	8	2000	2.5	1500	80	3	3.2	0.4526	2067.0000	186.2245	64.5000	12.4908	0.4313	4.2	0.7390	1985.8000	159.7016	55.5000	10.0870	0.5908	0.1173
10	8	8	2000	2.5	1500	80	4	3.2	0.4526	2065.7000	190.9682	63.4000	13.4257	0.4315	4.0	0.7543	1974.9000	163.3078	53.2000	10.2800	0.5702	0.1196
10	8	8	2000	2.5	1500	80	5	3.2	0.4526	2060.3000	194.4886	65.2000	13.4663	0.4188	4.6	0.9051	1975.7000	162.8046	55.5000	9.6252	0.6970	0.1977
10	8	8	2000	2.5	1500	80	6	3.2	0.4526	2048.1001	188.2615	63.1000	13.4310	0.4233	4.6	0.9051	1960.1000	164.9001	52.7000	10.1645	0.7123	0.2076
10	8	8	3000	2.849	1500	80	1	3.0	0.0000	1803.0590	162.3165	13.9000	6.6993	0.5656	4.2	1.0006	1739.5033	124.6756	8.2000	3.2669	0.9360	0.3324
10	8	8	3000	2.849	1500	80	2	3.0	0.0000	1844.7018	138.9499	14.1000	5.5267	0.6046	4.4	0.9659	1794.7976	124.5181	8.4000	3.6047	1.0500	0.3541
10	8	8	3000	2.849	1500	80	3	3.0	0.0000	1857.2806	137.5060	14.1000	5.9049	0.6030	4.2	1.0006	1812.3738	117.5231	8.6000	3.5087	1.0076	0.3482
10	8	8	3000	2.849	1500	80	4	3.0	0.0000	1780.767.												

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	4000	3.125	1500	80	2	3.0	0.0000	1814.0648	131.5346	1.7912	0.6218	0.0572	4.2	0.7390	1784.7164	126.1675	0.9082	0.9549	0.1716
10	8	8	4000	3.125	1500	80	3	3.0	0.0000	1842.5228	141.1609	1.6611	0.6405	0.0565	4.0	0.7543	1809.8953	126.8503	0.3017	0.9205	0.1893
10	8	8	4000	3.125	1500	80	4	3.0	0.0000	1744.3196	130.3652	1.8000	0.5938	0.0489	4.2	0.7390	1715.7000	122.9581	0.4526	0.9110	0.1649
10	8	8	4000	3.125	1500	80	5	3.0	0.0000	1835.9768	142.7032	1.6000	0.6281	0.0603	3.8	0.7390	1812.5098	128.6953	0.8000	0.8609	0.1908
10	8	8	4000	3.125	1500	80	6	3.0	0.0000	1731.8851	134.4734	2.5000	0.5873	0.0499	4.2	0.7390	1685.0750	118.4589	0.6788	0.9031	0.1577
10	8	8	5000	3.358	1500	80	1	3.0	0.0000	1767.2904	144.7079	0.1000	0.5980	0.0478	3.8	0.7390	1726.2037	121.0270	0.0000	0.8152	0.1677
10	8	8	5000	3.358	1500	80	2	3.0	0.0000	1816.5850	134.2421	0.0000	0.6316	0.0552	4.0	0.7543	1796.1039	127.0508	0.0000	0.9100	0.1897
10	8	8	5000	3.358	1500	80	3	3.0	0.0000	1858.0293	137.8179	0.0000	0.6378	0.0541	4.2	0.7390	1825.9666	125.3482	0.0000	0.9784	0.1763
10	8	8	5000	3.358	1500	80	4	3.0	0.0000	1732.4402	126.3602	0.0000	0.6016	0.0506	4.0	0.7543	1714.4860	122.1550	0.0000	0.8642	0.1813
10	8	8	5000	3.358	1500	80	5	3.0	0.0000	1844.1136	139.1316	0.0000	0.6284	0.0614	3.8	0.7390	1820.3748	131.2409	0.0000	0.8656	0.1979
10	8	8	5000	3.358	1500	80	6	3.0	0.0000	1725.3162	134.5066	0.1000	0.5962	0.0472	4.2	0.7390	1687.6995	121.3215	0.0000	0.9070	0.1595
10	8	8	6000	3.561	1500	80	1	3.0	0.0000	1778.0133	140.6203	0.1000	0.5982	0.0478	4.0	0.7543	1738.6023	122.8480	0.0000	0.8676	0.1672
10	8	8	6000	3.561	1500	80	2	3.0	0.0000	1818.8145	131.3001	0.1000	0.6298	0.0580	3.8	0.7390	1795.4235	120.0940	0.0000	0.8656	0.1874
10	8	8	6000	3.561	1500	80	3	3.0	0.0000	1861.9795	132.9361	0.0000	0.6348	0.0528	4.2	0.7390	1829.4222	119.8479	0.0000	0.9804	0.1781
10	8	8	6000	3.561	1500	80	4	3.0	0.0000	1732.6277	126.8718	0.0000	0.6062	0.0519	4.0	0.7543	1711.4241	119.9291	0.0000	0.8664	0.1826
10	8	8	6000	3.561	1500	80	5	3.0	0.0000	1834.8252	134.3756	0.0000	0.6328	0.0620	3.8	0.7390	1815.2998	129.2549	0.0000	0.8702	0.1969
10	8	8	6000	3.561	1500	80	6	3.0	0.0000	1716.9167	128.5625	0.0000	0.5966	0.0466	4.0	0.7543	1691.7571	120.5603	0.0000	0.8562	0.1658
10	8	8	7000	3.742	1500	80	1	3.0	0.0000	1765.0111	139.5447	0.0000	0.6026	0.0469	4.0	0.7543	1727.5482	121.6780	0.0000	0.8718	0.1655
10	8	8	7000	3.742	1500	80	2	3.0	0.0000	1829.3453	135.0824	0.0000	0.6344	0.0574	4.0	0.7543	1808.0576	127.6831	0.0000	0.9070	0.1882
10	8	8	7000	3.742	1500	80	3	3.0	0.0000	1869.5270	132.0644	0.0000	0.6358	0.0532	4.2	0.7390	1836.3180	122.1534	0.0000	0.9826	0.1805
10	8	8	7000	3.742	1500	80	4	3.0	0.0000	1741.7932	131.1841	0.0000	0.6082	0.0535	3.8	0.7390	1720.2467	123.4992	0.0000	0.8240	0.1735
10	8	8	7000	3.742	1500	80	5	3.0	0.0000	1849.8402	141.6381	0.0000	0.6388	0.0644	3.8	0.7390	1831.6530	135.3094	0.0000	0.8732	0.1926
10	8	8	7000	3.742	1500	80	6	3.0	0.0000	1722.2483	129.7032	0.0000	0.5996	0.0465	4.0	0.7543	1691.8516	120.7622	0.0000	0.8614	0.1676
10	8	8	8000	3.906	1500	80	1	3.0	0.0000	1764.9674	139.5455	0.0000	0.5984	0.0471	4.0	0.7543	1727.0608	121.6421	0.0000	0.8692	0.1652
10	8	8	8000	3.906	1500	80	2	3.0	0.0000	1829.1604	135.1940	0.0000	0.6360	0.0563	4.0	0.7543	1808.1042	127.7402	0.0000	0.9122	0.1896
10	8	8	8000	3.906	1500	80	3	3.0	0.0000	1875.6312	131.0758	0.0000	0.6406	0.0550	4.2	0.7390	1837.1555	122.5750	0.0000	0.9866	0.1765
10	8	8	8000	3.906	1500	80	4	3.0	0.0000	1742.9668	131.2116	0.0000	0.6060	0.0517	3.8	0.7390	1719.8342	123.2524	0.0000	0.8214	0.1742
10	8	8	8000	3.906	1500	80	5	3.0	0.0000	1850.4597	141.7414	0.0000	0.6402	0.0654	3.8	0.7390	1832.2725	135.4648	0.0000	0.8790	0.1961
10	8	8	8000	3.906	1500	80	6	3.0	0.0000	1719.6100	129.5192	0.0000	0.6020	0.0474	4.0	0.7543	1691.8516	120.7622	0.0000	0.8576	0.1629
10	8	8	9000	4.057	1500	80	1	3.0	0.0000	1767.7828	141.4947	0.0000	0.6000	0.0483	4.0	0.7543	1727.2006	121.7166	0.0000	0.8686	0.1648
10	8	8	9000	4.057	1500	80	2	3.0	0.0000	1836.3293	140.9044	0.0000	0.6312	0.0570	4.0	0.7543	1808.5182	127.7145	0.0000	0.9093	0.1900
10	8	8	9000	4.057	1500	80	3	3.0	0.0000	1875.6312	131.0758	0.0000	0.6375	0.0563	4.2	0.7390	1837.3972	122.5750	0.0000	0.9814	0.1767
10	8	8	9000	4.057	1500	80	4	3.0	0.0000	1743.1047	130.7770	0.0000	0.6047	0.0541	3.8	0.7390	1722.1119	124.8764	0.0000	0.8282	0.1782
10	8	8	9000	4.057	1500	80	5	3.0	0.0000	1847.9965	140.7059	0.0000	0.6362	0.0657	3.6	0.6913	1831.5746	134.9261	0.0000	0.8142	0.1896
10	8	8	9000	4.057	1500	80	6	3.0	0.0000	1719.6100	129.5192	0.0000	0.6014	0.0467	4.0	0.7543	1691.8516	120.7622	0.0000	0.8593	0.1666
10	8	8	10000	4.197	1500	80	1	3.0	0.0000	1766.8256	140.1253	0.0000	0.5998	0.0459	4.0	0.7543	1728.4753	121.9597	0.0000	0.8670	0.1645
10	8	8	10000	4.197	1500	80	2	3.0	0.0000	1830.0654	135.1112	0.0000	0.6392	0.0577	4.0	0.7543	1808.4187	127.5637	0.0000	0.9063	0.1830
10	8	8	10000	4.197	1500	80	3	3.0	0.0000	1875.0322	130.9699	0.0000	0.6422	0.0543	4.2	0.7390	1838.0443	122.3584	0.0000	0.9798	0.1733
10	8	8	10000	4.197	1500	80	4	3.0	0.0000	1744.6176	132.5156	0.0000	0.6076	0.0537	3.8	0.7390	1723.6248	126.8384	0.0000	0.8264	0.1737
10	8	8	10000	4.197	1500	80	5	3.0	0.0000	1847.6422	141.8458	0.0000	0.6406	0.0642	3.6	0.6913	1830.6918	135.3297	0.0000	0.8188	0.1888
10	8	8	10000	4.197	1500	80	6	3.0	0.0000	1719.6615	129.5625	0.0000	0.5999	0.0485	4.0	0.7543	1691.8516	120.7622	0.0000	0.8564	0.1639
40	8	8	1000	5	500	0	1	3.0	0.0000	8023.2002	355.1719	314.9000	0.1968	0.0095	3.0	0.0000	8023.2002	355.1719	314.9000	0.1968	0.0095
40	8	8	1000	5	500	0	2	3.0	0.0000	8093.2002	369.6716	317.8000	0.1922	0.0076	3.0	0.0000	8093.2002	369.6716	317.8000	0.1922	0.0076
40	8	8	1000	5	500	0	3	3.0	0.0000	8170.0000	381.7559	321.3000	0.1968	0.0059	3.0	0.0000	8170.0000	381.7559	321.3000	0.1968	0.0059
40	8	8	1000	5	500	0	4	3.0	0.0000	8185.6001	392.4371	317.8000	0.19548	0.0046	3.0	0.0000	8185.6001	392.4371	317.8000	0.19548	0.0046
40	8	8	1000	5	500	0	5	3.0	0.0000	8167.3999	408.7860	320.6000	0.1967	0.0060	3.0	0.0000	8167.3999	408.7860	320.6000	0.1967	0.0060
40	8	8	1000	5	500	0	6	3.0	0.0000	8139.6001	404.5795	316.2000	0.2033	0.0052	3.0	0.0000	8139.6001	404.5795	316.2000	0.2033	0.0052
40	8	8	2000	6.25	500	0	1	1.0	0.0000	5383.5498	232.0925	95.6000	0.2655	0.0091	1.0	0.0000	5383.5498	232.0925	95.6000	0.2655	0.0091
40	8	8	2000	6.25	500	0	2	1.0	0.0000	5473.9502	213.5062	97.7000	0.2767	0.0076	1.0	0.0000	5473.9502	213.5062	97.7000	0.2767	0.0076

C	W	B	R _{max}	E/O	cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
40	8	8	2000	6.25	500	0	3	1	1.0	0.0000	5445.3501	98.1000	230.8003	0.0082	1.0	0.0000	5445.3501	98.1000	230.8003	0.0082
40	8	8	2000	6.25	500	0	4	1	1.0	0.0000	5439.1001	95.2000	232.8328	0.0082	1.0	0.0000	5439.1001	95.2000	232.8328	0.0082
40	8	8	2000	6.25	500	0	5	1	1.0	0.0000	5410.8999	96.4000	228.9305	0.0083	1.0	0.0000	5410.8999	96.4000	228.9305	0.0083
40	8	8	2000	6.25	500	0	6	1	1.0	0.0000	5418.7998	94.9000	231.6896	0.0088	1.0	0.0000	5418.7998	94.9000	231.6896	0.0088
40	8	8	3000	7.121	500	0	1	1	1.0	0.0000	4581.9878	168.7030	178.1838	0.0142	1.0	0.0000	4581.9878	168.7030	178.1838	0.0142
40	8	8	3000	7.121	500	0	2	1	1.0	0.0000	4688.1143	15.6000	178.1838	0.0158	1.0	0.0000	4688.1143	15.6000	178.1838	0.0158
40	8	8	3000	7.121	500	0	3	1	1.0	0.0000	4696.8921	16.6000	181.2602	0.0150	1.0	0.0000	4696.8921	16.6000	181.2602	0.0150
40	8	8	3000	7.121	500	0	4	1	1.0	0.0000	4558.0518	17.7242	172.7242	0.0152	1.0	0.0000	4558.0518	17.7242	172.7242	0.0152
40	8	8	3000	7.121	500	0	5	1	1.0	0.0000	4644.0835	170.2860	172.7242	0.0141	1.0	0.0000	4644.0835	170.2860	172.7242	0.0141
40	8	8	3000	7.121	500	0	6	1	1.0	0.0000	4572.9092	170.2987	170.2987	0.0161	1.0	0.0000	4572.9092	170.2987	170.2987	0.0161
40	8	8	4000	7.813	500	0	1	1	1.0	0.0000	4481.2798	163.0843	163.0843	0.0130	1.0	0.0000	4481.2798	163.0843	163.0843	0.0130
40	8	8	4000	7.813	500	0	2	1	1.0	0.0000	4555.0718	190.3312	190.3312	0.0143	1.0	0.0000	4555.0718	190.3312	190.3312	0.0143
40	8	8	4000	7.813	500	0	3	1	1.0	0.0000	4606.7036	164.1339	164.1339	0.0132	1.0	0.0000	4606.7036	164.1339	164.1339	0.0132
40	8	8	4000	7.813	500	0	4	1	1.0	0.0000	4424.1704	170.4995	170.4995	0.0130	1.0	0.0000	4424.1704	170.4995	170.4995	0.0130
40	8	8	4000	7.813	500	0	5	1	1.0	0.0000	4603.6875	169.6089	169.6089	0.0130	1.0	0.0000	4603.6875	169.6089	169.6089	0.0130
40	8	8	4000	7.813	500	0	6	1	1.0	0.0000	4421.9941	175.0249	175.0249	0.0168	1.2	0.4526	4415.8193	175.1886	175.1886	0.0168
40	8	8	5000	8.394	500	0	1	1	1.0	0.0000	4540.4492	155.1660	155.1660	0.0257	1.0	0.0000	4540.4492	155.1660	155.1660	0.0257
40	8	8	5000	8.394	500	0	2	1	1.0	0.0000	4623.7656	184.6220	184.6220	0.0220	1.0	0.0000	4623.7656	184.6220	184.6220	0.0220
40	8	8	5000	8.394	500	0	3	1	1.0	0.0000	4676.3096	170.9110	170.9110	0.0236	1.4	0.6034	4675.7275	170.8704	170.8704	0.0236
40	8	8	5000	8.394	500	0	4	1	1.0	0.0000	4475.2813	168.3793	168.3793	0.0154	1.0	0.0000	4475.2813	168.3793	168.3793	0.0154
40	8	8	5000	8.394	500	0	5	1	1.0	0.0000	4669.8340	162.5384	162.5384	0.0232	1.0	0.0000	4669.8340	162.5384	162.5384	0.0232
40	8	8	5000	8.394	500	0	6	1	1.0	0.0000	4476.2705	176.7037	176.7037	0.0182	1.2	0.4526	4474.0825	179.2316	179.2316	0.0182
40	8	8	6000	8.902	500	0	1	1	1.0	0.0000	4567.9360	154.4180	154.4180	0.0261	1.0	0.0000	4567.9360	154.4180	154.4180	0.0261
40	8	8	6000	8.902	500	0	2	1	1.0	0.0000	4638.4453	179.9855	179.9855	0.0194	1.0	0.0000	4638.4453	179.9855	179.9855	0.0194
40	8	8	6000	8.902	500	0	3	1	1.0	0.0000	4701.8433	165.6151	165.6151	0.0263	1.2	0.4526	4697.3784	171.0973	171.0973	0.0263
40	8	8	6000	8.902	500	0	4	1	1.0	0.0000	4480.8042	171.6391	171.6391	0.0131	1.0	0.0000	4480.8042	171.6391	171.6391	0.0131
40	8	8	6000	8.902	500	0	5	1	1.0	0.0000	4706.6733	162.1201	162.1201	0.0338	1.0	0.0000	4706.6733	162.1201	162.1201	0.0338
40	8	8	6000	8.902	500	0	6	1	1.0	0.0000	4483.3154	176.6963	176.6963	0.0191	1.2	0.4526	4480.7275	179.7029	179.7029	0.0191
40	8	8	7000	9.355	500	0	1	1	1.0	0.0000	4567.4653	174.9439	174.9439	0.0218	1.0	0.0000	4567.4653	174.9439	174.9439	0.0218
40	8	8	7000	9.355	500	0	2	1	1.0	0.0000	4646.1294	178.9193	178.9193	0.0280	1.2	0.4526	4642.9385	176.5532	176.5532	0.0280
40	8	8	7000	9.355	500	0	3	1	1.0	0.0000	4689.2305	166.6697	166.6697	0.0303	1.2	0.4526	4684.2217	173.0050	173.0050	0.0303
40	8	8	7000	9.355	500	0	4	1	1.0	0.0000	4482.0439	178.6659	178.6659	0.0148	1.0	0.0000	4482.0439	178.6659	178.6659	0.0148
40	8	8	7000	9.355	500	0	5	1	1.0	0.0000	4690.8286	172.1913	172.1913	0.0189	1.2	0.4526	4688.8979	172.2043	172.2043	0.0189
40	8	8	7000	9.355	500	0	6	1	1.0	0.0000	4479.7974	179.4723	179.4723	0.0149	1.2	0.4526	4477.6348	182.0250	182.0250	0.0149
40	8	8	8000	9.766	500	0	1	1	1.0	0.0000	4564.2686	167.2250	167.2250	0.0253	1.0	0.0000	4564.2686	167.2250	167.2250	0.0253
40	8	8	8000	9.766	500	0	2	1	1.0	0.0000	4654.7593	179.6518	179.6518	0.0224	1.4	0.6034	4653.9248	180.4882	180.4882	0.0224
40	8	8	8000	9.766	500	0	3	1	1.0	0.0000	4708.5713	157.9391	157.9391	0.0307	1.2	0.4526	4701.8389	166.4667	166.4667	0.0307
40	8	8	8000	9.766	500	0	4	1	1.0	0.0000	4483.4043	179.7433	179.7433	0.0162	1.0	0.0000	4483.4043	179.7433	179.7433	0.0162
40	8	8	8000	9.766	500	0	5	1	1.0	0.0000	4708.1670	181.2929	181.2929	0.0270	1.0	0.0000	4708.1670	181.2929	181.2929	0.0270
40	8	8	8000	9.766	500	0	6	1	1.0	0.0000	4480.2725	174.3389	174.3389	0.0206	1.2	0.4526	4477.6841	177.4746	177.4746	0.0206
40	8	8	9000	10.14	500	0	1	1	1.0	0.0000	4564.2686	167.2250	167.2250	0.0238	1.0	0.0000	4564.2686	167.2250	167.2250	0.0238
40	8	8	9000	10.14	500	0	2	1	1.0	0.0000	4655.1631	179.6840	179.6840	0.0266	1.4	0.6034	4654.3296	180.5213	180.5213	0.0266
40	8	8	9000	10.14	500	0	3	1	1.0	0.0000	4709.7979	158.3268	158.3268	0.0305	1.2	0.4526	4703.0649	166.8628	166.8628	0.0305
40	8	8	9000	10.14	500	0	4	1	1.0	0.0000	4486.4556	181.9866	181.9866	0.0179	1.0	0.0000	4486.4556	181.9866	181.9866	0.0179
40	8	8	9000	10.14	500	0	5	1	1.0	0.0000	4711.4282	181.7823	181.7823	0.0290	1.0	0.0000	4711.4282	181.7823	181.7823	0.0290
40	8	8	9000	10.14	500	0	6	1	1.0	0.0000	4481.2764	174.1961	174.1961	0.0202	1.2	0.4526	4478.6885	177.3426	177.3426	0.0202
40	8	8	10000	10.49	500	0	1	1	1.0	0.0000	4564.6592	167.3819	167.3819	0.0266	1.0	0.0000	4564.6592	167.3819	167.3819	0.0266
40	8	8	10000	10.49	500	0	2	1	1.0	0.0000	4656.6904	178.3857	178.3857	0.0247	1.4	0.6034	4655.8569	179.2331	179.2331	0.0247
40	8	8	10000	10.49	500	0	3	1	1.0	0.0000	4709.7979	158.3268	158.3268	0.0343	1.2	0.4526	4703.0649	166.8628	166.8628	0.0343

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs @ F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count	# of OEOs @ F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	1000	10.49	500	0	4	1.0	0.0000	4486.4556	181.9866	0.0000	0.0000	1.0	0.0000	4486.4556	181.9866	0.0000	0.0000	0.0142
40	8	8	1000	10.49	500	0	5	1.0	0.0000	4709.4072	184.3064	0.0000	0.0000	1.0	0.0000	4709.4072	184.3064	0.0000	0.0000	0.0278
40	8	8	1000	10.49	500	0	6	1.0	0.0000	4479.8428	173.3775	0.0000	0.0000	1.2	0.4526	4477.2544	176.5267	0.0000	0.0000	0.1060
40	8	8	1000	5	500	80	1	1.0	0.0000	1780.2000	266.0143	13.6983	0.0531	1.0	0.0000	1780.2000	266.0143	67.4000	0.0531	0.0058
40	8	8	1000	5	500	80	2	1.0	0.0000	1898.6000	259.3566	13.7174	0.0548	1.0	0.0000	1898.6000	259.3566	73.2000	0.0548	0.0060
40	8	8	1000	5	500	80	3	1.0	0.0000	1902.6000	267.3127	13.7243	0.0531	1.0	0.0000	1902.6000	267.3127	74.1000	0.0531	0.0058
40	8	8	1000	5	500	80	4	1.0	0.0000	1877.6000	296.0973	14.7612	0.0624	1.0	0.0000	1877.6000	296.0973	64.7000	0.0624	0.0004
40	8	8	1000	5	500	80	5	1.0	0.0000	1954.0000	302.3766	15.4089	0.0515	1.0	0.0000	1954.0000	302.3766	75.8000	0.0515	0.0054
40	8	8	1000	5	500	80	6	1.0	0.0000	1912.8000	293.2007	14.8685	0.0581	1.0	0.0000	1912.8000	293.2007	67.0000	0.0581	0.0055
40	8	8	2000	6.25	500	80	1	1.0	0.0000	1286.3000	155.8004	4.7368	0.1017	1.0	0.0000	1286.3000	155.8004	17.0000	0.1017	0.0095
40	8	8	2000	6.25	500	80	2	1.0	0.0000	1354.6500	153.5889	4.5287	0.1061	1.0	0.0000	1354.6500	153.5889	19.5000	0.1061	0.0069
40	8	8	2000	6.25	500	80	3	1.0	0.0000	1410.4000	122.5625	3.3401	0.1110	1.0	0.0000	1410.4000	122.5625	21.3000	0.1110	0.0063
40	8	8	2000	6.25	500	80	4	1.0	0.0000	1289.6500	146.9256	4.6624	0.1094	1.0	0.0000	1289.6500	146.9256	14.7000	0.1094	0.0091
40	8	8	2000	6.25	500	80	5	1.0	0.0000	1388.2500	157.8475	3.9018	0.1061	1.0	0.0000	1388.2500	157.8475	21.2000	0.1061	0.0071
40	8	8	2000	6.25	500	80	6	1.0	0.0000	1272.0500	169.3185	4.8537	0.1079	1.0	0.0000	1272.0500	169.3185	14.3000	0.1079	0.0084
40	8	8	3000	7.121	500	80	1	1.0	0.0000	1280.3254	132.7589	2.5197	0.1624	1.0	0.0000	1280.3254	132.7589	3.8000	0.1624	0.0142
40	8	8	3000	7.121	500	80	2	1.0	0.0000	1407.2396	109.3841	2.5953	0.1796	1.0	0.0000	1407.2396	109.3841	4.6000	0.1796	0.0109
40	8	8	3000	7.121	500	80	3	1.0	0.0000	1539.6799	121.6596	2.2678	0.2000	1.0	0.0000	1539.6799	121.6596	5.6000	0.2000	0.0090
40	8	8	3000	7.121	500	80	4	1.0	0.0000	1250.6910	143.7604	2.5788	0.1563	1.0	0.0000	1250.6910	143.7604	3.1000	0.1563	0.0150
40	8	8	3000	7.121	500	80	5	1.0	0.0000	1444.0068	114.6611	2.2678	0.1814	1.0	0.0000	1444.0068	114.6611	5.6000	0.1814	0.0122
40	8	8	3000	7.121	500	80	6	1.0	0.0000	1223.2809	132.0635	3.7000	0.1578	1.0	0.0000	1223.2809	132.0635	3.7000	0.1578	0.0133
40	8	8	4000	7.813	500	80	1	1.0	0.0000	1299.5671	161.0315	0.0000	0.1750	1.0	0.0000	1299.5671	161.0315	0.0000	0.1750	0.0164
40	8	8	4000	7.813	500	80	2	1.0	0.0000	1464.4202	111.2918	0.0000	0.1970	1.0	0.0000	1464.4202	111.2918	0.0000	0.1970	0.0093
40	8	8	4000	7.813	500	80	3	1.0	0.0000	1597.9524	125.3319	0.0000	0.2142	1.0	0.0000	1597.9524	125.3319	0.0000	0.2142	0.0119
40	8	8	4000	7.813	500	80	4	1.0	0.0000	1234.6487	142.2325	0.0000	0.1642	1.0	0.0000	1234.6487	142.2325	0.0000	0.1642	0.0185
40	8	8	4000	7.813	500	80	5	1.0	0.0000	1574.7107	129.0331	0.0000	0.2095	1.0	0.0000	1574.7107	129.0331	0.0000	0.2095	0.0131
40	8	8	4000	7.813	500	80	6	1.0	0.0000	1189.2070	141.2485	0.0000	0.1594	1.0	0.0000	1189.2070	141.2485	0.0000	0.1594	0.0128
40	8	8	5000	8.394	500	80	1	1.0	0.0000	1309.0100	164.7675	0.0000	0.1733	1.0	0.0000	1309.0100	164.7675	0.0000	0.1733	0.0135
40	8	8	5000	8.394	500	80	2	1.0	0.0000	1479.9956	110.9125	0.0000	0.1954	1.0	0.0000	1479.9956	110.9125	0.0000	0.1954	0.0095
40	8	8	5000	8.394	500	80	3	1.0	0.0000	1627.7115	122.0383	0.0000	0.2219	1.0	0.0000	1627.7115	122.0383	0.0000	0.2219	0.0115
40	8	8	5000	8.394	500	80	4	1.0	0.0000	1243.1199	146.5973	0.0000	0.1623	1.0	0.0000	1243.1199	146.5973	0.0000	0.1623	0.0159
40	8	8	5000	8.394	500	80	5	1.0	0.0000	1600.8010	127.4986	0.0000	0.2125	1.0	0.0000	1600.8010	127.4986	0.0000	0.2125	0.0118
40	8	8	5000	8.394	500	80	6	1.0	0.0000	1199.1898	143.7133	0.0000	0.1624	1.0	0.0000	1199.1898	143.7133	0.0000	0.1624	0.0152
40	8	8	6000	8.902	500	80	1	1.0	0.0000	1310.3040	164.5712	0.0000	0.1751	1.0	0.0000	1310.3040	164.5712	0.0000	0.1751	0.0165
40	8	8	6000	8.902	500	80	2	1.0	0.0000	1482.0724	108.1840	0.0000	0.2000	1.0	0.0000	1482.0724	108.1840	0.0000	0.2000	0.0104
40	8	8	6000	8.902	500	80	3	1.0	0.0000	1636.3440	118.7296	0.0000	0.2203	1.0	0.0000	1636.3440	118.7296	0.0000	0.2203	0.0112
40	8	8	6000	8.902	500	80	4	1.0	0.0000	1245.1296	148.3766	0.0000	0.1687	1.0	0.0000	1245.1296	148.3766	0.0000	0.1687	0.0165
40	8	8	6000	8.902	500	80	5	1.0	0.0000	1604.7668	126.3227	0.0000	0.2187	1.0	0.0000	1604.7668	126.3227	0.0000	0.2187	0.0129
40	8	8	6000	8.902	500	80	6	1.0	0.0000	1199.9381	144.5763	0.0000	0.1657	1.0	0.0000	1199.9381	144.5763	0.0000	0.1657	0.0132
40	8	8	7000	9.355	500	80	1	1.0	0.0000	1309.0260	164.0936	0.0000	0.1734	1.0	0.0000	1309.0260	164.0936	0.0000	0.1734	0.0170
40	8	8	7000	9.355	500	80	2	1.0	0.0000	1492.1501	101.5917	0.0000	0.2016	1.0	0.0000	1492.1501	101.5917	0.0000	0.2016	0.0133
40	8	8	7000	9.355	500	80	3	1.0	0.0000	1640.8724	121.8149	0.0000	0.2188	1.0	0.0000	1640.8724	121.8149	0.0000	0.2188	0.0129
40	8	8	7000	9.355	500	80	4	1.0	0.0000	1247.5103	146.4824	0.0000	0.1689	1.0	0.0000	1247.5103	146.4824	0.0000	0.1689	0.0173
40	8	8	7000	9.355	500	80	5	1.0	0.0000	1616.6018	127.3532	0.0000	0.2169	1.0	0.0000	1616.6018	127.3532	0.0000	0.2169	0.0135
40	8	8	7000	9.355	500	80	6	1.0	0.0000	1204.6467	143.5832	0.0000	0.1626	1.0	0.0000	1204.6467	143.5832	0.0000	0.1626	0.0152
40	8	8	8000	9.766	500	80	1	1.0	0.0000	1310.1410	165.7427	0.0000	0.1797	1.0	0.0000	1310.1410	165.7427	0.0000	0.1797	0.0142
40	8	8	8000	9.766	500	80	2	1.0	0.0000	1491.5955	105.2766	0.0000	0.2017	1.0	0.0000	1491.5955	105.2766	0.0000	0.2017	0.0111
40	8	8	8000	9.766	500	80	3	1.0	0.0000	1641.7459	119.1048	0.0000	0.2204	1.0	0.0000	1641.7459	119.1048	0.0000	0.2204	0.0112
40	8	8	8000	9.766	500	80	4	1.0	0.0000	1248.0443	148.7820	0.0000	0.1687	1.0	0.0000	1248.0443	148.7820	0.0000	0.1687	0.0196

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
[Gb/s]			[km]		[Gb/s]	[%]																	
40	8	8	8000	9.766	500	80	5	1.0	0.0000	1611.9698	123.6593	0.0000	0.0000	0.2204	0.0111	1.0	0.0000	1611.9698	123.6593	0.0000	0.0000	0.2204	0.0111
40	8	8	8000	9.766	500	80	6	1.0	0.0000	1202.0398	143.5158	0.0000	0.0000	0.1656	0.0140	1.0	0.0000	1202.0398	143.5158	0.0000	0.0000	0.1656	0.0140
40	8	8	9000	10.14	500	80	1	1.0	0.0000	1310.1410	165.7427	0.0000	0.0000	0.1767	0.0159	1.0	0.0000	1310.1410	165.7427	0.0000	0.0000	0.1767	0.0159
40	8	8	9000	10.14	500	80	2	1.0	0.0000	1491.5955	105.2766	0.0000	0.0000	0.2015	0.0098	1.0	0.0000	1491.5955	105.2766	0.0000	0.0000	0.2015	0.0098
40	8	8	9000	10.14	500	80	3	1.0	0.0000	1642.8242	118.7466	0.0000	0.0000	0.2219	0.0128	1.0	0.0000	1642.8242	118.7466	0.0000	0.0000	0.2219	0.0128
40	8	8	9000	10.14	500	80	4	1.0	0.0000	1248.2487	148.9343	0.0000	0.0000	0.1704	0.0155	1.0	0.0000	1248.2487	148.9343	0.0000	0.0000	0.1704	0.0155
40	8	8	9000	10.14	500	80	5	1.0	0.0000	1611.4176	123.2072	0.0000	0.0000	0.2190	0.0138	1.0	0.0000	1611.4176	123.2072	0.0000	0.0000	0.2190	0.0138
40	8	8	9000	10.14	500	80	6	1.0	0.0000	1202.0398	143.5158	0.0000	0.0000	0.1673	0.0166	1.0	0.0000	1202.0398	143.5158	0.0000	0.0000	0.1673	0.0166
40	8	8	10000	10.49	500	80	1	1.0	0.0000	1311.0211	165.4140	0.0000	0.0000	0.1751	0.0146	1.0	0.0000	1311.0211	165.4140	0.0000	0.0000	0.1751	0.0146
40	8	8	10000	10.49	500	80	2	1.0	0.0000	1493.7489	105.6276	0.0000	0.0000	0.2015	0.0111	1.0	0.0000	1493.7489	105.6276	0.0000	0.0000	0.2015	0.0111
40	8	8	10000	10.49	500	80	3	1.0	0.0000	1638.4072	120.8027	0.0000	0.0000	0.2221	0.0146	1.0	0.0000	1638.4072	120.8027	0.0000	0.0000	0.2221	0.0146
40	8	8	10000	10.49	500	80	4	1.0	0.0000	1249.4078	148.5348	0.0000	0.0000	0.1718	0.0150	1.0	0.0000	1249.4078	148.5348	0.0000	0.0000	0.1718	0.0150
40	8	8	10000	10.49	500	80	5	1.0	0.0000	1611.7693	122.8960	0.0000	0.0000	0.2218	0.0136	1.0	0.0000	1611.7693	122.8960	0.0000	0.0000	0.2218	0.0136
40	8	8	10000	10.49	500	80	6	1.0	0.0000	1203.5642	144.0057	0.0000	0.0000	0.1674	0.0139	1.0	0.0000	1203.5642	144.0057	0.0000	0.0000	0.1674	0.0139
40	8	8	1000	5	1500	0	1	6.0	0.7543	11739.5996	465.8766	462.9000	26.0112	0.4312	0.0666	6.0	0.7543	11739.5996	465.8766	462.9000	26.0112	0.4312	0.0666
40	8	8	1000	5	1500	0	2	6.0	0.7543	11798.5996	475.1937	462.1000	23.4849	0.4390	0.0700	6.0	0.7543	11798.5996	475.1937	462.1000	23.4849	0.4390	0.0700
40	8	8	1000	5	1500	0	3	6.0	0.7543	11859.5996	471.5565	465.6000	23.7971	0.4453	0.0699	6.0	0.7543	11859.5996	471.5565	465.6000	23.7971	0.4453	0.0699
40	8	8	1000	5	1500	0	4	6.0	0.7543	11891.0000	466.7280	469.3000	32.2958	0.4515	0.0720	6.0	0.7543	11891.0000	466.7280	469.3000	32.2958	0.4515	0.0720
40	8	8	1000	5	1500	0	5	6.0	0.7543	11857.5996	487.4485	465.4000	23.7660	0.4376	0.0709	6.0	0.7543	11857.5996	487.4485	465.4000	23.7660	0.4376	0.0709
40	8	8	1000	5	1500	0	6	6.0	0.7543	11849.7998	460.5399	466.7000	29.8288	0.4532	0.0710	6.0	0.7543	11849.7998	460.5399	466.7000	29.8288	0.4532	0.0710
40	8	8	2000	6.25	1500	0	1	3.0	0.0000	7831.0498	312.0763	138.2000	9.6226	0.6344	0.0096	3.0	0.0000	7831.0498	312.0763	138.2000	9.6226	0.6344	0.0096
40	8	8	2000	6.25	1500	0	2	3.0	0.0000	7949.3501	330.8463	140.5000	9.9507	0.6483	0.0149	3.0	0.0000	7949.3501	330.8463	140.5000	9.9507	0.6483	0.0149
40	8	8	2000	6.25	1500	0	3	3.0	0.0000	7908.2998	317.3059	140.3000	9.5350	0.6563	0.0159	3.0	0.0000	7908.2998	317.3059	140.3000	9.5350	0.6563	0.0159
40	8	8	2000	6.25	1500	0	4	3.0	0.0000	7917.8501	316.3549	138.5000	9.6311	0.6642	0.0120	3.0	0.0000	7917.8501	316.3549	138.5000	9.6311	0.6642	0.0120
40	8	8	2000	6.25	1500	0	5	3.0	0.0000	7889.2002	307.8364	139.3000	9.3967	0.6513	0.0174	3.0	0.0000	7889.2002	307.8364	139.3000	9.3967	0.6513	0.0174
40	8	8	2000	6.25	1500	0	6	3.0	0.0000	7884.1001	308.6702	137.4000	9.3247	0.6594	0.0101	3.0	0.0000	7884.1001	308.6702	137.4000	9.3247	0.6594	0.0101
40	8	8	3000	7.121	1500	0	1	3.0	0.0000	6645.9443	241.5396	22.9000	2.0916	0.9954	0.0247	3.0	0.0000	6645.9443	241.5396	22.9000	2.0916	0.9954	0.0247
40	8	8	3000	7.121	1500	0	2	3.0	0.0000	6793.0244	245.0626	23.2000	2.3321	1.0392	0.0253	3.0	0.0000	6793.0244	245.0626	23.2000	2.3321	1.0392	0.0253
40	8	8	3000	7.121	1500	0	3	3.0	0.0000	6792.7827	240.8261	23.5000	2.1400	1.0532	0.0191	3.0	0.0000	6792.7827	240.8261	23.5000	2.1400	1.0532	0.0191
40	8	8	3000	7.121	1500	0	4	3.0	0.0000	6656.7720	243.5807	22.6000	2.3174	1.0062	0.0169	3.0	0.0000	6656.7720	243.5807	22.6000	2.3174	1.0062	0.0169
40	8	8	3000	7.121	1500	0	5	3.0	0.0000	6746.7017	229.8810	23.5000	2.1400	1.0328	0.0187	3.0	0.0000	6746.7017	229.8810	23.5000	2.1400	1.0328	0.0187
40	8	8	3000	7.121	1500	0	6	3.0	0.0000	6649.7358	220.8716	22.6000	2.2927	1.0141	0.0170	3.0	0.0000	6649.7358	220.8716	22.6000	2.2927	1.0141	0.0170
40	8	8	4000	7.813	1500	0	1	3.0	0.0000	6457.2793	220.0153	0.0000	0.0000	1.0139	0.0186	3.0	0.0000	6457.2793	220.0153	0.0000	0.0000	1.0139	0.0186
40	8	8	4000	7.813	1500	0	2	3.0	0.0000	6605.6001	228.3214	0.0000	0.0000	1.0720	0.0291	3.0	0.0000	6605.6001	228.3214	0.0000	0.0000	1.0720	0.0291
40	8	8	4000	7.813	1500	0	3	3.0	0.0000	6603.0195	231.0265	0.0000	0.0000	1.0828	0.0229	3.0	0.0000	6603.0195	231.0265	0.0000	0.0000	1.0828	0.0229
40	8	8	4000	7.813	1500	0	4	3.0	0.0000	6445.3628	228.1600	0.0000	0.0000	1.0312	0.0182	3.0	0.0000	6445.3628	228.1600	0.0000	0.0000	1.0312	0.0182
40	8	8	4000	7.813	1500	0	5	3.0	0.0000	6607.5127	229.4387	0.0000	0.0000	1.0828	0.0230	3.0	0.0000	6607.5127	229.4387	0.0000	0.0000	1.0828	0.0230
40	8	8	4000	7.813	1500	0	6	3.0	0.0000	6424.4849	210.9227	0.0000	0.0000	1.0264	0.0191	3.0	0.0000	6424.4849	210.9227	0.0000	0.0000	1.0264	0.0191
40	8	8	5000	8.394	1500	0	1	3.0	0.0000	6505.2373	217.8156	0.0000	0.0000	1.0233	0.0199	3.0	0.0000	6505.2373	217.8156	0.0000	0.0000	1.0233	0.0199
40	8	8	5000	8.394	1500	0	2	3.0	0.0000	6644.7773	239.8583	0.0000	0.0000	1.0751	0.0262	3.0	0.0000	6644.7773	239.8583	0.0000	0.0000	1.0751	0.0262
40	8	8	5000	8.394	1500	0	3	3.0	0.0000	6679.4834	235.9291	0.0000	0.0000	1.0936	0.0241	3.0	0.0000	6679.4834	235.9291	0.0000	0.0000	1.0936	0.0241
40	8	8	5000	8.394	1500	0	4	3.0	0.0000	6502.6143	223.4794	0.0000	0.0000	1.0359	0.0189	3.0	0.0000	6502.6143	223.4794	0.0000	0.0000	1.0359	0.0189
40	8	8	5000	8.394	1500	0	5	3.0	0.0000	6713.7041	224.8521	0.0000	0.0000	1.0969	0.0223	3.0	0.0000	6713.7041	224.8521	0.0000	0.0000	1.0969	0.0223
40	8	8	5000	8.394	1500	0	6	3.0	0.0000	6480.0791	220.0011	0.0000	0.0000	1.0485	0.0239	3.0	0.0000	6480.0791	220.0011	0.0000	0.0000	1.0485	0.0239
40	8	8	6000	8.902	1500	0	1	3.0	0.0000	6521.3105	216.5638	0.0000	0.0000	1.0311	0.0190	3.0	0.0000	6521.3105	216.5638	0.0000	0.0000	1.0311	0.0190
40	8	8	6000	8.902	1500	0	2	3.0	0.0000	6663.9751	241.3010	0.0000	0.0000	1.0829	0.0263	3.0	0.0000	6663.9751	241.3010	0.0000	0.0000	1.0829	0.0263
40	8	8	6000	8.902	1500	0	3	3.0	0.0000	6693.2905	234.9419	0.0000	0.0000	1.0970	0.0252	3.0	0.0000	6693.2905	234.9419	0.0000	0.0000	1.0970	0.0252
40	8	8	6000	8.902	1500	0	4	3.0	0.0000	6508.1982	222.1390	0.0000	0.0000	1.0407	0.0183	3.0	0.0000	6508.1982	222.1390	0.0000	0.0000	1.0407	0.0183
40	8	8	6000	8.902	1500	0	5	3.0	0.0000	6730.6821	250.9924	0.0000	0.0000	1.0890	0.0235	3.0	0.0000	6730.6821	250.9924	0.0000	0.0000	1	

C	W	B	R _{max}	E/O	cost	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	Solve time	±CI	F _{opt}	±CI	Weighted port count	# of OEOs	Solve time	±CI
[Gb/s]			[km]	ratio	[km]	[Gb/s]	[%]				@F _{min}	@F _{min}	[sec]				@F _{opt}	@F _{opt}	[sec]	
40	8	8	6000	8.902	1500	0	6		3.0	0.0000	6490.4917	227.6116	1.0358	0.0000	3.0	0.0000	6490.4917	227.6116	1.0358	0.0218
40	8	8	7000	9.355	1500	0	1		3.0	0.0000	6534.2744	219.5779	1.0297	0.0000	3.0	0.0000	6534.2744	219.5779	1.0297	0.0170
40	8	8	7000	9.355	1500	0	2		3.0	0.0000	6689.1494	242.9890	1.0828	0.0000	3.0	0.0000	6689.1494	242.9890	1.0828	0.0257
40	8	8	7000	9.355	1500	0	3		3.0	0.0000	6686.0181	240.8948	1.0984	0.0000	3.0	0.0000	6686.0181	240.8948	1.0984	0.0224
40	8	8	7000	9.355	1500	0	4		3.0	0.0000	6517.0010	216.5960	1.0421	0.0000	3.0	0.0000	6517.0010	216.5960	1.0421	0.0229
40	8	8	7000	9.355	1500	0	5		3.0	0.0000	6728.8721	241.2552	1.1000	0.0000	3.0	0.0000	6728.8721	241.2552	1.1000	0.0249
40	8	8	7000	9.355	1500	0	6		3.0	0.0000	6505.3428	212.0757	1.0390	0.0000	3.0	0.0000	6505.3428	212.0757	1.0390	0.0175
40	8	8	8000	9.766	1500	0	1		3.0	0.0000	6531.6689	215.3468	1.0360	0.0000	3.0	0.0000	6531.6689	215.3468	1.0360	0.0211
40	8	8	8000	9.766	1500	0	2		3.0	0.0000	6670.1118	239.5378	1.0877	0.0000	3.0	0.0000	6670.1118	239.5378	1.0877	0.0259
40	8	8	8000	9.766	1500	0	3		3.0	0.0000	6696.2861	231.6667	1.1018	0.0000	3.0	0.0000	6696.2861	231.6667	1.1018	0.0213
40	8	8	8000	9.766	1500	0	4		3.0	0.0000	6508.2881	223.9171	1.0453	0.0000	3.0	0.0000	6508.2881	223.9171	1.0453	0.0194
40	8	8	8000	9.766	1500	0	5		3.0	0.0000	6736.6235	226.3086	1.1062	0.0000	3.0	0.0000	6736.6235	226.3086	1.1062	0.0267
40	8	8	8000	9.766	1500	0	6		3.0	0.0000	6505.4556	212.0819	1.0406	0.0000	3.0	0.0000	6505.4556	212.0819	1.0406	0.0177
40	8	8	9000	10.14	1500	0	1		3.0	0.0000	6531.6689	215.3468	1.0359	0.0000	3.0	0.0000	6531.6689	215.3468	1.0359	0.0167
40	8	8	9000	10.14	1500	0	2		3.0	0.0000	6668.5303	240.5506	1.0874	0.0000	3.0	0.0000	6668.5303	240.5506	1.0874	0.0225
40	8	8	9000	10.14	1500	0	3		3.0	0.0000	6697.3569	230.8624	1.1046	0.0000	3.0	0.0000	6697.3569	230.8624	1.1046	0.0223
40	8	8	9000	10.14	1500	0	4		3.0	0.0000	6507.1890	222.1661	1.0469	0.0000	3.0	0.0000	6507.1890	222.1661	1.0469	0.0210
40	8	8	9000	10.14	1500	0	5		3.0	0.0000	6737.1982	226.4862	1.1078	0.0000	3.0	0.0000	6737.1982	226.4862	1.1078	0.0241
40	8	8	9000	10.14	1500	0	6		3.0	0.0000	6505.4556	212.0819	1.0439	0.0000	3.0	0.0000	6505.4556	212.0819	1.0439	0.0181
40	8	8	10000	10.49	1500	0	1		3.0	0.0000	6531.6689	215.3468	1.0391	0.0000	3.0	0.0000	6531.6689	215.3468	1.0391	0.0183
40	8	8	10000	10.49	1500	0	2		3.0	0.0000	6669.5322	239.2634	1.0890	0.0000	3.0	0.0000	6669.5322	239.2634	1.0890	0.0234
40	8	8	10000	10.49	1500	0	3		3.0	0.0000	6705.2959	237.7518	1.1061	0.0000	3.0	0.0000	6705.2959	237.7518	1.1061	0.0217
40	8	8	10000	10.49	1500	0	4		3.0	0.0000	6501.8950	225.3750	1.0484	0.0000	3.0	0.0000	6501.8950	225.3750	1.0484	0.0185
40	8	8	10000	10.49	1500	0	5		3.0	0.0000	6743.2979	224.8158	1.1078	0.0000	3.0	0.0000	6743.2979	224.8158	1.1078	0.0272
40	8	8	10000	10.49	1500	0	6		3.0	0.0000	6511.3281	214.1177	1.0406	0.0000	3.0	0.0000	6511.3281	214.1177	1.0406	0.0175
40	8	8	1000	5	1500	80	1		2.8	0.4526	2840.6001	343.7424	0.1407	0.0206	2.8	0.4526	2840.6001	343.7424	0.1407	0.0206
40	8	8	1000	5	1500	80	2		2.8	0.4526	2924.6001	362.5554	0.1452	0.0252	2.8	0.4526	2924.6001	362.5554	0.1452	0.0252
40	8	8	1000	5	1500	80	3		2.8	0.4526	2957.2000	357.1150	0.1437	0.0251	2.8	0.4526	2957.2000	357.1150	0.1437	0.0251
40	8	8	1000	5	1500	80	4		2.8	0.4526	3000.2000	362.2587	0.1469	0.0254	2.8	0.4526	3000.2000	362.2587	0.1469	0.0254
40	8	8	1000	5	1500	80	5		2.8	0.4526	3023.2000	389.7054	0.1472	0.0212	2.8	0.4526	3023.2000	389.7054	0.1472	0.0212
40	8	8	1000	5	1500	80	6		2.8	0.4526	2959.0000	370.4637	0.1471	0.0214	2.8	0.4526	2959.0000	370.4637	0.1471	0.0214
40	8	8	2000	6.25	1500	80	1		1.0	0.0000	2095.0500	254.3930	0.1237	0.0082	2.0	0.7543	2050.6001	229.0514	0.2204	0.0703
40	8	8	2000	6.25	1500	80	2		1.0	0.0000	2203.7000	245.6700	0.1297	0.0076	1.8	0.7390	2162.1001	218.9201	0.2093	0.0736
40	8	8	2000	6.25	1500	80	3		1.0	0.0000	2175.0000	269.4083	0.1251	0.0093	1.8	0.7390	2119.0500	227.3286	0.2094	0.0739
40	8	8	2000	6.25	1500	80	4		1.0	0.0000	2128.3501	247.5474	0.1312	0.0076	1.8	0.7390	2084.2000	218.2374	0.2094	0.0712
40	8	8	2000	6.25	1500	80	5		1.0	0.0000	2150.7000	243.2075	0.1188	0.0057	1.6	0.6913	2116.8000	221.1566	0.1814	0.0701
40	8	8	2000	6.25	1500	80	6		1.0	0.0000	2118.3999	239.4190	0.1297	0.0054	1.8	0.7390	2078.3501	215.7692	0.2109	0.0728
40	8	8	3000	7.121	1500	80	1		1.0	0.0000	1849.8635	170.1143	0.2015	0.0178	1.4	0.6034	1840.2920	165.7111	0.2576	0.0844
40	8	8	3000	7.121	1500	80	2		1.0	0.0000	1991.9762	148.9043	0.2173	0.0111	1.4	0.6034	1981.5547	150.5908	0.2797	0.0895
40	8	8	3000	7.121	1500	80	3		1.0	0.0000	2043.3450	172.5281	0.2125	0.0140	1.2	0.4526	2040.4707	169.2348	0.2452	0.0732
40	8	8	3000	7.121	1500	80	4		1.0	0.0000	1831.7561	173.0474	0.2017	0.0162	1.4	0.6034	1828.2360	173.3017	0.2595	0.0803
40	8	8	3000	7.121	1500	80	5		1.0	0.0000	2001.2963	129.6290	0.2156	0.0137	1.4	0.6034	1995.5020	127.5977	0.2796	0.0868
40	8	8	3000	7.121	1500	80	6		1.0	0.0000	1839.9277	151.6834	0.2042	0.0123	1.4	0.6034	1818.7334	153.4684	0.2564	0.0780
40	8	8	4000	7.813	1500	80	1		1.0	0.0000	1858.6599	197.2393	0.4000	0.0913	1.4	0.6034	1837.8395	181.0255	0.0000	0.0795
40	8	8	4000	7.813	1500	80	2		1.0	0.0000	1989.3967	145.9261	0.5003	0.0219	1.6	0.6913	1981.8217	147.1890	0.0000	0.1046
40	8	8	4000	7.813	1500	80	3		1.0	0.0000	2067.5178	166.7217	0.6954	0.0234	1.2	0.4526	2065.0691	165.6817	0.6913	0.0803
40	8	8	4000	7.813	1500	80	4		1.0	0.0000	1827.8242	178.9337	0.0000	0.0232	1.6	0.6913	1822.7894	177.5946	0.0000	0.2938
40	8	8	4000	7.813	1500	80	5		1.0	0.0000	2069.9995	161.5660	0.3000	0.0430	1.2	0.4526	2067.7876	162.1694	0.4526	0.0975
40	8	8	4000	7.813	1500	80	6		1.0	0.0000	1802.6191	159.0981	0.1000	0.2263	1.6	0.6913	1783.2240	160.9932	0.0000	0.2843

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	5000	8.394	1500	80	1	1.0	0.0000	1878.6272	196.605	0.0000	0.2016	0.0208	1.4	0.6034	1863.8334	183.5586	0.0000	0.0000	0.2627	0.0792
40	8	8	5000	8.394	1500	80	2	1.0	0.0000	2007.7117	148.2903	0.0000	0.2219	0.0148	1.4	0.6034	2004.1211	148.6330	0.0000	0.0000	0.2922	0.0934
40	8	8	5000	8.394	1500	80	3	1.0	0.0000	2105.1460	163.6739	0.0000	0.2359	0.0226	1.2	0.4526	2101.9302	162.3472	0.0000	0.0000	0.2702	0.0806
40	8	8	5000	8.394	1500	80	4	1.0	0.0000	1835.5615	173.1689	0.0000	0.2077	0.0173	1.2	0.4526	1834.5615	172.8898	0.0000	0.0000	0.2311	0.0546
40	8	8	5000	8.394	1500	80	5	1.0	0.0000	2096.3735	167.4442	0.0000	0.2375	0.0203	1.4	0.6034	2093.1646	164.8683	0.0000	0.0000	0.3110	0.0956
40	8	8	5000	8.394	1500	80	6	1.0	0.0000	1807.2494	156.7704	0.0000	0.2047	0.0171	1.6	0.6913	1787.9651	157.8882	0.0000	0.0000	0.2878	0.0857
40	8	8	6000	8.902	1500	80	1	1.0	0.0000	1883.4084	196.6257	0.0000	0.2000	0.0235	1.2	0.4526	1869.3099	183.4372	0.0000	0.0000	0.2329	0.0667
40	8	8	6000	8.902	1500	80	2	1.0	0.0000	2016.5752	154.7829	0.0000	0.2249	0.0162	1.4	0.6034	2010.6273	152.7154	0.0000	0.0000	0.2953	0.0923
40	8	8	6000	8.902	1500	80	3	1.0	0.0000	2120.6807	159.7713	0.0000	0.2344	0.0204	1.4	0.6034	2117.6499	157.9105	0.0000	0.0000	0.3093	0.1022
40	8	8	6000	8.902	1500	80	4	1.0	0.0000	1838.5472	176.3373	0.0000	0.2094	0.0199	1.2	0.4526	1837.5472	176.0729	0.0000	0.0000	0.2360	0.0578
40	8	8	6000	8.902	1500	80	5	1.0	0.0000	2110.3787	164.1445	0.0000	0.2391	0.0231	1.4	0.6034	2104.3169	162.2132	0.0000	0.0000	0.3157	0.0968
40	8	8	6000	8.902	1500	80	6	1.0	0.0000	1810.5554	154.7520	0.0000	0.2064	0.0173	1.6	0.6913	1790.7076	155.6938	0.0000	0.0000	0.2907	0.0862
40	8	8	7000	9.355	1500	80	1	1.0	0.0000	1892.6461	192.9100	0.0000	0.2063	0.0203	1.4	0.6034	1871.6008	180.1371	0.0000	0.0000	0.2673	0.0807
40	8	8	7000	9.355	1500	80	2	1.0	0.0000	2021.7670	150.9218	0.0000	0.2298	0.0167	1.4	0.6034	2012.1917	143.8297	0.0000	0.0000	0.2985	0.0913
40	8	8	7000	9.355	1500	80	3	1.0	0.0000	2124.9551	156.7016	0.0000	0.2374	0.0234	1.6	0.6913	2119.6262	156.4789	0.0000	0.0000	0.3531	0.1170
40	8	8	7000	9.355	1500	80	4	1.0	0.0000	1845.5469	174.0897	0.0000	0.2094	0.0197	1.2	0.4526	1844.5469	173.8448	0.0000	0.0000	0.2359	0.0578
40	8	8	7000	9.355	1500	80	5	1.0	0.0000	2117.7983	165.1226	0.0000	0.2407	0.0224	1.4	0.6034	2110.4646	162.1839	0.0000	0.0000	0.3171	0.0958
40	8	8	7000	9.355	1500	80	6	1.0	0.0000	1811.0338	155.3332	0.0000	0.2077	0.0168	1.6	0.6913	1789.3652	156.3129	0.0000	0.0000	0.2906	0.0870
40	8	8	8000	9.766	1500	80	1	1.0	0.0000	1892.4238	196.7831	0.0000	0.2048	0.0231	1.4	0.6034	1871.7559	183.7105	0.0000	0.0000	0.2687	0.0830
40	8	8	8000	9.766	1500	80	2	1.0	0.0000	2020.7621	151.1642	0.0000	0.2295	0.0176	1.4	0.6034	2015.5612	148.5439	0.0000	0.0000	0.2984	0.0917
40	8	8	8000	9.766	1500	80	3	1.0	0.0000	2132.3735	160.5491	0.0000	0.2423	0.0199	1.6	0.6913	2125.7705	161.4683	0.0000	0.0000	0.3514	0.1124
40	8	8	8000	9.766	1500	80	4	1.0	0.0000	1843.5271	176.6100	0.0000	0.2076	0.0184	1.2	0.4526	1842.5271	176.3621	0.0000	0.0000	0.2342	0.0578
40	8	8	8000	9.766	1500	80	5	1.0	0.0000	2116.8416	165.6157	0.0000	0.2390	0.0240	1.4	0.6034	2107.6248	162.4228	0.0000	0.0000	0.3138	0.0945
40	8	8	8000	9.766	1500	80	6	1.0	0.0000	1811.0488	155.0748	0.0000	0.2062	0.0181	1.6	0.6913	1790.7076	155.6938	0.0000	0.0000	0.2906	0.0870
40	8	8	9000	10.14	1500	80	1	1.0	0.0000	1892.4238	196.7831	0.0000	0.2063	0.0224	1.4	0.6034	1871.7559	183.7105	0.0000	0.0000	0.2688	0.0799
40	8	8	9000	10.14	1500	80	2	1.0	0.0000	2022.4375	149.1685	0.0000	0.2327	0.0170	1.4	0.6034	2017.2366	146.5463	0.0000	0.0000	0.3015	0.0901
40	8	8	9000	10.14	1500	80	3	1.0	0.0000	2134.8501	161.6913	0.0000	0.2390	0.0203	1.4	0.6034	2125.8186	161.5178	0.0000	0.0000	0.3109	0.1023
40	8	8	9000	10.14	1500	80	4	1.0	0.0000	1843.6770	176.7030	0.0000	0.2094	0.0200	1.2	0.4526	1842.6770	176.4557	0.0000	0.0000	0.2328	0.0551
40	8	8	9000	10.14	1500	80	5	1.0	0.0000	2119.2778	167.3369	0.0000	0.2438	0.0225	1.4	0.6034	2109.9063	164.2885	0.0000	0.0000	0.3188	0.0955
40	8	8	9000	10.14	1500	80	6	1.0	0.0000	1810.4065	154.6559	0.0000	0.2092	0.0178	1.6	0.6913	1791.3666	156.0062	0.0000	0.0000	0.2923	0.0860
40	8	8	10000	10.49	1500	80	1	1.0	0.0000	1892.4238	196.7831	0.0000	0.2048	0.0215	1.4	0.6034	1871.7559	183.7105	0.0000	0.0000	0.2689	0.0826
40	8	8	10000	10.49	1500	80	2	1.0	0.0000	2022.4375	149.1685	0.0000	0.2283	0.0191	1.4	0.6034	2018.7031	145.8982	0.0000	0.0000	0.2985	0.0915
40	8	8	10000	10.49	1500	80	3	1.0	0.0000	2134.8501	161.6913	0.0000	0.2408	0.0183	1.4	0.6034	2125.8186	161.5178	0.0000	0.0000	0.3110	0.1023
40	8	8	10000	10.49	1500	80	4	1.0	0.0000	1843.6770	176.7030	0.0000	0.2078	0.0183	1.2	0.4526	1842.6770	176.4557	0.0000	0.0000	0.2343	0.0577
40	8	8	10000	10.49	1500	80	5	1.0	0.0000	2119.2778	167.3369	0.0000	0.2404	0.0226	1.4	0.6034	2109.9063	164.2885	0.0000	0.0000	0.3157	0.0971
40	8	8	10000	10.49	1500	80	6	1.0	0.0000	1810.4065	154.6559	0.0000	0.2094	0.0177	1.6	0.6913	1791.3666	156.0062	0.0000	0.0000	0.2938	0.0878

Table C.3: Comparison of fiber-bifurcation-based heuristics without the optical-reach customization for the 8-node network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	4	4	1000	2	500	0	1	26.6	1.6247	5909.2002	366.0000	17.1830	0.5408	0.0525	5909.2002	366.0000	214.6959	0.5408	0.0525
10	4	4	1000	2	500	0	2	26.6	1.6247	5957.2002	370.7000	18.4169	0.5436	0.0505	5957.2002	370.7000	219.3763	0.5436	0.0505
10	4	4	1000	2	500	0	3	26.6	1.6247	6010.7998	371.8000	17.0694	0.5497	0.0497	6010.7998	371.8000	226.4085	0.5497	0.0497
10	4	4	1000	2	500	0	4	26.6	1.6247	5982.7998	379.6000	23.4479	0.5626	0.0509	5982.7998	379.6000	231.1693	0.5626	0.0509
10	4	4	1000	2	500	0	5	26.8	1.7133	6030.0000	373.0000	22.2728	0.5593	0.0485	6030.0000	373.0000	225.2728	0.5593	0.0485
10	4	4	1000	2	500	0	6	26.8	1.7133	5986.7998	377.2000	24.4471	0.5657	0.0494	5986.7998	377.2000	230.2578	0.5657	0.0494
10	4	4	2000	2.5	500	0	1	9.4	0.6034	4247.7998	135.5000	19.6866	0.3607	0.0511	4068.5000	110.8000	123.2196	0.3607	0.0511
10	4	4	2000	2.5	500	0	2	9.2	0.4526	4310.2002	140.3000	20.3622	0.3625	0.0473	4116.8999	114.7000	126.0438	0.3625	0.0473
10	4	4	2000	2.5	500	0	3	9.4	0.6034	4312.6001	136.3000	16.5422	0.3765	0.0518	4105.0000	112.9000	122.9773	0.3765	0.0518
10	4	4	2000	2.5	500	0	4	9.6	0.6913	4250.6001	133.6000	18.9832	0.4061	0.0657	4106.2002	110.5000	127.1651	0.4061	0.0657
10	4	4	2000	2.5	500	0	5	9.2	0.4526	4363.2002	139.6000	18.2248	0.3579	0.0404	4104.7998	112.8000	130.2529	0.3579	0.0404
10	4	4	2000	2.5	500	0	6	9.4	0.6034	4255.7002	135.3000	17.3184	0.3888	0.0515	4089.1001	110.4000	122.5962	0.3888	0.0515
10	4	4	3000	2.849	500	0	1	8.0	0.7543	3838.4575	57.5000	27.3685	0.3734	0.1032	3562.0813	17.7000	116.4170	0.3734	0.1032
10	4	4	3000	2.849	500	0	2	8.0	0.7543	3925.7488	55.7000	20.7414	0.4079	0.0866	3653.6577	18.4000	132.4322	0.4079	0.0866
10	4	4	3000	2.849	500	0	3	8.0	0.7543	3995.6563	67.8000	34.4369	0.3813	0.1039	3643.0488	18.4000	114.8056	0.3813	0.1039
10	4	4	3000	2.849	500	0	4	8.0	0.7543	3865.0547	55.4000	21.4059	0.4710	0.0939	3565.9329	17.4000	124.6820	0.4710	0.0939
10	4	4	3000	2.849	500	0	5	8.4	0.6913	3827.4075	163.8240	20.7061	0.4703	0.0990	3626.9817	18.7000	121.3182	0.4703	0.0990
10	4	4	3000	2.849	500	0	6	8.0	0.7543	3851.2876	176.6457	24.6994	0.4141	0.1060	3589.1392	17.8000	107.8742	0.4141	0.1060
10	4	4	4000	3.125	500	0	1	8.0	0.7543	3712.3000	184.9900	14.6091	0.4157	0.0929	3572.4751	0.9000	110.8722	0.4157	0.0929
10	4	4	4000	3.125	500	0	2	8.0	0.7543	3809.7500	170.7331	18.5000	0.4376	0.1110	3648.0750	0.2000	125.6954	0.4376	0.1110
10	4	4	4000	3.125	500	0	3	8.2	0.7390	3813.4751	210.6660	24.8675	0.4796	0.1238	3670.0249	0.1000	115.7883	0.4796	0.1238
10	4	4	4000	3.125	500	0	4	8.0	0.7543	3776.6499	175.1697	22.0000	0.4875	0.0936	3570.2749	0.0000	116.4955	0.4875	0.0936
10	4	4	4000	3.125	500	0	5	8.4	0.6913	3745.8250	147.0202	9.9000	0.4628	0.1123	3666.2251	0.3000	116.8526	0.4628	0.1123
10	4	4	4000	3.125	500	0	6	8.0	0.7543	3735.8000	181.0471	21.8000	0.4375	0.1039	3578.2000	0.4000	101.2356	0.4375	0.1039
10	4	4	5000	3.358	500	0	1	8.4	0.6913	3829.5396	96.6362	6.5000	0.3922	0.0644	3707.1016	0.0000	123.9263	0.3922	0.0644
10	4	4	5000	3.358	500	0	2	8.2	0.7390	3890.2878	126.5076	6.9000	0.4217	0.0868	3788.3364	0.0000	130.8882	0.4217	0.0868
10	4	4	5000	3.358	500	0	3	8.6	0.6034	3894.0571	122.8788	4.8000	0.4388	0.0625	3806.1523	0.2000	113.0514	0.4388	0.0625
10	4	4	5000	3.358	500	0	4	8.4	0.6913	3745.8074	119.7748	4.6000	0.4724	0.0690	3690.7727	0.1000	126.2405	0.4724	0.0690
10	4	4	5000	3.358	500	0	5	8.6	0.6034	3886.5288	144.4867	5.1000	0.3878	0.0687	3808.8523	0.7000	126.0529	0.3878	0.0687
10	4	4	5000	3.358	500	0	6	8.6	0.6034	3771.9634	130.7733	3.6000	0.4924	0.0668	3719.9160	0.0000	119.7359	0.4924	0.0668
10	4	4	6000	3.561	500	0	1	8.4	0.6913	3866.6128	104.9310	3.2000	0.5136	0.0452	3793.9758	0.0000	126.0214	0.5136	0.0452
10	4	4	6000	3.561	500	0	2	8.6	0.6034	3950.9863	160.6295	1.7000	0.3847	0.0867	3905.6433	0.0000	140.6718	0.3847	0.0867
10	4	4	6000	3.561	500	0	3	8.6	0.6034	3934.1863	127.3843	1.0000	0.5047	0.0663	3906.3286	0.0000	114.5462	0.5047	0.0663
10	4	4	6000	3.561	500	0	4	8.4	0.6913	3836.8914	146.4361	2.1000	0.4506	0.0851	3787.1392	0.0000	132.8480	0.4506	0.0851
10	4	4	6000	3.561	500	0	5	8.6	0.6034	3932.8892	135.5123	0.2000	0.4526	0.0675	3918.7285	0.0000	134.2143	0.4526	0.0675
10	4	4	6000	3.561	500	0	6	8.4	0.6913	3861.9858	129.4806	3.4000	0.4727	0.0844	3806.5242	0.0000	117.6458	0.4727	0.0844
10	4	4	7000	3.742	500	0	1	8.4	0.6913	3979.3169	99.9446	2.0000	0.3899	0.0700	3900.8687	0.0000	129.1690	0.3899	0.0700
10	4	4	7000	3.742	500	0	2	8.2	0.7390	4045.7070	134.3106	1.0000	0.4311	0.0862	3996.7297	0.0000	141.9239	0.4311	0.0862
10	4	4	7000	3.742	500	0	3	8.6	0.6034	4080.9524	124.8887	0.2000	0.3017	0.0428	4018.5200	0.0000	120.3943	0.3017	0.0428
10	4	4	7000	3.742	500	0	4	8.4	0.6913	3925.4458	123.6417	1.7000	0.2651	0.0465	3895.3237	0.1000	134.7827	0.2651	0.0465
10	4	4	7000	3.742	500	0	5	8.6	0.6034	4061.0105	125.6793	0.0000	0.4280	0.0699	4014.9714	0.0000	137.8951	0.4280	0.0699
10	4	4	7000	3.742	500	0	6	8.6	0.6034	3950.4915	140.3663	1.0000	0.2029	0.0462	3903.7141	0.0000	126.9583	0.2029	0.0462
10	4	4	8000	3.906	500	0	1	8.4	0.6913	4061.1750	108.5723	1.6000	0.3137	0.0891	3984.6001	0.0000	131.1523	0.3137	0.0891
10	4	4	8000	3.906	500	0	2	8.2	0.7390	4134.2437	136.3299	0.5000	0.7729	0.0855	4083.1687	0.0000	144.9608	0.7729	0.0855
10	4	4	8000	3.906	500	0	3	8.6	0.6034	4166.9688	129.1607	0.1000	0.2263	0.0693	4106.2563	0.0000	123.3344	0.2263	0.0693
10	4	4	8000	3.906	500	0	4	8.4	0.6913	4016.3374	127.1663	1.5000	0.2663	0.0462	3980.9563	0.1000	138.0048	0.2663	0.0462
10	4	4	8000	3.906	500	0	5	8.6	0.6034	4154.1250	127.6020	0.0000	0.0000	0.0688	4104.6748	0.0000	141.9936	0.0000	0.0688

C	W	B	R _{max} [km]	E/O cost	IN [Gb/s]	FR [°]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	4	4	7000	3.742	500	80	1	3.2	0.4526	1317.9408	134.1111	0.4000	0.6913	0.1074	0.0236	1253.4346	116.6357	0.0000	0.0000	0.2124
10	4	4	7000	3.742	500	80	2	3.2	0.4526	1393.8438	139.2647	0.1000	0.2263	0.1108	0.0230	1359.7566	122.8886	0.0000	0.0000	0.2172
10	4	4	7000	3.742	500	80	3	3.2	0.4526	1420.4694	126.6576	0.1000	0.2263	0.1188	0.0251	1384.8889	118.9617	0.0000	0.0000	0.2390
10	4	4	7000	3.742	500	80	4	3.2	0.4526	1286.0797	139.7021	0.2000	0.3017	0.1118	0.0211	1245.0442	119.8389	0.0000	0.0000	0.2128
10	4	4	7000	3.742	500	80	5	3.2	0.4526	1423.2726	125.5766	0.3000	0.6788	0.1188	0.0232	1396.2921	119.3369	0.0000	0.0000	0.2090
10	4	4	7000	3.742	500	80	6	3.2	0.4526	1246.9056	146.5250	0.1000	0.2263	0.1090	0.0201	1194.7251	123.4791	0.0000	0.0000	0.1956
10	4	4	8000	3.906	500	80	1	3.2	0.4526	1342.0875	134.3013	0.3000	0.6788	0.1125	0.0203	1279.4750	119.2421	0.0000	0.0000	0.2109
10	4	4	8000	3.906	500	80	2	3.2	0.4526	1421.5437	141.8690	0.0000	0.1189	0.0254	0.0	1388.3750	126.1206	0.0000	0.0000	0.2204
10	4	4	8000	3.906	500	80	3	3.2	0.4526	1446.9437	128.0048	0.0000	0.0000	0.1189	0.0249	1412.6687	121.5939	0.0000	0.0000	0.2406
10	4	4	8000	3.906	500	80	4	3.2	0.4526	1312.0188	142.5069	0.1000	0.2263	0.1110	0.0192	1272.6875	123.5106	0.0000	0.0000	0.2127
10	4	4	8000	3.906	500	80	5	3.2	0.4526	1454.0687	131.4841	1.1000	2.4890	0.1186	0.0226	1422.2063	121.7918	0.0000	0.0000	0.2078
10	4	4	8000	3.906	500	80	6	3.2	0.4526	1268.7562	146.0811	0.0000	0.0000	0.1111	0.0208	1219.5437	125.9728	0.0000	0.0000	0.1953
10	4	4	9000	4.057	500	80	1	3.2	0.4526	1366.1222	136.3376	0.3000	0.6788	0.1096	0.0211	1303.0247	121.4613	0.0000	0.0000	0.2173
10	4	4	9000	4.057	500	80	2	3.2	0.4526	1447.5541	144.4907	0.0000	0.0000	0.1203	0.0229	1413.3740	128.3514	0.0000	0.0000	0.2170
10	4	4	9000	4.057	500	80	3	3.2	0.4526	1472.8372	130.9547	0.0000	0.0000	0.1206	0.0276	1437.9998	123.9826	0.0000	0.0000	0.2376
10	4	4	9000	4.057	500	80	4	3.2	0.4526	1329.6592	139.0830	0.1000	0.2263	0.1126	0.0188	1295.6561	125.6600	0.0000	0.0000	0.2124
10	4	4	9000	4.057	500	80	5	3.2	0.4526	1477.8831	132.5525	1.1000	2.4890	0.1155	0.0219	1447.0769	123.4488	0.0000	0.0000	0.1921
10	4	4	9000	4.057	500	80	6	3.2	0.4526	1291.8531	148.4521	0.0000	0.0000	0.1064	0.0217	1242.3387	128.2645	0.0000	0.0000	0.1952
10	4	4	10000	4.197	500	80	1	3.2	0.4526	1388.6863	138.5242	0.3000	0.6788	0.1048	0.0217	1324.8608	123.5197	0.0000	0.0000	0.2141
10	4	4	10000	4.197	500	80	2	3.2	0.4526	1470.9297	146.6068	0.0000	0.0000	0.1171	0.0265	1436.5537	130.4213	0.0000	0.0000	0.2188
10	4	4	10000	4.197	500	80	3	3.2	0.4526	1496.8606	133.2695	0.0000	0.0000	0.1233	0.0234	1461.4875	126.1976	0.0000	0.0000	0.2361
10	4	4	10000	4.197	500	80	4	3.2	0.4526	1351.3790	141.2417	0.1000	0.2263	0.1140	0.0211	1317.3241	127.7952	0.0000	0.0000	0.2142
10	4	4	10000	4.197	500	80	5	3.2	0.4526	1501.8186	134.9103	1.1000	2.4890	0.1189	0.0249	1470.5085	125.6253	0.0000	0.0000	0.1955
10	4	4	10000	4.197	500	80	6	3.2	0.4526	1313.2692	150.6553	0.0000	0.0000	0.1096	0.0210	1263.4749	130.3904	0.0000	0.0000	0.1936
10	4	4	1000	2	1500	0	1	78.2	4.5356	9305.5996	284.2246	623.2000	38.9676	2.7188	78.2	9305.5996	284.2246	623.2000	38.9676	2.7188
10	4	4	1000	2	1500	0	2	78.2	4.5356	9366.7998	314.5629	617.6000	28.2904	2.7375	78.2	9366.7998	314.5629	617.6000	28.2904	2.7375
10	4	4	1000	2	1500	0	3	78.2	4.5356	9383.5996	330.2444	616.4000	27.5879	2.7531	78.2	9383.5996	330.2444	616.4000	27.5879	2.7531
10	4	4	1000	2	1500	0	4	78.2	4.5356	9338.7998	331.7174	653.1000	48.6612	2.7939	78.2	9338.7998	331.7174	653.1000	48.6612	2.7939
10	4	4	1000	2	1500	0	5	78.2	4.5356	9412.7998	320.9104	618.7000	27.2389	2.7639	78.2	9412.7998	320.9104	618.7000	27.2389	2.7639
10	4	4	1000	2	1500	0	6	78.2	4.5356	9329.2002	319.8884	647.3000	42.7842	2.7892	78.2	9329.2002	319.8884	647.3000	42.7842	2.7892
10	4	4	2000	2.5	1500	0	1	26.2	1.9318	6974.2002	336.8353	266.7000	42.9050	1.5641	32.0	6422.2002	232.4080	188.4000	13.0736	3.0049
10	4	4	2000	2.5	1500	0	2	26.0	1.6866	7043.5000	374.9786	276.4000	43.3130	1.4014	33.6	6462.3999	251.8023	186.2000	12.4705	4.1218
10	4	4	2000	2.5	1500	0	3	26.4	1.6594	6992.3999	441.7442	252.4000	50.1055	1.5750	34.0	6447.7998	237.9846	186.0000	11.7140	4.0438
10	4	4	2000	2.5	1500	0	4	27.2	1.7133	6758.1001	310.3931	239.4000	28.7472	1.9033	34.8	6411.7002	248.4601	185.4000	10.5066	4.0578
10	4	4	2000	2.5	1500	0	5	26.4	1.7912	7029.1001	441.1678	251.4000	40.4369	1.4890	33.6	6447.0000	237.5513	187.5000	9.9906	3.2312
10	4	4	2000	2.5	1500	0	6	26.0	1.9377	6928.2998	300.7287	264.5000	36.1589	1.4486	33.0	6476.0000	257.7563	188.2000	14.1140	2.8312
10	4	4	3000	2.849	1500	0	1	22.2	1.3826	6496.8877	385.2939	143.6000	49.3528	1.1203	32.4	5604.3306	187.3930	32.7000	6.7719	3.9749
10	4	4	3000	2.849	1500	0	2	22.8	1.0560	6349.0078	351.5843	115.0000	31.1498	1.2717	33.0	5696.0376	200.7396	32.4000	5.2927	6.4125
10	4	4	3000	2.849	1500	0	3	23.0	1.1685	6385.8628	391.7403	112.0000	32.5222	1.1907	33.6	5680.4248	201.4346	31.4000	4.6764	5.7437
10	4	4	3000	2.849	1500	0	4	22.6	1.1289	6226.1162	260.5489	105.4000	17.0107	1.2856	31.6	5608.7642	205.2083	35.3000	9.4751	5.3248
10	4	4	3000	2.849	1500	0	5	22.6	1.4780	6489.2896	341.0860	127.6000	38.6633	1.1811	34.0	5685.0854	205.9093	31.7000	4.4501	5.8546
10	4	4	3000	2.849	1500	0	6	22.4	1.1782	6242.0103	290.6868	106.0000	21.7978	1.2670	32.2	5639.0278	200.3900	32.4000	6.4107	4.9796
10	4	4	4000	3.125	1500	0	1	22.4	1.3577	6068.3501	227.8109	43.8000	23.0085	1.2043	28.6	5612.7749	199.1215	0.5000	0.6954	3.8531
10	4	4	4000	3.125	1500	0	2	22.6	1.1289	6193.1748	371.3281	50.3000	32.4715	1.3047	28.6	5716.5249	215.8316	0.9000	0.8567	4.4622
10	4	4	4000	3.125	1500	0	3	22.4	0.9659	6344.2251	477.2537	62.4000	47.9223	1.1623	29.6	5705.5000	197.7445	0.5000	0.7729	4.2218
10	4	4	4000	3.125	1500	0	4	22.6	1.1289	5948.1250	265.5281	35.1000	14.7704	1.4314	31.0	5585.7998	193.8973	0.4000	0.9051	5.2655
10	4	4	4000	3.125	1500	0	5	22.4	1.3577	6142.7251	245.4634	40.5000	21.5306	1.2155	28.2	5720.1001	204.9305	0.5000	1.1314	3.4359
10	4	4	4000	3.125	1500	0	6	22.4	0.9659	5961.3501	298.4161	33.6000	14.6961	1.3781	29.2	5609.0249	198.2293	0.8000	1.2068	3.5985
10	4	4	5000	3.358	1500	0	1	23.0	1.3492	6211.5908	326.5577	27.8000	17.5396	1.1735	31.2	5817.0864	207.0462	0.0000	0.0000	4.1420

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	4	4	5000	3.358	1500	0	2	23.2	1.5749	6350.8726	23.8019	10.0712	1.2767	0.2694	0.2694	5938.8506	0.2000	0.4526	0.4162
10	4	4	5000	3.358	1500	0	3	23.6	1.6594	6371.3179	347.4334	21.7376	1.2345	0.2785	0.2785	5929.6641	0.0000	0.0000	2.1887
10	4	4	5000	3.358	1500	0	4	22.6	1.1289	6111.1709	233.2905	18.0045	1.3389	0.3131	0.3131	5895.8872	0.6000	0.7692	0.4253
10	4	4	5000	3.358	1500	0	5	23.6	1.5160	6528.6343	402.0723	21.5353	1.1577	0.2027	0.2027	5950.2505	0.7000	1.5839	1.7610
10	4	4	5000	3.358	1500	0	6	23.2	1.4231	6186.8052	246.9244	12.4488	1.3218	0.3119	0.3119	5832.1147	0.0000	0.0000	1.6917
10	4	4	6000	3.561	1500	0	1	22.8	1.0560	6320.3115	310.1559	16.2148	1.2235	0.2210	0.2210	6002.2002	0.0000	0.0000	3.7921
10	4	4	6000	3.561	1500	0	2	23.0	1.1689	6381.5542	284.1796	13.7464	1.2936	0.2953	0.2953	6113.6533	0.1000	0.2263	0.6322
10	4	4	6000	3.561	1500	0	3	23.0	0.9541	6346.3682	325.2124	14.9000	1.2956	0.2820	0.2820	6114.0166	0.0000	0.0000	1.4840
10	4	4	6000	3.561	1500	0	4	22.8	1.0560	6212.5674	287.5235	17.4000	1.4439	0.3449	0.3449	5979.6245	0.1000	0.2263	1.9531
10	4	4	6000	3.561	1500	0	5	23.2	1.0560	6368.7358	328.4250	17.6000	1.4127	0.1976	0.1976	6119.7559	0.0000	0.0000	1.4593
10	4	4	6000	3.561	1500	0	6	22.6	1.1289	6282.8589	238.6009	18.0000	1.3622	0.272	0.272	5986.7979	0.0000	0.0000	1.3366
10	4	4	7000	3.742	1500	0	1	23.2	1.4231	6400.5439	265.1379	13.7191	1.1778	0.2425	0.2425	6160.5586	0.0000	0.0000	4.4860
10	4	4	7000	3.742	1500	0	2	23.2	1.5749	6406.1006	297.3384	17.2003	1.2760	0.2676	0.2676	6280.2578	0.1000	0.2263	2.2391
10	4	4	7000	3.742	1500	0	3	23.8	1.6798	6562.7593	400.9772	16.9000	1.2474	0.2752	0.2752	6284.7612	0.0000	0.0000	1.4895
10	4	4	7000	3.742	1500	0	4	22.6	1.1289	6458.5273	306.9783	23.8000	1.3096	0.3309	0.3309	6141.8037	0.2000	0.3017	0.5866
10	4	4	7000	3.742	1500	0	5	23.6	1.5160	6734.7061	376.1921	30.7000	1.1578	0.1762	0.1762	6285.6162	0.0000	0.0000	0.6508
10	4	4	7000	3.742	1500	0	6	23.2	1.4231	6436.7988	259.6037	15.0000	1.3344	0.3105	0.3105	6167.1460	0.0000	0.0000	1.4386
10	4	4	8000	3.906	1500	0	1	23.2	1.4231	6531.0313	282.9326	10.9000	1.1904	0.2521	0.2521	6304.2437	0.0000	0.0000	0.9292
10	4	4	8000	3.906	1500	0	2	23.2	1.5749	6750.2686	298.4876	19.7000	1.2812	0.2770	0.2770	6426.5000	0.0000	0.0000	1.6940
10	4	4	8000	3.906	1500	0	3	23.8	1.6798	6700.7188	396.0125	16.0000	1.4984	0.7202	0.7202	6430.4189	0.0000	0.0000	0.7514
10	4	4	8000	3.906	1500	0	4	22.6	1.1289	6611.5000	312.1291	23.9000	1.6062	0.8627	0.8627	6285.5874	0.2000	0.3017	0.7438
10	4	4	8000	3.906	1500	0	5	23.6	1.5160	6881.4375	386.7525	29.6000	1.1685	0.1761	0.1761	6425.4751	0.0000	0.0000	0.6407
10	4	4	8000	3.906	1500	0	6	23.2	1.4231	6582.6001	267.0138	14.7000	1.6596	0.9420	0.9420	6310.0938	0.0000	0.0000	0.7936
10	4	4	9000	4.057	1500	0	1	23.2	1.4231	6668.5947	290.7614	10.1000	1.1892	0.2457	0.2457	6436.2134	0.0000	0.0000	0.9290
10	4	4	9000	4.057	1500	0	2	23.2	1.5749	6878.3564	426.7237	18.2000	1.2532	0.2545	0.2545	6558.8101	0.0000	0.0000	1.6345
10	4	4	9000	4.057	1500	0	3	23.8	1.6798	6855.4814	436.1528	16.1000	1.4799	0.6968	0.6968	6564.1885	0.0000	0.0000	0.6923
10	4	4	9000	4.057	1500	0	4	22.6	1.1289	6750.7134	318.9870	23.9000	1.5938	0.8437	0.8437	6414.9243	0.0000	0.0000	0.7788
10	4	4	9000	4.057	1500	0	5	23.6	1.5160	6998.8740	383.0305	28.6000	1.1747	0.1812	0.1812	6561.6655	0.0000	0.0000	0.6466
10	4	4	9000	4.057	1500	0	6	23.2	1.4231	6689.5342	278.0866	12.4000	1.6530	0.9594	0.9594	6442.8164	0.0000	0.0000	0.7904
10	4	4	10000	4.197	1500	0	1	23.2	1.4231	6793.5171	296.4822	10.1000	1.1569	0.2521	0.2521	6558.5791	0.0000	0.0000	0.9207
10	4	4	10000	4.197	1500	0	2	23.2	1.5749	7015.2251	298.6304	19.1000	1.2624	0.2528	0.2528	6668.3843	0.0000	0.0000	0.5510
10	4	4	10000	4.197	1500	0	3	23.8	1.6798	6983.6421	445.8889	16.1000	1.3391	0.3460	0.3460	6697.6055	0.0000	0.0000	1.1788
10	4	4	10000	4.197	1500	0	4	22.6	1.1289	6880.4858	326.4666	23.9000	1.5970	0.8536	0.8536	6537.3179	0.0000	0.0000	0.7698
10	4	4	10000	4.197	1500	0	5	23.6	1.5160	7126.8018	392.1061	28.1000	1.1736	0.1771	0.1771	6685.0264	0.0000	0.0000	0.6354
10	4	4	10000	4.197	1500	0	6	23.2	1.4231	6824.1421	277.0253	12.5000	1.6328	0.9161	0.9161	6566.5337	0.0000	0.0000	0.7652
10	4	4	1000	2	1500	80	1	23.0	3.3050	2896.3999	296.2126	175.0000	0.4046	0.0869	0.0869	2896.3999	296.2126	24.5358	0.0869
10	4	4	1000	2	1500	80	2	23.0	3.3050	2943.6001	309.6763	177.9000	0.4079	0.0861	0.0861	2943.6001	309.6763	25.0849	0.0861
10	4	4	1000	2	1500	80	3	23.0	3.3050	2946.3999	310.6147	178.0000	0.4078	0.0866	0.0866	2946.3999	310.6147	24.6791	0.0866
10	4	4	1000	2	1500	80	4	23.0	3.3050	2940.8000	299.5535	180.0000	0.4187	0.0900	0.0900	2940.8000	299.5535	32.8217	0.0900
10	4	4	1000	2	1500	80	5	23.0	3.3050	2966.3999	288.6039	184.7000	0.4109	0.0895	0.0895	2966.3999	288.6039	32.5048	0.0895
10	4	4	1000	2	1500	80	6	23.0	3.3050	2947.2000	287.2813	180.4000	0.4157	0.0900	0.0900	2947.2000	287.2813	32.7630	0.0900
10	4	4	2000	2.5	1500	80	1	8.6	1.6247	2334.3000	179.2170	82.4000	0.2235	0.0530	0.0530	2048.1001	170.0862	54.0000	0.1838
10	4	4	2000	2.5	1500	80	2	8.8	1.5749	2445.6001	228.6964	95.3000	0.2249	0.0577	0.0577	2099.3000	171.8017	55.1000	0.1501
10	4	4	2000	2.5	1500	80	3	8.8	1.5749	2385.3999	207.3574	84.0000	0.2328	0.0507	0.0507	2091.7000	171.9903	55.2000	0.1863
10	4	4	2000	2.5	1500	80	4	9.0	1.7849	2354.7000	191.9283	81.7000	0.2501	0.0622	0.0622	2076.0000	172.2382	53.2000	0.1412
10	4	4	2000	2.5	1500	80	5	8.8	1.5749	2351.2000	194.0061	79.9000	0.2359	0.0527	0.0527	2074.5000	174.4558	55.1000	0.1827
10	4	4	2000	2.5	1500	80	6	8.8	1.5749	2389.5000	225.2632	87.7000	0.2342	0.0601	0.0601	2071.5000	181.7823	53.1000	0.1131
10	4	4	3000	2.849	1500	80	1	7.8	1.0066	2100.7368	190.0214	29.3000	0.8028	0.0571	0.0571	1851.8059	144.5015	8.9000	0.1522
10	4	4	3000	2.849	1500	80	2	7.8	1.2068	2180.1079	139.8722	33.1000	0.7822	0.0668	0.0668	1932.4219	145.7838	2.6816	0.1406

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	4	4	3000	2.849	1500	80	3	7.6	1.1782	2211.6626	133.5888	35.7000	11.4986	0.2690	0.0736	14.2	3.5825	1956.8219	151.7905	9.5000	2.8869	0.7765	0.2723
10	4	4	3000	2.849	1500	80	4	7.6	1.1782	2166.6145	135.0592	37.4000	12.1535	0.2608	0.0676	15.2	3.5345	1852.2966	140.6162	7.5000	2.9647	0.8236	0.2488
10	4	4	3000	2.849	1500	80	5	7.8	1.3826	2175.9504	130.1380	33.3000	9.9267	0.2749	0.0730	13.2	4.2510	1919.6459	143.7451	9.6000	3.2213	0.6986	0.1247
10	4	4	3000	2.849	1500	80	6	7.6	1.1782	2205.3784	176.6087	39.1000	10.7011	0.2468	0.0559	15.2	3.2669	1852.8545	141.6174	8.1000	2.9876	0.8266	0.2475
10	4	4	4000	3.125	1500	80	1	8.0	1.2162	2074.0249	187.5980	11.3000	4.8302	0.2719	0.0503	12.6	2.5061	1902.1250	153.8088	1.0000	0.9541	0.6080	0.1503
10	4	4	4000	3.125	1500	80	2	7.4	1.1289	2205.2500	174.1117	17.8000	10.2134	0.2468	0.0612	13.6	2.5287	1973.0500	150.5989	0.8000	0.8796	0.7206	0.1418
10	4	4	4000	3.125	1500	80	3	7.8	1.3826	2184.5750	152.7473	15.1000	9.0915	0.2657	0.0634	13.6	2.5287	2000.8250	156.3420	0.3000	0.3456	0.7266	0.1587
10	4	4	4000	3.125	1500	80	4	7.8	1.3826	2106.7251	143.0157	16.8000	9.7167	0.2644	0.0673	12.8	2.4741	1890.9000	153.2143	0.7000	0.7580	0.6406	0.1433
10	4	4	4000	3.125	1500	80	5	7.6	1.1782	2225.8999	174.3715	18.7000	9.7123	0.2577	0.0630	13.8	2.5422	1999.2500	155.4878	0.6000	0.6913	0.7515	0.1497
10	4	4	4000	3.125	1500	80	6	7.8	1.3826	2085.3750	156.5865	15.3000	8.0323	0.2627	0.0625	13.4	2.5061	1862.0500	145.8637	0.4000	0.5003	0.6751	0.1462
10	4	4	5000	3.358	1500	80	1	8.0	1.2162	2081.4661	177.5502	2.1000	2.2740	0.2701	0.0573	13.4	2.8462	1947.0746	148.6585	0.0000	0.0000	0.6735	0.1661
10	4	4	5000	3.358	1500	80	2	7.6	0.9659	2158.1001	203.7836	3.9000	4.8349	0.2577	0.0542	13.8	2.4510	2039.5953	157.1771	0.0000	0.0000	0.7440	0.1371
10	4	4	5000	3.358	1500	80	3	8.0	1.2162	2152.0271	178.0989	1.8000	2.1808	0.2842	0.0582	13.6	2.6172	2058.2815	161.2239	0.0000	0.0000	0.7513	0.1614
10	4	4	5000	3.358	1500	80	4	7.8	1.2068	2063.3809	178.6204	3.8000	5.3843	0.2655	0.0590	13.4	2.5953	1942.3600	159.7244	0.0000	0.0000	0.6844	0.1433
10	4	4	5000	3.358	1500	80	5	7.8	1.0006	2173.9729	191.2598	4.5000	5.7665	0.2703	0.0541	13.2	2.6517	2049.6099	168.1133	0.0000	0.0000	0.7049	0.1547
10	4	4	5000	3.358	1500	80	6	8.0	1.2162	2024.5774	154.3815	1.4000	1.1782	0.2844	0.0543	13.4	2.7651	1920.8445	153.8632	0.0000	0.0000	0.6718	0.1621
10	4	4	6000	3.561	1500	80	1	8.0	1.2162	2108.9573	170.2328	1.3000	1.8180	0.2828	0.0718	13.4	2.8462	2004.5051	152.5678	0.0000	0.0000	0.6752	0.1663
10	4	4	6000	3.561	1500	80	2	8.0	1.2162	2192.8550	168.7660	1.3000	1.6194	0.2938	0.0749	14.0	2.5466	2095.9365	167.3103	0.0000	0.0000	0.7660	0.1451
10	4	4	6000	3.561	1500	80	3	7.8	1.2068	2225.6104	165.2469	2.9000	3.8966	0.2770	0.0641	13.6	2.7856	2121.3853	169.1496	0.0000	0.0000	0.7452	0.1710
10	4	4	6000	3.561	1500	80	4	7.8	1.2068	2082.4087	173.2634	1.5000	2.9261	0.2738	0.0548	12.0	2.9599	1992.5686	159.6852	0.1000	0.2263	0.6016	0.1615
10	4	4	6000	3.561	1500	80	5	7.8	1.0006	2223.1831	171.2085	3.8000	4.7440	0.2800	0.0699	13.2	2.6985	2123.1729	165.1797	0.0000	0.0000	0.6952	0.1697
10	4	4	6000	3.561	1500	80	6	8.2	1.3826	2070.3511	164.3725	1.0000	1.3492	0.2930	0.0617	13.2	2.8181	1977.6471	156.2301	0.0000	0.0000	0.6558	0.1624
10	4	4	7000	3.742	1500	80	1	8.0	1.2162	2174.6968	173.6483	0.4000	0.9051	0.2814	0.0687	13.6	2.6172	2054.6487	157.3673	0.0000	0.0000	0.6892	0.1463
10	4	4	7000	3.742	1500	80	2	7.6	0.9659	2227.4482	182.1424	0.2000	0.4526	0.2642	0.0503	13.0	2.6985	2152.0127	177.2628	0.0000	0.0000	0.6888	0.1561
10	4	4	7000	3.742	1500	80	3	7.8	1.2068	2250.7288	181.0672	1.4000	3.1679	0.2780	0.0601	12.8	2.7362	2127.9575	173.1919	0.0000	0.0000	0.6798	0.1736
10	4	4	7000	3.742	1500	80	4	7.8	1.2068	2141.7646	164.0727	0.9000	1.5982	0.2690	0.0602	12.2	2.9561	2037.7035	164.1392	0.0000	0.0000	0.6184	0.1511
10	4	4	7000	3.742	1500	80	5	7.6	1.1782	2320.9343	227.1883	7.8000	11.8722	0.2626	0.0714	12.8	2.6517	2160.6094	179.9122	0.0000	0.0000	0.6818	0.1672
10	4	4	7000	3.742	1500	80	6	8.0	1.2162	2129.2356	165.0601	0.0000	0.0000	0.2706	0.0595	12.6	2.5061	2034.2682	169.6511	0.0000	0.0000	0.6248	0.1634
10	4	4	8000	3.906	1500	80	1	8.0	1.2162	2221.1375	177.2987	0.4000	0.9051	0.2765	0.0694	13.2	2.4741	2102.0376	160.8418	0.0000	0.0000	0.6672	0.1483
10	4	4	8000	3.906	1500	80	2	7.6	0.9659	2277.7563	187.7807	0.3000	0.4830	0.2626	0.0532	13.0	2.6985	2194.5437	180.4690	0.0000	0.0000	0.6939	0.1606
10	4	4	8000	3.906	1500	80	3	7.8	1.2068	2296.9500	185.4861	1.4000	3.1679	0.2749	0.0624	13.4	2.8462	2216.5874	177.0101	0.0000	0.0000	0.7253	0.1776
10	4	4	8000	3.906	1500	80	4	7.8	1.2068	2187.8438	168.4710	0.9000	1.5982	0.2703	0.0578	12.2	2.9561	2082.4937	168.9877	0.0000	0.0000	0.6219	0.1588
10	4	4	8000	3.906	1500	80	5	7.8	1.0006	2303.1250	191.9843	0.9000	1.2371	0.2828	0.0629	12.8	2.6517	2206.2063	183.8686	0.0000	0.0000	0.6778	0.1625
10	4	4	8000	3.906	1500	80	6	8.0	1.2162	2176.0874	166.4359	0.0000	0.0000	0.2734	0.0578	12.2	2.2577	2079.0437	174.3617	0.0000	0.0000	0.5843	0.1493
10	4	4	9000	4.057	1500	80	1	8.0	1.2162	2256.1926	176.7943	0.0000	0.0000	0.2796	0.0655	13.6	2.6172	2138.6724	165.0518	0.0000	0.0000	0.6844	0.1432
10	4	4	9000	4.057	1500	80	2	7.6	0.9659	2316.8813	193.4903	0.2000	0.4526	0.2641	0.0493	13.6	2.7856	2231.5784	179.6926	0.0000	0.0000	0.7390	0.1671
10	4	4	9000	4.057	1500	80	3	7.8	1.2068	2338.6187	190.4091	1.4000	3.1679	0.2765	0.0626	13.4	2.8462	2258.5129	180.8034	0.0000	0.0000	0.7252	0.1774
10	4	4	9000	4.057	1500	80	4	7.8	1.2068	2227.4126	173.2078	0.9000	1.5982	0.2672	0.0571	13.0	3.0170	2121.8491	172.0407	0.0000	0.0000	0.6674	0.1667
10	4	4	9000	4.057	1500	80	5	7.8	1.0006	2343.0615	194.0421	0.8000	1.2531	0.2779	0.0645	13.0	2.6128	2246.4014	187.1160	0.0000	0.0000	0.6923	0.1605
10	4	4	9000	4.057	1500	80	6	8.0	1.2162	2217.1636	171.2457	0.0000	0.0000	0.2750	0.0583	12.2	2.2577	2117.9463	177.4854	0.0000	0.0000	0.5860	0.1522
10	4	4	10000	4.197	1500	80	1	8.0	1.2162	2294.0977	180.0240	0.0000	0.0000	0.2811	0.0667	13.2	2.4741	2179.5933	167.9473	0.0000	0.0000	0.6641	0.1438
10	4	4	10000	4.197	1500	80	2	7.6	0.9659	2355.5383	196.8745	0.2000	0.4526	0.2655	0.0495	13.6	2.7856	2270.1834	183.0798	0.0000	0.0000	0.7375	0.1639
10	4	4	10000	4.197	1500	80	3	7.8	1.2068	2376.8115	193.7113	1.4000	3.1679	0.2747	0.0635	13.2	2.7362	2295.4019	183.7958	0.0000	0.0000	0.7093	0.1693
10	4	4	10000	4.197	1500	80	4	7.8	1.2068	2265.1216	176.4506	0.9000	1.5982	0.2688	0.0586	13.0	3.0170	2159.1143	175.5036	0.0000	0.0000	0.6654	0.1698
10	4	4	10000	4.197	1500	80	5	7.8	1.0006	2382.1145	197.4515	0.8000	1.2531	0.2813	0.0642	13.0	2.6128	2285.0625	190.4593	0.0000	0.0000	0.6872	0.1620
10	4	4	10000	4.197	1500	80	6	8.0	1.2162	2255.1089	174.6953	0.0000	0.0000	0.2750	0.0617	12.2	2.2577	2154.7593	180.7746	0.0000	0.0000	0.5893	0.1476
10	8	8	1000	2	500	0	1	7.2	0.4526	8164.3999	407.8532	539.0000	31.6660	0.5376	0.0451	7.2	0.4526	8164.3999	407.8532	539.0000	31.6660	0.5376	0.0451
10	8	8	1000	2	500	0	2	7.2	0.4526	8184.0000	395.5964	542.5000	31.3105	0.5221	0.0426	7.2	0.4526	8184.0000	395.5964	542.5000	31.3105	0.5221	0.0426
10	8	8	1000	2	500	0	3	7.2	0.4526	8226.4004	413.7070	544.8000	30.9387	0.5327	0.0398	7.2	0.4526	8226.4004	413.7070	544.8000	30.9387	0.5327	0.0398

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	1000	2	500	0	4	7.2	0.4526	8226.7998	542.5000	30.1196	0.5407	0.0415	7.2	0.4526	8226.7998	542.5000	30.1196	0.5407	0.0415
10	8	8	1000	2	500	0	5	7.2	0.4526	8250.0000	546.0000	30.6174	0.5327	0.0397	7.2	0.4526	8250.0000	546.0000	30.6174	0.5327	0.0397
10	8	8	1000	2	500	0	6	7.2	0.4526	8215.2002	543.6000	31.2559	0.5391	0.0428	7.2	0.4526	8215.2002	543.6000	31.2559	0.5391	0.0428
10	8	8	2000	2.5	500	0	1	3.0	0.0000	5570.7002	161.6000	12.4860	0.6141	0.0236	3.2	0.4526	5566.7998	161.0000	12.4140	0.6515	0.0745
10	8	8	2000	2.5	500	0	2	3.0	0.0000	5619.0000	165.0000	13.1552	0.6343	0.0177	3.2	0.4526	5611.2998	164.3000	13.3750	0.6873	0.0873
10	8	8	2000	2.5	500	0	3	3.0	0.0000	5608.5000	164.2000	13.1845	0.6390	0.0170	3.2	0.4526	5606.7002	164.0000	13.1508	0.6827	0.0968
10	8	8	2000	2.5	500	0	4	3.0	0.0000	5601.7998	162.4000	13.1257	0.6439	0.0166	3.2	0.4526	5598.2002	161.0000	12.6120	0.6814	0.0817
10	8	8	2000	2.5	500	0	5	3.0	0.0000	5584.1001	163.4000	12.8365	0.6359	0.0157	3.0	0.0000	5584.1001	163.4000	12.8365	0.6359	0.0157
10	8	8	2000	2.5	500	0	6	3.0	0.0000	5584.2002	162.0000	13.2156	0.6483	0.0150	3.2	0.4526	5581.7998	160.5000	12.6717	0.6874	0.0838
10	8	8	3000	2.849	500	0	1	3.0	0.0000	4878.7456	26.3000	3.7265	0.9718	0.0437	3.2	0.4526	4869.7695	24.7000	3.3401	1.0468	0.1358
10	8	8	3000	2.849	500	0	2	3.0	0.0000	4928.4888	237.2675	3.8311	1.0216	0.0355	3.0	0.0000	4928.4888	237.2675	3.8311	1.0216	0.0355
10	8	8	3000	2.849	500	0	3	3.0	0.0000	4907.0581	244.4204	3.5546	1.0358	0.0370	3.0	0.0000	4907.0581	244.4204	3.5546	1.0358	0.0370
10	8	8	3000	2.849	500	0	4	3.0	0.0000	4865.5576	230.2849	3.5345	1.0000	0.0294	3.4	0.6034	4853.1118	229.6790	3.5865	1.1172	0.1708
10	8	8	3000	2.849	500	0	5	3.0	0.0000	4915.1396	248.0545	3.6361	1.0298	0.0359	3.0	0.0000	4915.1396	248.0545	3.6361	1.0298	0.0359
10	8	8	3000	2.849	500	0	6	3.0	0.0000	4874.7393	221.3662	3.4100	1.0109	0.0270	3.0	0.0000	4874.7393	221.3662	3.4100	1.0109	0.0270
10	8	8	4000	3.125	500	0	1	3.0	0.0000	4880.9248	225.1599	0.9051	0.9858	0.0568	3.2	0.4526	4875.6250	232.3340	0.0000	1.0578	0.1192
10	8	8	4000	3.125	500	0	2	3.0	0.0000	4984.9248	227.9534	0.2263	1.0405	0.0329	3.0	0.0000	4984.9248	227.9534	0.2263	1.0405	0.0329
10	8	8	4000	3.125	500	0	3	3.0	0.0000	4978.6748	250.8717	0.1000	1.0516	0.0388	3.2	0.4526	4978.0498	250.1468	0.0000	1.1219	0.1548
10	8	8	4000	3.125	500	0	4	3.0	0.0000	4864.1499	237.8695	0.1000	1.0168	0.0276	3.2	0.4526	4861.7500	236.5237	0.1000	1.0777	0.1440
10	8	8	4000	3.125	500	0	5	3.0	0.0000	4964.2002	250.5839	0.4000	1.0642	0.0304	3.0	0.0000	4964.2002	250.5839	0.4000	1.0642	0.0304
10	8	8	4000	3.125	500	0	6	3.0	0.0000	4884.6250	223.8147	0.1000	1.0938	0.0335	3.0	0.0000	4884.6250	223.8147	0.1000	1.0938	0.0335
10	8	8	5000	3.358	500	0	1	3.0	0.0000	5068.5322	231.4110	0.0000	0.9908	0.0608	3.2	0.4526	5059.6323	235.1103	0.0000	1.0659	0.1210
10	8	8	5000	3.358	500	0	2	3.0	0.0000	5140.5674	233.7802	0.0000	1.0546	0.0331	3.0	0.0000	5140.5674	233.7802	0.0000	1.0546	0.0331
10	8	8	5000	3.358	500	0	3	3.0	0.0000	5167.7402	252.0550	0.0000	1.0469	0.0413	3.2	0.4526	5160.0684	254.4864	0.0000	1.1172	0.1397
10	8	8	5000	3.358	500	0	4	3.0	0.0000	5060.9326	246.7626	0.0000	1.0501	0.0301	3.2	0.4526	5059.7324	246.0613	0.0000	1.0767	0.1450
10	8	8	5000	3.358	500	0	5	3.0	0.0000	5161.2256	243.2348	0.0000	1.0541	0.0536	3.2	0.4526	5154.5537	245.5810	0.0000	1.1220	0.1225
10	8	8	5000	3.358	500	0	6	3.0	0.0000	5058.3467	251.8537	0.0000	1.0284	0.0255	3.0	0.0000	5058.3467	251.8537	0.0000	1.0284	0.0255
10	8	8	6000	3.561	500	0	1	3.0	0.0000	5223.1621	244.4767	0.0000	1.0026	0.0528	3.0	0.0000	5223.1621	244.4767	0.0000	1.0026	0.0528
10	8	8	6000	3.561	500	0	2	3.0	0.0000	5300.5298	243.4752	0.0000	1.0550	0.0349	3.0	0.0000	5300.5298	243.4752	0.0000	1.0550	0.0349
10	8	8	6000	3.561	500	0	3	3.0	0.0000	5314.1274	258.1000	0.0000	1.0480	0.0477	3.2	0.4526	5312.6152	258.6152	0.0000	1.1168	0.1423
10	8	8	6000	3.561	500	0	4	3.0	0.0000	5218.1626	251.5061	0.0000	1.0110	0.0327	3.4	0.6034	5213.8623	252.5330	0.0000	1.1310	0.1679
10	8	8	6000	3.561	500	0	5	3.0	0.0000	5332.0908	255.9296	0.0000	1.0554	0.0496	3.2	0.4526	5328.7910	254.4488	0.0000	1.1212	0.1690
10	8	8	6000	3.561	500	0	6	3.0	0.0000	5213.2988	255.1218	0.0000	1.0358	0.0276	3.0	0.0000	5213.2988	255.1218	0.0000	1.0358	0.0276
10	8	8	7000	3.742	500	0	1	3.0	0.0000	5349.8706	251.8320	0.0000	1.0062	0.0452	3.0	0.0000	5349.8706	251.8320	0.0000	1.0062	0.0452
10	8	8	7000	3.742	500	0	2	3.0	0.0000	5435.0308	246.0604	0.0000	1.0612	0.0368	3.0	0.0000	5435.0308	246.0604	0.0000	1.0612	0.0368
10	8	8	7000	3.742	500	0	3	3.0	0.0000	5462.8179	262.0947	0.0000	1.0584	0.0435	3.2	0.4526	5457.7695	263.9572	0.0000	1.1302	0.1406
10	8	8	7000	3.742	500	0	4	3.0	0.0000	5357.2705	256.9253	0.0000	1.0190	0.0313	3.0	0.0000	5357.2705	256.9253	0.0000	1.0190	0.0313
10	8	8	7000	3.742	500	0	5	3.0	0.0000	5458.9731	270.4988	0.0000	1.0576	0.0515	3.2	0.4526	5458.8247	270.5689	0.0000	1.1308	0.1277
10	8	8	7000	3.742	500	0	6	3.0	0.0000	5343.3154	268.1214	0.0000	1.0390	0.0295	3.0	0.0000	5343.3154	268.1214	0.0000	1.0390	0.0295
10	8	8	8000	3.906	500	0	1	3.0	0.0000	5475.0811	258.0081	0.0000	1.0060	0.0473	3.0	0.0000	5475.0811	258.0081	0.0000	1.0060	0.0473
10	8	8	8000	3.906	500	0	2	3.0	0.0000	5562.4502	252.5097	0.0000	1.0648	0.0347	3.0	0.0000	5562.4502	252.5097	0.0000	1.0648	0.0347
10	8	8	8000	3.906	500	0	3	3.0	0.0000	5592.2998	269.5282	0.0000	1.0588	0.0405	3.2	0.4526	5587.2188	271.4296	0.0000	1.1276	0.1370
10	8	8	8000	3.906	500	0	4	3.0	0.0000	5482.4814	263.1750	0.0000	1.0250	0.0284	3.0	0.0000	5482.4814	263.1750	0.0000	1.0250	0.0284
10	8	8	8000	3.906	500	0	5	3.0	0.0000	5585.5562	276.3837	0.0000	1.0610	0.0537	3.2	0.4526	5585.3750	276.4691	0.0000	1.1362	0.0284
10	8	8	8000	3.906	500	0	6	3.0	0.0000	5467.6250	273.5544	0.0000	1.0422	0.0277	3.0	0.0000	5467.6250	273.5544	0.0000	1.0422	0.0277
10	8	8	9000	4.057	500	0	1	3.0	0.0000	5590.0825	263.6823	0.0000	1.0080	0.0469	3.0	0.0000	5590.0825	263.6823	0.0000	1.0080	0.0469
10	8	8	9000	4.057	500	0	2	3.0	0.0000	5679.1118	258.1750	0.0000	1.0664	0.0358	3.0	0.0000	5679.1118	258.1750	0.0000	1.0664	0.0358
10	8	8	9000	4.057	500	0	3	3.0	0.0000	5709.2041	275.1740	0.0000	1.0640	0.0429	3.4	0.6034	5704.0806	277.0930	0.0000	1.2078	0.1898
10	8	8	9000	4.057	500	0	4	3.0	0.0000	5597.4824	268.9166	0.0000	1.0230	0.0276	3.0	0.0000	5597.4824	268.9166	0.0000	1.0230	0.0276

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI	
10	8	8	9000	4.057	500	0	5	3.0	0.0000	5702.3687	282.0888	0.0000	0.0000	0.0000	0.0540	3.2	0.4526	5702.1572	282.1885	0.0000	0.0000	1.1396	0.1258
10	8	8	9000	4.057	500	0	6	3.0	0.0000	5582.7173	279.1028	0.0000	0.0000	0.0000	0.0281	3.0	0.0000	5582.7173	279.1028	0.0000	0.0000	1.0424	0.0281
10	8	8	10000	4.197	500	0	1	3.0	0.0000	5696.7158	268.9454	0.0000	0.0000	0.0000	0.0479	3.0	0.0000	5696.7158	268.9454	0.0000	0.0000	1.0126	0.0479
10	8	8	10000	4.197	500	0	2	3.0	0.0000	5783.2842	261.4382	0.0000	0.0000	0.0000	0.0356	3.0	0.0000	5783.2842	261.4382	0.0000	0.0000	1.0623	0.0356
10	8	8	10000	4.197	500	0	3	3.0	0.0000	5807.0000	277.1551	0.0000	0.0000	0.0000	0.0384	3.4	0.6034	5804.7212	278.0822	0.0000	0.0000	1.2060	0.1839
10	8	8	10000	4.197	500	0	4	3.0	0.0000	5704.1157	274.2418	0.0000	0.0000	0.0000	0.0297	3.0	0.0000	5704.1157	274.2418	0.0000	0.0000	1.0234	0.0297
10	8	8	10000	4.197	500	0	5	3.0	0.0000	5810.6821	287.3797	0.0000	0.0000	0.0000	0.0538	3.2	0.4526	5810.4424	287.4925	0.0000	0.0000	1.1421	0.1250
10	8	8	10000	4.197	500	0	6	3.0	0.0000	5689.4341	284.2483	0.0000	0.0000	0.0000	0.0301	3.0	0.0000	5689.4341	284.2483	0.0000	0.0000	1.0453	0.0301
10	8	8	1000	2	500	80	1	2.8	0.4526	1924.8000	251.3615	120.9000	0.1359	0.0230	2.8	0.4526	1924.8000	251.3615	120.9000	20.5966	0.1359	0.0230	
10	8	8	1000	2	500	80	2	2.8	0.4526	1969.6000	235.3815	124.5000	0.1390	0.0238	2.8	0.4526	1969.6000	235.3815	124.5000	19.2127	0.1390	0.0238	
10	8	8	1000	2	500	80	3	2.8	0.4526	1974.8000	227.5394	123.5000	0.1393	0.0199	2.8	0.4526	1974.8000	227.5394	123.5000	18.3897	0.1393	0.0199	
10	8	8	1000	2	500	80	4	2.8	0.4526	1977.2000	250.0809	118.8000	0.1407	0.0203	2.8	0.4526	1977.2000	250.0809	118.8000	19.6997	0.1407	0.0203	
10	8	8	1000	2	500	80	5	2.8	0.4526	1988.8000	252.1750	125.0000	0.1363	0.0231	2.8	0.4526	1988.8000	252.1750	125.0000	20.4735	0.1363	0.0231	
10	8	8	1000	2	500	80	6	2.8	0.4526	1995.2000	259.3462	121.1000	0.1361	0.0230	2.8	0.4526	1995.2000	259.3462	121.1000	20.8219	0.1361	0.0230	
10	8	8	2000	2.5	500	80	1	1.0	0.0000	1437.2000	171.8033	38.1000	0.1156	0.0077	2.2	0.7390	1378.4000	132.9861	32.0000	4.7822	0.2327	0.0667	
10	8	8	2000	2.5	500	80	2	1.4	0.6034	1497.5000	171.4036	40.2000	0.1670	0.0675	2.4	0.6913	1456.1000	151.7455	34.5000	4.3230	0.2686	0.0697	
10	8	8	2000	2.5	500	80	3	1.2	0.4526	1509.9000	202.1309	42.4000	0.1421	0.0476	2.0	0.7543	1428.2000	133.9144	33.7000	4.3987	0.2234	0.0772	
10	8	8	2000	2.5	500	80	4	1.0	0.0000	1447.3000	155.6843	36.9000	0.1265	0.0099	2.2	0.7390	1413.4000	138.3176	31.8000	4.5481	0.2469	0.0782	
10	8	8	2000	2.5	500	80	5	1.4	0.6034	1479.7000	195.9872	39.3000	0.1533	0.0575	2.2	0.7390	1422.8000	138.0602	33.7000	4.4629	0.2375	0.0776	
10	8	8	2000	2.5	500	80	6	1.0	0.0000	1453.6000	176.9759	38.0000	0.1190	0.0119	2.4	0.6913	1398.8000	145.4486	30.5000	4.4526	0.2057	0.0734	
10	8	8	3000	2.849	500	80	1	1.0	0.0000	1369.1267	142.6186	8.6000	0.1874	0.0210	1.8	0.7390	1339.9353	121.1859	5.6000	3.0768	0.3076	0.1037	
10	8	8	3000	2.849	500	80	2	1.0	0.0000	1472.9132	162.1301	13.5000	0.1999	0.0216	2.0	0.7543	1403.6121	120.5284	6.5000	2.8070	0.3594	0.1167	
10	8	8	3000	2.849	500	80	3	1.0	0.0000	1465.1979	161.0022	12.2000	0.2015	0.0207	1.8	0.7390	1420.8817	124.6787	7.2000	2.3804	0.3298	0.1205	
10	8	8	3000	2.849	500	80	4	1.0	0.0000	1357.4359	146.4095	9.3000	0.1953	0.0224	1.8	0.7390	1324.2170	123.4334	5.6000	2.9056	0.3125	0.1118	
10	8	8	3000	2.849	500	80	5	1.0	0.0000	1444.3218	159.7909	11.8000	0.1627	0.0213	2.2	0.7390	1400.6754	128.1150	6.9000	2.5567	0.3844	0.1092	
10	8	8	3000	2.849	500	80	6	1.0	0.0000	1352.0845	165.5921	10.4000	0.1827	0.0177	2.0	0.7543	1307.8896	131.2150	5.5000	2.5964	0.3328	0.1108	
10	8	8	4000	3.125	500	80	1	1.0	0.0000	1399.6750	154.4800	1.6000	0.1876	0.0203	2.0	0.7543	1373.7500	135.0758	0.1000	0.2263	0.3343	0.1115	
10	8	8	4000	3.125	500	80	2	1.0	0.0000	1484.0500	163.1808	3.1000	0.2032	0.0242	2.0	0.7543	1441.5500	140.8376	0.2000	0.3017	0.3717	0.1212	
10	8	8	4000	3.125	500	80	3	1.0	0.0000	1503.6000	163.0892	2.7000	0.2032	0.0205	1.8	0.7390	1468.5750	137.4506	0.1000	0.2263	0.3454	0.1303	
10	8	8	4000	3.125	500	80	4	1.0	0.0000	1377.8000	144.6344	1.5000	0.2186	0.0225	1.6	0.6913	1356.9000	137.9835	0.0000	0.0000	0.2951	0.1053	
10	8	8	4000	3.125	500	80	5	1.0	0.0000	1500.5500	160.7228	3.2000	0.2494	0.0214	1.8	0.7390	1464.7000	136.2519	0.5000	0.5060	0.3467	0.1242	
10	8	8	4000	3.125	500	80	6	1.0	0.0000	1345.3500	155.7396	2.0000	0.1813	0.0177	2.0	0.7543	1321.7000	142.1571	0.1000	0.2263	0.3405	0.1165	
10	8	8	5000	3.358	500	80	1	1.0	0.0000	1430.5787	142.3571	0.5000	0.1314	0.0178	2.2	0.7390	1410.3347	136.0685	0.0000	0.0000	0.3736	0.1048	
10	8	8	5000	3.358	500	80	2	1.0	0.0000	1520.0287	159.2431	1.8000	0.2877	0.0201	2.0	0.7543	1490.4977	146.8664	0.0000	0.0000	0.3784	0.1168	
10	8	8	5000	3.358	500	80	3	1.0	0.0000	1545.9012	169.9584	1.5000	0.3158	0.0219	2.0	0.7543	1510.4849	143.4878	0.0000	0.0000	0.3892	0.1269	
10	8	8	5000	3.358	500	80	4	1.0	0.0000	1410.7780	140.2314	0.5000	0.1314	0.0202	1.8	0.7390	1397.8772	137.1003	0.0000	0.0000	0.3292	0.1090	
10	8	8	5000	3.358	500	80	5	1.0	0.0000	1526.2849	151.4423	0.1000	0.2263	0.0224	2.0	0.7543	1510.5417	147.7339	0.0000	0.0000	0.3870	0.1261	
10	8	8	5000	3.358	500	80	6	1.0	0.0000	1373.0039	152.6513	0.0000	0.0000	0.0204	2.0	0.7543	1360.3745	147.7161	0.0000	0.0000	0.3390	0.1138	
10	8	8	6000	3.561	500	80	1	1.0	0.0000	1471.1697	147.5738	0.0000	0.1966	0.0189	2.2	0.7390	1454.2090	141.9571	0.0000	0.0000	0.3736	0.1026	
10	8	8	6000	3.561	500	80	2	1.0	0.0000	1557.2499	154.9883	1.2000	0.2032	0.0225	2.0	0.7543	1531.6799	147.7400	0.0000	0.0000	0.3782	0.1164	
10	8	8	6000	3.561	500	80	3	1.0	0.0000	1589.3472	168.0492	0.9000	0.1792	0.0218	2.0	0.7543	1561.5137	151.1260	0.0000	0.0000	0.3942	0.1231	
10	8	8	6000	3.561	500	80	4	1.0	0.0000	1446.2848	144.0384	0.0000	0.0000	0.0208	1.8	0.7390	1435.5483	144.2575	0.0000	0.0000	0.3314	0.1122	
10	8	8	6000	3.561	500	80	5	1.0	0.0000	1573.6257	154.5298	0.1000	0.2263	0.0228	2.2	0.7390	1558.6892	151.8216	0.0000	0.0000	0.4204	0.1207	
10	8	8	6000	3.561	500	80	6	1.0	0.0000	1410.2662	155.2331	0.0000	0.1878	0.0223	1.8	0.7390	1398.1931	151.0312	0.0000	0.0000	0.3144	0.1121	
10	8	8	7000	3.742	500	80	1	1.0	0.0000	1503.8228	151.6530	0.0000	0.1902	0.0197	2.2	0.7390	1485.4808	146.6254	0.0000	0.0000	0.3780	0.1134	
10	8	8	7000	3.742	500	80	2	1.0	0.0000	1588.4933	160.5622	0.6000	0.1377	0.0202	1.8	0.7390	1569.3063	151.5350	0.0000	0.0000	0.3482	0.1137	
10	8	8	7000	3.742	500	80	3	1.0	0.0000	1628.8220	171.6226	0.8000	0.1802	0.0233	2.0	0.7543	1597.7383	153.0762	0.0000	0.0000	0.3950	0.1321	
10	8	8	7000	3.742	500	80	4	1.0	0.0000	1481.0356	145.4804	0.0000	0.0000	0.0206	1.8	0.7390	1467.7905	145.8325	0.0000	0.0000	0.3262	0.1134	
10	8	8	7000	3.742	500	80	5	1.0	0.0000	1607.4900	158.9167	0.0000	0.2094	0.0236	2.0	0.7543	1589.4417	155.8170	0.0000	0.0000	0.3918	0.1181	

C	W	B	R _{max}	E/O	IN	FR	Policy	F _{min}	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	
10	8	8	7000	3.742	500	80	6	1.0	1451.2102	162.7633	0.0000	0.1858	0.0216	1.8	1433.5748	154.9291	0.0000	0.0000	0.3122	
10	8	8	8000	3.906	500	80	1	1.0	1534.6125	153.9684	0.0000	0.1966	0.0168	2.2	1518.2875	150.2361	0.0000	0.0000	0.3794	
10	8	8	8000	3.906	500	80	2	1.0	1622.4750	164.2459	0.6000	1.3577	0.2140	1.8	1603.4250	155.0713	0.0000	0.0000	0.3482	
10	8	8	8000	3.906	500	80	3	1.0	1664.2500	176.0071	0.7000	1.5839	0.2220	2.0	1632.6188	157.2559	0.0000	0.0000	0.3940	
10	8	8	8000	3.906	500	80	4	1.0	1513.9625	149.1138	0.0000	0.0000	0.2028	1.8	1502.4000	149.3720	0.0000	0.0000	0.3328	
10	8	8	8000	3.906	500	80	5	1.0	1642.7375	163.3798	0.0000	0.0000	0.2108	2.0	1621.2562	160.0466	0.0000	0.0000	0.3960	
10	8	8	8000	3.906	500	80	6	1.0	1483.4250	166.5319	0.0000	0.1918	0.0213	1.8	1465.4938	158.6197	0.0000	0.0000	0.3150	
10	8	8	9000	4.057	500	80	1	1.0	1562.8534	155.5350	0.0000	0.1953	0.0141	2.0	1549.6190	153.7741	0.0000	0.0000	0.3499	
10	8	8	9000	4.057	500	80	2	1.0	1650.5684	161.8846	0.0000	0.2141	0.0212	1.8	1635.3455	158.2450	0.0000	0.0000	0.3485	
10	8	8	9000	4.057	500	80	3	1.0	1690.7170	173.7345	0.2000	0.4526	0.2126	2.0	1664.4713	160.6411	0.0000	0.0000	0.3986	
10	8	8	9000	4.057	500	80	4	1.0	1547.1733	154.5619	0.0000	0.2093	0.0206	1.8	1535.3505	154.8808	0.0000	0.0000	0.3295	
10	8	8	9000	4.057	500	80	5	1.0	1674.9597	167.0387	0.0000	0.0000	0.2143	2.0	1654.2484	164.7650	0.0000	0.0000	0.3905	
10	8	8	9000	4.057	500	80	6	1.0	1513.0131	169.9951	0.0000	0.1876	0.0246	1.8	1494.8102	162.0107	0.0000	0.0000	0.3156	
10	8	8	10000	4.197	500	80	1	1.0	1590.8763	158.5535	0.0000	0.2001	0.0156	2.0	1577.5581	156.8524	0.0000	0.0000	0.3499	
10	8	8	10000	4.197	500	80	2	1.0	1679.4905	162.4662	0.0000	0.2190	0.0241	1.8	1663.5720	159.1412	0.0000	0.0000	0.3579	
10	8	8	10000	4.197	500	80	3	1.0	1714.2848	165.9808	0.0000	0.2154	0.0229	2.0	1696.2061	160.2380	0.0000	0.0000	0.4017	
10	8	8	10000	4.197	500	80	4	1.0	1575.0002	157.5256	0.0000	0.2077	0.0224	1.8	1563.1213	157.8966	0.0000	0.0000	0.3344	
10	8	8	10000	4.197	500	80	5	1.0	1706.2666	167.7286	0.0000	0.2142	0.0258	2.0	1685.5271	165.6115	0.0000	0.0000	0.4030	
10	8	8	10000	4.197	500	80	6	1.0	1540.4482	173.2078	0.0000	0.1923	0.0219	1.8	1521.9933	165.1562	0.0000	0.0000	0.3188	
10	8	8	1000	2	1500	0	1	20.4	9569.2002	348.2026	635.8000	1.9154	0.1825	20.4	9569.2002	348.2026	635.8000	29.3147	1.9154	
10	8	8	1000	2	1500	0	2	20.4	9623.2002	354.0219	637.3000	1.9237	0.1878	20.4	9623.2002	354.0219	637.3000	29.3675	1.9237	
10	8	8	1000	2	1500	0	3	20.4	9625.2002	360.6935	638.0000	1.9406	0.1859	20.4	9625.2002	360.6935	638.0000	30.3337	1.9406	
10	8	8	1000	2	1500	0	4	20.4	9612.7998	373.8798	637.8000	1.9813	0.1956	20.4	9612.7998	373.8798	637.8000	31.7786	1.9813	
10	8	8	1000	2	1500	0	5	20.4	9655.2002	358.7673	640.3000	1.9498	0.1861	20.4	9655.2002	358.7673	640.3000	30.5096	1.9498	
10	8	8	1000	2	1500	0	6	20.4	9601.5996	375.2224	636.6000	1.9766	0.1905	20.4	9601.5996	375.2224	636.6000	30.5955	1.9766	
10	8	8	2000	2.5	1500	0	1	7.2	4526.6801	376.6179	218.4000	2.3268	0.2311	8.6	4526.6801	376.6179	218.4000	14.6606	2.3268	
10	8	8	2000	2.5	1500	0	2	7.2	4526.6877	379.5919	225.5000	2.2018	0.1986	8.8	4526.6877	379.5919	225.5000	14.7116	2.2018	
10	8	8	2000	2.5	1500	0	3	7.2	4526.6867	410.3717	225.9000	1.7376	0.2549	9.0	4526.6867	410.3717	225.9000	14.673	2.2549	
10	8	8	2000	2.5	1500	0	4	7.2	4526.6822	385.9300	230.9000	1.2572	0.2501	8.6	4526.6822	385.9300	230.9000	12.6123	1.2572	
10	8	8	2000	2.5	1500	0	5	7.2	4526.6916	446.5615	230.1000	1.6937	0.2835	9.0	4526.6916	446.5615	230.1000	14.4653	1.6937	
10	8	8	2000	2.5	1500	0	6	7.2	4526.6833	399.9999	228.2000	1.2614	0.2891	8.8	4526.6833	399.9999	228.2000	14.3762	1.2614	
10	8	8	3000	2.849	1500	0	1	6.8	4526.5945	200.6219	59.2000	1.3743	0.4893	9.0	4526.5945	200.6219	59.2000	3.3264	0.4893	
10	8	8	3000	2.849	1500	0	2	6.6	4526.6034	212.1863	59.8000	1.7061	0.6593	8.4	4526.6034	212.1863	59.8000	3.3187	0.6593	
10	8	8	3000	2.849	1500	0	3	6.8	4526.6005	224.7514	58.6000	1.52695	0.5063	8.4	4526.6005	224.7514	58.6000	3.2538	0.5063	
10	8	8	3000	2.849	1500	0	4	6.4	4526.6153	469.7497	89.9000	54.1902	0.7810	8.8	4526.6153	469.7497	89.9000	3.5698	0.7810	
10	8	8	3000	2.849	1500	0	5	6.8	4526.5929	259.7710	50.3000	1.60038	0.5482	8.4	4526.5929	259.7710	50.3000	3.6981	0.5482	
10	8	8	3000	2.849	1500	0	6	6.6	4526.6016	879.4	67.1000	1.7512	0.23408	8.6	4526.6016	879.4	67.1000	3.3765	0.23408	
10	8	8	4000	3.125	1500	0	1	6.8	4526.5798	8501	150.6444	6.3000	0.6721	8.6	4526.5798	8501	150.6444	0.0000	0.6721	
10	8	8	4000	3.125	1500	0	2	6.6	4526.5918	4502	155.7960	8.0000	0.62471	7.8	4526.5918	4502	155.7960	0.0000	0.62471	
10	8	8	4000	3.125	1500	0	3	6.6	4526.5918	8252	183.9476	9.5000	1.1377	7.8	4526.5918	8252	183.9476	0.0000	1.1377	
10	8	8	4000	3.125	1500	0	4	6.8	4526.5830	2749	155.9182	9.2000	0.92487	8.6	4526.5830	2749	155.9182	0.0000	0.92487	
10	8	8	4000	3.125	1500	0	5	6.8	4526.5948	7749	314.2168	13.8000	28.2735	7.8	4526.5948	7749	314.2168	0.0000	28.2735	
10	8	8	4000	3.125	1500	0	6	6.6	4526.5839	7251	162.4891	10.4000	1.15487	7.6	4526.5839	7251	162.4891	0.0000	1.15487	
10	8	8	5000	3.358	1500	0	1	6.6	4526.6108	3755	267.5991	14.0000	20.2836	2.0624	8.0	4526.6108	3755	267.5991	0.0000	20.2836
10	8	8	5000	3.358	1500	0	2	7.0	4526.6075	1670	209.1295	3.1094	0.1950	8.0	4526.6075	1670	209.1295	0.0000	0.1950	
10	8	8	5000	3.358	1500	0	3	7.0	4526.6139	8447	214.4682	5.3000	0.6378	8.8	4526.6139	8447	214.4682	0.0000	0.6378	
10	8	8	5000	3.358	1500	0	4	6.6	4526.6156	5552	445.1651	20.2000	39.6263	7.8	4526.6156	5552	445.1651	0.0000	39.6263	
10	8	8	5000	3.358	1500	0	5	7.0	4526.6104	4419	185.6093	3.4000	0.40925	8.0	4526.6104	4419	185.6093	0.0000	0.40925	
10	8	8	5000	3.358	1500	0	6	6.8	4526.6009	8638	200.9855	2.0000	0.3358	8.8	4526.6009	8638	200.9855	0.0000	0.3358	

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	Solve time	±CI	F _{opt}	Weighted port count	# of OEOs	±CI	Solve time	±CI
[Gb/s]			[km]	[mW]	[Gb/s]	[%]				@F _{min}	@F _{min}	[sec]			@F _{opt}	@F _{opt}		[sec]	
10	8	8	6000	3.561	1500	0	1	6.8	0.4526	6175.9067	2.3000	4.4756	0.5379	8.2	6140.2158	0.0000	198.8462	4.7026	1.9629
10	8	8	6000	3.561	1500	0	2	6.8	0.4526	6250.5811	0.0000	0.0000	0.5332	7.8	6218.7568	0.0000	222.4374	4.0592	0.5786
10	8	8	6000	3.561	1500	0	3	6.8	0.4526	6349.4775	12.2000	27.3551	0.6066	8.0	6199.7197	0.0000	21.8894	4.7646	1.9804
10	8	8	6000	3.561	1500	0	4	6.6	0.6034	6299.5854	15.4000	32.6465	0.6197	8.0	6114.1396	0.0000	196.9979	3.7940	0.5954
10	8	8	6000	3.561	1500	0	5	6.8	0.4526	6274.4087	3.5000	7.9196	0.6026	7.6	6228.4077	0.0000	213.9776	3.7076	0.6278
10	8	8	6000	3.561	1500	0	6	6.6	0.6034	6326.3223	15.1000	30.5829	0.6395	8.2	6127.8887	0.0000	187.2994	4.7436	2.1308
10	8	8	7000	3.742	1500	0	1	6.6	0.6034	6456.2783	13.4000	20.3933	0.5620	8.4	6294.3413	0.0000	203.9012	4.1874	0.5456
10	8	8	7000	3.742	1500	0	2	6.8	0.4526	6477.6982	2.6000	5.8832	0.4949	8.0	6421.7920	0.0000	216.9701	4.0738	0.6386
10	8	8	7000	3.742	1500	0	3	7.0	0.0000	6444.2407	0.0000	0.0000	0.3514	9.0	6395.3467	0.0000	206.6519	5.5974	2.2610
10	8	8	7000	3.742	1500	0	4	6.8	0.4526	6397.8760	6.9000	15.6130	0.5299	8.2	6294.0381	0.0000	186.8538	3.9768	0.6013
10	8	8	7000	3.742	1500	0	5	7.0	0.0000	6414.4468	202.8795	0.0000	0.3174	8.2	6395.5015	0.0000	194.0315	4.2452	0.6530
10	8	8	7000	3.742	1500	0	6	6.8	0.4526	6341.1699	0.1000	0.2263	0.4836	8.4	6287.2803	0.0000	193.8372	4.1232	0.6292
10	8	8	8000	3.906	1500	0	1	6.6	0.6034	6650.4312	16.4000	24.8519	0.5651	8.6	6444.0313	0.0000	210.8758	5.8140	2.6899
10	8	8	8000	3.906	1500	0	2	6.8	0.4526	6641.2939	3.6000	8.1459	0.4905	8.0	6574.0874	0.0000	221.0525	4.0566	0.6374
10	8	8	8000	3.906	1500	0	3	7.0	0.0000	6592.6689	0.0000	0.0000	0.3960	9.0	6542.6436	0.0000	211.5648	5.6556	2.2165
10	8	8	8000	3.906	1500	0	4	6.8	0.4526	6544.3374	250.2968	15.6130	0.5230	8.2	6437.5127	0.0000	192.0690	4.0246	0.5547
10	8	8	8000	3.906	1500	0	5	7.0	0.0000	6564.1436	0.0000	0.0000	0.3272	8.2	6545.1001	0.0000	199.2559	4.2436	0.6580
10	8	8	8000	3.906	1500	0	6	6.8	0.4526	6499.8877	0.1000	0.2263	0.4937	8.6	6437.1187	0.0000	192.9154	4.3956	0.4353
10	8	8	9000	4.057	1500	0	1	6.6	0.6034	6786.4204	15.9000	24.0332	0.5684	8.6	6580.0459	0.0000	215.6027	5.7892	2.6509
10	8	8	9000	4.057	1500	0	2	6.8	0.4526	6779.8672	3.6000	8.1459	0.4933	8.0	6710.3438	0.0000	226.8280	4.0700	0.6459
10	8	8	9000	4.057	1500	0	3	7.0	0.0000	6762.7554	0.0000	0.0000	0.3977	9.0	6680.4092	0.0000	214.3118	5.6456	2.2220
10	8	8	9000	4.057	1500	0	4	6.8	0.4526	6723.2788	406.2337	29.8684	0.5559	8.2	6573.5571	0.0000	196.8193	4.0126	0.5466
10	8	8	9000	4.057	1500	0	5	7.0	0.0000	6700.9092	0.0000	0.0000	0.3249	8.2	6730.3750	0.0000	203.6746	4.2424	0.6561
10	8	8	9000	4.057	1500	0	6	6.8	0.4526	6635.2837	207.9590	0.0000	0.4953	8.6	6573.3149	0.0000	197.6212	4.3892	0.4242
10	8	8	10000	4.197	1500	0	1	6.6	0.6034	6922.1548	16.2000	24.5214	0.6218	8.8	6714.2236	0.0000	219.3710	10.6938	2.7081
10	8	8	10000	4.197	1500	0	2	6.8	0.4526	6908.7280	3.6000	8.1459	0.5721	8.0	6838.1689	0.0000	231.3732	8.3172	3.5609
10	8	8	10000	4.197	1500	0	3	7.0	0.0000	6855.1084	0.0000	0.0000	0.4503	9.0	6809.0508	0.0000	219.2237	10.7248	3.0134
10	8	8	10000	4.197	1500	0	4	6.8	0.4526	6893.9478	415.7270	29.8684	0.6321	8.2	6790.5024	0.0000	201.6666	8.6015	3.1414
10	8	8	10000	4.197	1500	0	5	7.0	0.0000	6829.6509	217.1251	0.0000	0.3647	8.2	6810.0322	0.0000	208.4749	9.2422	3.4416
10	8	8	10000	4.197	1500	0	6	6.8	0.4526	6751.2969	0.0000	0.0000	0.2823	8.4	6700.6001	0.0000	202.3903	9.6982	2.9988
10	8	8	1000	2	1500	80	1	6.6	0.6034	2838.0000	312.7177	178.4000	0.407	6.6	2838.0000	312.7177	178.4000	26.5647	0.0407
10	8	8	1000	2	1500	80	2	6.6	0.6034	2880.3999	328.4480	181.3000	0.0441	6.6	2880.3999	328.4480	181.3000	27.6185	0.0441
10	8	8	1000	2	1500	80	3	6.6	0.6034	2881.2000	314.5773	181.4000	0.0447	6.6	2881.2000	314.5773	181.4000	26.9305	0.0447
10	8	8	1000	2	1500	80	4	6.6	0.6034	2899.6001	311.9955	178.1000	0.0466	6.6	2899.6001	311.9955	178.1000	26.4321	0.0466
10	8	8	1000	2	1500	80	5	6.6	0.6034	2904.8000	306.1596	182.7000	0.0450	6.6	2904.8000	306.1596	182.7000	26.1804	0.0450
10	8	8	1000	2	1500	80	6	6.6	0.6034	2898.0000	310.1779	178.4000	0.0430	6.6	2898.0000	310.1779	178.4000	26.4423	0.0430
10	8	8	2000	2.5	1500	80	1	3.0	0.6746	2177.8999	132.4087	69.9000	0.1121	4.4	2022.0000	166.6341	53.9000	9.9918	0.2115
10	8	8	2000	2.5	1500	80	2	3.2	0.4526	2169.3999	185.3700	66.0000	0.0923	4.6	2070.5000	165.0562	55.5000	9.9792	0.2145
10	8	8	2000	2.5	1500	80	3	3.2	0.4526	2151.3999	184.1500	65.3000	0.0959	4.2	2061.1001	161.2366	55.5000	10.0870	0.1182
10	8	8	2000	2.5	1500	80	4	3.2	0.4526	2148.3000	188.8130	64.2000	0.1002	4.2	2056.2000	162.2160	53.3000	10.2703	0.1219
10	8	8	2000	2.5	1500	80	5	3.2	0.4526	2143.0000	193.7670	66.1000	0.13076	4.6	2050.3999	164.5197	55.5000	9.6252	0.1987
10	8	8	2000	2.5	1500	80	6	3.2	0.4526	2131.6001	188.2224	63.8000	0.12834	4.6	2037.9000	167.0121	52.7000	10.1645	0.2075
10	8	8	3000	2.849	1500	80	1	2.8	0.4526	1936.7230	133.0908	16.9000	0.6481	4.2	1837.3093	131.5798	8.2000	3.2669	0.9234
10	8	8	3000	2.849	1500	80	2	3.0	0.0000	1953.6267	141.7262	14.9000	0.9626	4.4	1896.2949	134.4824	8.4000	3.6047	0.3592
10	8	8	3000	2.849	1500	80	3	3.0	0.0000	1961.8112	141.0784	14.9000	0.5075	4.4	1912.0162	125.2359	8.6000	3.5087	1.0484
10	8	8	3000	2.849	1500	80	4	3.0	0.0000	1883.5922	139.9012	14.1000	0.0577	4.4	1829.4304	125.6753	7.4000	3.5087	1.0002
10	8	8	3000	2.849	1500	80	5	3.0	0.0000	1931.8352	144.1025	14.8000	0.5469	4.2	1883.9309	132.4888	9.0000	3.3731	0.9688
10	8	8	3000	2.849	1500	80	6	3.0	0.0000	1893.2379	132.6097	14.6000	0.5278	4.4	1827.8278	124.8172	8.2000	3.5825	1.0046
10	8	8	4000	3.125	1500	80	1	2.8	0.4526	1931.8500	145.0955	3.8000	0.1147	4.2	1867.6750	134.3015	0.3000	0.6788	0.8970

C	W	B	R _{max}	E/O	IN	FR	Policy	F _{min}	Weighted port count	# of OEOs	Solve time	±CI	F _{opt}	Weighted port count	# of OEOs	±CI	Solve time	±CI
[Gb/s]			[km]	ratio	[Gb/s]	[%]			@F _{min}	@F _{min}	[sec]			@F _{opt}	@F _{opt}		[sec]	
10	8	8	4000	3.125	1500	80	2	2.8	0.4526	1985.9250	131.6400	3.4638	0.1257	1938.5250	146.0657	0.5000	0.9082	0.1694
10	8	8	4000	3.125	1500	80	3	2.8	0.4526	2007.3500	135.7166	3.3528	0.1282	1961.4250	143.5614	0.1000	0.2263	0.1774
10	8	8	4000	3.125	1500	80	4	2.8	0.4526	1919.9000	118.9243	3.6055	0.1147	1864.5250	137.5253	0.2000	0.4526	0.1664
10	8	8	4000	3.125	1500	80	5	2.8	0.4526	2005.4500	138.5243	3.3528	0.1245	1961.7500	145.3704	0.5000	0.5060	0.1946
10	8	8	4000	3.125	1500	80	6	2.8	0.4526	1905.3250	124.0776	3.8673	0.1142	1836.8000	133.7849	0.3000	0.6788	0.1580
10	8	8	5000	3.358	1500	80	1	3.0	0.0000	1959.5791	162.4614	0.2263	0.5712	1925.6920	143.5841	0.0000	0.0000	0.1663
10	8	8	5000	3.358	1500	80	2	3.0	0.0000	2022.9270	155.0773	0.0000	0.6056	2001.4408	153.4429	0.0000	0.8986	0.1875
10	8	8	5000	3.358	1500	80	3	3.0	0.0000	2055.6702	155.2714	0.0000	0.6078	2028.1272	149.7069	0.0000	0.9186	0.1947
10	8	8	5000	3.358	1500	80	4	3.0	0.0000	1932.9203	145.2541	0.0000	0.5788	1912.4772	144.3296	0.0000	0.8610	0.1833
10	8	8	5000	3.358	1500	80	5	3.0	0.0000	2039.2986	160.7773	0.0000	0.6144	2021.7555	155.7701	0.0000	0.8562	0.1922
10	8	8	5000	3.358	1500	80	6	3.0	0.0000	1927.5488	150.0707	0.0000	0.5752	1890.7617	142.0964	0.0000	0.8990	0.1587
10	8	8	6000	3.561	1500	80	1	2.8	0.4526	2040.4001	141.3001	1.2000	0.5236	1990.3842	150.1920	0.0000	0.8486	0.1759
10	8	8	6000	3.561	1500	80	2	2.8	0.4526	2098.2100	139.6149	1.3000	0.5476	2055.4155	152.8746	0.0000	0.9000	0.1898
10	8	8	6000	3.561	1500	80	3	2.8	0.4526	2129.6467	134.1844	1.2000	0.5592	2084.9644	148.4126	0.0000	0.9154	0.1902
10	8	8	6000	3.561	1500	80	4	2.8	0.4526	2008.6908	122.3998	1.0000	0.5322	1962.7600	148.0711	0.0000	0.8642	0.1844
10	8	8	6000	3.561	1500	80	5	2.8	0.4526	2107.5103	140.3005	1.0000	0.5586	2071.6523	159.4669	0.0000	0.8052	0.1885
10	8	8	6000	3.561	1500	80	6	2.8	0.4526	1993.6936	126.1261	0.9000	0.5298	1948.7385	145.8045	0.0000	0.8934	0.1570
10	8	8	7000	3.742	1500	80	1	3.0	0.0000	2060.9451	165.7146	0.0000	0.5778	2030.6614	152.4530	0.0000	0.8512	0.1719
10	8	8	7000	3.742	1500	80	2	2.8	0.4526	2137.3220	162.4532	0.0000	0.5602	2115.0769	163.1024	0.0000	0.8988	0.1847
10	8	8	7000	3.742	1500	80	3	3.0	0.0000	2169.5671	157.8343	0.0000	0.6188	2140.9702	154.8676	0.0000	0.9752	0.1752
10	8	8	7000	3.742	1500	80	4	2.8	0.4526	2053.5483	136.0078	0.0000	0.5406	2019.1644	153.9308	0.0000	0.8628	0.1812
10	8	8	7000	3.742	1500	80	5	3.0	0.0000	2152.2190	169.5200	0.0000	0.6184	2136.3220	169.3224	0.0000	0.8640	0.1959
10	8	8	7000	3.742	1500	80	6	2.8	0.4526	2038.3099	138.4477	0.0000	0.5396	1995.7806	150.1859	0.0000	0.8986	0.1572
10	8	8	8000	3.906	1500	80	1	3.0	0.0000	2105.4187	169.7695	0.0000	0.5768	2074.2063	156.3501	0.0000	0.8520	0.1741
10	8	8	8000	3.906	1500	80	2	2.8	0.4526	2182.8750	166.8798	0.0000	0.5604	2161.1313	167.3211	0.0000	0.9018	0.1863
10	8	8	8000	3.906	1500	80	3	3.0	0.0000	2220.8188	160.8914	0.0000	0.6206	2187.5562	159.0085	0.0000	0.9726	0.1745
10	8	8	8000	3.906	1500	80	4	2.8	0.4526	2101.1563	139.8534	0.0000	0.5368	2062.4438	158.1088	0.0000	0.8658	0.1808
10	8	8	8000	3.906	1500	80	5	3.0	0.0000	2198.6375	173.6570	0.0000	0.6172	2182.6750	173.4937	0.0000	0.8590	0.1939
10	8	8	8000	3.906	1500	80	6	2.8	0.4526	2081.2876	143.6972	0.0000	0.5354	2039.7312	154.0109	0.0000	0.9032	0.1614
10	8	8	9000	4.057	1500	80	1	3.0	0.0000	2148.2495	174.5797	0.0000	0.5797	2114.9351	159.9390	0.0000	0.8531	0.1714
10	8	8	9000	4.057	1500	80	2	2.8	0.4526	2231.4644	175.1451	0.0000	0.5576	2204.0303	171.0794	0.0000	0.9045	0.1868
10	8	8	9000	4.057	1500	80	3	3.0	0.0000	2263.2988	164.5544	0.0000	0.6159	2229.9761	162.6777	0.0000	0.9718	0.1752
10	8	8	9000	4.057	1500	80	4	2.8	0.4526	2141.7268	142.4995	0.0000	0.5374	2104.7124	162.9848	0.0000	0.8655	0.1801
10	8	8	9000	4.057	1500	80	5	3.0	0.0000	2239.8872	178.2186	0.0000	0.6125	2222.9044	176.6478	0.0000	0.8079	0.1916
10	8	8	9000	4.057	1500	80	6	2.8	0.4526	2122.0469	147.1082	0.0000	0.5360	2080.0979	157.5278	0.0000	0.9012	0.1591
10	8	8	10000	4.197	1500	80	1	3.0	0.0000	2186.0950	177.2113	0.0000	0.5906	2153.1006	163.2898	0.0000	0.8751	0.1792
10	8	8	10000	4.197	1500	80	2	2.8	0.4526	2264.9695	173.3455	0.0000	0.5671	2242.6511	173.6424	0.0000	0.9266	0.1985
10	8	8	10000	4.197	1500	80	3	3.0	0.0000	2301.8879	167.9061	0.0000	0.6295	2268.7090	165.7562	0.0000	0.9952	0.1849
10	8	8	10000	4.197	1500	80	4	2.8	0.4526	2180.5161	146.8786	0.0000	0.5874	2143.2214	167.5201	0.0000	0.9331	0.1945
10	8	8	10000	4.197	1500	80	5	3.0	0.0000	2277.2483	181.1369	0.0000	0.6343	2261.2695	180.5903	0.0000	0.8250	0.1921
10	8	8	10000	4.197	1500	80	6	2.8	0.4526	2160.2397	150.6108	0.0000	0.5404	2117.5271	160.7917	0.0000	0.9173	0.1636
40	8	8	1000	5	500	0	1	3.0	0.0000	8023.2002	355.1719	314.9000	0.0054	8023.2002	355.1719	314.9000	0.1873	0.0054
40	8	8	1000	5	500	0	2	3.0	0.0000	8093.2002	369.6716	317.8000	0.0079	8093.2002	369.6716	317.8000	0.1952	0.0079
40	8	8	1000	5	500	0	3	3.0	0.0000	8170.0000	381.7559	321.3000	0.0057	8170.0000	381.7559	321.3000	0.1938	0.0057
40	8	8	1000	5	500	0	4	3.0	0.0000	8185.6001	392.4371	317.8000	0.0056	8185.6001	392.4371	317.8000	0.1969	0.0056
40	8	8	1000	5	500	0	5	3.0	0.0000	8167.3999	378.7860	320.6000	0.0057	8167.3999	378.7860	320.6000	0.1970	0.0057
40	8	8	1000	5	500	0	6	3.0	0.0000	8139.6001	404.5795	316.2000	0.0058	8139.6001	404.5795	316.2000	0.1969	0.0058
40	8	8	2000	6.25	500	0	1	1.0	0.0000	5706.7998	247.9070	95.6000	0.0092	5706.7998	247.9070	95.6000	0.2703	0.0092
40	8	8	2000	6.25	500	0	2	1.0	0.0000	5803.4502	228.0810	97.7000	0.0092	5803.4502	228.0810	97.7000	0.2767	0.0092

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	2000	6.25	500	0	3	1.0	0.0000	5772.3501	98.1000	246.1892	0.0098	5.9719	1.0	0.0000	5772.3501	98.1000	246.1892	0.2830	0.0098
40	8	8	2000	6.25	500	0	4	1.0	0.0000	5764.6001	95.2000	247.4877	0.0098	6.7950	1.0	0.0000	5764.6001	95.2000	247.4877	0.2797	0.0098
40	8	8	2000	6.25	500	0	5	1.0	0.0000	5733.3999	96.4000	244.8804	0.0088	6.5771	1.0	0.0000	5733.3999	96.4000	244.8804	0.2781	0.0088
40	8	8	2000	6.25	500	0	6	1.0	0.0000	5749.2998	94.9000	246.0443	0.2781	6.5185	1.0	0.0000	5749.2998	94.9000	246.0443	0.2781	0.0103
40	8	8	3000	7.121	500	0	1	1.0	0.0000	5005.3604	15.7000	188.1789	0.0158	2.0253	1.0	0.0000	5005.3604	15.7000	188.1789	0.4422	0.0158
40	8	8	3000	7.121	500	0	2	1.0	0.0000	5121.6982	15.6000	199.0846	0.0124	2.1651	1.0	0.0000	5121.6982	15.6000	199.0846	0.4562	0.0124
40	8	8	3000	7.121	500	0	3	1.0	0.0000	5127.7959	16.6000	202.7059	0.0177	2.0848	1.0	0.0000	5127.7959	16.6000	202.7059	0.4687	0.0177
40	8	8	3000	7.121	500	0	4	1.0	0.0000	4987.3115	15.7000	190.9410	0.0118	2.2890	1.0	0.0000	4987.3115	15.7000	190.9410	0.4486	0.0118
40	8	8	3000	7.121	500	0	5	1.0	0.0000	5074.9346	16.6000	190.5707	0.0141	2.0848	1.0	0.0000	5074.9346	16.6000	190.5707	0.4591	0.0141
40	8	8	3000	7.121	500	0	6	1.0	0.0000	5003.3359	15.5000	188.5156	0.0143	2.4148	1.0	0.0000	5003.3359	15.5000	188.5156	0.4514	0.0143
40	8	8	4000	7.813	500	0	1	1.0	0.0000	5117.9375	0.0000	197.7970	0.0121	0.0000	1.0	0.0000	5117.9375	0.0000	197.7970	0.4609	0.0121
40	8	8	4000	7.813	500	0	2	1.0	0.0000	5210.0625	0.0000	221.4392	0.0141	0.0000	1.0	0.0000	5210.0625	0.0000	221.4392	0.4750	0.0141
40	8	8	4000	7.813	500	0	3	1.0	0.0000	5252.7998	0.0000	202.2196	0.0143	0.0000	1.0	0.0000	5252.7998	0.0000	202.2196	0.4921	0.0143
40	8	8	4000	7.813	500	0	4	1.0	0.0000	5062.7876	0.0000	203.8344	0.0151	0.0000	1.0	0.0000	5062.7876	0.0000	203.8344	0.4624	0.0151
40	8	8	4000	7.813	500	0	5	1.0	0.0000	5242.2876	0.0000	203.3231	0.0175	0.0000	1.0	0.0000	5242.2876	0.0000	203.3231	0.4921	0.0175
40	8	8	4000	7.813	500	0	6	1.0	0.0000	5066.5625	0.0000	207.7852	0.0263	0.0000	1.2	0.4526	5066.5625	0.0000	208.1137	0.5095	0.1087
40	8	8	5000	8.394	500	0	1	1.0	0.0000	5390.0845	0.0000	201.5959	0.0246	0.0000	1.0	0.0000	5390.0845	0.0000	201.5959	0.4656	0.0246
40	8	8	5000	8.394	500	0	2	1.0	0.0000	5496.3975	0.0000	227.3974	0.0223	0.0000	1.0	0.0000	5496.3975	0.0000	227.3974	0.4844	0.0223
40	8	8	5000	8.394	500	0	3	1.0	0.0000	5542.7803	0.0000	218.0763	0.0223	0.0000	1.0	0.0000	5542.7803	0.0000	218.0763	0.4874	0.0223
40	8	8	5000	8.394	500	0	4	1.0	0.0000	5328.6069	0.0000	215.7604	0.0129	0.0000	1.0	0.0000	5328.6069	0.0000	215.7604	0.4687	0.0129
40	8	8	5000	8.394	500	0	5	1.0	0.0000	5530.5649	0.0000	215.1744	0.0235	0.0000	1.2	0.4526	5529.2861	0.0000	216.7547	0.5515	0.1100
40	8	8	5000	8.394	500	0	6	1.0	0.0000	5330.5913	0.0000	218.9845	0.0210	0.0000	1.2	0.4526	5328.1123	0.0000	221.8715	0.5200	0.1018
40	8	8	6000	8.902	500	0	1	1.0	0.0000	5633.9922	0.0000	208.2061	0.0228	0.0000	1.0	0.0000	5633.9922	0.0000	208.2061	0.4687	0.0228
40	8	8	6000	8.902	500	0	2	1.0	0.0000	5738.0669	0.0000	233.1963	0.0261	0.0000	1.0	0.0000	5738.0669	0.0000	233.1963	0.4826	0.0261
40	8	8	6000	8.902	500	0	3	1.0	0.0000	5790.7725	0.0000	229.7962	0.0272	0.0000	1.2	0.4526	5789.3726	0.0000	231.5457	0.5517	0.1093
40	8	8	6000	8.902	500	0	4	1.0	0.0000	5562.6846	0.0000	226.0036	0.0168	0.0000	1.0	0.0000	5562.6846	0.0000	226.0036	0.4794	0.0168
40	8	8	6000	8.902	500	0	5	1.0	0.0000	5779.7510	0.0000	222.0027	0.0329	0.0000	1.0	0.0000	5779.7510	0.0000	222.0027	0.4953	0.0329
40	8	8	6000	8.902	500	0	6	1.0	0.0000	5564.8633	0.0000	229.1845	0.0200	0.0000	1.2	0.4526	5561.8833	0.0000	232.6846	0.5205	0.1022
40	8	8	7000	9.355	500	0	1	1.0	0.0000	5839.9492	0.0000	228.7385	0.0244	0.0000	1.0	0.0000	5839.9492	0.0000	228.7385	0.4766	0.0244
40	8	8	7000	9.355	500	0	2	1.0	0.0000	5946.8999	0.0000	244.7236	0.0233	0.0000	1.2	0.4526	5943.8291	0.0000	243.0404	0.5423	0.1213
40	8	8	7000	9.355	500	0	3	1.0	0.0000	5986.2925	0.0000	234.5014	0.0280	0.0000	1.2	0.4526	5985.8926	0.0000	235.0033	0.5639	0.1066
40	8	8	7000	9.355	500	0	4	1.0	0.0000	5770.4302	0.0000	234.0707	0.0166	0.0000	1.0	0.0000	5770.4302	0.0000	234.0707	0.4812	0.0166
40	8	8	7000	9.355	500	0	5	1.0	0.0000	5977.0888	0.0000	236.5902	0.0205	0.0000	1.2	0.4526	5974.7378	0.0000	236.7263	0.5580	0.1201
40	8	8	7000	9.355	500	0	6	1.0	0.0000	5762.0459	0.0000	238.9684	0.0176	0.0000	1.2	0.4526	5759.5757	0.0000	241.8396	0.5283	0.1038
40	8	8	8000	9.766	500	0	1	1.0	0.0000	6025.9971	0.0000	229.8232	0.0202	0.0000	1.2	0.4526	6025.6968	0.0000	229.7070	0.5235	0.1294
40	8	8	8000	9.766	500	0	2	1.0	0.0000	6141.7280	0.0000	254.2360	0.0238	0.0000	1.0	0.0000	6141.7280	0.0000	254.2360	0.4813	0.0238
40	8	8	8000	9.766	500	0	3	1.0	0.0000	6192.5249	0.0000	245.3487	0.0281	0.0000	1.2	0.4526	6191.1250	0.0000	247.1347	0.5484	0.1113
40	8	8	8000	9.766	500	0	4	1.0	0.0000	5957.1343	0.0000	242.3271	0.0130	0.0000	1.0	0.0000	5957.1343	0.0000	242.3271	0.4797	0.0130
40	8	8	8000	9.766	500	0	5	1.0	0.0000	6184.0127	0.0000	247.0547	0.0261	0.0000	1.0	0.0000	6184.0127	0.0000	247.0547	0.5016	0.0261
40	8	8	8000	9.766	500	0	6	1.0	0.0000	5950.1221	0.0000	243.5495	0.0191	0.0000	1.2	0.4526	5946.9688	0.0000	247.3271	0.5283	0.1038
40	8	8	9000	10.14	500	0	1	1.0	0.0000	6198.6191	0.0000	236.7806	0.0223	0.0000	1.2	0.4526	6198.3193	0.0000	236.6643	0.5283	0.1322
40	8	8	9000	10.14	500	0	2	1.0	0.0000	6317.3208	0.0000	261.7968	0.0239	0.0000	1.0	0.0000	6317.3208	0.0000	261.7968	0.4860	0.0239
40	8	8	9000	10.14	500	0	3	1.0	0.0000	6369.2495	0.0000	252.7289	0.0284	0.0000	1.2	0.4526	6367.8496	0.0000	254.5155	0.5547	0.1092
40	8	8	9000	10.14	500	0	4	1.0	0.0000	6129.8477	0.0000	250.0816	0.0140	0.0000	1.0	0.0000	6129.8477	0.0000	250.0816	0.4841	0.0140
40	8	8	9000	10.14	500	0	5	1.0	0.0000	6360.8354	0.0000	254.4188	0.0259	0.0000	1.0	0.0000	6360.8354	0.0000	254.4188	0.5079	0.0259
40	8	8	9000	10.14	500	0	6	1.0	0.0000	6121.3330	0.0000	250.8089	0.0203	0.0000	1.2	0.4526	6118.1045	0.0000	254.6818	0.5332	0.1024
40	8	8	10000	10.49	500	0	1	1.0	0.0000	6359.6802	0.0000	243.6332	0.0230	0.0000	1.0	0.0000	6359.6802	0.0000	243.6332	0.4717	0.0230
40	8	8	10000	10.49	500	0	2	1.0	0.0000	6480.3213	0.0000	268.8258	0.0251	0.0000	1.0	0.0000	6480.3213	0.0000	268.8258	0.4876	0.0251
40	8	8	10000	10.49	500	0	3	1.0	0.0000	6533.2998	0.0000	259.6338	0.0319	0.0000	1.2	0.4526	6531.8999	0.0000	261.4209	0.5500	0.1111

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
40	8	8	10000	10.49	500	0	4	1.0	0.0000	6288.5088	256.9073	0.0000	0.4875	1.0	0.0000	6288.5088	256.9073	0.0000	0.4875
40	8	8	10000	10.49	500	0	5	1.0	0.0000	6522.6064	263.7808	0.0000	0.5108	1.0	0.0000	6522.6064	263.7808	0.0000	0.5108
40	8	8	10000	10.49	500	0	6	1.0	0.0000	6277.9146	256.6729	0.0000	0.4813	1.2	0.4526	6274.6157	260.6317	0.0000	0.5328
40	8	8	1000	5	500	80	1	1.0	0.0000	1780.2000	266.0143	67.4000	0.0485	1.0	0.0000	1780.2000	266.0143	67.4000	0.0485
40	8	8	1000	5	500	80	2	1.0	0.0000	1898.6000	259.3566	73.2000	0.0500	1.0	0.0000	1898.6000	259.3566	73.2000	0.0500
40	8	8	1000	5	500	80	3	1.0	0.0000	1902.6000	267.3127	74.1000	0.0546	1.0	0.0000	1902.6000	267.3127	74.1000	0.0546
40	8	8	1000	5	500	80	4	1.0	0.0000	1877.6000	296.0973	64.7000	0.0562	1.0	0.0000	1877.6000	296.0973	64.7000	0.0562
40	8	8	1000	5	500	80	5	1.0	0.0000	1954.0000	302.3766	75.8000	0.0532	1.0	0.0000	1954.0000	302.3766	75.8000	0.0532
40	8	8	1000	5	500	80	6	1.0	0.0000	1912.8000	293.2007	67.0000	0.0499	1.0	0.0000	1912.8000	293.2007	67.0000	0.0499
40	8	8	2000	6.25	500	80	1	1.0	0.0000	1354.3000	166.3115	17.6000	0.0983	1.0	0.0000	1354.3000	166.3115	17.6000	0.0983
40	8	8	2000	6.25	500	80	2	1.0	0.0000	1422.9000	161.8140	19.5000	0.1030	1.0	0.0000	1422.9000	161.8140	19.5000	0.1030
40	8	8	2000	6.25	500	80	3	1.0	0.0000	1483.6500	130.6554	21.3000	0.1092	1.0	0.0000	1483.6500	130.6554	21.3000	0.1092
40	8	8	2000	6.25	500	80	4	1.0	0.0000	1356.6500	156.1066	14.7000	0.1050	1.0	0.0000	1356.6500	156.1066	14.7000	0.1050
40	8	8	2000	6.25	500	80	5	1.0	0.0000	1457.5000	167.9693	21.2000	0.1062	1.0	0.0000	1457.5000	167.9693	21.2000	0.1062
40	8	8	2000	6.25	500	80	6	1.0	0.0000	1351.8000	179.9412	14.3000	0.1078	1.0	0.0000	1351.8000	179.9412	14.3000	0.1078
40	8	8	3000	7.121	500	80	1	1.0	0.0000	1401.6733	142.0283	3.8000	0.1591	1.0	0.0000	1401.6733	142.0283	3.8000	0.1591
40	8	8	3000	7.121	500	80	2	1.0	0.0000	1536.8552	117.9686	4.6000	0.1767	1.0	0.0000	1536.8552	117.9686	4.6000	0.1767
40	8	8	3000	7.121	500	80	3	1.0	0.0000	1665.0455	129.4569	5.6000	0.1969	1.0	0.0000	1665.0455	129.4569	5.6000	0.1969
40	8	8	3000	7.121	500	80	4	1.0	0.0000	1370.0847	151.1110	3.1000	0.1593	1.0	0.0000	1370.0847	151.1110	3.1000	0.1593
40	8	8	3000	7.121	500	80	5	1.0	0.0000	1569.0767	120.3933	5.6000	0.1782	1.0	0.0000	1569.0767	120.3933	5.6000	0.1782
40	8	8	3000	7.121	500	80	6	1.0	0.0000	1351.7876	177.0557	3.7000	0.1595	1.0	0.0000	1351.7876	177.0557	3.7000	0.1595
40	8	8	4000	7.813	500	80	1	1.0	0.0000	1478.4375	137.9342	0.0000	0.1688	1.0	0.0000	1478.4375	137.9342	0.0000	0.1688
40	8	8	4000	7.813	500	80	2	1.0	0.0000	1660.2625	123.4262	0.0000	0.1938	1.0	0.0000	1660.2625	123.4262	0.0000	0.1938
40	8	8	4000	7.813	500	80	3	1.0	0.0000	1792.8750	140.9682	0.0000	0.2123	1.0	0.0000	1792.8750	140.9682	0.0000	0.2123
40	8	8	4000	7.813	500	80	4	1.0	0.0000	1410.2875	155.3777	0.0000	0.1687	1.0	0.0000	1410.2875	155.3777	0.0000	0.1687
40	8	8	4000	7.813	500	80	5	1.0	0.0000	1763.5250	141.2237	0.0000	0.2142	1.0	0.0000	1763.5250	141.2237	0.0000	0.2142
40	8	8	4000	7.813	500	80	6	1.0	0.0000	1370.0500	156.4766	0.0000	0.1578	1.0	0.0000	1370.0500	156.4766	0.0000	0.1578
40	8	8	5000	8.394	500	80	1	1.0	0.0000	1546.9384	186.6260	0.0000	0.1720	1.0	0.0000	1546.9384	186.6260	0.0000	0.1720
40	8	8	5000	8.394	500	80	2	1.0	0.0000	1738.9749	128.6526	0.0000	0.1970	1.0	0.0000	1738.9749	128.6526	0.0000	0.1970
40	8	8	5000	8.394	500	80	3	1.0	0.0000	1884.3555	143.3694	0.0000	0.2171	1.0	0.0000	1884.3555	143.3694	0.0000	0.2171
40	8	8	5000	8.394	500	80	4	1.0	0.0000	1475.3298	163.9697	0.0000	0.1657	1.0	0.0000	1475.3298	163.9697	0.0000	0.1657
40	8	8	5000	8.394	500	80	5	1.0	0.0000	1851.2090	143.4885	0.0000	0.2139	1.0	0.0000	1851.2090	143.4885	0.0000	0.2139
40	8	8	5000	8.394	500	80	6	1.0	0.0000	1440.1469	162.0190	0.0000	0.1623	1.0	0.0000	1440.1469	162.0190	0.0000	0.1623
40	8	8	6000	8.902	500	80	1	1.0	0.0000	1608.1667	195.0030	0.0000	0.1782	1.0	0.0000	1608.1667	195.0030	0.0000	0.1782
40	8	8	6000	8.902	500	80	2	1.0	0.0000	1809.7136	132.0591	0.0000	0.1999	1.0	0.0000	1809.7136	132.0591	0.0000	0.1999
40	8	8	6000	8.902	500	80	3	1.0	0.0000	1959.6729	146.4626	0.0000	0.2189	1.0	0.0000	1959.6729	146.4626	0.0000	0.2189
40	8	8	6000	8.902	500	80	4	1.0	0.0000	1534.1165	170.6196	0.0000	0.1671	1.0	0.0000	1534.1165	170.6196	0.0000	0.1671
40	8	8	6000	8.902	500	80	5	1.0	0.0000	1924.9086	147.7676	0.0000	0.2156	1.0	0.0000	1924.9086	147.7676	0.0000	0.2156
40	8	8	6000	8.902	500	80	6	1.0	0.0000	1499.0110	168.8480	0.0000	0.1611	1.0	0.0000	1499.0110	168.8480	0.0000	0.1611
40	8	8	7000	9.355	500	80	1	1.0	0.0000	1662.8981	200.8653	0.0000	0.1734	1.0	0.0000	1662.8981	200.8653	0.0000	0.1734
40	8	8	7000	9.355	500	80	2	1.0	0.0000	1873.2480	133.9642	0.0000	0.1954	1.0	0.0000	1873.2480	133.9642	0.0000	0.1954
40	8	8	7000	9.355	500	80	3	1.0	0.0000	2029.4080	153.0668	0.0000	0.2217	1.0	0.0000	2029.4080	153.0668	0.0000	0.2217
40	8	8	7000	9.355	500	80	4	1.0	0.0000	1586.0116	175.0309	0.0000	0.1674	1.0	0.0000	1586.0116	175.0309	0.0000	0.1674
40	8	8	7000	9.355	500	80	5	1.0	0.0000	1993.7566	154.2231	0.0000	0.2142	1.0	0.0000	1993.7566	154.2231	0.0000	0.2142
40	8	8	7000	9.355	500	80	6	1.0	0.0000	1551.3474	175.0287	0.0000	0.1639	1.0	0.0000	1551.3474	175.0287	0.0000	0.1639
40	8	8	8000	9.766	500	80	1	1.0	0.0000	1715.3969	208.5004	0.0000	0.1767	1.0	0.0000	1715.3969	208.5004	0.0000	0.1767
40	8	8	8000	9.766	500	80	2	1.0	0.0000	1932.7281	141.1826	0.0000	0.1983	1.0	0.0000	1932.7281	141.1826	0.0000	0.1983
40	8	8	8000	9.766	500	80	3	1.0	0.0000	2090.2437	156.3160	0.0000	0.2186	1.0	0.0000	2090.2437	156.3160	0.0000	0.2186
40	8	8	8000	9.766	500	80	4	1.0	0.0000	1637.3093	182.6250	0.0000	0.1703	1.0	0.0000	1637.3093	182.6250	0.0000	0.1703

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	8000	9.766	500	80	5	1.0	0.0000	2053.0063	160.1324	0.0000	0.0000	0.0123	1.0	0.0000	2053.0063	160.1324	0.0000	0.0123
40	8	8	8000	9.766	500	80	6	1.0	0.0000	1599.6125	180.2401	0.0000	0.0000	0.1640	1.0	0.0000	1599.6125	180.2401	0.0000	0.1640
40	8	8	9000	10.14	500	80	1	1.0	0.0000	1762.4207	214.2471	0.0000	0.0000	0.1766	1.0	0.0000	1762.4207	214.2471	0.0000	0.1766
40	8	8	9000	10.14	500	80	2	1.0	0.0000	1985.3376	145.3125	0.0000	0.0000	0.2031	1.0	0.0000	1985.3376	145.3125	0.0000	0.2031
40	8	8	9000	10.14	500	80	3	1.0	0.0000	2147.2534	160.8218	0.0000	0.0000	0.2203	1.0	0.0000	2147.2534	160.8218	0.0000	0.2203
40	8	8	9000	10.14	500	80	4	1.0	0.0000	1681.8199	187.3842	0.0000	0.0000	0.1704	1.0	0.0000	1681.8199	187.3842	0.0000	0.1704
40	8	8	9000	10.14	500	80	5	1.0	0.0000	2106.5103	163.5278	0.0000	0.0000	0.2188	1.0	0.0000	2106.5103	163.5278	0.0000	0.2188
40	8	8	9000	10.14	500	80	6	1.0	0.0000	1643.3909	185.3222	0.0000	0.0000	0.1687	1.0	0.0000	1643.3909	185.3222	0.0000	0.1687
40	8	8	10000	10.49	500	80	1	1.0	0.0000	1806.0231	219.5766	0.0000	0.0000	0.1719	1.0	0.0000	1806.0231	219.5766	0.0000	0.1719
40	8	8	10000	10.49	500	80	2	1.0	0.0000	2036.3190	149.5271	0.0000	0.0000	0.2016	1.0	0.0000	2036.3190	149.5271	0.0000	0.2016
40	8	8	10000	10.49	500	80	3	1.0	0.0000	2197.7441	165.6165	0.0000	0.0000	0.2219	1.0	0.0000	2197.7441	165.6165	0.0000	0.2219
40	8	8	10000	10.49	500	80	4	1.0	0.0000	1723.8625	191.9445	0.0000	0.0000	0.1675	1.0	0.0000	1723.8625	191.9445	0.0000	0.1675
40	8	8	10000	10.49	500	80	5	1.0	0.0000	2159.1611	167.2299	0.0000	0.0000	0.2156	1.0	0.0000	2159.1611	167.2299	0.0000	0.2156
40	8	8	10000	10.49	500	80	6	1.0	0.0000	1684.3835	190.1619	0.0000	0.0000	0.1640	1.0	0.0000	1684.3835	190.1619	0.0000	0.1640
40	8	8	1000	5	1500	0	1	6.0	0.7543	11739.5996	465.8766	462.9000	26.0112	0.4218	6.0	0.7543	11739.5996	465.8766	462.9000	26.0112
40	8	8	1000	5	1500	0	2	6.0	0.7543	11798.5996	475.1937	462.1000	23.4849	0.4282	6.0	0.7543	11798.5996	475.1937	462.1000	23.4849
40	8	8	1000	5	1500	0	3	6.0	0.7543	11859.5996	471.5565	465.6000	23.7971	0.4313	6.0	0.7543	11859.5996	471.5565	465.6000	23.7971
40	8	8	1000	5	1500	0	4	6.0	0.7543	11891.0000	466.7280	469.3000	32.2958	0.4423	6.0	0.7543	11891.0000	466.7280	469.3000	32.2958
40	8	8	1000	5	1500	0	5	6.0	0.7543	11857.5996	487.4485	465.4000	23.7660	0.4359	6.0	0.7543	11857.5996	487.4485	465.4000	23.7660
40	8	8	1000	5	1500	0	6	6.0	0.7543	11849.7998	460.5399	466.7000	29.8288	0.4391	6.0	0.7543	11849.7998	460.5399	466.7000	29.8288
40	8	8	2000	6.25	1500	0	1	3.0	0.0000	8301.0498	330.6989	138.2000	9.6226	0.6250	3.0	0.0000	8301.0498	330.6989	138.2000	9.6226
40	8	8	2000	6.25	1500	0	2	3.0	0.0000	8426.0996	349.4461	140.5000	9.9507	0.6456	3.0	0.0000	8426.0996	349.4461	140.5000	9.9507
40	8	8	2000	6.25	1500	0	3	3.0	0.0000	8380.5498	335.3871	140.3000	9.5350	0.6517	3.0	0.0000	8380.5498	335.3871	140.3000	9.5350
40	8	8	2000	6.25	1500	0	4	3.0	0.0000	8390.3496	333.1093	138.5000	9.6311	0.6590	3.0	0.0000	8390.3496	333.1093	138.5000	9.6311
40	8	8	2000	6.25	1500	0	5	3.0	0.0000	8360.2002	326.2195	139.3000	9.3967	0.6501	3.0	0.0000	8360.2002	326.2195	139.3000	9.3967
40	8	8	2000	6.25	1500	0	6	3.0	0.0000	8361.0996	326.2651	137.4000	9.3247	0.6527	3.0	0.0000	8361.0996	326.2651	137.4000	9.3247
40	8	8	3000	7.121	1500	0	1	3.0	0.0000	7257.5718	265.3273	22.9000	2.0916	0.9969	3.0	0.0000	7257.5718	265.3273	22.9000	0.9969
40	8	8	3000	7.121	1500	0	2	3.0	0.0000	7416.6772	270.7134	23.2000	2.3321	1.0391	3.0	0.0000	7416.6772	270.7134	23.2000	1.0391
40	8	8	3000	7.121	1500	0	3	3.0	0.0000	7408.0562	264.5889	23.5000	2.1400	1.0454	3.0	0.0000	7408.0562	264.5889	23.5000	1.0454
40	8	8	3000	7.121	1500	0	4	3.0	0.0000	7268.9990	267.1461	22.6000	2.3174	1.0063	3.0	0.0000	7268.9990	267.1461	22.6000	1.0063
40	8	8	3000	7.121	1500	0	5	3.0	0.0000	7360.2710	255.6342	23.5000	2.1400	1.0266	3.0	0.0000	7360.2710	255.6342	23.5000	1.0266
40	8	8	3000	7.121	1500	0	6	3.0	0.0000	7266.7446	248.4810	22.6000	2.2927	1.0157	3.0	0.0000	7266.7446	248.4810	22.6000	1.0157
40	8	8	4000	7.813	1500	0	1	3.0	0.0000	7377.1001	258.8651	0.0000	0.0000	1.0108	3.0	0.0000	7377.1001	258.8651	0.0000	1.0108
40	8	8	4000	7.813	1500	0	2	3.0	0.0000	7542.9873	265.8221	0.0000	0.0000	1.0640	3.0	0.0000	7542.9873	265.8221	0.0000	1.0640
40	8	8	4000	7.813	1500	0	3	3.0	0.0000	7538.5625	268.5494	0.0000	0.0000	1.0844	3.0	0.0000	7538.5625	268.5494	0.0000	1.0844
40	8	8	4000	7.813	1500	0	4	3.0	0.0000	7367.5874	261.5657	0.0000	0.0000	1.0235	3.0	0.0000	7367.5874	261.5657	0.0000	1.0235
40	8	8	4000	7.813	1500	0	5	3.0	0.0000	7536.9375	270.1491	0.0000	0.0000	1.0734	3.0	0.0000	7536.9375	270.1491	0.0000	1.0734
40	8	8	4000	7.813	1500	0	6	3.0	0.0000	7357.1499	248.0522	0.0000	0.0000	1.0264	3.0	0.0000	7357.1499	248.0522	0.0000	1.0264
40	8	8	5000	8.394	1500	0	1	3.0	0.0000	7753.2305	267.9608	0.0000	0.0000	1.0202	3.0	0.0000	7753.2305	267.9608	0.0000	1.0202
40	8	8	5000	8.394	1500	0	2	3.0	0.0000	7924.1143	289.9634	0.0000	0.0000	1.0750	3.0	0.0000	7924.1143	289.9634	0.0000	1.0750
40	8	8	5000	8.394	1500	0	3	3.0	0.0000	7943.6572	278.9193	0.0000	0.0000	1.0827	3.0	0.0000	7943.6572	278.9193	0.0000	1.0827
40	8	8	5000	8.394	1500	0	4	3.0	0.0000	7744.1357	261.8168	0.0000	0.0000	1.0298	3.0	0.0000	7744.1357	261.8168	0.0000	1.0298
40	8	8	5000	8.394	1500	0	5	3.0	0.0000	7952.0986	288.9843	0.0000	0.0000	1.0875	3.0	0.0000	7952.0986	288.9843	0.0000	1.0875
40	8	8	5000	8.394	1500	0	6	3.0	0.0000	7734.7148	267.2997	0.0000	0.0000	1.0313	3.0	0.0000	7734.7148	267.2997	0.0000	1.0313
40	8	8	6000	8.902	1500	0	1	3.0	0.0000	8101.1650	279.3567	0.0000	0.0000	1.0268	3.0	0.0000	8101.1650	279.3567	0.0000	1.0268
40	8	8	6000	8.902	1500	0	2	3.0	0.0000	8275.6494	305.4762	0.0000	0.0000	1.0751	3.0	0.0000	8275.6494	305.4762	0.0000	1.0751
40	8	8	6000	8.902	1500	0	3	3.0	0.0000	8289.9893	291.2242	0.0000	0.0000	1.0907	3.0	0.0000	8289.9893	291.2242	0.0000	1.0907
40	8	8	6000	8.902	1500	0	4	3.0	0.0000	8077.5635	275.9550	0.0000	0.0000	1.0327	3.0	0.0000	8077.5635	275.9550	0.0000	1.0327
40	8	8	6000	8.902	1500	0	5	3.0	0.0000	8296.3271	298.2678	0.0000	0.0000	1.0859	3.0	0.0000	8296.3271	298.2678	0.0000	1.0859

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [°]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	6000	8.902	1500	0	6	3.0	0.0000	8083.4438	289.7347	0.0000	0.0000	1.0376	0.0192	3.0	0.0000	8083.4438	289.7347	0.0000	0.0000	1.0376	0.0192
40	8	8	7000	9.355	1500	0	1	3.0	0.0000	8404.8662	290.6331	0.0000	0.0000	1.0280	0.0203	3.0	0.0000	8404.8662	290.6331	0.0000	0.0000	1.0280	0.0203
40	8	8	7000	9.355	1500	0	2	3.0	0.0000	8581.5195	315.1805	0.0000	0.0000	1.0828	0.0274	3.0	0.0000	8581.5195	315.1805	0.0000	0.0000	1.0828	0.0274
40	8	8	7000	9.355	1500	0	3	3.0	0.0000	8579.6777	306.8347	0.0000	0.0000	1.0952	0.0238	3.0	0.0000	8579.6777	306.8347	0.0000	0.0000	1.0952	0.0238
40	8	8	7000	9.355	1500	0	4	3.0	0.0000	8377.1123	282.9493	0.0000	0.0000	1.0359	0.0191	3.0	0.0000	8377.1123	282.9493	0.0000	0.0000	1.0359	0.0191
40	8	8	7000	9.355	1500	0	5	3.0	0.0000	8599.4365	307.5804	0.0000	0.0000	1.0954	0.0266	3.0	0.0000	8599.4365	307.5804	0.0000	0.0000	1.0954	0.0266
40	8	8	7000	9.355	1500	0	6	3.0	0.0000	8383.9824	288.4592	0.0000	0.0000	1.0344	0.0189	3.0	0.0000	8383.9824	288.4592	0.0000	0.0000	1.0344	0.0189
40	8	8	8000	9.766	1500	0	1	3.0	0.0000	8676.1504	299.0470	0.0000	0.0000	1.0311	0.0204	3.0	0.0000	8676.1504	299.0470	0.0000	0.0000	1.0311	0.0204
40	8	8	8000	9.766	1500	0	2	3.0	0.0000	8857.9092	325.5041	0.0000	0.0000	1.0813	0.0272	3.0	0.0000	8857.9092	325.5041	0.0000	0.0000	1.0813	0.0272
40	8	8	8000	9.766	1500	0	3	3.0	0.0000	8872.9033	308.1967	0.0000	0.0000	1.0968	0.0195	3.0	0.0000	8872.9033	308.1967	0.0000	0.0000	1.0968	0.0195
40	8	8	8000	9.766	1500	0	4	3.0	0.0000	8644.7842	297.2658	0.0000	0.0000	1.0405	0.0182	3.0	0.0000	8644.7842	297.2658	0.0000	0.0000	1.0405	0.0182
40	8	8	8000	9.766	1500	0	5	3.0	0.0000	8881.7969	305.0956	0.0000	0.0000	1.0969	0.0252	3.0	0.0000	8881.7969	305.0956	0.0000	0.0000	1.0969	0.0252
40	8	8	8000	9.766	1500	0	6	3.0	0.0000	8655.6377	298.2193	0.0000	0.0000	1.0359	0.0191	3.0	0.0000	8655.6377	298.2193	0.0000	0.0000	1.0359	0.0191
40	8	8	9000	10.14	1500	0	1	3.0	0.0000	8926.1387	308.1341	0.0000	0.0000	1.0281	0.0234	3.0	0.0000	8926.1387	308.1341	0.0000	0.0000	1.0281	0.0234
40	8	8	9000	10.14	1500	0	2	3.0	0.0000	9112.3564	335.2980	0.0000	0.0000	1.0842	0.0260	3.0	0.0000	9112.3564	335.2980	0.0000	0.0000	1.0842	0.0260
40	8	8	9000	10.14	1500	0	3	3.0	0.0000	9127.7988	317.6373	0.0000	0.0000	1.1031	0.0243	3.0	0.0000	9127.7988	317.6373	0.0000	0.0000	1.1031	0.0243
40	8	8	9000	10.14	1500	0	4	3.0	0.0000	8893.3965	304.5991	0.0000	0.0000	1.0405	0.0205	3.0	0.0000	8893.3965	304.5991	0.0000	0.0000	1.0405	0.0205
40	8	8	9000	10.14	1500	0	5	3.0	0.0000	9135.5410	315.1808	0.0000	0.0000	1.1018	0.0244	3.0	0.0000	9135.5410	315.1808	0.0000	0.0000	1.1018	0.0244
40	8	8	9000	10.14	1500	0	6	3.0	0.0000	8905.3262	307.2119	0.0000	0.0000	1.0407	0.0192	3.0	0.0000	8905.3262	307.2119	0.0000	0.0000	1.0407	0.0192
40	8	8	10000	10.49	1500	0	1	3.0	0.0000	9157.9375	316.5612	0.0000	0.0000	1.0342	0.0189	3.0	0.0000	9157.9375	316.5612	0.0000	0.0000	1.0342	0.0189
40	8	8	10000	10.49	1500	0	2	3.0	0.0000	9349.4434	344.1668	0.0000	0.0000	1.0875	0.0237	3.0	0.0000	9349.4434	344.1668	0.0000	0.0000	1.0875	0.0237
40	8	8	10000	10.49	1500	0	3	3.0	0.0000	9369.4473	330.8804	0.0000	0.0000	1.1000	0.0255	3.0	0.0000	9369.4473	330.8804	0.0000	0.0000	1.1000	0.0255
40	8	8	10000	10.49	1500	0	4	3.0	0.0000	9121.5449	314.4198	0.0000	0.0000	1.0454	0.0179	3.0	0.0000	9121.5449	314.4198	0.0000	0.0000	1.0454	0.0179
40	8	8	10000	10.49	1500	0	5	3.0	0.0000	9375.7500	320.9715	0.0000	0.0000	1.1061	0.0283	3.0	0.0000	9375.7500	320.9715	0.0000	0.0000	1.1061	0.0283
40	8	8	10000	10.49	1500	0	6	3.0	0.0000	9143.5449	319.1400	0.0000	0.0000	1.0407	0.0177	3.0	0.0000	9143.5449	319.1400	0.0000	0.0000	1.0407	0.0177
40	8	8	1000	5	1500	80	1	2.8	0.4526	2840.6001	343.7424	110.4000	16.2408	0.1389	0.0238	2.8	0.4526	2840.6001	343.7424	110.4000	16.2408	0.1389	0.0238
40	8	8	1000	5	1500	80	2	2.8	0.4526	2924.6001	362.5554	114.5000	16.3909	0.1421	0.0244	2.8	0.4526	2924.6001	362.5554	114.5000	16.3909	0.1421	0.0244
40	8	8	1000	5	1500	80	3	2.8	0.4526	2957.2000	357.1150	116.3000	16.7473	0.1421	0.0208	2.8	0.4526	2957.2000	357.1150	116.3000	16.7473	0.1421	0.0208
40	8	8	1000	5	1500	80	4	2.8	0.4526	3000.2000	362.2587	111.3000	16.8759	0.1453	0.0210	2.8	0.4526	3000.2000	362.2587	111.3000	16.8759	0.1453	0.0210
40	8	8	1000	5	1500	80	5	2.8	0.4526	3023.2000	389.7054	118.6000	17.9227	0.1406	0.0241	2.8	0.4526	3023.2000	389.7054	118.6000	17.9227	0.1406	0.0241
40	8	8	1000	5	1500	80	6	2.8	0.4526	2959.0000	370.4637	109.5000	17.0743	0.1453	0.0210	2.8	0.4526	2959.0000	370.4637	109.5000	17.0743	0.1453	0.0210
40	8	8	2000	6.25	1500	80	1	1.0	0.0000	2216.8000	266.2616	37.9000	8.9591	0.1187	0.0077	2.0	0.7543	2169.8501	238.6486	35.1000	7.9139	0.2172	0.0704
40	8	8	2000	6.25	1500	80	2	1.0	0.0000	2327.7000	254.0040	40.8000	8.2265	0.1297	0.0094	1.8	0.7390	2286.3501	226.4780	37.8000	6.7950	0.2032	0.0705
40	8	8	2000	6.25	1500	80	3	1.0	0.0000	2298.2500	280.6139	41.8000	9.6403	0.1218	0.0070	1.8	0.7390	2239.0500	235.5626	38.2000	7.7199	0.2033	0.0730
40	8	8	2000	6.25	1500	80	4	1.0	0.0000	2247.6001	257.3464	36.7000	8.8286	0.1295	0.0075	1.8	0.7390	2200.4500	224.8216	33.8000	7.5486	0.2093	0.0714
40	8	8	2000	6.25	1500	80	5	1.0	0.0000	2270.9500	254.4534	39.7000	8.9120	0.1220	0.0070	1.6	0.6913	2235.8000	230.6973	37.3000	7.5880	0.1813	0.0651
40	8	8	2000	6.25	1500	80	6	1.0	0.0000	2252.8999	251.4944	36.6000	9.3491	0.1281	0.0088	1.8	0.7390	2210.6001	225.5869	33.9000	8.0281	0.2079	0.0724
40	8	8	3000	7.121	1500	80	1	1.0	0.0000	2004.7936	188.0942	4.9000	2.5788	0.1987	0.0183	1.4	0.6034	1995.8962	183.8867	4.7000	2.4336	0.2550	0.0825
40	8	8	3000	7.121	1500	80	2	1.0	0.0000	2160.1209	165.6905	5.8000	2.0182	0.2157	0.0137	1.4	0.6034	2149.3511	168.0198	5.2000	2.1546	0.2781	0.0905
40	8	8	3000	7.121	1500	80	3	1.0	0.0000	2203.9126	189.4731	7.0000	2.1860	0.2173	0.0144	1.6	0.6913	2199.8154	186.5971	6.7000	2.0532	0.3126	0.1062
40	8	8	3000	7.121	1500	80	4	1.0	0.0000	1986.5505	193.5479	4.7000	2.1873	0.2000	0.0188	1.4	0.6034	1984.3264	194.0164	4.5000	2.3911	0.2579	0.0817
40	8	8	3000	7.121	1500	80	5	1.0	0.0000	2164.9482	148.0281	6.8000	2.2324	0.2154	0.0157	1.4	0.6034	2159.8511	146.2591	6.3000	2.2132	0.2796	0.0872
40	8	8	3000	7.121	1500	80	6	1.0	0.0000	2001.1449	169.1441	4.9000	2.0642	0.2016	0.0133	1.4	0.6034	1979.6777	170.8063	4.6000	2.1387	0.2563	0.0751
40	8	8	4000	7.813	1500	80	1	1.0	0.0000	2102.7749	224.7299	0.4000	0.6913	0.1984	0.0199	1.4	0.6034	2082.8750	208.1634	0.0000	0.0000	0.2595	0.0804
40	8	8	4000	7.813	1500	80	2	1.0	0.0000	2254.3875	174.2255	0.4000	0.5003	0.2219	0.0145	1.6	0.6913	2247.3750	175.2031	0.0000	0.0000	0.3217	0.1037
40	8	8	4000	7.813	1500	80	3	1.0	0.0000	2317.1875	191.0488	0.5000	0.6954	0.2296	0.0191	1.2	0.4526	2315.0249	192.9810	0.4000	0.6913	0.2657	0.0810
40	8	8	4000	7.813	1500	80	4	1.0	0.0000	2064.3000	210.5592	0.0000	0.0000	0.2016	0.0238	1.4	0.6034	2061.6626	209.5059	0.0000	0.0000	0.2642	0.0857
40	8	8	4000	7.813	1500	80	5	1.0	0.0000	2314.2124	189.1724	0.3000	0.4830	0.2313	0.0229	1.2	0.4526	2313.0500	189.4879	0.2000	0.4526	0.2687	0.0764
40	8	8	4000	7.813	1500	80	6	1.0	0.0000	2052.1125	190.2920	0.1000	0.2263	0.1999	0.0157	1.6	0.6913	2032.2500	191.4475	0.0000	0.0000	0.2813	0.0862

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	5000	8.394	1500	80	1	1.0	0.0000	2211.0652	0.0000	0.0000	0.1954	1.4	0.0208	2194.4131	0.0000	224.6749	0.2594	0.0864
40	8	8	5000	8.394	1500	80	2	1.0	0.0000	2362.3765	0.0000	0.0000	0.2249	1.4	0.0140	2358.8611	0.0000	186.6757	0.2921	0.0908
40	8	8	5000	8.394	1500	80	3	1.0	0.0000	2445.7063	0.0000	0.0000	0.2330	1.2	0.0201	2443.2273	0.0000	202.7736	0.2674	0.0806
40	8	8	5000	8.394	1500	80	4	1.0	0.0000	2157.8091	0.0000	0.0000	0.2092	1.2	0.0151	2156.8091	0.0000	215.9743	0.2326	0.0535
40	8	8	5000	8.394	1500	80	5	1.0	0.0000	2427.8540	0.0000	0.0000	0.2344	1.2	0.0231	2423.8962	0.0000	200.6651	0.2734	0.0745
40	8	8	5000	8.394	1500	80	6	1.0	0.0000	2146.4934	0.0000	0.0000	0.1999	1.6	0.0156	2126.4624	0.0000	201.4388	0.2842	0.0868
40	8	8	6000	8.902	1500	80	1	1.0	0.0000	2303.7075	0.0000	0.0000	0.1983	1.4	0.0198	2286.5454	0.0000	234.8168	0.2625	0.0850
40	8	8	6000	8.902	1500	80	2	1.0	0.0000	2461.4102	0.0000	0.0000	0.2233	1.4	0.0182	2456.2886	0.0000	197.0606	0.2921	0.0913
40	8	8	6000	8.902	1500	80	3	1.0	0.0000	2547.8799	0.0000	0.0000	0.2343	1.4	0.0216	2546.6997	0.0000	210.7740	0.3094	0.1026
40	8	8	6000	8.902	1500	80	4	1.0	0.0000	2244.1201	0.0000	0.0000	0.2093	1.2	0.0192	2243.1201	0.0000	225.9943	0.2358	0.0576
40	8	8	6000	8.902	1500	80	5	1.0	0.0000	2530.7173	0.0000	0.0000	0.2409	1.4	0.0231	2526.1567	0.0000	209.0472	0.3143	0.0947
40	8	8	6000	8.902	1500	80	6	1.0	0.0000	2236.5986	0.0000	0.0000	0.2031	1.6	0.0129	2215.1558	0.0000	209.4931	0.2828	0.0850
40	8	8	7000	9.355	1500	80	1	1.0	0.0000	2391.5208	0.0000	0.0000	0.2081	1.6	0.0191	2370.3240	0.0000	239.8006	0.2955	0.0893
40	8	8	7000	9.355	1500	80	2	1.0	0.0000	2549.3481	0.0000	0.0000	0.2250	1.4	0.0143	2538.6646	0.0000	201.0030	0.2924	0.0907
40	8	8	7000	9.355	1500	80	3	1.0	0.0000	2638.4639	0.0000	0.0000	0.2376	1.4	0.0164	2636.1929	0.0000	217.5637	0.3047	0.0986
40	8	8	7000	9.355	1500	80	4	1.0	0.0000	2326.4309	0.0000	0.0000	0.2109	1.2	0.0176	2325.4309	0.0000	233.3620	0.2376	0.0569
40	8	8	7000	9.355	1500	80	5	1.0	0.0000	2621.0671	0.0000	0.0000	0.2405	1.2	0.0212	2615.5254	0.0000	219.4179	0.2781	0.0735
40	8	8	7000	9.355	1500	80	6	1.0	0.0000	2314.7468	0.0000	0.0000	0.2047	1.6	0.0170	2293.1792	0.0000	218.3267	0.2874	0.0854
40	8	8	8000	9.766	1500	80	1	1.0	0.0000	2464.3657	0.0000	0.0000	0.2001	1.6	0.0211	2443.3938	0.0000	251.2983	0.2925	0.0937
40	8	8	8000	9.766	1500	80	2	1.0	0.0000	2629.4063	0.0000	0.0000	0.2233	1.4	0.0130	2623.1938	0.0000	209.2179	0.2906	0.0913
40	8	8	8000	9.766	1500	80	3	1.0	0.0000	2724.2407	0.0000	0.0000	0.2359	1.4	0.0163	2721.6875	0.0000	226.4765	0.3047	0.1015
40	8	8	8000	9.766	1500	80	4	1.0	0.0000	2397.3501	0.0000	0.0000	0.2078	1.2	0.0183	2396.3501	0.0000	242.4821	0.2312	0.0549
40	8	8	8000	9.766	1500	80	5	1.0	0.0000	2703.5688	0.0000	0.0000	0.2404	1.4	0.0230	2696.0625	0.0000	226.4540	0.3169	0.0960
40	8	8	8000	9.766	1500	80	6	1.0	0.0000	2387.5376	0.0000	0.0000	0.2063	1.6	0.0180	2365.1125	0.0000	225.3663	0.2876	0.0832
40	8	8	9000	10.14	1500	80	1	1.0	0.0000	2532.3730	0.0000	0.0000	0.2014	1.6	0.0207	2510.8726	0.0000	258.7204	0.2982	0.0951
40	8	8	9000	10.14	1500	80	2	1.0	0.0000	2702.2178	0.0000	0.0000	0.2235	1.4	0.0158	2695.7034	0.0000	215.5295	0.2938	0.0929
40	8	8	9000	10.14	1500	80	3	1.0	0.0000	2799.6902	0.0000	0.0000	0.2391	1.4	0.0198	2796.2617	0.0000	233.4296	0.3108	0.1024
40	8	8	9000	10.14	1500	80	4	1.0	0.0000	2463.5723	0.0000	0.0000	0.2094	1.2	0.0185	2462.5723	0.0000	249.6706	0.2359	0.0574
40	8	8	9000	10.14	1500	80	5	1.0	0.0000	2778.8899	0.0000	0.0000	0.2407	1.4	0.0238	2770.2329	0.0000	235.5489	0.3157	0.0938
40	8	8	9000	10.14	1500	80	6	1.0	0.0000	2452.8579	0.0000	0.0000	0.2077	1.6	0.0190	2430.4290	0.0000	232.1974	0.2921	0.0859
40	8	8	10000	10.49	1500	80	1	1.0	0.0000	2595.4316	0.0000	0.0000	0.2080	1.6	0.0183	2573.4414	0.0000	265.6039	0.2955	0.0891
40	8	8	10000	10.49	1500	80	2	1.0	0.0000	2769.5457	0.0000	0.0000	0.2297	1.4	0.0151	2763.1514	0.0000	221.4122	0.2954	0.0899
40	8	8	10000	10.49	1500	80	3	1.0	0.0000	2868.9080	0.0000	0.0000	0.2374	1.4	0.0217	2865.4094	0.0000	239.8772	0.3079	0.1042
40	8	8	10000	10.49	1500	80	4	1.0	0.0000	2525.1614	0.0000	0.0000	0.2110	1.2	0.0218	2524.1614	0.0000	256.4570	0.2375	0.0581
40	8	8	10000	10.49	1500	80	5	1.0	0.0000	2847.6177	0.0000	0.0000	0.2377	1.4	0.0222	2838.8206	0.0000	241.9469	0.3143	0.0972
40	8	8	10000	10.49	1500	80	6	1.0	0.0000	2514.1670	0.0000	0.0000	0.2081	1.6	0.0175	2491.1782	0.0000	238.6305	0.2894	0.0850

Table C.4: Comparison of fiber-bifurcation-based heuristics with the optical-reach customization for the 8-node network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	4	4	1000	2	500	0	1	26.6	1.6247	5909.2002	366.0000	0.5533	17.1830	26.6	1.6247	5909.2002	366.0000	214.6959	0.5533	17.1830
10	4	4	1000	2	500	0	2	26.6	1.6247	5957.2002	370.7000	0.5533	18.4169	26.6	1.6247	5957.2002	370.7000	219.3763	0.5533	18.4169
10	4	4	1000	2	500	0	3	26.6	1.6247	6010.7998	371.8000	0.5593	17.0694	26.6	1.6247	6010.7998	371.8000	226.4085	0.5593	17.0694
10	4	4	1000	2	500	0	4	26.6	1.6247	5982.7998	379.6000	0.5736	23.4479	26.6	1.6247	5982.7998	379.6000	201.1693	0.5736	23.4479
10	4	4	1000	2	500	0	5	26.8	1.7133	6030.0000	373.0000	0.5720	17.3740	26.8	1.7133	6030.0000	373.0000	225.2728	0.5720	17.3740
10	4	4	1000	2	500	0	6	26.8	1.7133	5986.7998	377.2000	0.5760	24.4471	26.8	1.7133	5986.7998	377.2000	220.2578	0.5760	24.4471
10	4	4	2000	2.5	500	0	1	9.4	0.6034	4093.2000	183.9005	0.3720	19.6866	11.8	1.0066	3921.3999	110.8000	118.0332	0.3720	19.6866
10	4	4	2000	2.5	500	0	2	9.2	0.4526	4154.5000	202.1669	0.3657	20.3622	11.6	1.1782	3967.8000	114.7000	121.0995	0.3657	20.3622
10	4	4	2000	2.5	500	0	3	9.4	0.6034	4161.2002	215.9335	0.3779	16.5422	12.0	1.0119	3957.6001	112.9000	118.3047	0.3779	16.5422
10	4	4	2000	2.5	500	0	4	9.6	0.6913	4093.3000	168.6886	0.4125	18.9832	12.0	1.0119	3958.3999	122.4364	110.5000	0.4125	18.9832
10	4	4	2000	2.5	500	0	5	9.2	0.4526	4210.7998	242.8103	0.3673	18.2248	12.0	1.0119	3957.3999	124.7562	112.8000	0.3673	18.2248
10	4	4	2000	2.5	500	0	6	9.4	0.6034	4098.7002	170.1476	0.3938	17.3184	11.8	1.2068	3939.6001	110.4000	116.8955	0.3938	17.3184
10	4	4	3000	2.849	500	0	1	8.0	0.7543	3620.5874	202.6135	0.3768	27.3685	11.8	1.2068	3371.1431	105.0352	17.7000	0.3768	27.3685
10	4	4	3000	2.849	500	0	2	8.0	0.7543	3712.4614	167.4089	0.4157	20.7414	11.6	0.9659	3459.9375	120.2931	2.6603	0.4157	20.7414
10	4	4	3000	2.849	500	0	3	8.0	0.7543	3780.6792	200.9529	0.3844	0.1015	11.6	1.3577	3452.1284	103.6604	18.4000	0.3844	0.1015
10	4	4	3000	2.849	500	0	4	8.0	0.7543	3642.5815	167.0983	0.4218	21.4059	11.6	1.1782	3374.3433	112.1674	17.4000	0.4218	21.4059
10	4	4	3000	2.849	500	0	5	8.4	0.6913	3626.2878	146.1152	0.4782	20.7061	11.4	1.3151	3435.6890	109.2768	18.7000	0.4782	20.7061
10	4	4	3000	2.849	500	0	6	8.0	0.7543	3632.4624	156.8074	0.4187	24.6994	11.6	1.3577	3396.2734	96.2640	17.8000	0.4187	24.6994
10	4	4	4000	3.125	500	0	1	8.0	0.7543	3409.0208	166.8781	0.4234	14.6091	10.2	0.7390	3281.2422	97.7102	0.9000	0.4234	14.6091
10	4	4	4000	3.125	500	0	2	8.0	0.7543	3501.8660	177.8563	0.4804	17.5831	10.2	0.7390	3351.3579	112.8334	0.2000	0.4804	17.5831
10	4	4	4000	3.125	500	0	3	8.2	0.7390	3506.7065	141.4323	0.4412	21.0000	10.2	0.7390	3377.6667	101.8591	1.1000	0.4412	21.0000
10	4	4	4000	3.125	500	0	4	8.0	0.7543	3464.9302	146.2161	0.4501	17.8265	10.8	0.8124	3283.3015	101.1732	0.0000	0.4501	17.8265
10	4	4	4000	3.125	500	0	5	8.4	0.6913	3451.0808	126.4479	0.5328	14.6428	10.2	0.7390	3375.7102	102.0333	0.3000	0.5328	14.6428
10	4	4	4000	3.125	500	0	6	8.0	0.7543	3419.9702	150.1115	0.4424	24.1356	10.2	1.0066	3286.0449	88.1486	0.4000	0.4424	24.1356
10	4	4	5000	3.358	500	0	1	8.4	0.6913	3441.7700	87.6297	0.3968	6.0552	10.8	0.8124	3316.5854	107.5265	0.0000	0.3968	6.0552
10	4	4	5000	3.358	500	0	2	8.2	0.7390	3492.8848	112.3763	0.4281	4.6305	11.2	1.2531	3388.9915	112.7937	0.0000	0.4281	4.6305
10	4	4	5000	3.358	500	0	3	8.6	0.6034	3507.7473	114.3029	0.4393	3.2494	11.4	1.3151	3412.7227	101.1664	0.0000	0.4393	3.2494
10	4	4	5000	3.358	500	0	4	8.4	0.6913	3352.2212	99.4990	0.4724	4.6000	10.8	0.7871	3300.9980	107.6243	0.1000	0.4724	4.6000
10	4	4	5000	3.358	500	0	5	8.6	0.6034	3500.4077	135.3721	0.4406	3.8378	10.2	1.2068	3413.8755	110.6462	0.7000	0.4406	3.8378
10	4	4	5000	3.358	500	0	6	8.6	0.6034	3383.5176	114.3301	0.4609	3.4924	10.8	1.0560	3320.4629	103.2021	0.0000	0.4609	3.4924
10	4	4	6000	3.561	500	0	1	8.4	0.6913	3368.9773	84.3218	0.4500	5.1356	10.8	0.8124	3298.2886	104.3091	0.0000	0.4500	5.1356
10	4	4	6000	3.561	500	0	2	8.6	0.6034	3451.1746	138.7089	0.5499	0.8667	10.4	0.9659	3401.4321	116.1905	0.0000	0.5499	0.8667
10	4	4	6000	3.561	500	0	3	8.6	0.6034	3441.3188	109.7575	0.5078	1.3492	10.8	0.8124	3407.8560	93.5644	0.0000	0.5078	1.3492
10	4	4	6000	3.561	500	0	4	8.4	0.6913	3342.3235	121.0744	0.5062	4.5060	9.6	0.9659	3296.1504	108.0259	0.0000	0.9659	4.5060
10	4	4	6000	3.561	500	0	5	8.6	0.6034	3441.3716	117.4503	0.5283	0.4526	10.0	1.0119	3421.1128	113.6420	0.0000	0.5283	0.4526
10	4	4	6000	3.561	500	0	6	8.4	0.6913	3359.5005	107.0302	0.5000	4.7727	10.0	1.2162	3308.1472	98.5388	0.0000	0.5000	4.7727
10	4	4	7000	3.742	500	0	1	8.4	0.6913	3403.3364	73.5013	0.3964	3.3899	11.0	0.6746	3312.5483	105.6048	0.0000	0.3964	3.3899
10	4	4	7000	3.742	500	0	2	8.2	0.7390	3462.0339	113.0969	0.4344	1.4311	11.2	1.4231	3396.8606	115.5410	0.0000	0.4344	1.4311
10	4	4	7000	3.742	500	0	3	8.6	0.6034	3510.2397	105.6294	0.4214	0.3017	11.4	0.9051	3423.7297	99.5640	0.0000	0.4214	0.3017
10	4	4	7000	3.742	500	0	4	8.4	0.6913	3345.8555	95.0205	0.4658	2.6571	10.8	1.5749	3310.0034	107.9209	0.0000	0.4658	2.6571
10	4	4	7000	3.742	500	0	5	8.6	0.6034	3490.5840	108.6327	0.4342	0.0000	11.0	0.6746	3423.4766	117.4887	0.0000	0.4342	0.0000
10	4	4	7000	3.742	500	0	6	8.6	0.6034	3371.2605	120.0344	0.4652	2.0239	10.4	0.9659	3314.0847	103.5099	0.0000	0.4652	2.0239
10	4	4	8000	3.906	500	0	1	8.4	0.6913	3399.6790	77.8259	0.3970	3.1317	10.8	0.8124	3311.0168	104.7059	0.0000	0.3970	3.1317
10	4	4	8000	3.906	500	0	2	8.2	0.7390	3466.8640	113.1239	0.4376	0.8845	11.2	1.4231	3395.1816	115.9123	0.0000	0.4376	0.8845
10	4	4	8000	3.906	500	0	3	8.6	0.6034	3508.8716	106.0595	0.4250	0.2263	11.4	0.9051	3423.7297	99.5640	0.0000	0.4250	0.2263
10	4	4	8000	3.906	500	0	4	8.4	0.6913	3352.1147	94.4489	0.4640	2.6613	10.8	1.5749	3310.4585	107.6665	0.0000	0.4640	2.6613
10	4	4	8000	3.906	500	0	5	8.6	0.6034	3494.4207	108.1994	0.4281	0.0000	10.8	0.8124	3427.7839	120.1210	0.0000	0.4281	0.0000

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]				
10	4	4	8000	3.906	500	0	6	8.6	0.6034	3367.9595	116.4223	0.6000	1.1289	0.4625	0.0681	10.4	0.9659	3314.0847	103.5099	0.0000	0.0000	0.7046	0.1101
10	4	4	9000	4.057	500	0	1	8.4	0.6913	3398.3267	77.9076	1.5000	3.1508	0.3955	0.0696	10.8	0.8124	3311.0168	104.7059	0.0000	0.0000	0.7218	0.0768
10	4	4	9000	4.057	500	0	2	8.6	0.6034	3454.2063	123.6159	0.0000	0.0000	0.4827	0.0726	11.2	1.4231	3396.4233	117.2876	0.0000	0.0000	0.8000	0.1188
10	4	4	9000	4.057	500	0	3	8.6	0.6034	3506.4199	104.0254	0.0000	0.0000	0.4357	0.0683	11.4	0.9051	3423.6575	99.5752	0.0000	0.0000	0.8048	0.0939
10	4	4	9000	4.057	500	0	4	8.4	0.6913	3352.8516	94.4975	1.4000	2.6816	0.4626	0.0750	10.8	1.5749	3310.4585	107.6665	0.0000	0.0000	0.7530	0.1399
10	4	4	9000	4.057	500	0	5	8.6	0.6034	3499.8755	105.6211	0.0000	0.0000	0.4300	0.0695	10.8	0.8124	3428.4421	119.6059	0.0000	0.0000	0.7608	0.0845
10	4	4	9000	4.057	500	0	6	8.6	0.6034	3367.1519	113.9097	0.5000	1.1314	0.4576	0.0651	10.4	0.9659	3315.0247	103.2150	0.0000	0.0000	0.7030	0.1102
10	4	4	10000	4.197	500	0	1	8.4	0.6913	3397.6479	79.0332	1.4000	3.1679	0.3939	0.0669	10.8	0.8124	3308.4778	104.4030	0.0000	0.0000	0.7170	0.0788
10	4	4	10000	4.197	500	0	2	8.4	0.6913	3456.4285	119.3951	0.2000	0.4526	0.4562	0.0785	11.2	1.4231	3392.9673	115.3006	0.0000	0.0000	0.7937	0.1173
10	4	4	10000	4.197	500	0	3	8.6	0.6034	3500.4185	106.7688	0.0000	0.0000	0.4390	0.0682	11.2	1.0560	3423.6704	104.7850	0.0000	0.0000	0.7955	0.1062
10	4	4	10000	4.197	500	0	4	8.4	0.6913	3351.1726	96.9204	1.3000	2.6995	0.4671	0.0785	11.0	1.3492	3309.3679	108.2914	0.0000	0.0000	0.7703	0.1095
10	4	4	10000	4.197	500	0	5	8.6	0.6034	3512.7212	120.4092	1.2000	2.2577	0.4250	0.0728	10.8	0.8124	3426.5649	114.3668	0.0000	0.0000	0.7562	0.0850
10	4	4	10000	4.197	500	0	6	8.6	0.6034	3367.1519	113.9097	0.5000	1.1314	0.4625	0.0646	10.4	0.9659	3315.0247	103.2150	0.0000	0.0000	0.7030	0.1093
10	4	4	1000	2	500	80	1	8.0	1.3908	1618.4000	175.6054	94.3000	13.4969	0.1093	0.0217	8.0	1.3908	1618.4000	175.6054	94.3000	13.4969	0.1093	0.0217
10	4	4	1000	2	500	80	2	8.0	1.3908	1663.6000	150.4302	99.7000	14.0827	0.1124	0.0196	8.0	1.3908	1663.6000	150.4302	99.7000	14.0827	0.1124	0.0196
10	4	4	1000	2	500	80	3	8.0	1.3908	1670.0000	160.5391	97.8000	12.5160	0.0193	0.0196	8.0	1.3908	1670.0000	160.5391	97.8000	12.5160	0.0193	0.0193
10	4	4	1000	2	500	80	4	8.0	1.3908	1672.4000	182.2755	93.8000	14.6325	0.1158	0.0227	8.0	1.3908	1672.4000	182.2755	93.8000	14.6325	0.1158	0.0227
10	4	4	1000	2	500	80	5	8.0	1.3908	1683.2000	172.3913	100.0000	15.0699	0.0195	0.0195	8.0	1.3908	1683.2000	172.3913	100.0000	15.0699	0.0195	0.0195
10	4	4	1000	2	500	80	6	8.0	1.3908	1696.0000	193.3335	96.5000	16.0613	0.1126	0.0194	8.0	1.3908	1696.0000	193.3335	96.5000	16.0613	0.1126	0.0194
10	4	4	2000	2.5	500	80	1	3.6	0.6913	1231.2000	159.1296	36.6000	9.5299	0.0906	0.0181	5.6	0.9659	1112.3000	119.4927	26.1000	4.2727	0.1516	0.0284
10	4	4	2000	2.5	500	80	2	3.2	0.4526	1287.2000	170.2111	40.0000	10.6347	0.0968	0.0172	5.4	1.1289	1198.7000	126.9960	28.0000	3.9481	0.1563	0.0338
10	4	4	2000	2.5	500	80	3	3.6	0.6913	1289.9000	167.0339	40.3000	10.3255	0.0938	0.0198	5.4	1.1289	1167.3000	115.9288	27.7000	4.1043	0.1515	0.0332
10	4	4	2000	2.5	500	80	4	3.6	0.6913	1291.7000	159.0632	36.0000	8.7050	0.0968	0.0202	5.2	1.2531	1154.3000	118.5690	26.0000	4.2800	0.1499	0.0381
10	4	4	2000	2.5	500	80	5	3.6	0.6913	1263.3000	152.3335	39.1000	9.9576	0.0938	0.0218	5.4	1.1289	1147.7000	106.8070	27.1000	3.8378	0.1531	0.0316
10	4	4	2000	2.5	500	80	6	3.6	0.6913	1235.9000	171.1984	35.8000	9.8793	0.0937	0.0205	5.4	1.1289	1136.1000	114.8499	24.8000	4.2906	0.1625	0.0358
10	4	4	3000	2.849	500	80	1	3.2	0.4526	1172.4360	148.5133	13.5000	7.0856	0.1062	0.0189	5.2	1.0560	1081.4227	99.3472	4.6000	2.2170	0.2141	0.0446
10	4	4	3000	2.849	500	80	2	3.2	0.4526	1245.8184	161.1527	14.4000	6.4725	0.1158	0.0238	5.0	1.1685	1136.9382	103.7082	5.7000	2.2890	0.2159	0.0482
10	4	4	3000	2.849	500	80	3	3.2	0.4526	1253.5732	160.3884	15.0000	6.5598	0.1172	0.0225	4.8	1.2531	1168.6628	107.2119	6.9000	2.3959	0.2110	0.0537
10	4	4	3000	2.849	500	80	4	3.2	0.4526	1159.2600	159.5000	13.1000	6.1595	0.1127	0.0180	4.8	1.2531	1071.6680	100.2307	4.7000	2.5253	0.1985	0.0572
10	4	4	3000	2.849	500	80	5	3.2	0.4526	1233.8156	144.3779	15.3000	6.8803	0.1126	0.0212	5.2	1.0560	1159.7839	117.4568	6.3000	2.0807	0.2249	0.0506
10	4	4	3000	2.849	500	80	6	3.2	0.4526	1156.3480	173.5018	14.9000	7.6209	0.1109	0.0186	4.8	1.0560	1044.9348	101.2289	4.8000	2.1011	0.2000	0.0440
10	4	4	4000	3.125	500	80	1	3.2	0.4526	1150.5146	126.8943	6.0000	4.4622	0.1126	0.0216	5.2	1.0560	1074.6165	100.4455	0.1000	0.2263	0.2187	0.0437
10	4	4	4000	3.125	500	80	2	3.2	0.4526	1205.0300	139.2421	5.7000	4.7590	0.1204	0.0230	5.0	1.1685	1159.6858	108.9265	0.2000	0.3017	0.2249	0.0539
10	4	4	4000	3.125	500	80	3	3.2	0.4526	1251.3289	137.8113	6.4000	5.4931	0.1218	0.0246	5.2	1.0560	1197.9094	105.6005	0.2000	0.3017	0.2345	0.0542
10	4	4	4000	3.125	500	80	4	3.2	0.4526	1132.2146	151.1060	5.7000	4.8887	0.1141	0.0197	4.8	1.2531	1065.8995	103.7903	0.0000	0.0000	0.2016	0.0578
10	4	4	4000	3.125	500	80	5	3.2	0.4526	1253.7272	137.2890	6.1000	5.1538	0.1204	0.0230	5.2	1.0560	1200.1921	110.1388	0.4000	0.3695	0.2389	0.0509
10	4	4	4000	3.125	500	80	6	3.2	0.6034	1084.3900	151.0203	5.7000	5.1934	0.1205	0.0269	4.8	1.0560	1014.4116	103.6024	0.2000	0.3017	0.1984	0.0462
10	4	4	5000	3.358	500	80	1	3.2	0.4526	1145.9058	128.3579	1.8000	2.3564	0.1110	0.0178	5.2	1.0560	1076.9866	98.5294	0.0000	0.0000	0.2141	0.0462
10	4	4	5000	3.358	500	80	2	3.2	0.4526	1214.6338	134.0687	2.6000	3.4267	0.1187	0.0204	5.0	1.1685	1166.0227	107.0990	0.0000	0.0000	0.2233	0.0556
10	4	4	5000	3.358	500	80	3	3.2	0.4526	1247.6473	126.8182	2.4000	3.3256	0.1235	0.0271	5.4	0.9051	1194.3273	103.9873	0.0000	0.0000	0.2484	0.0429
10	4	4	5000	3.358	500	80	4	3.2	0.4526	1130.3958	141.6452	2.2000	3.3528	0.1187	0.0191	5.0	1.1685	1073.2885	103.7149	0.0000	0.0000	0.2141	0.0494
10	4	4	5000	3.358	500	80	5	3.2	0.4526	1245.2595	125.2366	2.1000	2.8512	0.1250	0.0225	5.0	0.9541	1212.1301	107.9297	0.1000	0.2263	0.2267	0.0450
10	4	4	5000	3.358	500	80	6	3.2	0.4526	1082.6360	143.8805	1.8000	2.4741	0.1080	0.0178	4.8	1.0560	1012.5067	104.4638	0.0000	0.0000	0.1935	0.0454
10	4	4	6000	3.561	500	80	1	3.2	0.4526	1141.0289	120.8217	1.5000	2.6826	0.1128	0.0216	5.2	1.0560	1073.8269	101.8520	0.0000	0.0000	0.2174	0.0449
10	4	4	6000	3.561	500	80	2	3.2	0.4526	1216.1418	128.3303	1.3000	1.8180	0.1202	0.0242	5.2	1.0560	1176.1765	108.3892	0.0000	0.0000	0.2330	0.0470
10	4	4	6000	3.561	500	80	3	3.2	0.4526	1254.5728	114.6812	1.3000	2.0532	0.1220	0.0289	5.4	0.9051	1200.6155	99.6420	0.0000	0.0000	0.2450	0.0444
10	4	4	6000	3.561	500	80	4	3.2	0.4526	1121.6500	137.5102	1.2000	1.7133	0.1146	0.0155	4.8	1.2531	1071.7031	104.8152	0.0000	0.0000	0.2046	0.0561
10	4	4	6000	3.561	500	80	5	3.2	0.4526	1259.0374	128.3205	1.5000	2.4845	0.1218	0.0241	5.0	0.9541	1213.9749	108.9060	0.0000	0.0000	0.2264	0.0453
10	4	4	6000	3.561	500	80	6	3.2	0.4526	1082.0812	147.7238	1.3000	2.1347	0.1098	0.0165	4.6	1.1289	1013.8257	105.5874	0.0000	0.0000	0.1860	0.0511

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI	
10	4	4	7000	3.742	500	80	1	3.2	0.4526	1144.8127	124.7771	0.4000	0.6913	0.1092	0.0223	5.2	1.0560	1073.4611	97.9125	0.0000	0.0000	0.2158	0.0456
10	4	4	7000	3.742	500	80	2	3.2	0.4526	1216.0591	130.9872	0.1000	0.2263	0.1186	0.0243	5.0	1.1685	1171.6669	105.1183	0.0000	0.0000	0.2198	0.0545
10	4	4	7000	3.742	500	80	3	3.2	0.4526	1247.7048	118.0391	0.1000	0.2263	0.1186	0.0236	5.4	0.9051	1201.3937	100.4301	0.0000	0.0000	0.2504	0.0458
10	4	4	7000	3.742	500	80	4	3.2	0.4526	1119.1410	130.8126	0.2000	0.3017	0.1152	0.0214	5.0	1.1685	1071.8339	103.0278	0.0000	0.0000	0.2124	0.0514
10	4	4	7000	3.742	500	80	5	3.2	0.4526	1250.8259	114.3358	0.3000	0.6788	0.1176	0.0206	5.0	0.9541	1216.2527	102.5671	0.0000	0.0000	0.2232	0.0475
10	4	4	7000	3.742	500	80	6	3.2	0.4526	1077.0939	138.3863	0.1000	0.2263	0.1136	0.0198	4.8	1.0560	1015.7084	106.7589	0.0000	0.0000	0.1982	0.0447
10	4	4	8000	3.906	500	80	1	3.2	0.4526	1143.1454	122.7630	0.3000	0.6788	0.1093	0.0211	5.2	1.0560	1073.9302	98.1616	0.0000	0.0000	0.2139	0.0458
10	4	4	8000	3.906	500	80	2	3.2	0.4526	1216.7245	131.4565	0.0000	0.0000	0.1202	0.0264	5.0	1.1685	1173.2084	106.1668	0.0000	0.0000	0.2202	0.0545
10	4	4	8000	3.906	500	80	3	3.2	0.4526	1246.3792	115.9657	0.0000	0.0000	0.1188	0.0244	5.4	0.9051	1201.6628	100.4578	0.0000	0.0000	0.2501	0.0456
10	4	4	8000	3.906	500	80	4	3.2	0.4526	1119.4102	131.1318	0.1000	0.2263	0.1094	0.0190	5.0	1.1685	1074.5559	104.5563	0.0000	0.0000	0.2140	0.0514
10	4	4	8000	3.906	500	80	5	3.2	0.4526	1251.0953	115.3304	0.1000	2.4890	0.1194	0.0241	5.0	0.9541	1215.0720	102.5619	0.0000	0.0000	0.2249	0.0469
10	4	4	8000	3.906	500	80	6	3.2	0.4526	1074.4646	135.4996	0.0000	0.0000	0.1094	0.0190	4.8	1.0560	1015.7084	106.7589	0.0000	0.0000	0.1985	0.0440
10	4	4	9000	4.057	500	80	1	3.2	0.4526	1143.1113	122.6757	0.3000	0.6788	0.1078	0.0201	5.2	1.0560	1073.9302	98.1616	0.0000	0.0000	0.2171	0.0453
10	4	4	9000	4.057	500	80	2	3.2	0.4526	1217.9302	131.8178	0.0000	0.0000	0.1190	0.0248	5.0	1.1685	1173.2084	106.1668	0.0000	0.0000	0.2218	0.0579
10	4	4	9000	4.057	500	80	3	3.2	0.4526	1246.9988	117.0451	0.0000	0.0000	0.1219	0.0282	5.4	0.9051	1201.6628	100.4578	0.0000	0.0000	0.2468	0.0439
10	4	4	9000	4.057	500	80	4	3.2	0.4526	1113.3964	124.5163	0.1000	0.2263	0.1125	0.0230	5.0	1.1685	1073.3014	103.9451	0.0000	0.0000	0.2154	0.0531
10	4	4	9000	4.057	500	80	5	3.2	0.4526	1249.1287	113.8157	0.1000	2.4890	0.1206	0.0249	5.0	0.9541	1215.2422	102.3257	0.0000	0.0000	0.2265	0.0450
10	4	4	9000	4.057	500	80	6	3.2	0.4526	1074.4646	135.4996	0.0000	0.0000	0.1092	0.0218	4.8	1.0560	1015.7084	106.7589	0.0000	0.0000	0.1953	0.0454
10	4	4	10000	4.197	500	80	1	3.2	0.4526	1143.1113	122.6757	0.3000	0.6788	0.1108	0.0214	5.2	1.0560	1073.9302	98.1616	0.0000	0.0000	0.2154	0.0480
10	4	4	10000	4.197	500	80	2	3.2	0.4526	1217.9302	131.8178	0.0000	0.0000	0.1171	0.0264	5.0	1.1685	1173.2084	106.1668	0.0000	0.0000	0.2218	0.0548
10	4	4	10000	4.197	500	80	3	3.2	0.4526	1247.3262	117.2370	0.0000	0.0000	0.1234	0.0255	5.4	0.9051	1201.6628	100.4578	0.0000	0.0000	0.2469	0.0424
10	4	4	10000	4.197	500	80	4	3.2	0.4526	1113.2067	124.4383	0.1000	0.2263	0.1095	0.0224	5.0	1.1685	1073.3014	103.9451	0.0000	0.0000	0.2111	0.0497
10	4	4	10000	4.197	500	80	5	3.2	0.4526	1249.1287	113.8157	0.1000	2.4890	0.1184	0.0243	5.0	0.9541	1215.2422	102.3257	0.0000	0.0000	0.2282	0.0448
10	4	4	10000	4.197	500	80	6	3.2	0.4526	1074.4646	135.4996	0.0000	0.0000	0.1094	0.0190	4.8	1.0560	1015.7084	106.7589	0.0000	0.0000	0.1983	0.0442
10	4	4	1000	2	1500	0	1	78.2	4.5356	9305.5996	284.2246	623.2000	38.9676	2.7496	0.2700	78.2	4.5356	9305.5996	284.2246	623.2000	38.9676	2.7496	0.2700
10	4	4	1000	2	1500	0	2	78.2	4.5356	9366.7998	314.5629	617.6000	28.2904	2.7627	0.2748	78.2	4.5356	9366.7998	314.5629	617.6000	28.2904	2.7627	0.2748
10	4	4	1000	2	1500	0	3	78.2	4.5356	9383.5996	330.2444	616.4000	27.5879	2.7673	0.2755	78.2	4.5356	9383.5996	330.2444	616.4000	27.5879	2.7673	0.2755
10	4	4	1000	2	1500	0	4	78.2	4.5356	9338.7998	331.7174	653.1000	48.6612	2.8141	0.2772	78.2	4.5356	9338.7998	331.7174	653.1000	48.6612	2.8141	0.2772
10	4	4	1000	2	1500	0	5	78.2	4.5356	9412.7998	320.9104	618.7000	27.2389	0.2688	0.2799	78.2	4.5356	9412.7998	320.9104	618.7000	27.2389	0.2688	0.2799
10	4	4	1000	2	1500	0	6	78.2	4.5356	9329.2002	319.8884	647.3000	42.7842	2.8080	0.2790	78.2	4.5356	9329.2002	319.8884	647.3000	42.7842	2.8080	0.2790
10	4	4	2000	2.5	1500	0	1	26.2	1.9318	6700.1001	316.8701	266.7000	42.9050	1.4157	0.3376	32.0	3.1822	6175.8999	222.6325	188.4000	13.0736	2.6562	0.4455
10	4	4	2000	2.5	1500	0	2	26.0	1.6866	6773.0000	361.8770	276.4000	43.3130	1.3939	0.2735	33.6	3.1679	6215.2002	240.1832	186.2000	12.4705	2.9483	0.4251
10	4	4	2000	2.5	1500	0	3	26.4	1.6594	6730.5000	423.5674	252.4000	50.1055	1.4859	0.3144	34.0	2.8019	6201.2002	226.7066	186.0000	11.7140	2.9875	0.3356
10	4	4	2000	2.5	1500	0	4	27.2	1.7133	6494.2998	295.7617	239.4000	28.7472	1.6955	0.2873	34.4	2.8662	6104.5000	237.2538	187.1000	12.4643	3.0392	0.3885
10	4	4	2000	2.5	1500	0	5	26.4	1.7912	6768.0000	424.3943	251.4000	40.4369	1.4905	0.3292	33.6	2.8662	6200.5000	226.8931	187.5000	9.9906	2.9454	0.3388
10	4	4	2000	2.5	1500	0	6	26.0	1.9377	6658.2998	283.5595	264.5000	36.1589	1.4392	0.3285	32.8	2.8282	6226.5000	247.1667	189.6000	15.0480	2.7984	0.2850
10	4	4	3000	2.849	1500	0	1	22.2	1.3826	6088.4517	347.6791	143.6000	49.3528	1.1654	0.3160	32.4	3.0208	5278.5098	176.2372	32.7000	6.7719	4.6875	1.1593
10	4	4	3000	2.849	1500	0	2	22.8	1.0560	5968.3135	327.2818	115.0000	31.1498	1.3203	0.2414	32.8	3.4696	5367.9044	186.3599	33.2000	4.8624	5.3938	1.6888
10	4	4	3000	2.849	1500	0	3	23.0	1.1685	6032.4702	365.7483	112.0000	32.5222	1.2406	0.2079	33.4	3.2912	5354.9004	187.2125	32.1000	5.3700	5.9420	1.9064
10	4	4	3000	2.849	1500	0	4	22.6	1.1289	5847.5205	235.8943	105.4000	17.0107	1.3391	0.3121	32.6	2.9553	5272.3765	189.5411	33.3000	7.1955	5.1924	1.2955
10	4	4	3000	2.849	1500	0	5	22.6	1.4780	6123.8682	313.0565	127.6000	38.6633	1.2202	0.2891	33.8	3.5825	5356.3491	193.6531	32.4000	5.1511	5.3967	1.7857
10	4	4	3000	2.849	1500	0	6	22.4	1.1782	5859.0938	275.1557	106.0000	21.7978	1.3061	0.2996	32.2	4.0590	5301.2700	177.9741	31.9000	6.0383	4.3281	1.0100
10	4	4	4000	3.125	1500	0	1	22.4	1.3577	5546.0303	205.0425	43.8000	23.0085	1.2392	0.2674	28.6	2.0013	5125.6445	181.4114	0.5000	0.6954	3.9780	1.3250
10	4	4	4000	3.125	1500	0	2	22.6	1.1289	5665.7041	336.8149	50.3000	32.4715	1.3391	0.2946	28.6	2.4136	5232.3081	196.1397	0.9000	0.8567	4.5515	1.9315
10	4	4	4000	3.125	1500	0	3	22.4	0.9659	5805.9775	414.3159	62.4000	47.9223	1.1796	0.2146	29.2	1.9611	5215.4321	181.0228	0.5000	0.7729	4.2422	1.3239
10	4	4	4000	3.125	1500	0	4	22.6	1.1289	5417.8481	222.6073	35.1000	14.7704	1.4578	0.3144	30.6	2.1119	5100.6201	175.8030	0.4000	0.9051	5.7189	1.8215
10	4	4	4000	3.125	1500	0	5	22.4	1.3577	5636.3452	222.6073	40.5000	21.5306	1.2421	0.2557	28.6	1.8841	5222.9873	185.9369	0.5000	1.1314	3.6486	0.4946
10	4	4	4000	3.125	1500	0	6	22.4	0.9659	5439.4619	274.4683	33.6000	14.6961	1.4125	0.2783	29.2	1.7133	5118.8647	181.6757	0.8000	1.2068	3.7610	0.4766
10	4	4	5000	3.358	1500	0	1	23.0	1.3492	5533.7588	277.5761	27.8000	17.5396	1.1843	0.2703	30.8	3.3558	5187.6699	185.6255	1.0000	2.2628	4.7393	2.3616

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}		Weighted port count @F _{min}		# of OEOs @F _{min}	Solve time [sec]		F _{opt}	Weighted port count @F _{opt}		# of OEOs @F _{opt}	Solve time [sec]				
								±CI	±CI	±CI	±CI		±CI	±CI		±CI	±CI		±CI	±CI			
10	4	4	5000	3.358	1500	0	2	23.2	1.5749	5661.5244	209.7057	31.9000	10.0712	1.2954	0.2829	32.6	2.4136	5278.0435	185.3662	0.1000	0.2263	5.2063	1.9623
10	4	4	5000	3.358	1500	0	3	23.6	1.6594	5697.1494	287.0836	34.0000	21.7376	1.2469	0.2912	32.6	2.3174	5272.8267	192.6968	0.0000	0.0000	6.1187	2.4758
10	4	4	5000	3.358	1500	0	4	22.6	1.1289	5422.9131	191.8741	23.7000	18.0045	1.3609	0.3270	28.2	2.2577	5148.3037	178.9807	0.6000	0.7692	3.3095	0.7908
10	4	4	5000	3.358	1500	0	5	23.6	1.5160	5816.2686	349.2484	49.3000	21.5353	1.1862	0.2088	31.6	2.7856	5288.9053	192.8997	0.7000	1.5839	4.6251	1.7301
10	4	4	5000	3.358	1500	0	6	23.2	1.4231	5493.7432	213.1267	27.3000	12.4488	1.3372	0.3228	31.4	2.5061	5179.0928	191.9547	0.0000	0.0000	4.6439	1.6408
10	4	4	6000	3.561	1500	0	1	22.8	1.0560	5460.2236	269.4669	21.8000	16.2148	1.2409	0.2212	29.2	2.2828	5169.5298	184.9918	0.0000	0.0000	3.8354	1.3295
10	4	4	6000	3.561	1500	0	2	23.0	1.1685	5525.9731	239.3994	18.2000	13.7464	1.4516	0.3057	29.4	2.4136	5273.7202	178.9670	0.0000	0.0000	4.5624	1.6714
10	4	4	6000	3.561	1500	0	3	23.0	0.9541	5512.3794	275.2007	14.9000	15.0679	1.3176	0.2862	29.8	2.0462	5280.1729	186.9522	0.0000	0.0000	4.6468	1.8287
10	4	4	6000	3.561	1500	0	4	22.8	1.0560	5352.2036	233.8630	17.4000	19.7672	1.4548	0.3515	29.2	2.5645	5148.0376	175.1567	0.1000	0.2263	3.9226	1.3341
10	4	4	6000	3.561	1500	0	5	23.2	1.0560	5526.3389	273.2657	17.6000	14.1277	1.2960	0.2039	28.8	1.5749	5287.9458	185.1894	0.0000	0.0000	4.5372	1.8593
10	4	4	6000	3.561	1500	0	6	22.6	1.1289	5425.0928	209.9206	18.0000	14.5904	1.3800	0.3272	27.6	1.6594	5151.6611	174.2766	0.0000	0.0000	3.4842	1.2081
10	4	4	7000	3.742	1500	0	1	23.2	1.4231	5418.1689	212.5536	12.6000	13.7191	1.1908	0.2503	31.4	3.6827	5173.7866	190.2328	0.0000	0.0000	4.4550	1.4381
10	4	4	7000	3.742	1500	0	2	23.2	1.5749	5598.5508	258.7508	20.4000	17.2003	1.2892	0.2755	31.6	2.7856	5290.1782	194.2142	0.1000	0.2263	5.4452	2.4669
10	4	4	7000	3.742	1500	0	3	23.8	1.6798	5577.1885	316.0841	16.9000	23.2291	1.2680	0.2731	33.2	2.5645	5293.4092	192.4025	0.0000	0.0000	6.2608	2.3815
10	4	4	7000	3.742	1500	0	4	22.6	1.1289	5413.6499	222.1374	23.8000	27.7044	1.3180	0.3324	30.6	2.8462	5159.4810	177.4304	0.2000	0.3017	5.3390	2.4628
10	4	4	7000	3.742	1500	0	5	23.6	1.5160	5703.9189	300.6989	30.7000	18.6196	1.1666	0.1889	31.4	2.3174	5298.0947	193.0567	0.0000	0.0000	3.9638	0.6006
10	4	4	7000	3.742	1500	0	6	23.2	1.4231	5436.6499	210.3868	15.0000	13.5640	1.3502	0.3215	30.8	2.9752	5182.7354	182.7545	0.0000	0.0000	3.9766	0.8063
10	4	4	8000	3.906	1500	0	1	23.2	1.4231	5407.1523	222.5280	10.9000	14.0317	1.2029	0.2493	31.4	3.6827	5173.7866	190.2328	0.0000	0.0000	3.6719	0.9183
10	4	4	8000	3.906	1500	0	2	23.2	1.5749	5593.3179	253.7109	19.7000	17.3414	1.4657	0.5120	32.4	2.6172	5290.3789	194.2896	0.0000	0.0000	4.3109	0.5598
10	4	4	8000	3.906	1500	0	3	23.8	1.6798	5567.2002	303.1166	16.0000	22.0984	1.6048	0.7327	33.2	2.5645	5293.4092	192.4025	0.0000	0.0000	5.1171	1.9230
10	4	4	8000	3.906	1500	0	4	22.6	1.1289	5415.3057	217.6145	23.9000	27.6667	1.3188	0.3324	30.6	2.8462	5159.4810	177.4304	0.2000	0.3017	3.6080	0.6196
10	4	4	8000	3.906	1500	0	5	23.6	1.5160	5699.6123	299.7546	29.6000	19.0012	1.4703	0.5413	31.2	2.4741	5292.0366	192.5288	0.0000	0.0000	3.9078	0.6297
10	4	4	8000	3.906	1500	0	6	23.2	1.4231	5434.9131	212.2503	14.7000	13.1467	1.2032	1.3114	30.4	2.6172	5181.2993	182.7812	0.0000	0.0000	4.8610	1.8231
10	4	4	9000	4.057	1500	0	1	23.2	1.4231	5413.6167	223.7715	10.1000	14.1569	1.4408	0.6988	31.4	3.6827	5173.7866	190.2328	0.0000	0.0000	4.2578	2.0345
10	4	4	9000	4.057	1500	0	2	23.2	1.5749	5589.3281	244.5001	18.2000	17.9087	1.4407	0.7088	31.6	2.4371	5289.6338	194.1948	0.0000	0.0000	4.0906	0.5044
10	4	4	9000	4.057	1500	0	3	23.8	1.6798	5582.3999	327.0835	16.1000	23.8788	1.5831	0.7088	33.2	2.5645	5293.4092	192.4025	0.0000	0.0000	5.1500	2.0098
10	4	4	9000	4.057	1500	0	4	22.6	1.1289	5416.7290	217.0261	23.9000	27.4934	1.3156	0.3319	30.2	2.6302	5158.2041	177.3736	0.0000	0.0000	3.4265	0.5813
10	4	4	9000	4.057	1500	0	5	23.6	1.5160	5679.4014	288.1535	28.6000	18.5098	1.4952	0.5500	30.8	2.8181	5296.2119	193.0888	0.0000	0.0000	3.8017	0.7148
10	4	4	9000	4.057	1500	0	6	23.2	1.4231	5415.6631	217.1823	12.4000	12.6535	1.2066	1.3294	30.8	2.0739	5182.5728	181.5859	0.0000	0.0000	4.9298	1.7266
10	4	4	10000	4.197	1500	0	1	23.2	1.4231	5413.4092	223.3158	10.1000	14.1569	1.2014	0.2554	31.4	3.6827	5173.7866	190.2328	0.0000	0.0000	4.2750	2.0653
10	4	4	10000	4.197	1500	0	2	23.2	1.5749	5593.9595	245.9657	19.1000	17.5579	1.2781	0.2440	32.8	2.3804	5271.8682	185.7181	0.0000	0.0000	4.9783	1.8748
10	4	4	10000	4.197	1500	0	3	23.8	1.6798	5582.3999	327.0835	16.1000	23.8788	1.2452	0.2732	32.4	1.7912	5308.9932	194.3104	0.0000	0.0000	5.7705	1.9382
10	4	4	10000	4.197	1500	0	4	22.6	1.1289	5416.8193	216.1759	23.9000	27.4934	1.3204	0.3403	30.2	2.6302	5158.2041	177.3736	0.0000	0.0000	3.4125	0.5707
10	4	4	10000	4.197	1500	0	5	23.6	1.5160	5678.8159	288.2827	28.1000	18.7214	1.4813	0.5406	30.8	2.8181	5294.8623	192.1743	0.0000	0.0000	3.7891	0.6997
10	4	4	10000	4.197	1500	0	6	23.2	1.4231	5423.5562	210.2449	12.5000	12.7209	2.0078	1.3126	31.2	2.2828	5182.6860	181.5060	0.0000	0.0000	4.5470	1.4517
10	4	4	1000	2	1500	80	1	23.0	3.3050	2896.3999	296.2126	175.0000	24.5358	0.3968	0.0736	23.0	3.3050	2896.3999	296.2126	175.0000	24.5358	0.3968	0.0736
10	4	4	1000	2	1500	80	2	23.0	3.3050	2943.6001	309.6763	177.9000	25.0849	0.3999	0.0782	23.0	3.3050	2943.6001	309.6763	177.9000	25.0849	0.3999	0.0782
10	4	4	1000	2	1500	80	3	23.0	3.3050	2946.3999	310.6147	178.0000	24.6791	0.3999	0.0762	23.0	3.3050	2946.3999	310.6147	178.0000	24.6791	0.3999	0.0762
10	4	4	1000	2	1500	80	4	23.0	3.3050	2940.8000	299.5535	180.0000	32.8217	0.4110	0.0769	23.0	3.3050	2940.8000	299.5535	180.0000	32.8217	0.4110	0.0769
10	4	4	1000	2	1500	80	5	23.0	3.3050	2966.3999	288.6039	184.7000	32.5048	0.4063	0.0748	23.0	3.3050	2966.3999	288.6039	184.7000	32.5		

C	W	B	R _{max}	E/O	cost	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs @ F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count	# of OEOs @ F _{opt}	±CI	Solve time [sec]	±CI
10	4	4	3000	2.849	1500	80	3	3	7.6	1.1782	2107.1497	127.9619	127.9619	0.2702	0.0710	14.8	3.4696	1855.4828	9.2000	139.9382	0.8361	0.2808
10	4	4	3000	2.849	1500	80	4	4	7.6	1.1782	2055.3340	132.4097	132.4097	0.2641	0.0712	15.2	3.5345	1755.4915	7.5000	130.3270	0.8421	0.2670
10	4	4	3000	2.849	1500	80	5	5	7.8	1.3826	2074.1558	128.5104	128.5104	0.2829	0.0720	13.4	2.8462	1819.7223	10.3000	134.6337	0.6571	0.1599
10	4	4	3000	2.849	1500	80	6	6	7.6	1.1782	2091.8799	173.5911	173.5911	0.2594	0.0588	15.0	3.4399	1752.5006	8.1000	132.4266	0.8233	0.2719
10	4	4	4000	3.125	1500	80	1	1	8.0	1.2162	1930.9910	176.9311	176.9311	0.2751	0.0476	14.0	2.7195	1744.5657	0.5000	133.1214	0.7170	0.1517
10	4	4	4000	3.125	1500	80	2	2	7.4	1.1289	2051.1653	163.6880	163.6880	0.2516	0.0603	13.6	2.5287	1820.2744	0.8000	132.7727	0.7282	0.1484
10	4	4	4000	3.125	1500	80	3	3	7.8	1.3826	2039.9402	144.6503	144.6503	0.2735	0.0631	13.6	2.5287	1851.9875	0.3000	134.9328	0.7312	0.1574
10	4	4	4000	3.125	1500	80	4	4	7.8	1.3826	1955.7283	133.3446	133.3446	0.2659	0.0664	13.0	2.6985	1735.1920	1.0000	134.2327	0.6577	0.1534
10	4	4	4000	3.125	1500	80	5	5	7.6	1.1782	2072.1196	162.5105	162.5105	0.2596	0.0592	13.8	2.5422	1850.1270	0.6000	140.1959	0.7596	0.1533
10	4	4	4000	3.125	1500	80	6	6	7.8	1.3826	1935.9519	149.2685	149.2685	0.2624	0.0615	13.6	2.2426	1714.2604	0.6000	131.4512	0.6844	0.1183
10	4	4	5000	3.358	1500	80	1	1	8.0	1.2162	1898.6908	161.1323	161.1323	0.2750	0.0582	13.4	2.8462	1745.0569	0.0000	127.9066	0.6812	0.1701
10	4	4	5000	3.358	1500	80	2	2	7.6	0.9659	1968.9612	185.6474	185.6474	0.2625	0.0551	13.8	2.4510	1831.5912	0.0000	133.4089	0.7516	0.1375
10	4	4	5000	3.358	1500	80	3	3	8.0	1.2162	1970.0808	160.9861	160.9861	0.2859	0.0562	13.6	2.6172	1853.9277	0.0000	138.0271	0.7546	0.1564
10	4	4	5000	3.358	1500	80	4	4	7.8	1.2068	1878.9482	159.0907	159.0907	0.2703	0.0594	13.4	2.5953	1741.3806	0.0000	139.7131	0.6905	0.1466
10	4	4	5000	3.358	1500	80	5	5	7.8	1.0006	1985.0045	169.0793	169.0793	0.2718	0.0514	13.4	2.5953	1845.4613	0.0000	145.5761	0.7280	0.1562
10	4	4	5000	3.358	1500	80	6	6	8.0	1.2162	1840.0068	137.9587	137.9587	0.2860	0.0561	13.4	2.7651	1717.6097	0.0000	132.5685	0.6782	0.1624
10	4	4	6000	3.561	1500	80	1	1	8.0	1.2162	1875.1703	151.2462	151.2462	0.2858	0.0741	13.4	2.8462	1750.5283	0.0000	126.6561	0.6810	0.1705
10	4	4	6000	3.561	1500	80	2	2	8.0	1.2162	1951.5121	148.7365	148.7365	0.2970	0.0736	14.0	2.5466	1833.2383	0.0000	139.2048	0.7670	0.1417
10	4	4	6000	3.561	1500	80	3	3	7.8	1.2068	1984.4739	139.5090	139.5090	0.2798	0.0630	13.6	2.7856	1864.0322	0.0000	141.1406	0.7484	0.1732
10	4	4	6000	3.561	1500	80	4	4	7.8	1.2068	1844.6934	148.8183	148.8183	0.2764	0.0595	12.2	2.9561	1741.2224	0.1000	135.3206	0.6236	0.1554
10	4	4	6000	3.561	1500	80	5	5	7.8	1.0006	1978.7083	145.2111	145.2111	0.2862	0.0709	13.6	2.7856	1868.2842	0.0000	137.6246	0.7484	0.1700
10	4	4	6000	3.561	1500	80	6	6	8.2	1.3826	1834.7327	143.0604	143.0604	0.2934	0.0618	13.6	2.5287	1722.3314	0.0000	131.0246	0.6948	0.1409
10	4	4	7000	3.742	1500	80	1	1	8.0	1.2162	1893.0446	151.2887	151.2887	0.2796	0.0696	13.6	2.6172	1753.6432	0.0000	127.4326	0.6966	0.1488
10	4	4	7000	3.742	1500	80	2	2	7.6	0.9659	1941.2064	157.4830	157.4830	0.2670	0.0546	14.0	2.7195	1832.5697	0.0000	138.6468	0.7770	0.1648
10	4	4	7000	3.742	1500	80	3	3	7.8	1.2068	1965.9449	150.9667	150.9667	0.2830	0.0615	13.8	2.7153	1866.1351	0.0000	141.3081	0.7680	0.1631
10	4	4	7000	3.742	1500	80	4	4	7.8	1.2068	1862.0061	136.7710	136.7710	0.2750	0.0584	13.0	3.0170	1740.3330	0.0000	135.6618	0.6704	0.1659
10	4	4	7000	3.742	1500	80	5	5	7.6	1.1782	2014.5632	184.1273	184.1273	0.2642	0.0731	13.4	2.7651	1857.8278	0.0000	150.3787	0.7344	0.1649
10	4	4	7000	3.742	1500	80	6	6	8.0	1.2162	1849.3298	142.5562	142.5562	0.2766	0.0600	13.4	2.7651	1722.2487	0.0000	136.1446	0.6798	0.1628
10	4	4	8000	3.906	1500	80	1	1	8.0	1.2162	1895.7151	151.0514	151.0514	0.2812	0.0687	13.6	2.6172	1753.6432	0.0000	127.4326	0.6952	0.1498
10	4	4	8000	3.906	1500	80	2	2	7.6	0.9659	1946.7195	159.5658	159.5658	0.2673	0.0519	14.0	2.7195	1829.8108	0.0000	137.8494	0.7719	0.1609
10	4	4	8000	3.906	1500	80	3	3	7.8	1.2068	1967.2141	151.1577	151.1577	0.2798	0.0588	13.8	2.7153	1866.1351	0.0000	141.3081	0.7673	0.1620
10	4	4	8000	3.906	1500	80	4	4	7.8	1.2068	1862.0061	136.7710	136.7710	0.2701	0.0598	13.0	3.0170	1741.2037	0.0000	136.3790	0.6719	0.1672
10	4	4	8000	3.906	1500	80	5	5	7.8	1.0006	1972.6750	161.6243	161.6243	0.2842	0.0670	13.4	2.7651	1858.0215	0.0000	150.5970	0.7312	0.1619
10	4	4	8000	3.906	1500	80	6	6	8.0	1.2162	1853.4117	140.2522	140.2522	0.2766	0.0567	13.4	2.7651	1723.7891	0.0000	137.1081	0.6734	0.1647
10	4	4	9000	4.057	1500	80	1	1	8.0	1.2162	1892.9294	148.2854	148.2854	0.2843	0.0668	13.6	2.6172	1754.1830	0.0000	127.8581	0.6939	0.1462
10	4	4	9000	4.057	1500	80	2	2	7.6	0.9659	1944.2972	161.5010	161.5010	0.2673	0.0487	14.0	2.7195	1829.8108	0.0000	137.8494	0.7686	0.1600
10	4	4	9000	4.057	1500	80	3	3	7.8	1.2068	1967.4512	151.9776	151.9776	0.2781	0.0602	13.8	2.7153	1866.4518	0.0000	141.6146	0.7640	0.1614
10	4	4	9000	4.057	1500	80	4	4	7.8	1.2068	1860.5867	138.4314	138.4314	0.2703	0.0602	13.0	3.0170	1740.4180	0.0000	135.7207	0.6719	0.1664
10	4	4	9000	4.057	1500	80	5	5	7.8	1.0006	1970.3500	159.8297	159.8297	0.2813	0.0643	13.2	2.5645	1857.7527	0.0000	150.7854	0.7109	0.1532
10	4	4	9000	4.057	1500	80	6	6	8.0	1.2162	1854.9529	141.8623	141.8623	0.2764	0.0575	13.2	2.6517	1724.1277	0.0000	137.2961	0.6657	0.1526
10	4	4	10000	4.197	1500	80	1	1	8.0	1.2162	1892.9294	148.2854	148.2854	0.2782	0.0708	13.6	2.6172	1754.1830	0.0000	127.8581	0.6922	0.1466
10	4	4	10000	4.197	1500	80	2	2	7.6	0.9659	1944.8015	161.6431	161.6431	0.2671	0.0516	14.0	2.7195	1829.8108	0.0000	137.8494	0.7719	0.1602
10	4	4	10000	4.197	1500	80	3	3	7.8	1.2068	1966.7445	151.6844	151.6844	0.2796	0.0611	13.6	2.6172	1864.3988	0.0000	141.2413	0.7466	0.1583
10	4	4	10000	4.197	1500	80	4	4	7.8	1.2068	1860.5867	138.4314	138.4314	0.2704	0.0561	13.0	3.0170	1741.0726	0.0000	136.2810	0.6720	0.1681
10	4	4	10000	4.197	1500	80	5	5	7.8	1.0006	1970.3500	159.8297	159.8297	0.2858	0.0653	13.2	2.5645	1857.7527	0.0000	150.7854	0.7063	0.1556
10	4	4	10000	4.197	1500	80	6	6	8.0	1.2162	1855.5824	142.1105	142.1105	0.2764	0.0619	13.2	2.6517	1724.1277	0.0000	137.2961	0.6659	0.1542
10	8	8	1000	2	500	0	1	1	7.2	0.4526	8164.3999	407.8532	407.8532	0.5391	0.0472	7.2	0.4526	8164.3999	539.0000	407.8532	0.5391	0.0472
10	8	8	1000	2	500	0	2	2	7.2	0.4526	8184.0000	395.5964	395.5964	0.5391	0.0416	7.2	0.4526	8184.0000	542.5000	395.5964	0.5391	0.0416
10	8	8	1000	2	500	0	3	3	7.2	0.4526	8226.4004	413.7070	413.7070	0.5467	0.0442	7.2	0.4526	8226.4004	544.8000	413.7070	0.5467	0.0442

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	±CI	Solve time	F _{opt}	±CI	Weighted port count	# of OEOs	±CI	Solve time
[Gb/s]			[km]	ratio	[Gb/s]	[%]				@F _{min}	@F _{min}		[sec]			@F _{opt}	@F _{opt}		[sec]
10	8	8	1000	2	500	0	4	7.2	0.4526	8226.7998	542.5000	30.1196	0.5531	7.2	0.4526	8226.7998	542.5000	30.1196	0.5531
10	8	8	1000	2	500	0	5	7.2	0.4526	8250.0000	546.0000	30.6174	0.5470	7.2	0.4526	8250.0000	546.0000	30.6174	0.5470
10	8	8	1000	2	500	0	6	7.2	0.4526	8215.2002	543.6000	31.2559	0.5547	7.2	0.4526	8215.2002	543.6000	31.2559	0.5547
10	8	8	2000	2.5	500	0	1	3.0	0.0000	5350.2998	271.0803	12.4860	0.6236	3.2	0.4526	5352.3999	271.5616	12.4140	0.6626
10	8	8	2000	2.5	500	0	2	3.0	0.0000	5402.3999	284.5736	13.1552	0.6344	3.2	0.4526	5394.7002	283.3712	16.3400	0.6766
10	8	8	2000	2.5	500	0	3	3.0	0.0000	5393.1001	284.3677	13.1845	0.6452	3.2	0.4526	5391.2998	283.1993	13.1508	0.6891
10	8	8	2000	2.5	500	0	4	3.0	0.0000	5386.6001	272.0332	13.1257	0.6452	3.2	0.4526	5382.8999	273.1162	16.1000	0.6842
10	8	8	2000	2.5	500	0	5	3.0	0.0000	5369.2002	284.3158	13.4000	0.6438	3.0	0.0000	5369.2002	284.3158	16.3400	0.6438
10	8	8	2000	2.5	500	0	6	3.0	0.0000	5365.7998	281.0019	13.2156	0.6516	3.2	0.4526	5364.7998	281.1968	16.0500	0.6892
10	8	8	3000	2.849	500	0	1	3.0	0.0000	4603.8110	219.0775	26.3000	0.9767	3.2	0.4526	4595.9443	215.3986	24.7000	1.0533
10	8	8	3000	2.849	500	0	2	3.0	0.0000	4652.0635	223.8340	25.0000	1.0247	3.0	0.0000	4652.0635	223.8340	25.0000	1.0247
10	8	8	3000	2.849	500	0	3	3.0	0.0000	4630.3994	230.7430	25.3000	1.0454	3.0	0.0000	4630.3994	230.7430	25.3000	1.0454
10	8	8	3000	2.849	500	0	4	3.0	0.0000	4588.4351	214.9018	25.8000	1.0049	3.4	0.6034	4579.0537	214.3637	24.3000	1.1737
10	8	8	3000	2.849	500	0	5	3.0	0.0000	4640.1689	232.5601	25.6000	1.0409	3.0	0.0000	4640.1689	232.5601	25.6000	1.0409
10	8	8	3000	2.849	500	0	6	3.0	0.0000	4598.6045	207.7833	24.6000	1.0156	3.0	0.0000	4598.6045	207.7833	24.6000	1.0156
10	8	8	4000	3.125	500	0	1	3.0	0.0000	4456.1309	204.1934	0.4000	0.9959	3.2	0.4526	4451.0811	211.4364	0.0000	1.0642
10	8	8	4000	3.125	500	0	2	3.0	0.0000	4559.1670	205.5716	0.1000	1.0515	3.0	0.0000	4559.1670	205.5716	0.1000	1.0515
10	8	8	4000	3.125	500	0	3	3.0	0.0000	4549.4131	229.7742	0.2263	1.0189	3.2	0.4526	4549.4132	229.3126	0.0000	1.1220
10	8	8	4000	3.125	500	0	4	3.0	0.0000	4439.4736	214.0372	0.1000	1.0849	3.2	0.4526	4437.6367	213.0759	0.1000	1.0829
10	8	8	4000	3.125	500	0	5	3.0	0.0000	4537.2422	229.6355	0.4000	1.0703	3.0	0.0000	4537.2422	229.6355	0.4000	1.0703
10	8	8	4000	3.125	500	0	6	3.0	0.0000	4459.1655	202.0811	0.1000	1.0187	3.0	0.0000	4459.1655	202.0811	0.1000	1.0187
10	8	8	5000	3.358	500	0	1	3.0	0.0000	4497.1182	202.6338	0.0000	0.9984	3.2	0.4526	4486.4712	206.3331	0.0000	1.0718
10	8	8	5000	3.358	500	0	2	3.0	0.0000	4560.9731	205.4091	0.0000	1.0625	3.0	0.0000	4560.9731	205.4091	0.0000	1.0625
10	8	8	5000	3.358	500	0	3	3.0	0.0000	4586.6455	227.9397	0.0000	1.0529	3.2	0.4526	4581.1763	229.1390	0.0000	1.1248
10	8	8	5000	3.358	500	0	4	3.0	0.0000	4486.4033	214.9123	0.0000	1.0155	3.2	0.4526	4484.2896	213.7444	0.0000	1.0795
10	8	8	5000	3.358	500	0	5	3.0	0.0000	4586.6445	217.8181	0.0000	1.0561	3.2	0.4526	4579.5259	219.6554	0.0000	1.1327
10	8	8	5000	3.358	500	0	6	3.0	0.0000	4484.5068	226.4216	0.0000	1.0390	3.0	0.0000	4484.5068	226.4216	0.0000	1.0390
10	8	8	6000	3.561	500	0	1	3.0	0.0000	4495.1406	208.6924	0.0000	1.0050	3.0	0.0000	4495.1406	208.6924	0.0000	1.0050
10	8	8	6000	3.561	500	0	2	3.0	0.0000	4568.9644	211.2178	0.0000	1.0668	3.0	0.0000	4568.9644	211.2178	0.0000	1.0668
10	8	8	6000	3.561	500	0	3	3.0	0.0000	4584.5659	228.4538	0.0000	1.0534	3.2	0.4526	4583.4150	228.6836	0.0000	1.1238
10	8	8	6000	3.561	500	0	4	3.0	0.0000	4492.4575	212.7571	0.0000	1.0172	3.4	0.6034	4486.8052	212.5678	0.0000	1.1402
10	8	8	6000	3.561	500	0	5	3.0	0.0000	4599.1167	219.2316	0.0000	1.0608	3.2	0.4526	4597.0977	218.0855	0.0000	1.1266
10	8	8	6000	3.561	500	0	6	3.0	0.0000	4483.6592	221.4389	0.0000	1.0380	3.0	0.0000	4483.6592	221.4389	0.0000	1.0380
10	8	8	7000	3.742	500	0	1	3.0	0.0000	4489.2759	207.6716	0.0000	1.0110	3.0	0.0000	4489.2759	207.6716	0.0000	1.0110
10	8	8	7000	3.742	500	0	2	3.0	0.0000	4564.9834	205.0791	0.0000	1.0712	3.0	0.0000	4564.9834	205.0791	0.0000	1.0712
10	8	8	7000	3.742	500	0	3	3.0	0.0000	4590.6201	223.6292	0.0000	1.0624	3.2	0.4526	4586.7007	224.4326	0.0000	1.1312
10	8	8	7000	3.742	500	0	4	3.0	0.0000	4495.6406	211.3233	0.0000	1.0220	3.2	0.4526	4494.6606	211.5790	0.0000	1.0780
10	8	8	7000	3.742	500	0	5	3.0	0.0000	4591.9395	231.4318	0.0000	1.0654	3.0	0.0000	4591.9395	231.4318	0.0000	1.0654
10	8	8	7000	3.742	500	0	6	3.0	0.0000	4479.6997	227.8283	0.0000	1.0468	3.0	0.0000	4479.6997	227.8283	0.0000	1.0468
10	8	8	8000	3.906	500	0	1	3.0	0.0000	4489.2759	207.6716	0.0000	1.0122	3.0	0.0000	4489.2759	207.6716	0.0000	1.0122
10	8	8	8000	3.906	500	0	2	3.0	0.0000	4565.7891	205.5574	0.0000	1.0708	3.0	0.0000	4565.7891	205.5574	0.0000	1.0708
10	8	8	8000	3.906	500	0	3	3.0	0.0000	4593.5327	225.2720	0.0000	1.0654	3.2	0.4526	4589.6143	226.0984	0.0000	1.1342
10	8	8	8000	3.906	500	0	4	3.0	0.0000	4495.6406	211.3233	0.0000	1.0254	3.2	0.4526	4494.6606	211.5790	0.0000	1.0800
10	8	8	8000	3.906	500	0	5	3.0	0.0000	4590.7666	230.8201	0.0000	1.0750	3.0	0.0000	4590.7666	230.8201	0.0000	1.0750
10	8	8	8000	3.906	500	0	6	3.0	0.0000	4479.1777	226.8283	0.0000	1.0464	3.0	0.0000	4479.1777	226.8283	0.0000	1.0464
10	8	8	9000	4.057	500	0	1	3.0	0.0000	4489.2759	207.6716	0.0000	1.0219	3.0	0.0000	4489.2759	207.6716	0.0000	1.0219
10	8	8	9000	4.057	500	0	2	3.0	0.0000	4565.7891	205.5574	0.0000	1.0767	3.0	0.0000	4565.7891	205.5574	0.0000	1.0767
10	8	8	9000	4.057	500	0	3	3.0	0.0000	4593.5327	225.2720	0.0000	1.0705	3.2	0.4526	4589.6143	226.0984	0.0000	1.1408
10	8	8	9000	4.057	500	0	4	3.0	0.0000	4495.6406	211.3233	0.0000	1.0280	3.2	0.4526	4494.6606	211.5790	0.0000	1.0843

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	9000	4.057	500	0	5	3.0	0.0000	4590.7666	230.8201	0.0000	1.0766	0.0500	3.0	0.0000	4590.7666	230.8201	0.0000	0.0000	1.0766
10	8	8	9000	4.057	500	0	6	3.0	0.0000	4479.1777	226.8283	0.0000	1.0518	0.0289	3.0	0.0000	4479.1777	226.8283	0.0000	0.0000	1.0518
10	8	8	10000	4.197	500	0	1	3.0	0.0000	4489.2759	207.6716	0.0000	1.0188	0.0489	3.0	0.0000	4489.2759	207.6716	0.0000	0.0000	1.0188
10	8	8	10000	4.197	500	0	2	3.0	0.0000	4559.5596	200.9624	0.0000	1.0798	0.0351	3.0	0.0000	4559.5596	200.9624	0.0000	0.0000	1.0798
10	8	8	10000	4.197	500	0	3	3.0	0.0000	4582.1250	222.0419	0.0000	1.0720	0.0417	3.2	0.4526	4581.0273	222.3362	0.0000	0.0000	1.1347
10	8	8	10000	4.197	500	0	4	3.0	0.0000	4495.6406	211.3233	0.0000	1.0344	0.0279	3.2	0.4526	4494.6606	211.5790	0.0000	0.0000	1.0844
10	8	8	10000	4.197	500	0	5	3.0	0.0000	4590.7666	230.8201	0.0000	1.0782	0.0563	3.0	0.0000	4590.7666	230.8201	0.0000	0.0000	1.0782
10	8	8	10000	4.197	500	0	6	3.0	0.0000	4479.1777	226.8283	0.0000	1.0547	0.0291	3.0	0.0000	4479.1777	226.8283	0.0000	0.0000	1.0547
10	8	8	1000	2	500	80	1	2.8	0.4526	1924.8000	251.3615	120.9000	0.1406	0.0203	2.8	0.4526	1924.8000	251.3615	120.9000	20.5966	0.1406
10	8	8	1000	2	500	80	2	2.8	0.4526	1969.6000	235.3815	124.5000	0.1438	0.0209	2.8	0.4526	1969.6000	235.3815	124.5000	19.2127	0.1438
10	8	8	1000	2	500	80	3	2.8	0.4526	1974.8000	227.5394	123.5000	0.1453	0.0212	2.8	0.4526	1974.8000	227.5394	123.5000	18.3897	0.1453
10	8	8	1000	2	500	80	4	2.8	0.4526	1977.2000	250.0809	118.8000	0.1455	0.0213	2.8	0.4526	1977.2000	250.0809	118.8000	19.6997	0.1455
10	8	8	1000	2	500	80	5	2.8	0.4526	1988.8000	252.1750	125.0000	0.1468	0.0213	2.8	0.4526	1988.8000	252.1750	125.0000	20.4735	0.1468
10	8	8	1000	2	500	80	6	2.8	0.4526	1995.2000	259.3462	121.1000	0.1455	0.0213	2.8	0.4526	1995.2000	259.3462	121.1000	20.8219	0.1455
10	8	8	2000	2.5	500	80	1	1.0	0.0000	1386.5000	165.0617	38.1000	0.1156	0.0078	2.2	0.7390	1329.8000	127.2845	32.0000	4.7822	0.2344
10	8	8	2000	2.5	500	80	2	1.4	0.6034	1446.3000	165.3956	40.2000	0.1624	0.0689	2.4	0.6913	1405.2000	145.9698	34.5000	4.3230	0.2704
10	8	8	2000	2.5	500	80	3	1.2	0.4526	1460.4000	195.7949	42.4000	0.1423	0.0513	2.0	0.7543	1379.1000	128.1254	33.7000	4.3987	0.2250
10	8	8	2000	2.5	500	80	4	1.0	0.0000	1396.6000	149.2825	36.9000	0.1294	0.0105	2.2	0.7390	1364.1000	133.3949	31.8000	4.5481	0.2515
10	8	8	2000	2.5	500	80	5	1.4	0.6034	1430.7000	191.1252	39.3000	0.1594	0.0582	2.2	0.7390	1374.0000	133.0848	33.7000	4.4629	0.2076
10	8	8	2000	2.5	500	80	6	1.0	0.0000	1399.8000	170.9381	38.0000	0.1220	0.0102	2.4	0.6913	1346.0000	140.1180	30.5000	4.4526	0.2721
10	8	8	3000	2.849	500	80	1	1.0	0.0000	1289.0396	134.3399	8.6000	0.1858	0.0208	1.8	0.7390	1259.7664	111.5840	5.6000	3.0768	0.3109
10	8	8	3000	2.849	500	80	2	1.0	0.0000	1389.2345	153.8573	13.5000	0.2002	0.0241	2.0	0.7543	1321.0031	110.9856	6.5000	2.8070	0.3597
10	8	8	3000	2.849	500	80	3	1.0	0.0000	1386.3105	153.5311	12.2000	0.2046	0.0218	1.8	0.7390	1340.0367	115.3202	7.2000	2.8004	0.3343
10	8	8	3000	2.849	500	80	4	1.0	0.0000	1276.2544	137.4540	9.3000	0.1922	0.0223	1.8	0.7390	1244.3629	114.0615	5.6000	2.9056	0.3126
10	8	8	3000	2.849	500	80	5	1.0	0.0000	1365.0253	153.0935	11.8000	0.1956	0.0199	2.2	0.7390	1318.6029	118.8184	6.9000	2.5567	0.3845
10	8	8	3000	2.849	500	80	6	1.0	0.0000	1285.8514	153.9474	10.4000	0.1828	0.0191	2.0	0.7543	1226.7271	121.9447	5.5000	2.5964	0.3405
10	8	8	4000	3.125	500	80	1	1.0	0.0000	1282.4125	141.1616	1.6000	0.1938	0.0200	2.0	0.7543	1255.8932	119.5907	0.1000	0.2263	0.3422
10	8	8	4000	3.125	500	80	2	1.0	0.0000	1364.7053	152.4052	3.1000	0.2047	0.0208	2.0	0.7543	1320.0664	125.9894	0.2000	0.3017	0.3750
10	8	8	4000	3.125	500	80	3	1.0	0.0000	1389.0657	151.9905	2.7000	0.2031	0.0211	1.8	0.7390	1351.7242	123.3935	0.1000	0.2263	0.3514
10	8	8	4000	3.125	500	80	4	1.0	0.0000	1261.0590	131.8920	1.5000	0.1969	0.0225	1.6	0.6913	1242.8855	124.9156	0.0000	0.0000	0.2983
10	8	8	4000	3.125	500	80	5	1.0	0.0000	1386.0654	151.2219	3.2000	0.2061	0.0240	2.0	0.7543	1347.7292	122.9952	0.4000	0.3695	0.3876
10	8	8	4000	3.125	500	80	6	1.0	0.0000	1225.3132	142.1328	2.0000	0.1843	0.0210	2.0	0.7543	1204.1538	127.6612	0.1000	0.2263	0.3451
10	8	8	5000	3.358	500	80	1	1.0	0.0000	1275.5507	126.7965	0.5000	0.2004	0.0156	2.2	0.7390	1253.1271	116.9522	0.0000	0.0000	0.3818
10	8	8	5000	3.358	500	80	2	1.0	0.0000	1364.3890	143.5882	1.8000	0.2076	0.0208	2.0	0.7543	1330.6584	126.9420	0.0000	0.0000	0.3796
10	8	8	5000	3.358	500	80	3	1.0	0.0000	1392.2598	153.9945	1.5000	0.2120	0.0217	2.0	0.7543	1352.2063	124.5037	0.0000	0.0000	0.3918
10	8	8	5000	3.358	500	80	4	1.0	0.0000	1259.0798	124.5155	0.5000	0.1936	0.0207	2.0	0.7543	1244.6925	119.3781	0.0000	0.0000	0.3638
10	8	8	5000	3.358	500	80	5	1.0	0.0000	1377.1727	138.7965	0.1000	0.2080	0.0243	2.0	0.7543	1354.5518	129.4215	0.0000	0.0000	0.3924
10	8	8	5000	3.358	500	80	6	1.0	0.0000	1216.4812	136.1942	0.0000	0.1854	0.0203	2.0	0.7543	1200.7177	128.3292	0.0000	0.0000	0.3416
10	8	8	6000	3.561	500	80	1	1.0	0.0000	1277.6604	128.4372	0.0000	0.1936	0.0203	2.2	0.7390	1257.3021	118.7626	0.0000	0.0000	0.3820
10	8	8	6000	3.561	500	80	2	1.0	0.0000	1362.7754	137.6264	1.2000	0.2080	0.0195	2.0	0.7543	1330.3176	123.7059	0.0000	0.0000	0.3798
10	8	8	6000	3.561	500	80	3	1.0	0.0000	1398.8174	147.5344	0.9000	0.2170	0.0211	2.2	0.7390	1364.3021	126.4108	0.0000	0.0000	0.4240
10	8	8	6000	3.561	500	80	4	1.0	0.0000	1259.0392	125.1822	0.0000	0.2076	0.0182	2.0	0.7543	1246.1202	122.4511	0.0000	0.0000	0.3606
10	8	8	6000	3.561	500	80	5	1.0	0.0000	1387.3102	135.3470	0.1000	0.2263	0.0231	2.0	0.7543	1364.9729	127.7173	0.0000	0.0000	0.3910
10	8	8	6000	3.561	500	80	6	1.0	0.0000	1215.5081	134.9731	0.0000	0.1888	0.0193	2.0	0.7543	1200.1311	127.5381	0.0000	0.0000	0.3420
10	8	8	7000	3.742	500	80	1	1.0	0.0000	1278.0796	128.4441	0.0000	0.1950	0.0175	2.4	0.6913	1256.5912	118.8768	0.0000	0.0000	0.4144
10	8	8	7000	3.742	500	80	2	1.0	0.0000	1359.1342	137.8223	0.6000	0.2094	0.0235	2.0	0.7543	1332.9210	123.9400	0.0000	0.0000	0.3860
10	8	8	7000	3.742	500	80	3	1.0	0.0000	1401.5789	149.3251	0.8000	0.2102	0.0241	2.0	0.7543	1363.9222	125.9508	0.0000	0.0000	0.3966
10	8	8	7000	3.742	500	80	4	1.0	0.0000	1258.3673	121.9585	0.0000	0.2106	0.0166	2.0	0.7543	1245.1100	119.6184	0.0000	0.0000	0.3654
10	8	8	7000	3.742	500	80	5	1.0	0.0000	1382.4642	136.8035	0.0000	0.2142	0.0215	2.0	0.7543	1359.7727	128.3704	0.0000	0.0000	0.3962

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	7000	3.742	500	80	6	1.0	0.0000	1221.5873	139.1302	0.0000	0.0000	0.1920	0.0212	2.0	0.7543	1200.6459	127.9306	0.0000	0.0000	0.3468	0.1149
10	8	8	8000	3.906	500	80	1	1.0	0.0000	1276.1733	127.2932	0.0000	0.0000	0.2000	0.0180	2.4	0.6913	1236.5912	118.8768	0.0000	0.0000	0.4128	0.1066
10	8	8	8000	3.906	500	80	2	1.0	0.0000	1359.0205	137.2541	0.6000	1.3577	0.2142	0.0206	2.0	0.7543	1332.9540	123.9380	0.0000	0.0000	0.3830	0.1171
10	8	8	8000	3.906	500	80	3	1.0	0.0000	1402.5575	142.7602	0.7000	1.5839	0.2126	0.0245	2.0	0.7543	1364.4727	126.5334	0.0000	0.0000	0.3946	0.1321
10	8	8	8000	3.906	500	80	4	1.0	0.0000	1259.3542	129.5979	0.0000	0.0000	0.2044	0.0227	2.0	0.7543	1245.0500	119.4978	0.0000	0.0000	0.3606	0.1180
10	8	8	8000	3.906	500	80	5	1.0	0.0000	1384.7593	139.1168	0.0000	0.0000	0.2154	0.0253	2.0	0.7543	1357.4147	128.7047	0.0000	0.0000	0.3984	0.1301
10	8	8	8000	3.906	500	80	6	1.0	0.0000	1221.5873	139.1302	0.0000	0.0000	0.1864	0.0201	2.0	0.7543	1200.6459	127.9306	0.0000	0.0000	0.3484	0.1179
10	8	8	9000	4.057	500	80	1	1.0	0.0000	1275.3563	126.6654	0.0000	0.0000	0.2032	0.0149	2.2	0.7390	1258.6189	119.5642	0.0000	0.0000	0.3843	0.1060
10	8	8	9000	4.057	500	80	2	1.0	0.0000	1357.5598	134.2457	0.0000	0.0000	0.2156	0.0222	2.0	0.7543	1333.5958	123.9063	0.0000	0.0000	0.3829	0.1156
10	8	8	9000	4.057	500	80	3	1.0	0.0000	1398.8093	145.7379	0.2000	0.4526	0.2158	0.0258	2.0	0.7543	1364.4727	126.5334	0.0000	0.0000	0.4048	0.1344
10	8	8	9000	4.057	500	80	4	1.0	0.0000	1262.6945	124.8422	0.0000	0.0000	0.2093	0.0205	1.8	0.7390	1248.6885	122.1431	0.0000	0.0000	0.3359	0.1143
10	8	8	9000	4.057	500	80	5	1.0	0.0000	1384.9801	139.3367	0.0000	0.0000	0.2171	0.0215	2.0	0.7543	1358.8074	129.9655	0.0000	0.0000	0.3968	0.1307
10	8	8	9000	4.057	500	80	6	1.0	0.0000	1221.7272	139.0211	0.0000	0.0000	0.1922	0.0205	2.0	0.7543	1200.7859	127.8250	0.0000	0.0000	0.3483	0.1159
10	8	8	10000	4.197	500	80	1	1.0	0.0000	1275.3563	126.6654	0.0000	0.0000	0.2030	0.0140	2.2	0.7390	1258.6189	119.5642	0.0000	0.0000	0.3828	0.1062
10	8	8	10000	4.197	500	80	2	1.0	0.0000	1354.5491	129.3946	0.0000	0.0000	0.2111	0.0205	2.0	0.7543	1333.7156	122.7721	0.0000	0.0000	0.3858	0.1198
10	8	8	10000	4.197	500	80	3	1.0	0.0000	1391.4511	132.4752	0.0000	0.0000	0.2140	0.0229	2.0	0.7543	1367.1680	122.8346	0.0000	0.0000	0.3954	0.1322
10	8	8	10000	4.197	500	80	4	1.0	0.0000	1262.6945	124.8422	0.0000	0.0000	0.2091	0.0225	1.8	0.7390	1248.6885	122.1431	0.0000	0.0000	0.3358	0.1149
10	8	8	10000	4.197	500	80	5	1.0	0.0000	1386.6368	137.1107	0.0000	0.0000	0.2157	0.0229	2.0	0.7543	1360.4641	127.7693	0.0000	0.0000	0.3983	0.1316
10	8	8	10000	4.197	500	80	6	1.0	0.0000	1221.7272	139.0211	0.0000	0.0000	0.1921	0.0218	2.0	0.7543	1200.7859	127.8250	0.0000	0.0000	0.3485	0.1192
10	8	8	1000	2	1500	0	1	20.4	1.1782	9569.2002	348.2026	635.8000	29.3147	1.9469	0.1847	20.4	1.1782	9569.2002	348.2026	635.8000	29.3147	1.9469	0.1847
10	8	8	1000	2	1500	0	2	20.4	1.1782	9623.2002	354.0219	637.3000	29.3675	1.9515	0.1864	20.4	1.1782	9623.2002	354.0219	637.3000	29.3675	1.9515	0.1864
10	8	8	1000	2	1500	0	3	20.4	1.1782	9625.2002	360.6935	638.0000	30.3337	1.9657	0.1873	20.4	1.1782	9625.2002	360.6935	638.0000	30.3337	1.9657	0.1873
10	8	8	1000	2	1500	0	4	20.4	1.1782	9612.7998	373.8788	637.8000	31.7786	2.0077	0.1994	20.4	1.1782	9612.7998	373.8788	637.8000	31.7786	2.0077	0.1994
10	8	8	1000	2	1500	0	5	20.4	1.1782	9655.2002	358.7673	640.3000	30.5096	1.9828	0.1900	20.4	1.1782	9655.2002	358.7673	640.3000	30.5096	1.9828	0.1900
10	8	8	1000	2	1500	0	6	20.4	1.1782	9601.5996	357.2224	636.6000	30.5955	2.0033	0.1941	20.4	1.1782	9601.5996	357.2224	636.6000	30.5955	2.0033	0.1941
10	8	8	2000	2.5	1500	0	1	7.2	0.4526	6539.6001	359.0316	218.4000	21.3268	1.7126	0.2298	8.6	0.9051	6316.2998	239.7331	189.7000	14.6606	2.6283	0.4128
10	8	8	2000	2.5	1500	0	2	7.2	0.4526	6610.7998	361.6405	225.5000	28.4329	2.2218	1.0065	8.8	0.8124	6372.6001	243.3702	190.6000	14.7116	3.3123	1.3342
10	8	8	2000	2.5	1500	0	3	7.2	0.4526	6605.2002	390.5910	225.9000	34.7749	1.7483	0.2575	9.0	0.6746	6330.6001	239.1629	190.7000	14.1673	2.8642	0.2495
10	8	8	2000	2.5	1500	0	4	7.2	0.4526	6552.2002	364.1787	230.9000	30.1502	2.2624	1.2696	8.6	0.6034	6314.2002	248.6484	191.3000	12.6123	3.1767	1.0605
10	8	8	2000	2.5	1500	0	5	7.2	0.4526	6653.7998	427.7709	230.1000	35.9446	1.7094	0.2816	9.0	0.6746	6329.5000	239.2059	190.3000	14.4653	2.8670	0.2728
10	8	8	2000	2.5	1500	0	6	7.2	0.4526	6557.3999	354.9126	228.2000	36.5136	2.3108	1.2801	8.8	0.8124	6331.2998	232.2852	187.9000	14.3762	3.7327	1.5499
10	8	8	3000	2.849	1500	0	1	6.8	0.4526	5599.6772	195.2435	59.2000	13.7423	2.4233	0.4890	9.0	0.9541	5406.7568	160.4668	32.5000	3.3264	6.0845	2.8002
10	8	8	3000	2.849	1500	0	2	6.8	0.6034	5685.4658	202.0834	59.8000	17.0961	2.6220	0.6601	8.4	0.6913	5479.2700	190.9556	33.2000	3.3187	4.3892	0.4898
10	8	8	3000	2.849	1500	0	3	6.8	0.4526	5658.3330	218.0974	58.6000	15.2695	2.5203	0.5057	8.4	0.6913	5461.4155	174.8448	33.3000	3.2538	4.3172	0.4962
10	8	8	3000	2.849	1500	0	4	6.4	0.6913	5772.5439	384.3436	89.9000	54.1902	2.3047	0.7868	8.8	0.8124	5392.5146	172.8873	32.0000	3.5698	5.2014	2.0584
10	8	8	3000	2.849	1500	0	5	6.8	0.4526	5590.4321	243.1959	50.3000	16.0038	2.7562	0.5442	8.6	0.9051	5445.6514	168.6174	33.3000	3.2538	5.2016	2.1274
10	8	8	3000	2.849	1500	0	6	6.8	0.6034	5649.3765	238.8198	67.1000	17.7512	2.3641	0.5673	8.6	0.6034	5401.2725	178.2242	32.6000	3.3765	4.3517	0.3775
10	8	8	4000	3.125	1500	0	1	6.8	0.4526	5297.5913	128.4045	6.3000	6.0721	2.7468	0.5397	8.2	0.7390	5225.3062	170.5132	0.0000	0.0000	4.8047	1.9173
10	8	8	4000	3.125	1500	0	2	6.6	0.6034	5404.8965	140.3871	8.0000	6.2471	2.8359	0.6545	7.8	0.7390	5313.4014	171.2406	0.0000	0.0000	4.0515	0.5504
10	8	8	4000	3.125	1500	0	3	6.6	0.6034	5411.3662	161.5000	9.5000	11.1377	2.6829	0.7331	7.8	0.7390	5319.3525	165.1876	0.0000	0.0000	3.9986	0.5892
10	8	8	4000	3.125	1500	0	4	6.8	0.4526	5320.0869	141.5911	9.2000	9.2487	2.7732	0.5387	8.4	0.9659	5230.6548	163.1349	0.0000	0.0000	0.6788	4.1781
10	8	8	4000	3.125	1500	0	5	6.8	0.4526	5423.5957	264.8750	13.8000	28.2735	3.0499	0.5938	7.4	0.6034	5314.5400	161.3788	0.4000	0.9051	3.6390	0.4982
10	8	8	4000	3.125	1500	0	6	6.6	0.6034	5325.2227	142.9477	10.4000	11.5487	2.6951	0.6772	7.6	0.6913	5239.0337	164.7117	0.0000	0.0000	3.6562	0.4749
10	8	8	5000	3.358	1500	0	1	6.6	0.6034	5421.6558	226.0904	14.0000	20.2836	2.0611	0.5652	8.0	0.7543	5276.5815	171.9850	0.0000	0.0000	3.6251	0.7841
10	8	8	5000	3.358	1500	0	2	7.0	0.0000	5398.5952	193.9704	0.0000	0.0000	3.1235	0.1910	8.2	0.7390	5374.9810	184.6740	0.0000	0.0000	4.2422	0.6075
10	8	8	5000	3.358	1500	0	3	7.0	0.0000	5468.4219	199.1776	5.3000	6.3738	2.5811	0.3602	8.8	1.0560	5365.3857	163.4701	0.0000	0.0000	5.4483	2.3317
10	8	8	5000	3.358	1500	0	4	6.6	0.6034	5440.4658	254.5844	20.2000	39.6263	2.3234	0.5792	8.2	1.0006	5255.2334	155.1731	0.0000	0.0000	4.7062	2.3178
10	8	8	5000	3.358	1500	0	5	7.0	0.0000	5428.5420	170.8416	3.4000	4.0925	2.7813	0.4195	8.0	0.7543	5365.6714	149.6530	0.0000	0.0000	4.0313	0.7081
10	8	8	5000	3.358	1500	0	6	6.8	0.4526	5329.0493	181.8686	2.0000	3.0358	2.5498	0.4424	8.8	0.8124	5261.1938	163.4356	0.0000	0.0000	5.1252	2.1034

C	W	B	R _{max}	E/O	IN	FR	Policy	F _{min}	Weighted port count	# of OEOs	Solve time	±CI	F _{opt}	Weighted port count	# of OEOs	±CI	Solve time	±CI
[Gb/s]			[km]	cost ratio	[Gb/s]	[%]			@F _{min}	@F _{min}	[sec]			@F _{opt}	@F _{opt}		[sec]	
10	8	8	6000	3.561	1500	0	1	6.8	0.4526	5327.2573	161.5035	4.4756	0.5426	5286.1011	161.7656	0.0000	5.5844	2.8780
10	8	8	6000	3.561	1500	0	2	6.8	0.4526	5389.6011	203.6007	0.0000	0.5361	5348.5156	187.5699	0.0000	4.0706	0.5745
10	8	8	6000	3.561	1500	0	3	6.8	0.4526	5460.8008	277.7121	12.2000	0.6133	5334.6255	189.2807	0.0000	4.7808	1.9789
10	8	8	6000	3.561	1500	0	4	6.6	0.6034	5406.5649	328.5009	15.4000	0.6148	5249.4014	165.6519	0.0000	3.8136	0.6078
10	8	8	6000	3.561	1500	0	5	6.8	0.4526	5406.7207	189.8183	3.5000	0.6058	5367.3564	179.9322	0.0000	3.7326	0.6327
10	8	8	6000	3.561	1500	0	6	6.6	0.6034	5433.8843	333.5196	15.1000	0.6473	5266.8350	158.5919	0.0000	4.7708	2.1432
10	8	8	7000	3.742	1500	0	1	6.6	0.6034	5418.3213	202.8231	13.4000	0.5612	5279.0117	161.3212	0.0000	3.9956	0.6494
10	8	8	7000	3.742	1500	0	2	6.8	0.4526	5460.8643	191.5071	2.6000	0.4965	5383.5557	182.8948	0.0000	4.2518	0.6438
10	8	8	7000	3.742	1500	0	3	7.0	0.0000	5443.9209	178.4033	0.0000	0.3553	5372.3857	161.8513	0.0000	5.4402	2.3212
10	8	8	7000	3.742	1500	0	4	6.8	0.4526	5362.8032	185.8153	6.9000	0.5252	5273.7881	147.9266	0.0000	4.8986	2.2254
10	8	8	7000	3.742	1500	0	5	7.0	0.0000	5399.1670	170.6201	0.0000	0.3245	5371.0537	151.4437	0.0000	4.2500	0.6525
10	8	8	7000	3.742	1500	0	6	6.8	0.4526	5328.2314	178.5773	0.1000	0.2263	5265.5713	162.3396	0.0000	4.1482	0.6380
10	8	8	8000	3.906	1500	0	1	6.6	0.6034	5445.6826	236.1534	16.4000	0.5734	5281.8447	164.8172	0.0000	5.6408	2.7966
10	8	8	8000	3.906	1500	0	2	6.8	0.4526	5468.8438	196.0566	3.6000	0.4907	5386.5151	181.3841	0.0000	4.2336	0.6341
10	8	8	8000	3.906	1500	0	3	7.0	0.0000	5440.6694	179.6678	0.0000	0.3983	5369.3691	162.9390	0.0000	5.5032	2.2814
10	8	8	8000	3.906	1500	0	4	6.8	0.4526	5358.9800	181.8685	6.9000	0.5291	5268.6436	148.8327	0.0000	4.9594	2.2046
10	8	8	8000	3.906	1500	0	5	7.0	0.0000	5397.5913	170.5424	0.0000	0.3194	5369.4775	151.1895	0.0000	4.2496	0.6514
10	8	8	8000	3.906	1500	0	6	6.8	0.4526	5340.1782	167.3416	0.1000	0.2263	5267.9238	155.1141	0.0000	4.4020	0.6412
10	8	8	9000	4.057	1500	0	1	6.6	0.6034	5443.3896	233.3485	15.9000	0.5707	5281.8447	164.8172	0.0000	8.5935	3.4836
10	8	8	9000	4.057	1500	0	2	6.8	0.4526	5468.6855	196.0509	3.6000	0.4921	5385.3755	181.8118	0.0000	8.9624	3.5439
10	8	8	9000	4.057	1500	0	3	7.0	0.0000	5434.6938	179.5481	0.0000	0.4035	5369.3691	162.9390	0.0000	9.4230	3.3768
10	8	8	9000	4.057	1500	0	4	6.8	0.4526	5424.6904	300.0201	13.2000	0.5884	5268.6436	148.8327	0.0000	8.6440	3.3770
10	8	8	9000	4.057	1500	0	5	7.0	0.0000	5395.8335	169.5854	0.0000	0.3215	5368.2173	150.7674	0.0000	8.9699	3.5433
10	8	8	9000	4.057	1500	0	6	6.8	0.4526	5339.5078	167.2441	0.0000	0.4937	5267.9238	155.1141	0.0000	10.2781	2.6626
10	8	8	10000	4.197	1500	0	1	6.6	0.6034	5450.0972	217.6030	16.2000	0.5427	5289.6963	165.1316	0.0000	9.4250	3.1771
10	8	8	10000	4.197	1500	0	2	6.8	0.4526	5468.6855	196.0509	3.6000	0.4937	5385.3755	181.8118	0.0000	8.9748	3.5440
10	8	8	10000	4.197	1500	0	3	7.0	0.0000	5436.8945	181.4748	0.0000	0.5292	5367.1479	161.2627	0.0000	9.3785	3.3785
10	8	8	10000	4.197	1500	0	4	6.8	0.4526	5425.4609	300.0048	13.2000	0.5575	5269.4136	149.2608	0.0000	7.8360	3.1585
10	8	8	10000	4.197	1500	0	5	7.0	0.0000	5397.2134	169.6579	0.0000	0.3141	5369.5972	150.9926	0.0000	8.9656	3.5129
10	8	8	10000	4.197	1500	0	6	6.8	0.4526	5327.7988	165.0856	0.0000	0.5255	5267.1621	154.8638	0.0000	9.4827	3.0735
10	8	8	1000	2	1500	80	1	6.6	0.6034	2838.0000	312.7177	178.4000	0.0429	2838.0000	312.7177	178.4000	0.3936	0.0429
10	8	8	1000	2	1500	80	2	6.6	0.6034	2880.3999	328.4480	181.3000	0.0436	2880.3999	328.4480	181.3000	0.3955	0.0436
10	8	8	1000	2	1500	80	3	6.6	0.6034	2881.2000	314.5773	181.4000	0.0472	2881.2000	314.5773	181.4000	0.3969	0.0472
10	8	8	1000	2	1500	80	4	6.6	0.6034	2899.6001	311.9955	178.1000	0.0453	2899.6001	311.9955	178.1000	0.4062	0.0453
10	8	8	1000	2	1500	80	5	6.6	0.6034	2904.8000	306.1596	182.7000	0.0427	2904.8000	306.1596	182.7000	0.4000	0.0427
10	8	8	1000	2	1500	80	6	6.6	0.6034	2898.0000	310.1779	178.4000	0.0448	2898.0000	310.1779	178.4000	0.4063	0.0448
10	8	8	2000	2.5	1500	80	1	3.0	0.6746	2101.7000	127.9906	69.9000	0.3749	1947.6000	164.4426	53.9000	0.6470	0.2160
10	8	8	2000	2.5	1500	80	2	3.2	0.4526	2092.6001	183.6669	66.0000	0.4188	1994.7000	163.6397	55.5000	0.7000	0.2120
10	8	8	2000	2.5	1500	80	3	3.2	0.4526	2074.7000	182.9651	65.3000	0.4172	1985.8000	159.7016	55.5000	0.5890	0.1236
10	8	8	2000	2.5	1500	80	4	3.2	0.4526	2071.7000	184.2526	64.2000	0.4203	1980.7000	160.9101	55.3000	0.6017	0.1208
10	8	8	2000	2.5	1500	80	5	3.2	0.4526	2067.6001	191.7261	66.1000	0.4142	1975.7000	162.8046	55.5000	0.6906	0.1977
10	8	8	2000	2.5	1500	80	6	3.2	0.4526	2053.0000	186.2511	63.8000	0.4188	1960.1000	164.9001	52.7000	0.7093	0.2118
10	8	8	3000	2.849	1500	80	1	2.8	0.4526	1837.5320	124.5243	16.9000	0.5124	1739.5033	124.6756	8.2000	0.9376	0.3299
10	8	8	3000	2.849	1500	80	2	3.0	0.0000	1852.8080	132.1855	14.9000	0.4926	1794.7976	124.5181	8.4000	1.0516	0.3524
10	8	8	3000	2.849	1500	80	3	3.0	0.0000	1862.2686	133.8528	14.9000	0.5938	1812.8344	117.1879	8.6000	1.0530	0.3410
10	8	8	3000	2.849	1500	80	4	3.0	0.0000	1785.1862	132.2393	14.1000	0.5671	1731.3942	117.0970	7.4000	1.0079	0.3234
10	8	8	3000	2.849	1500	80	5	3.0	0.0000	1833.7988	136.8248	14.8000	0.5876	1785.5371	124.7676	9.0000	1.0949	0.3979
10	8	8	3000	2.849	1500	80	6	3.0	0.0000	1790.3955	125.6558	14.6000	0.5278	1726.8308	117.1142	8.2000	1.0094	0.3387
10	8	8	4000	3.125	1500	80	1	2.8	0.4526	1787.6072	128.8916	3.8000	0.1180	1719.6628	118.6290	0.3000	0.9047	0.1600

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	4000	3.125	1500	80	2	2.8	0.4526	1834.4900	111.1576	0.5595	0.1249	4.2	0.7390	1784.7164	126.1675	0.9082	0.1679
10	8	8	4000	3.125	1500	80	3	2.8	0.4526	1858.9873	118.9726	0.5642	0.1257	4.0	0.7543	1809.8953	126.8503	0.9017	0.1966
10	8	8	4000	3.125	1500	80	4	2.8	0.4526	1771.8484	93.3535	0.5298	0.1141	4.2	0.7390	1715.7000	122.9581	0.9126	0.1680
10	8	8	4000	3.125	1500	80	5	2.8	0.4526	1859.7905	122.1260	0.5578	0.1273	3.8	0.7390	1812.5098	128.6953	0.8796	0.1932
10	8	8	4000	3.125	1500	80	6	2.8	0.4526	1756.6799	108.3333	0.5247	0.1177	4.2	0.7390	1685.0750	118.4589	0.9048	0.1597
10	8	8	5000	3.358	1500	80	1	3.0	0.0000	1767.4476	142.7062	0.5810	0.0553	4.0	0.7543	1727.3392	120.0691	0.0000	0.8546
10	8	8	5000	3.358	1500	80	2	3.0	0.0000	1822.4319	129.3580	0.6130	0.0692	4.0	0.7543	1796.1039	127.0508	0.0000	0.1883
10	8	8	5000	3.358	1500	80	3	3.0	0.0000	1859.6022	134.1488	0.6164	0.0656	4.2	0.7390	1825.9666	125.3482	0.0000	0.9706
10	8	8	5000	3.358	1500	80	4	3.0	0.0000	1738.5742	123.6572	0.5860	0.0613	4.0	0.7543	1714.4860	122.1550	0.0000	0.8674
10	8	8	5000	3.358	1500	80	5	3.0	0.0000	1843.2029	139.3177	0.6158	0.0677	3.8	0.7390	1820.3748	131.2409	0.0000	0.8642
10	8	8	5000	3.358	1500	80	6	3.0	0.0000	1732.4574	132.8440	0.5776	0.0596	4.2	0.7390	1687.6995	121.3215	0.0000	0.9046
10	8	8	6000	3.561	1500	80	1	2.8	0.4526	1797.4720	112.5861	0.5296	0.1231	4.0	0.7543	1740.4766	121.1467	0.0000	0.8612
10	8	8	6000	3.561	1500	80	2	2.8	0.4526	1845.2781	105.8606	0.5566	0.1356	4.0	0.7543	1795.7748	119.8133	0.0000	0.9102
10	8	8	6000	3.561	1500	80	3	2.8	0.4526	1880.4583	106.4926	0.5628	0.1313	4.2	0.7390	1829.4222	119.8479	0.0000	0.1776
10	8	8	6000	3.561	1500	80	4	2.8	0.4526	1762.5524	92.1200	0.5374	0.1225	4.0	0.7543	1711.4241	119.9291	0.0000	0.8612
10	8	8	6000	3.561	1500	80	5	2.8	0.4526	1858.1887	107.8060	0.5608	0.1355	3.8	0.7390	1815.2998	129.2549	0.0000	0.8704
10	8	8	6000	3.561	1500	80	6	2.8	0.4526	1744.7260	96.2678	0.5334	0.1232	4.2	0.7390	1692.5071	120.0475	0.0000	0.9048
10	8	8	7000	3.742	1500	80	1	3.0	0.0000	1767.4163	135.9951	0.5814	0.0545	4.2	0.7390	1729.5853	119.5173	0.0000	0.9076
10	8	8	8000	3.906	1500	80	2	2.8	0.4526	1837.6436	126.2859	0.5638	0.1286	4.0	0.7543	1808.1042	127.7602	0.0000	0.9070
10	8	8	8000	3.906	1500	80	3	3.0	0.0000	1878.0231	126.8190	0.6212	0.0695	4.2	0.7390	1837.1555	122.3446	0.0000	0.9844
10	8	8	8000	3.906	1500	80	4	2.8	0.4526	1767.2595	102.7996	0.5376	0.1167	4.0	0.7543	1720.6414	122.7333	0.0000	0.8690
10	8	8	8000	3.906	1500	80	5	3.0	0.0000	1855.7272	140.0670	0.6230	0.0699	3.8	0.7390	1832.2725	135.4648	0.0000	0.8796
10	8	8	8000	3.906	1500	80	6	2.8	0.4526	1744.4063	105.8735	0.5404	0.1213	4.2	0.7390	1692.6016	120.2563	0.0000	0.9082
10	8	8	9000	4.057	1500	80	1	3.0	0.0000	1770.2314	137.9660	0.5861	0.0543	4.2	0.7390	1729.7252	119.5914	0.0000	0.9125
10	8	8	9000	4.057	1500	80	2	2.8	0.4526	1845.0541	131.8235	0.5658	0.1301	4.0	0.7543	1808.5182	127.7145	0.0000	0.9139
10	8	8	9000	4.057	1500	80	3	3.0	0.0000	1878.0231	126.8190	0.6253	0.0677	4.2	0.7390	1837.3972	122.5750	0.0000	0.9796
10	8	8	9000	4.057	1500	80	4	2.8	0.4526	1767.3975	102.2258	0.5468	0.1174	4.0	0.7543	1722.9193	124.3557	0.0000	0.8703
10	8	8	9000	4.057	1500	80	5	3.0	0.0000	1853.6071	138.9249	0.6250	0.0693	3.6	0.6913	1831.5746	134.9261	0.0000	0.8173
10	8	8	9000	4.057	1500	80	6	2.8	0.4526	1744.6481	105.9570	0.5454	0.1169	4.2	0.7390	1692.6016	120.2563	0.0000	0.9108
10	8	8	10000	4.197	1500	80	1	3.0	0.0000	1769.2747	136.5710	0.5876	0.0568	4.2	0.7390	1731.0000	119.8235	0.0000	0.9110
10	8	8	10000	4.197	1500	80	2	2.8	0.4526	1838.7903	125.8595	0.5656	0.1302	4.0	0.7543	1808.4187	127.5637	0.0000	0.9094
10	8	8	10000	4.197	1500	80	3	3.0	0.0000	1877.4238	126.7160	0.6250	0.0659	4.2	0.7390	1838.0443	122.3584	0.0000	0.9811
10	8	8	10000	4.197	1500	80	4	2.8	0.4526	1768.9104	104.2403	0.5452	0.1197	4.0	0.7543	1724.4320	126.3203	0.0000	0.8688
10	8	8	10000	4.197	1500	80	5	3.0	0.0000	1853.2532	140.0873	0.6234	0.0690	3.6	0.6913	1830.6918	135.3297	0.0000	0.8188
10	8	8	10000	4.197	1500	80	6	2.8	0.4526	1744.6996	106.0029	0.5405	0.1183	4.2	0.7390	1692.6016	120.2563	0.0000	0.9063
40	8	8	1000	5	500	0	1	3.0	0.0000	8023.2002	355.1719	0.1968	0.0095	3.0	0.0000	8023.2002	355.1719	0.0000	0.1968
40	8	8	1000	5	500	0	2	3.0	0.0000	8093.2002	369.6716	0.1922	0.0076	3.0	0.0000	8093.2002	369.6716	0.0000	0.1922
40	8	8	1000	5	500	0	3	3.0	0.0000	8170.1000	381.7559	0.1968	0.0059	3.0	0.0000	8170.1000	381.7559	0.0000	0.1968
40	8	8	1000	5	500	0	4	3.0	0.0000	8185.6001	392.4371	0.19548	0.0046	3.0	0.0000	8185.6001	392.4371	0.0000	0.19548
40	8	8	1000	5	500	0	5	3.0	0.0000	8167.3999	387.7860	0.1967	0.0060	3.0	0.0000	8167.3999	387.7860	0.0000	0.1967
40	8	8	1000	5	500	0	6	3.0	0.0000	8139.6001	404.5795	0.2033	0.0052	3.0	0.0000	8139.6001	404.5795	0.0000	0.2033
40	8	8	2000	6.25	500	0	1	1.0	0.0000	5383.5498	232.0925	0.2655	0.0091	1.0	0.0000	5383.5498	232.0925	0.0000	0.2655
40	8	8	2000	6.25	500	0	2	1.0	0.0000	5473.9502	213.5062	0.2767	0.0076	1.0	0.0000	5473.9502	213.5062	0.0000	0.2767

C	W	B	R _{max} [km]	E/O cost	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	2000	6.25	500	0	3	1.0	0.0000	5445.3501	98.1000	0.2799	0.0082	1.0	0.0000	5445.3501	98.1000	0.0000	0.2799	0.0082
40	8	8	2000	6.25	500	0	4	1.0	0.0000	5439.1001	95.2000	0.2828	0.0082	1.0	0.0000	5439.1001	95.2000	0.0000	0.2828	0.0082
40	8	8	2000	6.25	500	0	5	1.0	0.0000	5410.8999	96.4000	0.2829	0.0083	1.0	0.0000	5410.8999	96.4000	0.0000	0.2829	0.0083
40	8	8	2000	6.25	500	0	6	1.0	0.0000	5418.7998	94.9000	0.2783	0.0088	1.0	0.0000	5418.7998	94.9000	0.0000	0.2783	0.0088
40	8	8	3000	7.121	500	0	1	1.0	0.0000	4581.9878	15.7000	0.4435	0.0142	1.0	0.0000	4581.9878	15.7000	0.0000	0.4435	0.0142
40	8	8	3000	7.121	500	0	2	1.0	0.0000	4688.1143	15.6000	0.4578	0.0158	1.0	0.0000	4688.1143	15.6000	0.0000	0.4578	0.0158
40	8	8	3000	7.121	500	0	3	1.0	0.0000	4696.8921	16.6000	0.4640	0.0150	1.0	0.0000	4696.8921	16.6000	0.0000	0.4640	0.0150
40	8	8	3000	7.121	500	0	4	1.0	0.0000	4558.0518	17.2424	0.4453	0.0152	1.0	0.0000	4558.0518	17.2424	0.0000	0.4453	0.0152
40	8	8	3000	7.121	500	0	5	1.0	0.0000	4644.0835	17.02860	0.4623	0.0141	1.0	0.0000	4644.0835	17.02860	0.0000	0.4623	0.0141
40	8	8	3000	7.121	500	0	6	1.0	0.0000	4572.9092	17.02987	0.4515	0.0161	1.0	0.0000	4572.9092	17.02987	0.0000	0.4515	0.0161
40	8	8	4000	7.813	500	0	1	1.0	0.0000	4481.2798	0.0000	0.4641	0.0130	1.0	0.0000	4481.2798	0.0000	0.0000	0.4641	0.0130
40	8	8	4000	7.813	500	0	2	1.0	0.0000	4555.0718	190.3312	0.4766	0.0143	1.0	0.0000	4555.0718	190.3312	0.0000	0.4766	0.0143
40	8	8	4000	7.813	500	0	3	1.0	0.0000	4606.7036	164.1339	0.4923	0.0132	1.0	0.0000	4606.7036	164.1339	0.0000	0.4923	0.0132
40	8	8	4000	7.813	500	0	4	1.0	0.0000	4424.1704	170.4995	0.4624	0.0130	1.0	0.0000	4424.1704	170.4995	0.0000	0.4624	0.0130
40	8	8	4000	7.813	500	0	5	1.0	0.0000	4603.6875	169.6089	0.4906	0.0130	1.0	0.0000	4603.6875	169.6089	0.0000	0.4906	0.0130
40	8	8	4000	7.813	500	0	6	1.0	0.0000	4421.9941	175.0249	0.4611	0.0168	1.2	0.4526	4415.8193	175.1886	0.0000	0.5126	0.1076
40	8	8	5000	8.394	500	0	1	1.0	0.0000	4540.4492	155.1660	0.4654	0.0257	1.0	0.0000	4540.4492	155.1660	0.0000	0.4654	0.0257
40	8	8	5000	8.394	500	0	2	1.0	0.0000	4623.7656	184.6220	0.4889	0.0220	1.0	0.0000	4623.7656	184.6220	0.0000	0.4889	0.0220
40	8	8	5000	8.394	500	0	3	1.0	0.0000	4676.3096	170.9110	0.4829	0.0236	1.4	0.6034	4675.7275	170.8704	0.0000	0.6062	0.1615
40	8	8	5000	8.394	500	0	4	1.0	0.0000	4475.2813	168.3793	0.4704	0.0154	1.0	0.0000	4475.2813	168.3793	0.0000	0.4704	0.0154
40	8	8	5000	8.394	500	0	5	1.0	0.0000	4669.8340	162.5384	0.4985	0.0232	1.0	0.0000	4669.8340	162.5384	0.0000	0.4985	0.0232
40	8	8	5000	8.394	500	0	6	1.0	0.0000	4476.2705	176.7037	0.4687	0.0182	1.2	0.4526	4474.0825	179.2316	0.0000	0.5187	0.1023
40	8	8	6000	8.902	500	0	1	1.0	0.0000	4567.9360	154.4180	0.4673	0.0261	1.0	0.0000	4567.9360	154.4180	0.0000	0.4673	0.0261
40	8	8	6000	8.902	500	0	2	1.0	0.0000	4638.4453	179.9855	0.4860	0.0194	1.0	0.0000	4638.4453	179.9855	0.0000	0.4860	0.0194
40	8	8	6000	8.902	500	0	3	1.0	0.0000	4701.8433	165.6131	0.4970	0.0263	1.2	0.4526	4697.3784	171.0973	0.0000	0.5533	0.1053
40	8	8	6000	8.902	500	0	4	1.0	0.0000	4480.8042	171.6391	0.4782	0.0131	1.0	0.0000	4480.8042	171.6391	0.0000	0.4782	0.0131
40	8	8	6000	8.902	500	0	5	1.0	0.0000	4706.6733	162.1201	0.5000	0.0338	1.0	0.0000	4706.6733	162.1201	0.0000	0.5000	0.0338
40	8	8	6000	8.902	500	0	6	1.0	0.0000	4483.3154	176.6963	0.4734	0.0191	1.2	0.4526	4480.7275	179.7029	0.0000	0.5234	0.1012
40	8	8	7000	9.355	500	0	1	1.0	0.0000	4567.4653	174.9439	0.4782	0.0218	1.0	0.0000	4567.4653	174.9439	0.0000	0.4782	0.0218
40	8	8	7000	9.355	500	0	2	1.0	0.0000	4646.1294	178.9193	0.4923	0.0280	1.2	0.4526	4642.9385	176.5532	0.0000	0.5454	0.1175
40	8	8	7000	9.355	500	0	3	1.0	0.0000	4689.2305	166.6697	0.5045	0.0303	1.2	0.4526	4684.2217	173.0050	0.0000	0.5623	0.1075
40	8	8	7000	9.355	500	0	4	1.0	0.0000	4482.0439	178.6659	0.4811	0.0148	1.0	0.0000	4482.0439	178.6659	0.0000	0.4811	0.0148
40	8	8	7000	9.355	500	0	5	1.0	0.0000	4690.8286	172.1913	0.5000	0.0189	1.2	0.4526	4688.8979	172.2043	0.0000	0.5579	0.1201
40	8	8	7000	9.355	500	0	6	1.0	0.0000	4479.7974	179.4723	0.4735	0.0149	1.2	0.4526	4477.6348	182.0250	0.0000	0.5234	0.1047
40	8	8	8000	9.766	500	0	1	1.0	0.0000	4564.2686	167.2250	0.4687	0.0253	1.0	0.0000	4564.2686	167.2250	0.0000	0.4687	0.0253
40	8	8	8000	9.766	500	0	2	1.0	0.0000	4654.7593	179.6518	0.4842	0.0224	1.4	0.6034	4653.9248	180.4882	0.0000	0.5890	0.1444
40	8	8	8000	9.766	500	0	3	1.0	0.0000	4708.5713	157.9391	0.4939	0.0307	1.2	0.4526	4701.8389	166.4667	0.0000	0.5532	0.1096
40	8	8	8000	9.766	500	0	4	1.0	0.0000	4483.4043	179.7433	0.4858	0.0162	1.0	0.0000	4483.4043	179.7433	0.0000	0.4858	0.0162
40	8	8	8000	9.766	500	0	5	1.0	0.0000	4708.1670	181.2929	0.5062	0.0270	1.0	0.0000	4708.1670	181.2929	0.0000	0.5062	0.0270
40	8	8	8000	9.766	500	0	6	1.0	0.0000	4480.2725	174.3389	0.4793	0.0206	1.2	0.4526	4477.6841	177.4746	0.0000	0.5299	0.1037
40	8	8	9000	10.14	500	0	1	1.0	0.0000	4564.2686	167.2250	0.4750	0.0238	1.0	0.0000	4564.2686	167.2250	0.0000	0.4750	0.0238
40	8	8	9000	10.14	500	0	2	1.0	0.0000	4655.1631	179.6840	0.4859	0.0266	1.4	0.6034	4654.3296	180.5213	0.0000	0.5969	0.1469
40	8	8	9000	10.14	500	0	3	1.0	0.0000	4709.7979	158.3268	0.4961	0.0305	1.2	0.4526	4703.0649	166.8628	0.0000	0.5547	0.1131
40	8	8	9000	10.14	500	0	4	1.0	0.0000	4486.4556	181.9866	0.4861	0.0179	1.0	0.0000	4486.4556	181.9866	0.0000	0.4861	0.0179
40	8	8	9000	10.14	500	0	5	1.0	0.0000	4711.4282	181.7823	0.5063	0.0290	1.0	0.0000	4711.4282	181.7823	0.0000	0.5063	0.0290
40	8	8	9000	10.14	500	0	6	1.0	0.0000	4481.2764	174.1961	0.4812	0.0202	1.2	0.4526	4478.6885	177.3426	0.0000	0.5327	0.1026
40	8	8	10000	10.49	500	0	1	1.0	0.0000	4564.6592	167.3819	0.4766	0.0206	1.0	0.0000	4564.6592	167.3819	0.0000	0.4766	0.0206
40	8	8	10000	10.49	500	0	2	1.0	0.0000	4656.6904	178.3857	0.4891	0.0247	1.4	0.6034	4655.8569	179.2331	0.0000	0.5953	0.1453
40	8	8	10000	10.49	500	0	3	1.0	0.0000	4709.7979	158.3268	0.4953	0.0343	1.2	0.4526	4703.0649	166.8628	0.0000	0.5563	0.1137

C	W	B	R _{max}	E/O	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	Solve time	±CI	F _{opt}	±CI	Weighted port count	# of OEOs	Solve time	±CI
[Gb/s]			[km]	cost ratio	[Gb/s]	[%]				@F _{min}	@E _{min}	[sec]				@F _{opt}	@E _{opt}	[sec]	
40	8	8	1000	10.49	500	0	4	1.0	0.0000	4486.4556	181.9866	0.0000	0.0000	1.0	0.0000	4486.4556	181.9866	0.4890	0.0142
40	8	8	10000	10.49	500	0	5	1.0	0.0000	4709.4072	184.3064	0.0000	0.0000	1.0	0.0000	4709.4072	184.3064	0.5108	0.0278
40	8	8	10000	10.49	500	0	6	1.0	0.0000	4479.8428	173.3775	0.0000	0.0000	1.2	0.4526	4477.2544	176.5267	0.5360	0.1060
40	8	8	1000	5	500	80	1	1.0	0.0000	1780.2000	266.0143	67.4000	13.6983	1.0	0.0000	1780.2000	266.0143	0.0531	0.0058
40	8	8	1000	5	500	80	2	1.0	0.0000	1898.6000	259.3566	73.2000	13.7174	1.0	0.0000	1898.6000	259.3566	0.0548	0.0060
40	8	8	1000	5	500	80	3	1.0	0.0000	1902.6000	267.3127	74.1000	13.7243	1.0	0.0000	1902.6000	267.3127	0.0531	0.0058
40	8	8	1000	5	500	80	4	1.0	0.0000	1877.6000	296.0973	64.7000	14.7612	1.0	0.0000	1877.6000	296.0973	0.0624	0.0004
40	8	8	1000	5	500	80	5	1.0	0.0000	1954.0000	302.3766	75.8000	15.4089	1.0	0.0000	1954.0000	302.3766	0.0515	0.0054
40	8	8	1000	5	500	80	6	1.0	0.0000	1912.8000	293.2007	67.0000	14.8685	1.0	0.0000	1912.8000	293.2007	0.0581	0.0055
40	8	8	2000	6.25	500	80	1	1.0	0.0000	1286.3000	155.8004	17.6000	4.7368	1.0	0.0000	1286.3000	155.8004	0.1017	0.0095
40	8	8	2000	6.25	500	80	2	1.0	0.0000	1354.6500	153.5889	19.5000	4.5287	1.0	0.0000	1354.6500	153.5889	0.1061	0.0069
40	8	8	2000	6.25	500	80	3	1.0	0.0000	1410.4000	122.5625	21.3000	3.3401	1.0	0.0000	1410.4000	122.5625	0.1110	0.0063
40	8	8	2000	6.25	500	80	4	1.0	0.0000	1289.6500	146.9256	14.7000	4.6624	1.0	0.0000	1289.6500	146.9256	0.1094	0.0091
40	8	8	2000	6.25	500	80	5	1.0	0.0000	1388.2500	157.8475	21.2000	3.9018	1.0	0.0000	1388.2500	157.8475	0.1061	0.0071
40	8	8	2000	6.25	500	80	6	1.0	0.0000	1272.0500	169.3185	14.3000	4.8537	1.0	0.0000	1272.0500	169.3185	0.1079	0.0084
40	8	8	3000	7.121	500	80	1	1.0	0.0000	1280.3254	132.7589	3.8000	2.5197	1.0	0.0000	1280.3254	132.7589	0.1624	0.0142
40	8	8	3000	7.121	500	80	2	1.0	0.0000	1407.2396	109.3841	4.6000	2.5953	1.0	0.0000	1407.2396	109.3841	0.1796	0.0109
40	8	8	3000	7.121	500	80	3	1.0	0.0000	1539.6799	121.6596	5.6000	2.2678	1.0	0.0000	1539.6799	121.6596	0.2000	0.0090
40	8	8	3000	7.121	500	80	4	1.0	0.0000	1250.6910	143.7604	3.1000	2.5788	1.0	0.0000	1250.6910	143.7604	0.1563	0.0150
40	8	8	3000	7.121	500	80	5	1.0	0.0000	1444.0068	114.6611	5.6000	2.2678	1.0	0.0000	1444.0068	114.6611	0.1814	0.0122
40	8	8	3000	7.121	500	80	6	1.0	0.0000	1223.2809	132.0635	3.7000	2.5253	1.0	0.0000	1223.2809	132.0635	0.1578	0.0133
40	8	8	4000	7.813	500	80	1	1.0	0.0000	1299.5671	161.0315	0.0000	0.0000	1.0	0.0000	1299.5671	161.0315	0.1750	0.0164
40	8	8	4000	7.813	500	80	2	1.0	0.0000	1464.4202	111.2918	0.0000	0.0000	1.0	0.0000	1464.4202	111.2918	0.1970	0.0093
40	8	8	4000	7.813	500	80	3	1.0	0.0000	1597.9524	125.3319	0.0000	0.0000	1.0	0.0000	1597.9524	125.3319	0.2142	0.0119
40	8	8	4000	7.813	500	80	4	1.0	0.0000	1234.6487	142.2325	0.0000	0.0000	1.0	0.0000	1234.6487	142.2325	0.1642	0.0185
40	8	8	4000	7.813	500	80	5	1.0	0.0000	1574.7107	129.0331	0.0000	0.0000	1.0	0.0000	1574.7107	129.0331	0.2095	0.0131
40	8	8	4000	7.813	500	80	6	1.0	0.0000	1189.2070	141.2485	0.0000	0.0000	1.0	0.0000	1189.2070	141.2485	0.1594	0.0128
40	8	8	5000	8.394	500	80	1	1.0	0.0000	1309.0100	164.7675	0.0000	0.0000	1.0	0.0000	1309.0100	164.7675	0.1733	0.0135
40	8	8	5000	8.394	500	80	2	1.0	0.0000	1479.9956	110.9125	0.0000	0.0000	1.0	0.0000	1479.9956	110.9125	0.1954	0.0095
40	8	8	5000	8.394	500	80	3	1.0	0.0000	1627.7115	122.0383	0.0000	0.0000	1.0	0.0000	1627.7115	122.0383	0.2219	0.0115
40	8	8	5000	8.394	500	80	4	1.0	0.0000	1243.1199	146.5973	0.0000	0.0000	1.0	0.0000	1243.1199	146.5973	0.1623	0.0159
40	8	8	5000	8.394	500	80	5	1.0	0.0000	1600.8010	127.4986	0.0000	0.0000	1.0	0.0000	1600.8010	127.4986	0.2125	0.0118
40	8	8	5000	8.394	500	80	6	1.0	0.0000	1199.1898	143.7133	0.0000	0.0000	1.0	0.0000	1199.1898	143.7133	0.1624	0.0152
40	8	8	6000	8.902	500	80	1	1.0	0.0000	1310.3040	164.5712	0.0000	0.0000	1.0	0.0000	1310.3040	164.5712	0.1751	0.0165
40	8	8	6000	8.902	500	80	2	1.0	0.0000	1482.0724	108.1840	0.0000	0.0000	1.0	0.0000	1482.0724	108.1840	0.2000	0.0104
40	8	8	6000	8.902	500	80	3	1.0	0.0000	1636.3440	118.7296	0.0000	0.0000	1.0	0.0000	1636.3440	118.7296	0.2203	0.0112
40	8	8	6000	8.902	500	80	4	1.0	0.0000	1245.1296	148.3766	0.0000	0.0000	1.0	0.0000	1245.1296	148.3766	0.1687	0.0165
40	8	8	6000	8.902	500	80	5	1.0	0.0000	1604.7668	126.3227	0.0000	0.0000	1.0	0.0000	1604.7668	126.3227	0.2187	0.0129
40	8	8	6000	8.902	500	80	6	1.0	0.0000	1199.9381	144.5763	0.0000	0.0000	1.0	0.0000	1199.9381	144.5763	0.1657	0.0132
40	8	8	7000	9.355	500	80	1	1.0	0.0000	1309.0260	164.0936	0.0000	0.0000	1.0	0.0000	1309.0260	164.0936	0.1734	0.0170
40	8	8	7000	9.355	500	80	2	1.0	0.0000	1492.1501	101.5917	0.0000	0.0000	1.0	0.0000	1492.1501	101.5917	0.2016	0.0133
40	8	8	7000	9.355	500	80	3	1.0	0.0000	1640.8724	121.8149	0.0000	0.0000	1.0	0.0000	1640.8724	121.8149	0.2188	0.0129
40	8	8	7000	9.355	500	80	4	1.0	0.0000	1247.5103	146.4824	0.0000	0.0000	1.0	0.0000	1247.5103	146.4824	0.1689	0.0173
40	8	8	7000	9.355	500	80	5	1.0	0.0000	1616.6018	127.3532	0.0000	0.0000	1.0	0.0000	1616.6018	127.3532	0.2169	0.0135
40	8	8	7000	9.355	500	80	6	1.0	0.0000	1204.6467	143.5832	0.0000	0.0000	1.0	0.0000	1204.6467	143.5832	0.1626	0.0152
40	8	8	8000	9.766	500	80	1	1.0	0.0000	1310.1410	165.7427	0.0000	0.0000	1.0	0.0000	1310.1410	165.7427	0.1797	0.0142
40	8	8	8000	9.766	500	80	2	1.0	0.0000	1491.5955	105.2766	0.0000	0.0000	1.0	0.0000	1491.5955	105.2766	0.2017	0.0111
40	8	8	8000	9.766	500	80	3	1.0	0.0000	1641.7459	119.1048	0.0000	0.0000	1.0	0.0000	1641.7459	119.1048	0.2204	0.0112
40	8	8	8000	9.766	500	80	4	1.0	0.0000	1248.0443	148.7820	0.0000	0.0000	1.0	0.0000	1248.0443	148.7820	0.1687	0.0196

C	W	B	R _{max}	E/O	cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	8000	9.766	500	80	5	1	1.0	0.0000	1611.9698	123.6593	143.5158	0.0000	0.0000	1.0	0.0000	1611.9698	123.6593	0.0000	0.0000	0.0000
40	8	8	8000	9.766	500	80	6	1	1.0	0.0000	1202.0398	143.5158	165.7427	0.0000	0.0000	1.0	0.0000	1202.0398	143.5158	0.0000	0.0000	0.0000
40	8	8	9000	10.14	500	80	1	1	1.0	0.0000	1310.1410	165.7427	105.2766	0.0000	0.0000	1.0	0.0000	1310.1410	165.7427	0.0000	0.0000	0.0000
40	8	8	9000	10.14	500	80	2	1	1.0	0.0000	1491.5955	105.2766	118.7466	0.0000	0.0000	1.0	0.0000	1491.5955	105.2766	0.0000	0.0000	0.0000
40	8	8	9000	10.14	500	80	3	1	1.0	0.0000	1642.8242	118.7466	148.9343	0.0000	0.0000	1.0	0.0000	1642.8242	118.7466	0.0000	0.0000	0.0000
40	8	8	9000	10.14	500	80	4	1	1.0	0.0000	1248.2487	148.9343	123.2072	0.0000	0.0000	1.0	0.0000	1248.2487	148.9343	0.0000	0.0000	0.0000
40	8	8	9000	10.14	500	80	5	1	1.0	0.0000	1611.4176	123.2072	143.5158	0.0000	0.0000	1.0	0.0000	1611.4176	123.2072	0.0000	0.0000	0.0000
40	8	8	9000	10.14	500	80	6	1	1.0	0.0000	1202.0398	143.5158	165.7427	0.0000	0.0000	1.0	0.0000	1202.0398	143.5158	0.0000	0.0000	0.0000
40	8	8	10000	10.49	500	80	1	1	1.0	0.0000	1311.0211	165.7427	105.2766	0.0000	0.0000	1.0	0.0000	1311.0211	165.7427	0.0000	0.0000	0.0000
40	8	8	10000	10.49	500	80	2	1	1.0	0.0000	1493.7489	105.2766	118.7466	0.0000	0.0000	1.0	0.0000	1493.7489	105.2766	0.0000	0.0000	0.0000
40	8	8	10000	10.49	500	80	3	1	1.0	0.0000	1638.4072	120.8027	148.5348	0.0000	0.0000	1.0	0.0000	1638.4072	120.8027	0.0000	0.0000	0.0000
40	8	8	10000	10.49	500	80	4	1	1.0	0.0000	1249.4078	148.5348	122.8960	0.0000	0.0000	1.0	0.0000	1249.4078	148.5348	0.0000	0.0000	0.0000
40	8	8	10000	10.49	500	80	5	1	1.0	0.0000	1611.7693	122.8960	144.0057	0.0000	0.0000	1.0	0.0000	1611.7693	122.8960	0.0000	0.0000	0.0000
40	8	8	10000	10.49	500	80	6	1	1.0	0.0000	1203.5642	144.0057	165.7427	0.0000	0.0000	1.0	0.0000	1203.5642	144.0057	0.0000	0.0000	0.0000
40	8	8	1000	5	1500	0	1	1	6.0	0.7543	11739.5996	465.8766	475.1937	0.0000	0.0000	6.0	0.7543	11739.5996	465.8766	0.0000	0.0000	0.0000
40	8	8	1000	5	1500	0	2	1	6.0	0.7543	11798.5996	475.1937	462.1000	0.0000	0.0000	6.0	0.7543	11798.5996	475.1937	0.0000	0.0000	0.0000
40	8	8	1000	5	1500	0	3	1	6.0	0.7543	11859.5996	471.5565	465.6000	0.0000	0.0000	6.0	0.7543	11859.5996	471.5565	0.0000	0.0000	0.0000
40	8	8	1000	5	1500	0	4	1	6.0	0.7543	11891.0000	466.7280	469.3000	0.0000	0.0000	6.0	0.7543	11891.0000	466.7280	0.0000	0.0000	0.0000
40	8	8	1000	5	1500	0	5	1	6.0	0.7543	11857.5996	487.4485	465.4000	0.0000	0.0000	6.0	0.7543	11857.5996	487.4485	0.0000	0.0000	0.0000
40	8	8	1000	5	1500	0	6	1	6.0	0.7543	11849.7998	460.5399	466.7000	0.0000	0.0000	6.0	0.7543	11849.7998	460.5399	0.0000	0.0000	0.0000
40	8	8	2000	6.25	1500	0	1	1	3.0	0.0000	7831.0498	312.0763	330.8463	0.0000	0.0000	3.0	0.0000	7831.0498	312.0763	0.0000	0.0000	0.0000
40	8	8	2000	6.25	1500	0	2	1	3.0	0.0000	7949.3501	330.8463	317.3059	0.0000	0.0000	3.0	0.0000	7949.3501	330.8463	0.0000	0.0000	0.0000
40	8	8	2000	6.25	1500	0	3	1	3.0	0.0000	7908.2998	317.3059	330.8463	0.0000	0.0000	3.0	0.0000	7908.2998	317.3059	0.0000	0.0000	0.0000
40	8	8	2000	6.25	1500	0	4	1	3.0	0.0000	7917.8501	316.3549	330.8463	0.0000	0.0000	3.0	0.0000	7917.8501	316.3549	0.0000	0.0000	0.0000
40	8	8	2000	6.25	1500	0	5	1	3.0	0.0000	7889.2002	307.8364	330.8463	0.0000	0.0000	3.0	0.0000	7889.2002	307.8364	0.0000	0.0000	0.0000
40	8	8	2000	6.25	1500	0	6	1	3.0	0.0000	7884.1001	308.6702	330.8463	0.0000	0.0000	3.0	0.0000	7884.1001	308.6702	0.0000	0.0000	0.0000
40	8	8	3000	7.121	1500	0	1	1	3.0	0.0000	6645.9443	241.5396	229.8810	0.0000	0.0000	3.0	0.0000	6645.9443	241.5396	0.0000	0.0000	0.0000
40	8	8	3000	7.121	1500	0	2	1	3.0	0.0000	6793.0244	245.0626	230.8261	0.0000	0.0000	3.0	0.0000	6793.0244	245.0626	0.0000	0.0000	0.0000
40	8	8	3000	7.121	1500	0	3	1	3.0	0.0000	6792.7827	240.8261	230.8261	0.0000	0.0000	3.0	0.0000	6792.7827	240.8261	0.0000	0.0000	0.0000
40	8	8	3000	7.121	1500	0	4	1	3.0	0.0000	6656.7720	243.5807	229.8810	0.0000	0.0000	3.0	0.0000	6656.7720	243.5807	0.0000	0.0000	0.0000
40	8	8	3000	7.121	1500	0	5	1	3.0	0.0000	6746.7017	229.8810	229.8810	0.0000	0.0000	3.0	0.0000	6746.7017	229.8810	0.0000	0.0000	0.0000
40	8	8	3000	7.121	1500	0	6	1	3.0	0.0000	6649.7358	220.8716	229.8810	0.0000	0.0000	3.0	0.0000	6649.7358	220.8716	0.0000	0.0000	0.0000
40	8	8	4000	7.813	1500	0	1	1	3.0	0.0000	6457.2793	220.0153	216.5638	0.0000	0.0000	3.0	0.0000	6457.2793	220.0153	0.0000	0.0000	0.0000
40	8	8	4000	7.813	1500	0	2	1	3.0	0.0000	6605.6001	228.3214	235.9291	0.0000	0.0000	3.0	0.0000	6605.6001	228.3214	0.0000	0.0000	0.0000
40	8	8	4000	7.813	1500	0	3	1	3.0	0.0000	6603.0195	231.0265	235.9291	0.0000	0.0000	3.0	0.0000	6603.0195	231.0265	0.0000	0.0000	0.0000
40	8	8	4000	7.813	1500	0	4	1	3.0	0.0000	6445.3628	228.1600	244.8521	0.0000	0.0000	3.0	0.0000	6445.3628	228.1600	0.0000	0.0000	0.0000
40	8	8	4000	7.813	1500	0	5	1	3.0	0.0000	6607.5127	229.4387	220.0011	0.0000	0.0000	3.0	0.0000	6607.5127	229.4387	0.0000	0.0000	0.0000
40	8	8	4000	7.813	1500	0	6	1	3.0	0.0000	6424.4849	210.9227	220.0011	0.0000	0.0000	3.0	0.0000	6424.4849	210.9227	0.0000	0.0000	0.0000
40	8	8	5000	8.394	1500	0	1	1	3.0	0.0000	6505.2373	217.8156	239.8583	0.0000	0.0000	3.0	0.0000	6505.2373	217.8156	0.0000	0.0000	0.0000
40	8	8	5000	8.394	1500	0	2	1	3.0	0.0000	6644.7773	235.9291	235.9291	0.0000	0.0000	3.0	0.0000	6644.7773	235.9291	0.0000	0.0000	0.0000
40	8	8	5000	8.394	1500	0	3	1	3.0	0.0000	6679.4834	235.9291	235.9291	0.0000	0.0000	3.0	0.0000	6679.4834	235.9291	0.0000	0.0000	0.0000
40	8	8	5000	8.394	1500	0	4	1	3.0	0.0000	6502.6143	223.4794	244.8521	0.0000	0.0000	3.0	0.0000	6502.6143	223.4794	0.0000	0.0000	0.0000
40	8	8	5000	8.394	1500	0	5	1	3.0	0.0000	6713.7041	244.8521	220.0011	0.0000	0.0000	3.0	0.0000	6713.7041	244.8521	0.0000	0.0000	0.0000
40	8	8	5000	8.394	1500	0	6	1	3.0	0.0000	6480.0791	220.0011	216.5638	0.0000	0.0000	3.0	0.0000	6480.0791	220.0011	0.0000	0.0000	0.0000
40	8	8	6000	8.902	1500	0	1	1	3.0	0.0000	6521.3105	216.5638	234.9419	0.0000	0.0000	3.0	0.0000	6521.3105	216.5638	0.0000	0.0000	0.0000
40	8	8	6000	8.902	1500	0	2	1	3.0	0.0000	6663.9751	241.3010	234.9419	0.0000	0.0000	3.0	0.0000	6663.9751	241.3010	0.0000	0.0000	0.0000
40	8	8	6000	8.902	1500	0	3	1	3.0	0.0000	6693.2905	234.9419	222.1390	0.0000	0.0000	3.0	0.0000	6693.2905	234.9419	0.0000	0.0000	0.0000
40	8	8	6000	8.902	1500	0	4	1	3.0	0.0000	6508.1982	222.1390	250.9924	0.0000	0.0000	3.0	0.0000	6508.1982	222.1390	0.0000	0.0000	0.0000
40	8	8	6000	8.902	1500	0	5	1	3.0	0.0000	6730.6821	250.9924	220.0011	0.0000	0.0000	3.0	0.0000	6730.6821	250.9924	0.0000	0.0000	0.0000

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
40	8	8	6000	8.902	1500	0	6	3.0	0.0000	6499.4917	227.6116	0.0000	1.0358	3.0	0.0000	6499.4917	227.6116	0.0000	1.0358
40	8	8	7000	9.355	1500	0	1	3.0	0.0000	6534.2744	219.5779	0.0000	1.0297	3.0	0.0000	6534.2744	219.5779	0.0000	1.0297
40	8	8	7000	9.355	1500	0	2	3.0	0.0000	6689.1494	242.9890	0.0000	1.0828	3.0	0.0000	6689.1494	242.9890	0.0000	1.0828
40	8	8	7000	9.355	1500	0	3	3.0	0.0000	6686.0181	240.8948	0.0000	1.0984	3.0	0.0000	6686.0181	240.8948	0.0000	1.0984
40	8	8	7000	9.355	1500	0	4	3.0	0.0000	6517.0010	216.5960	0.0000	1.0421	3.0	0.0000	6517.0010	216.5960	0.0000	1.0421
40	8	8	7000	9.355	1500	0	5	3.0	0.0000	6728.8721	241.2552	0.0000	1.1000	3.0	0.0000	6728.8721	241.2552	0.0000	1.1000
40	8	8	7000	9.355	1500	0	6	3.0	0.0000	6505.3428	212.0757	0.0000	1.0390	3.0	0.0000	6505.3428	212.0757	0.0000	1.0390
40	8	8	8000	9.766	1500	0	1	3.0	0.0000	6531.6689	215.3468	0.0000	1.0360	3.0	0.0000	6531.6689	215.3468	0.0000	1.0360
40	8	8	8000	9.766	1500	0	2	3.0	0.0000	6670.1118	239.5378	0.0000	1.0877	3.0	0.0000	6670.1118	239.5378	0.0000	1.0877
40	8	8	8000	9.766	1500	0	3	3.0	0.0000	6696.2861	231.6667	0.0000	1.1018	3.0	0.0000	6696.2861	231.6667	0.0000	1.1018
40	8	8	8000	9.766	1500	0	4	3.0	0.0000	6508.2881	223.9171	0.0000	1.0453	3.0	0.0000	6508.2881	223.9171	0.0000	1.0453
40	8	8	8000	9.766	1500	0	5	3.0	0.0000	6736.6235	226.3086	0.0000	1.1062	3.0	0.0000	6736.6235	226.3086	0.0000	1.1062
40	8	8	8000	9.766	1500	0	6	3.0	0.0000	6505.4556	212.0819	0.0000	1.0406	3.0	0.0000	6505.4556	212.0819	0.0000	1.0406
40	8	8	9000	10.14	1500	0	1	3.0	0.0000	6531.6689	215.3468	0.0000	1.0359	3.0	0.0000	6531.6689	215.3468	0.0000	1.0359
40	8	8	9000	10.14	1500	0	2	3.0	0.0000	6668.5303	240.5506	0.0000	1.0874	3.0	0.0000	6668.5303	240.5506	0.0000	1.0874
40	8	8	9000	10.14	1500	0	3	3.0	0.0000	6697.3569	230.8624	0.0000	1.1046	3.0	0.0000	6697.3569	230.8624	0.0000	1.1046
40	8	8	9000	10.14	1500	0	4	3.0	0.0000	6507.1890	222.1661	0.0000	1.0469	3.0	0.0000	6507.1890	222.1661	0.0000	1.0469
40	8	8	9000	10.14	1500	0	5	3.0	0.0000	6737.1982	226.4862	0.0000	1.1094	3.0	0.0000	6737.1982	226.4862	0.0000	1.1094
40	8	8	9000	10.14	1500	0	6	3.0	0.0000	6505.4556	212.0819	0.0000	1.0439	3.0	0.0000	6505.4556	212.0819	0.0000	1.0439
40	8	8	10000	10.49	1500	0	1	3.0	0.0000	6531.6689	215.3468	0.0000	1.0391	3.0	0.0000	6531.6689	215.3468	0.0000	1.0391
40	8	8	10000	10.49	1500	0	2	3.0	0.0000	6669.5322	239.2634	0.0000	1.0890	3.0	0.0000	6669.5322	239.2634	0.0000	1.0890
40	8	8	10000	10.49	1500	0	3	3.0	0.0000	6705.2959	237.7518	0.0000	1.1061	3.0	0.0000	6705.2959	237.7518	0.0000	1.1061
40	8	8	10000	10.49	1500	0	4	3.0	0.0000	6501.8950	225.3750	0.0000	1.0484	3.0	0.0000	6501.8950	225.3750	0.0000	1.0484
40	8	8	10000	10.49	1500	0	5	3.0	0.0000	6743.2979	224.8158	0.0000	1.1078	3.0	0.0000	6743.2979	224.8158	0.0000	1.1078
40	8	8	10000	10.49	1500	0	6	3.0	0.0000	6511.3281	214.1177	0.0000	1.0406	3.0	0.0000	6511.3281	214.1177	0.0000	1.0406
40	8	8	1000	5	1500	80	1	2.8	0.4526	2840.6001	343.7424	110.4000	0.1407	2.8	0.4526	2840.6001	343.7424	110.4000	0.1407
40	8	8	1000	5	1500	80	2	2.8	0.4526	2924.6001	362.5554	114.5000	0.1452	2.8	0.4526	2924.6001	362.5554	114.5000	0.1452
40	8	8	1000	5	1500	80	3	2.8	0.4526	2957.2000	357.1150	116.3000	0.1437	2.8	0.4526	2957.2000	357.1150	116.3000	0.1437
40	8	8	1000	5	1500	80	4	2.8	0.4526	3000.2000	362.2587	111.3000	0.1469	2.8	0.4526	3000.2000	362.2587	111.3000	0.1469
40	8	8	1000	5	1500	80	5	2.8	0.4526	3023.2000	389.7054	118.6000	0.1472	2.8	0.4526	3023.2000	389.7054	118.6000	0.1472
40	8	8	1000	5	1500	80	6	2.8	0.4526	2959.0000	370.4637	109.5000	0.1471	2.8	0.4526	2959.0000	370.4637	109.5000	0.1471
40	8	8	2000	6.25	1500	80	1	1.0	0.0000	2095.0500	254.3930	37.9000	0.1237	1.0	0.0000	2095.0500	254.3930	37.9000	0.1237
40	8	8	2000	6.25	1500	80	2	1.0	0.0000	2203.7000	245.6700	40.8000	0.1297	1.0	0.0000	2203.7000	245.6700	40.8000	0.1297
40	8	8	2000	6.25	1500	80	3	1.0	0.0000	2175.0000	269.4083	41.8000	0.1251	1.0	0.0000	2175.0000	269.4083	41.8000	0.1251
40	8	8	2000	6.25	1500	80	4	1.0	0.0000	2128.3501	247.5474	36.7000	0.1312	1.0	0.0000	2128.3501	247.5474	36.7000	0.1312
40	8	8	2000	6.25	1500	80	5	1.0	0.0000	2150.7000	243.2075	39.7000	0.1188	1.0	0.0000	2150.7000	243.2075	39.7000	0.1188
40	8	8	2000	6.25	1500	80	6	1.0	0.0000	2118.3999	239.4190	36.6000	0.1297	1.0	0.0000	2118.3999	239.4190	36.6000	0.1297
40	8	8	3000	7.121	1500	80	1	1.0	0.0000	1849.8635	170.1143	4.9000	0.2015	1.0	0.0000	1849.8635	170.1143	4.9000	0.2015
40	8	8	3000	7.121	1500	80	2	1.0	0.0000	1991.9762	148.9043	5.8000	0.2173	1.0	0.0000	1991.9762	148.9043	5.8000	0.2173
40	8	8	3000	7.121	1500	80	3	1.0	0.0000	2043.3450	172.5281	7.0000	0.2125	1.0	0.0000	2043.3450	172.5281	7.0000	0.2125
40	8	8	3000	7.121	1500	80	4	1.0	0.0000	1831.7561	173.0474	4.7000	0.2187	1.0	0.0000	1831.7561	173.0474	4.7000	0.2187
40	8	8	3000	7.121	1500	80	5	1.0	0.0000	2001.2963	129.6290	6.8000	0.2156	1.0	0.0000	2001.2963	129.6290	6.8000	0.2156
40	8	8	3000	7.121	1500	80	6	1.0	0.0000	1839.9277	151.6834	4.9000	0.2042	1.0	0.0000	1839.9277	151.6834	4.9000	0.2042
40	8	8	4000	7.813	1500	80	1	1.0	0.0000	1858.6599	197.2393	0.4000	0.6013	1.0	0.0000	1858.6599	197.2393	0.4000	0.6013
40	8	8	4000	7.813	1500	80	2	1.0	0.0000	1989.3967	145.9261	0.4000	0.5003	1.0	0.0000	1989.3967	145.9261	0.4000	0.5003
40	8	8	4000	7.813	1500	80	3	1.0	0.0000	2067.5178	166.7217	0.5000	0.6954	1.0	0.0000	2067.5178	166.7217	0.5000	0.6954
40	8	8	4000	7.813	1500	80	4	1.0	0.0000	1827.8242	178.9337	0.3000	0.2032	1.0	0.0000	1827.8242	178.9337	0.3000	0.2032
40	8	8	4000	7.813	1500	80	5	1.0	0.0000	2069.9995	161.5660	0.3000	0.4830	1.0	0.0000	2069.9995	161.5660	0.3000	0.4830
40	8	8	4000	7.813	1500	80	6	1.0	0.0000	1802.6191	159.0981	0.1000	0.2263	1.0	0.0000	1802.6191	159.0981	0.1000	0.2263

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
40	8	8	5000	8.394	1500	80	1	1.0	0.0000	1878.6272	196.6605	0.0000	0.0000	0.2016	0.0208	1.4	0.6034	1863.8334	183.5586	0.0000	0.0000	0.2627	0.0792
40	8	8	5000	8.394	1500	80	2	1.0	0.0000	2007.7117	148.2903	0.0000	0.0000	0.2219	0.0148	1.4	0.6034	2004.1211	148.6330	0.0000	0.0000	0.2922	0.0934
40	8	8	5000	8.394	1500	80	3	1.0	0.0000	2105.1460	163.6739	0.0000	0.0000	0.2359	0.0226	1.2	0.4526	2101.9302	162.3472	0.0000	0.0000	0.2702	0.0806
40	8	8	5000	8.394	1500	80	4	1.0	0.0000	1835.5615	173.1689	0.0000	0.0000	0.2077	0.0173	1.2	0.4526	1834.5615	172.8898	0.0000	0.0000	0.2311	0.0546
40	8	8	5000	8.394	1500	80	5	1.0	0.0000	2096.3735	167.4442	0.0000	0.0000	0.2375	0.0203	1.4	0.6034	2093.1046	164.8683	0.0000	0.0000	0.3110	0.0956
40	8	8	5000	8.394	1500	80	6	1.0	0.0000	1807.2494	156.7704	0.0000	0.0000	0.2047	0.0171	1.6	0.6913	1787.9651	157.8882	0.0000	0.0000	0.2878	0.0857
40	8	8	6000	8.902	1500	80	1	1.0	0.0000	1883.4084	196.6257	0.0000	0.0000	0.2000	0.0235	1.2	0.4526	1869.3099	183.4372	0.0000	0.0000	0.2329	0.0667
40	8	8	6000	8.902	1500	80	2	1.0	0.0000	2016.5752	154.7829	0.0000	0.0000	0.2249	0.0162	1.4	0.6034	2010.6273	152.7154	0.0000	0.0000	0.2953	0.0923
40	8	8	6000	8.902	1500	80	3	1.0	0.0000	2120.6807	159.7713	0.0000	0.0000	0.2344	0.0204	1.4	0.6034	2117.6499	157.9105	0.0000	0.0000	0.3093	0.1022
40	8	8	6000	8.902	1500	80	4	1.0	0.0000	1838.5472	176.3373	0.0000	0.0000	0.2094	0.0199	1.2	0.4526	1837.5472	176.0729	0.0000	0.0000	0.2360	0.0578
40	8	8	6000	8.902	1500	80	5	1.0	0.0000	2110.3787	164.1445	0.0000	0.0000	0.2391	0.0231	1.4	0.6034	2104.3169	162.2132	0.0000	0.0000	0.3157	0.0968
40	8	8	6000	8.902	1500	80	6	1.0	0.0000	1810.5554	154.7520	0.0000	0.0000	0.2064	0.0173	1.6	0.6913	1790.7076	155.6938	0.0000	0.0000	0.2907	0.0862
40	8	8	7000	9.355	1500	80	1	1.0	0.0000	1892.6461	192.9100	0.0000	0.0000	0.2063	0.0203	1.4	0.6034	1871.6008	180.1371	0.0000	0.0000	0.2673	0.0807
40	8	8	7000	9.355	1500	80	2	1.0	0.0000	2021.7670	150.9218	0.0000	0.0000	0.2298	0.0167	1.4	0.6034	2012.1917	143.8297	0.0000	0.0000	0.2985	0.0913
40	8	8	7000	9.355	1500	80	3	1.0	0.0000	2124.9551	156.7016	0.0000	0.0000	0.2374	0.0234	1.6	0.6913	2119.6262	156.4789	0.0000	0.0000	0.3531	0.1170
40	8	8	7000	9.355	1500	80	4	1.0	0.0000	1845.5469	174.0897	0.0000	0.0000	0.2094	0.0197	1.2	0.4526	1844.5469	173.8448	0.0000	0.0000	0.2359	0.0578
40	8	8	7000	9.355	1500	80	5	1.0	0.0000	2117.7983	165.1226	0.0000	0.0000	0.2407	0.0224	1.4	0.6034	2110.4646	162.1839	0.0000	0.0000	0.3171	0.0958
40	8	8	7000	9.355	1500	80	6	1.0	0.0000	1811.0338	155.3332	0.0000	0.0000	0.2077	0.0168	1.6	0.6913	1789.3652	156.3129	0.0000	0.0000	0.2906	0.0870
40	8	8	8000	9.766	1500	80	1	1.0	0.0000	1892.4238	196.7831	0.0000	0.0000	0.2048	0.0231	1.4	0.6034	1871.7559	183.7105	0.0000	0.0000	0.2687	0.0830
40	8	8	8000	9.766	1500	80	2	1.0	0.0000	2020.7621	151.1642	0.0000	0.0000	0.2295	0.0176	1.4	0.6034	2015.5612	148.5439	0.0000	0.0000	0.2984	0.0917
40	8	8	8000	9.766	1500	80	3	1.0	0.0000	2132.3735	160.5491	0.0000	0.0000	0.2423	0.0199	1.6	0.6913	2125.7705	161.4683	0.0000	0.0000	0.3514	0.1124
40	8	8	8000	9.766	1500	80	4	1.0	0.0000	1843.5271	176.6100	0.0000	0.0000	0.2076	0.0184	1.2	0.4526	1842.5271	176.3621	0.0000	0.0000	0.2342	0.0578
40	8	8	8000	9.766	1500	80	5	1.0	0.0000	2116.8416	165.6157	0.0000	0.0000	0.2390	0.0240	1.4	0.6034	2107.6248	162.4228	0.0000	0.0000	0.3138	0.0945
40	8	8	8000	9.766	1500	80	6	1.0	0.0000	1811.0488	155.0748	0.0000	0.0000	0.2062	0.0181	1.6	0.6913	1790.7076	155.6938	0.0000	0.0000	0.2906	0.0870
40	8	8	9000	10.14	1500	80	1	1.0	0.0000	1892.4238	196.7831	0.0000	0.0000	0.2063	0.0224	1.4	0.6034	1871.7559	183.7105	0.0000	0.0000	0.2688	0.0799
40	8	8	9000	10.14	1500	80	2	1.0	0.0000	2022.4375	149.1685	0.0000	0.0000	0.2327	0.0170	1.4	0.6034	2017.2366	146.5463	0.0000	0.0000	0.3015	0.0901
40	8	8	9000	10.14	1500	80	3	1.0	0.0000	2134.8501	161.6913	0.0000	0.0000	0.2390	0.0203	1.4	0.6034	2125.8186	161.5178	0.0000	0.0000	0.3109	0.1023
40	8	8	9000	10.14	1500	80	4	1.0	0.0000	1843.6770	176.7030	0.0000	0.0000	0.2094	0.0200	1.2	0.4526	1842.6770	176.4557	0.0000	0.0000	0.2328	0.0551
40	8	8	9000	10.14	1500	80	5	1.0	0.0000	2119.2778	167.3369	0.0000	0.0000	0.2438	0.0225	1.4	0.6034	2109.9063	164.2885	0.0000	0.0000	0.3188	0.0955
40	8	8	9000	10.14	1500	80	6	1.0	0.0000	1810.4065	154.6559	0.0000	0.0000	0.2092	0.0178	1.6	0.6913	1791.3666	156.0062	0.0000	0.0000	0.2923	0.0860
40	8	8	10000	10.49	1500	80	1	1.0	0.0000	1892.4238	196.7831	0.0000	0.0000	0.2048	0.0215	1.4	0.6034	1871.7559	183.7105	0.0000	0.0000	0.2689	0.0826
40	8	8	10000	10.49	1500	80	2	1.0	0.0000	2022.4375	149.1685	0.0000	0.0000	0.2283	0.0191	1.4	0.6034	2018.7031	145.8982	0.0000	0.0000	0.2985	0.0915
40	8	8	10000	10.49	1500	80	3	1.0	0.0000	2134.8501	161.6913	0.0000	0.0000	0.2408	0.0183	1.4	0.6034	2125.8186	161.5178	0.0000	0.0000	0.3110	0.1023
40	8	8	10000	10.49	1500	80	4	1.0	0.0000	1843.6770	176.7030	0.0000	0.0000	0.2078	0.0183	1.2	0.4526	1842.6770	176.4557	0.0000	0.0000	0.2343	0.0577
40	8	8	10000	10.49	1500	80	5	1.0	0.0000	2119.2778	167.3369	0.0000	0.0000	0.2404	0.0226	1.4	0.6034	2109.9063	164.2885	0.0000	0.0000	0.3157	0.0971
40	8	8	10000	10.49	1500	80	6	1.0	0.0000	1810.4065	154.6559	0.0000	0.0000	0.2094	0.0177	1.6	0.6913	1791.3666	156.0062	0.0000	0.0000	0.2938	0.0878

Table C.5: Comparison of no-bifurcation-based heuristics without the reach customization for the NSF network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	2000	2.5	500	0	1	17.6	0.6913	28525.0000	541.8353	1281.9000	33.3128	16.6721	0.6489	17.6	0.6913	28525.0000	541.8353	1281.9000	33.3128	16.6721	0.6489
10	8	8	2000	2.5	500	0	2	17.6	0.6913	28743.9004	530.4114	1287.2000	33.4072	16.9335	0.7052	17.8	0.7390	28739.8008	530.1270	1286.9000	33.2461	17.1379	0.721
10	8	8	2000	2.5	500	0	3	17.6	0.6913	28820.0996	567.3130	1290.9000	34.2707	17.0366	0.7258	17.6	0.6913	28820.0996	567.3130	1290.9000	34.2707	17.0366	0.725
10	8	8	2000	2.5	500	0	4	17.6	0.6913	28645.1992	602.4603	1282.7000	33.4178	16.8582	0.6938	17.8	0.7390	28641.0996	601.6375	1281.8000	32.9355	17.0435	0.693
10	8	8	2000	2.5	500	0	5	17.6	0.6913	28886.5996	571.0972	1287.5000	32.6518	17.0475	0.6764	17.6	0.6913	28886.5996	571.0972	1287.5000	32.6518	17.0475	0.676
10	8	8	2000	2.5	500	0	6	17.6	0.6913	28709.0000	560.7681	1281.5000	31.8635	16.8451	0.7110	17.8	0.7390	28707.6992	561.0290	1280.0000	32.2164	17.0723	0.765
10	8	8	3000	2.849	500	0	1	7.0	0.0000	20813.6152	601.7568	476.1000	48.5828	67.0894	6.7264	9.0	0.6746	20261.3594	381.5324	418.0000	14.1309	219.9191	175.7
10	8	8	3000	2.849	500	0	2	7.0	0.0000	20975.9883	509.1589	481.3000	45.9587	70.8341	4.2124	9.2	0.4526	20517.4375	428.2357	422.7000	14.0948	113.2227	5.747
10	8	8	3000	2.849	500	0	3	7.2	0.4526	20930.4473	519.4048	468.9000	34.2142	115.8415	100.7324	9.0	0.6746	20530.8613	393.2808	426.0000	13.5765	217.1428	159.8
10	8	8	3000	2.849	500	0	4	7.0	0.0000	20883.0430	718.2958	493.0000	70.8860	71.4280	6.9205	9.4	0.6034	20206.6309	380.1597	418.4000	13.3832	329.1862	201.4
10	8	8	3000	2.849	500	0	5	7.2	0.4526	20917.0391	476.4366	472.4000	26.6182	73.0518	6.9295	9.4	0.6034	20439.1289	396.0517	427.1000	13.6786	167.4690	119.8
10	8	8	3000	2.849	500	0	6	7.0	0.0000	20730.4824	552.4974	477.1000	42.3893	70.2724	5.7173	9.2	0.4526	20236.2539	402.4526	415.3000	14.2434	212.2034	153.1
10	8	8	4000	3.125	500	0	1	7.0	0.0000	18949.0254	330.7685	151.0000	21.7455	79.9821	4.3653	7.6	0.6913	18841.6250	332.5257	141.0000	12.0255	90.8098	9.421
10	8	8	4000	3.125	500	0	2	7.0	0.0000	19145.4492	418.3200	152.6000	19.4059	83.2848	3.0415	7.8	0.7390	19027.8242	365.2711	138.5000	11.6128	96.8662	10.65
10	8	8	4000	3.125	500	0	3	7.0	0.0000	19135.1758	397.6035	148.0000	17.3117	81.7106	5.3668	7.6	0.6913	19069.0254	339.9354	141.3000	10.9044	94.4701	10.20
10	8	8	4000	3.125	500	0	4	7.0	0.0000	18860.0508	402.4366	151.2000	20.6362	79.8870	3.1858	7.6	0.6913	18752.4258	314.4614	139.9000	10.4482	90.9029	9.869
10	8	8	4000	3.125	500	0	5	7.0	0.0000	19116.4004	425.6232	154.5000	22.8732	81.5710	4.4115	7.6	0.6913	19017.9004	337.1597	141.9000	11.6040	93.2188	10.91
10	8	8	4000	3.125	500	0	6	7.0	0.0000	18886.9492	423.6703	155.9000	26.4687	80.1642	4.4231	8.0	0.7543	18762.7500	328.6770	140.8000	10.0505	96.0332	10.42
10	8	8	5000	3.358	500	0	1	7.0	0.0000	18277.5430	349.9962	19.3000	3.3571	81.9939	4.1380	7.4	0.6034	18264.1133	343.6569	19.8000	3.3866	89.0991	7.654
10	8	8	5000	3.358	500	0	2	7.0	0.0000	18530.2598	350.5247	21.4000	4.5904	82.6720	4.5984	7.6	0.6913	18502.9277	340.2477	20.1000	3.3638	93.5196	11.20
10	8	8	5000	3.358	500	0	3	7.0	0.0000	18559.5586	363.4926	20.5000	4.2433	83.9776	4.4159	7.6	0.6913	18543.3711	355.2570	20.1000	3.6400	95.7696	9.766
10	8	8	5000	3.358	500	0	4	7.0	0.0000	18249.4141	331.5960	21.1000	5.3594	81.7352	2.8878	7.2	0.4526	18248.4863	330.4587	21.2000	5.2884	85.6030	8.276
10	8	8	5000	3.358	500	0	5	7.0	0.0000	18491.4883	323.8626	21.7000	5.8136	84.2261	4.6532	7.4	0.6034	18472.3574	316.7979	20.5000	3.9083	92.5952	8.280
10	8	8	5000	3.358	500	0	6	7.0	0.0000	18243.9707	345.2157	22.7000	7.2428	81.0488	4.7286	7.8	0.7390	18224.8965	335.3787	19.9000	3.7780	93.9269	10.09
10	8	8	6000	3.561	500	0	1	7.0	0.0000	18689.3770	361.1829	5.7000	2.0253	79.3776	5.5707	7.4	0.6034	18674.6523	345.2520	6.1000	1.9215	87.6632	10.83
10	8	8	6000	3.561	500	0	2	7.0	0.0000	18933.4688	307.8651	8.3000	3.5546	81.1992	4.7230	7.8	0.7390	18907.3633	302.8504	6.7000	1.8180	95.2200	13.59
10	8	8	6000	3.561	500	0	3	7.0	0.0000	18983.7305	327.4258	6.1000	1.7992	79.6568	7.3731	7.4	0.6034	18976.2051	327.2484	6.9000	1.6679	89.7392	10.61
10	8	8	6000	3.561	500	0	4	7.0	0.0000	18690.0176	345.1067	11.1000	10.6851	81.1104	4.0241	7.6	0.6913	18609.0352	316.5528	6.9000	1.6334	91.2208	9.400
10	8	8	6000	3.561	500	0	5	7.0	0.0000	18873.2031	348.2100	8.8000	5.5405	85.3000	3.1048	7.4	0.6034	18849.7461	336.3318	6.8000	1.7133	92.7704	8.509
10	8	8	6000	3.561	500	0	6	7.0	0.0000	18579.7031	357.1432	7.1000	4.0259	81.5136	3.2668	7.6	0.6913	18555.6816	334.9408	6.2000	1.6106	90.6336	9.971
10	8	8	7000	3.742	500	0	1	7.0	0.0000	19088.9336	391.2102	0.0000	0.0000	82.1885	4.2343	7.4	0.6034	19076.8398	377.2544	0.0000	0.0000	90.2872	11.03
10	8	8	7000	3.742	500	0	2	7.0	0.0000	19357.8184	343.0908	1.0000	2.2628	82.9670	4.3979	8.0	0.7543	19331.0313	333.1755	0.0000	0.0000	102.6255	11.83
10	8	8	7000	3.742	500	0	3	7.0	0.0000	19321.5352	292.4189	0.0000	0.0000	84.5445	4.3387	7.6	0.6913	19315.4355	292.5667	0.0000	0.0000	95.6385	11.81
10	8	8	7000	3.742	500	0	4	7.0	0.0000	19074.2148	333.1140	4.7000	9.6535	81.8088	3.4049	7.6	0.6913	18999.7852	294.1745	0.0000	0.0000	91.8701	9.570
10	8	8	7000	3.742	500	0	5	7.0	0.0000	19238.7676	325.0071	0.3000	0.6788	85.1840	4.3236	7.0	0.0000	19238.7676	325.0001	0.3000	0.6788	85.1840	4.323
10	8	8	7000	3.742	500	0	6	7.0	0.0000	19008.8496	346.0574	1.8000	2.7979	82.1368	3.9019	7.6	0.6913	18972.4277	337.1640	0.0000	0.0000	91.9096	9.361
10	8	8	8000	3.906	500	0	1	7.0	0.0000	19509.8555	401.9544	0.0000	0.0000	80.4400	4.9034	7.6	0.6913	19485.3691	381.2494	0.0000	0.0000	256.2904	198.1
10	8	8	8000	3.906	500	0	2	7.0	0.0000	19773.0000	369.2882	0.6000	1.3577	81.3296	5.0061	8.0	0.7543	19730.5117	354.8904	0.0000	0.0000	269.4216	200.2
10	8	8	8000	3.906	500	0	3	7.0	0.0000	19754.0684	302.2208	0.0000	0.0000	84.4946	4.3168	7.6	0.6913	19748.9688	302.4271	0.0000	0.0000	265.6832	207.1
10	8	8	8000	3.906	500	0	4	7.0	0.0000	19455.8945	322.7475	3.5000	7.4304	82.2304	3.3849	7.6	0.6913	19404.8945	298.9485	0.0000	0.0000	144.8576	123.6
10	8	8	8000	3.906	500	0	5	7.0	0.0000	19655.2441	331.8110	0.3000	0.6788	85.2960	4.2697	7.2	0.4526	19653.2441	331.9946	0.3000	0.6788	89.0432	8.222
10	8	8	8000	3.906	500	0	6	7.0	0.0000	19401.8184	372.6303	0.9000	2.0365	82.3536	4.1154	7.6	0.6913	19369.4434	353.8603	0.0000	0.0000	199.2912	169.7
10	8	8	9000	4.057	500	0	1	7.0	0.0000	19869.2773	417.4142	0.0000	0.0000	80.3712	4.9038	7.6	0.6913	19842.3105	391.3723	0.0000	0.0000	255.9104	197.7
10	8	8	9000	4.057	500	0	2	7.0	0.0000	20165.1445	375.4624	0.1000	0.2263	83.6992	4.0006	7.4	0.6034	20149.0430	368.1993	0.1000	0.2263	204.2464	179.0
10	8	8	9000	4.057	500	0	3	7.0	0.0000	20144.0742	308.5500	0.0000	0.0000	84.3264	4.3104	7.4	0.6034	20140.0742	309.3018	0.0000	0.0000	205.0592	180.7
10	8	8	9000	4.057																			

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	9000	4.057	500	0	6	7.0	0.0000	19757.7480	349.8791	0.2000	0.4526	4.0288	7.6	0.6913	19757.3145	348.7327	0.0000	199.5904
10	8	8	10000	4.197	500	0	1	7.0	0.0000	20209.5234	412.8401	0.0000	0.0000	2.7124	7.6	0.6913	20191.4863	398.7298	0.0000	65.5567
10	8	8	10000	4.197	500	0	2	7.0	0.0000	20519.7871	401.8832	0.0000	1.3577	56.6755	7.8	0.7390	20470.4902	373.1578	0.0000	69.6182
10	8	8	10000	4.197	500	0	3	7.0	0.0000	20504.8379	322.9265	0.0000	0.0000	58.9168	7.6	0.6913	20498.1367	323.4951	0.0000	67.5411
10	8	8	10000	4.197	500	0	4	7.0	0.0000	20130.2949	332.0278	1.5000	3.1508	57.6059	7.6	0.6913	20113.5820	322.1302	0.0000	65.3438
10	8	8	10000	4.197	500	0	5	7.0	0.0000	20381.4043	313.7643	0.0000	0.0000	59.0307	7.4	0.6034	20374.8262	311.9892	0.0000	65.7334
10	8	8	10000	4.197	500	0	6	7.0	0.0000	20126.1914	356.1992	0.1000	0.2263	57.9353	7.8	0.7390	20104.4355	354.8493	0.0000	67.0403
10	8	8	2000	2.5	500	80	1	5.0	0.0000	8406.7998	506.8704	371.5000	31.0863	0.1742	5.2	0.4526	8401.0000	504.0366	371.2000	30.9648
10	8	8	2000	2.5	500	80	2	5.0	0.0000	8530.9004	425.0790	372.7000	26.6477	0.0818	5.2	0.4526	8527.4004	423.2655	372.0000	26.4651
10	8	8	2000	2.5	500	80	3	5.0	0.0000	8544.5996	473.4550	382.1000	28.1982	0.0806	5.4	0.6034	8528.5996	466.8972	380.2000	27.2718
10	8	8	2000	2.5	500	80	4	5.0	0.0000	8439.2002	484.6077	369.1000	28.3491	0.0651	5.0	0.0000	8439.2002	484.6077	369.1000	28.3491
10	8	8	2000	2.5	500	80	5	5.0	0.0000	8580.0996	480.8262	381.5000	28.0765	0.0867	5.4	0.6034	8546.2002	474.9602	378.3000	26.6221
10	8	8	2000	2.5	500	80	6	5.0	0.0000	8398.7002	445.0009	366.5000	27.4080	0.0671	5.2	0.4526	8397.9004	444.6175	366.3000	27.3598
10	8	8	3000	2.849	500	80	1	3.0	0.0000	5806.0171	364.8026	119.3000	22.8005	0.9169	3.6	0.6913	5742.7764	313.9300	112.4000	15.7174
10	8	8	3000	2.849	500	80	2	3.0	0.0000	5991.5923	320.3373	118.0000	16.6893	0.8631	3.2	0.4526	5971.2798	312.5175	115.4000	15.2732
10	8	8	3000	2.849	500	80	3	3.0	0.0000	6101.4629	338.7871	123.0000	17.2227	0.7809	3.4	0.6034	6059.4136	314.0305	119.8000	15.3534
10	8	8	3000	2.849	500	80	4	3.0	0.0000	5848.4326	328.3304	116.4000	18.7571	0.8063	3.4	0.6034	5807.4961	293.0455	111.6000	14.7425
10	8	8	3000	2.849	500	80	5	3.0	0.0000	6029.8828	333.3235	121.6000	17.2267	1.0265	3.4	0.6034	6016.9282	325.9323	119.1000	15.8696
10	8	8	3000	2.849	500	80	6	3.0	0.0000	5758.7314	343.0324	112.2000	17.6946	0.7830	3.4	0.6034	5728.1489	315.6006	109.6000	16.2338
10	8	8	4000	3.125	500	80	1	3.0	0.0000	5494.6748	276.8776	37.8000	12.2449	1.0284	3.2	0.4526	5486.0000	274.0957	36.6000	11.5684
10	8	8	4000	3.125	500	80	2	3.0	0.0000	5725.8501	307.5716	39.9000	12.1547	0.9306	3.2	0.4526	5713.2749	302.1140	38.6000	11.3198
10	8	8	4000	3.125	500	80	3	3.0	0.0000	5783.7298	282.7298	41.8000	10.8403	0.8562	3.2	0.4526	5774.2998	278.3904	40.5000	9.9621
10	8	8	4000	3.125	500	80	4	3.0	0.0000	5555.1001	298.0586	38.8000	12.6517	0.7624	3.2	0.4526	5541.7749	291.0928	37.3000	11.6363
10	8	8	4000	3.125	500	80	5	3.0	0.0000	5771.3999	292.6527	41.4000	12.6625	0.9325	3.2	0.4526	5754.2749	283.5981	39.8000	11.5811
10	8	8	4000	3.125	500	80	6	3.0	0.0000	5445.5752	278.0579	36.5000	11.6177	0.8998	3.2	0.4526	5431.2998	275.6692	35.6000	11.1016
10	8	8	5000	3.358	500	80	1	3.0	0.0000	5435.7847	247.9549	6.2000	3.9596	0.8734	3.0	0.0000	5435.7847	247.9549	6.2000	3.9596
10	8	8	5000	3.358	500	80	2	3.0	0.0000	5652.7124	257.9002	6.4000	3.7592	0.8037	3.0	0.0000	5652.7124	257.9002	6.4000	3.7592
10	8	8	5000	3.358	500	80	3	3.0	0.0000	5731.5337	249.4515	6.7000	3.7569	0.7929	3.0	0.0000	5731.5337	249.4515	6.7000	3.7569
10	8	8	5000	3.358	500	80	4	3.0	0.0000	5477.0581	238.7396	6.5000	3.6212	0.7493	3.0	0.0000	5477.0581	238.7396	6.5000	3.6212
10	8	8	5000	3.358	500	80	5	3.0	0.0000	5696.1455	252.9998	6.7000	3.6649	0.7775	3.2	0.4526	5695.4545	252.0918	6.7000	3.6649
10	8	8	5000	3.358	500	80	6	3.0	0.0000	5341.5200	235.7117	6.2000	3.7833	0.7840	3.0	0.0000	5341.5200	235.7117	6.2000	3.7833
10	8	8	6000	3.561	500	80	1	3.0	0.0000	5546.6582	245.9759	2.0000	1.7849	0.8341	3.0	0.0000	5546.6582	245.9759	2.0000	1.7849
10	8	8	6000	3.561	500	80	2	3.0	0.0000	5765.4971	251.0882	2.2000	1.6456	0.7861	3.0	0.0000	5765.4971	251.0882	2.2000	1.6456
10	8	8	6000	3.561	500	80	3	3.0	0.0000	5877.3643	254.3029	2.2000	1.6456	0.8383	3.0	0.0000	5877.3643	254.3029	2.2000	1.6456
10	8	8	6000	3.561	500	80	4	3.0	0.0000	5592.7671	231.1514	2.3000	1.6542	0.7770	3.0	0.0000	5592.7671	231.1514	2.3000	1.6542
10	8	8	6000	3.561	500	80	5	3.0	0.0000	5822.0703	245.5338	2.3000	1.6194	0.8547	3.0	0.0000	5822.0703	245.5338	2.3000	1.6194
10	8	8	6000	3.561	500	80	6	3.0	0.0000	5461.7319	237.8510	2.1000	1.7017	0.7031	3.0	0.0000	5461.7319	237.8510	2.1000	1.7017
10	8	8	7000	3.742	500	80	1	3.0	0.0000	5686.2280	247.2464	0.0000	0.0000	0.8111	3.0	0.0000	5686.2280	247.2464	0.0000	0.8111
10	8	8	7000	3.742	500	80	2	3.0	0.0000	5872.2788	237.4452	0.0000	0.0000	0.7175	3.0	0.0000	5872.2788	237.4452	0.0000	0.7175
10	8	8	7000	3.742	500	80	3	3.0	0.0000	5991.1846	251.2612	0.0000	0.0000	0.8339	3.0	0.0000	5991.1846	251.2612	0.0000	0.8339
10	8	8	7000	3.742	500	80	4	3.0	0.0000	5692.0864	234.3336	0.0000	0.0000	0.8030	3.0	0.0000	5692.0864	234.3336	0.0000	0.8030
10	8	8	7000	3.742	500	80	5	3.0	0.0000	5959.9082	243.2050	0.0000	0.0000	0.8203	3.0	0.0000	5959.9082	243.2050	0.0000	0.8203
10	8	8	7000	3.742	500	80	6	3.0	0.0000	5544.7095	235.3943	0.0000	0.0000	0.7433	3.0	0.0000	5544.7095	235.3943	0.0000	0.7433
10	8	8	8000	3.906	500	80	1	3.0	0.0000	5801.3501	250.9303	0.0000	0.0000	0.7795	3.0	0.0000	5801.3501	250.9303	0.0000	0.7795
10	8	8	8000	3.906	500	80	2	3.0	0.0000	5992.9248	242.0627	0.0000	0.0000	0.7281	3.0	0.0000	5992.9248	242.0627	0.0000	0.7281
10	8	8	8000	3.906	500	80	3	3.0	0.0000	6111.9375	247.2094	0.0000	0.0000	0.8546	3.0	0.0000	6111.9375	247.2094	0.0000	0.8546
10	8	8	8000	3.906	500	80	4	3.0	0.0000	5815.3438	245.3636	0.0000	0.0000	0.8235	3.0	0.0000	5815.3438	245.3636	0.0000	0.8235
10	8	8	8000	3.906	500	80	5	3.0	0.0000	6089.8999	243.2788	0.0000	0.0000	0.8017	3.0	0.0000	6089.8999	243.2788	0.0000	0.8017
10	8	8	8000	3.906	500	80	6	3.0	0.0000	5659.0688	238.1352	0.0000	0.0000	0.7481	3.0	0.0000	5659.0688	238.1352	0.0000	0.7481

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	Solve time [sec]	±CI
10	8	8	9000	4.057	500	80	1	3.0	0.0000	5905.7017	260.6822	0.0000	18.8251	0.0000	3.0	0.0000	5905.7017	260.6822	0.0000	18.8251	0.0000
10	8	8	9000	4.057	500	80	2	3.0	0.0000	6108.0537	251.7662	0.0000	19.8575	0.0000	3.0	0.0000	6108.0537	251.7662	0.0000	19.8575	0.0000
10	8	8	9000	4.057	500	80	3	3.0	0.0000	6225.1182	256.2493	0.0000	20.6057	0.0000	3.0	0.0000	6225.1182	256.2493	0.0000	20.6057	0.0000
10	8	8	9000	4.057	500	80	4	3.0	0.0000	5918.0439	248.9115	0.0000	18.9742	0.0000	3.0	0.0000	5918.0439	248.9115	0.0000	18.9742	0.0000
10	8	8	9000	4.057	500	80	5	3.0	0.0000	6189.3574	250.1982	0.0000	20.4833	0.0000	3.0	0.0000	6189.3574	250.1982	0.0000	20.4833	0.0000
10	8	8	9000	4.057	500	80	6	3.0	0.0000	5761.9746	243.0956	0.0000	18.0952	0.0000	3.0	0.0000	5761.9746	243.0956	0.0000	18.0952	0.0000
10	8	8	10000	4.197	500	80	1	3.0	0.0000	6002.1714	260.6956	0.0000	14.3952	0.0000	3.0	0.0000	6002.1714	260.6956	0.0000	14.3952	0.0000
10	8	8	10000	4.197	500	80	2	3.0	0.0000	6189.3994	245.0852	0.0000	15.1272	0.0000	3.0	0.0000	6189.3994	245.0852	0.0000	15.1272	0.0000
10	8	8	10000	4.197	500	80	3	3.0	0.0000	6331.2871	270.7005	0.0000	15.6464	0.0000	3.0	0.0000	6331.2871	270.7005	0.0000	15.6464	0.0000
10	8	8	10000	4.197	500	80	4	3.0	0.0000	6016.2739	254.2527	0.0000	14.5100	0.0000	3.0	0.0000	6016.2739	254.2527	0.0000	14.5100	0.0000
10	8	8	10000	4.197	500	80	5	3.0	0.0000	6301.8350	246.9933	0.0000	15.5564	0.0000	3.0	0.0000	6301.8350	246.9933	0.0000	15.5564	0.0000
10	8	8	10000	4.197	500	80	6	3.0	0.0000	5858.0767	248.6933	0.0000	13.7736	0.0000	3.0	0.0000	5858.0767	248.6933	0.0000	13.7736	0.0000
10	8	8	2000	2.5	1500	0	1	49.8	1.8102	33539.3008	561.7399	1550.9000	58.5512	2.7752	50.0	1.6866	33375.5000	490.2373	1533.2000	59.1480	2.094
10	8	8	2000	2.5	1500	0	2	49.8	1.8102	33922.1992	601.4388	1560.9000	60.1054	2.5168	50.0	1.6866	33762.6016	452.2643	1541.3000	60.7793	1.723
10	8	8	2000	2.5	1500	0	3	49.8	1.8102	33948.8984	644.7278	1563.7000	60.1153	2.6073	50.2	1.6798	33774.5000	527.1653	1541.4000	60.9406	1.787
10	8	8	2000	2.5	1500	0	4	49.8	1.8102	33984.5000	769.8406	1589.9000	90.3514	59.1090	50.6	1.4780	33639.6992	524.9636	1540.8000	60.5931	1.583
10	8	8	2000	2.5	1500	0	5	49.8	1.8102	34140.3008	603.1827	1566.5000	51.7763	60.0364	50.2	1.6798	33938.6992	466.4764	1544.5000	60.8495	1.715
10	8	8	2000	2.5	1500	0	6	49.8	1.8102	33908.8008	655.0533	1570.9000	56.1484	59.5395	50.6	1.3151	33661.8008	545.4269	1532.9000	60.6010	1.447
10	8	8	3000	2.849	1500	0	1	17.8	1.0006	26868.4160	935.5723	880.8000	102.1724	16.8139	25.8	1.8102	23770.7695	364.6880	504.1000	10.4537	322.1868
10	8	8	3000	2.849	1500	0	2	17.6	0.6913	27396.3379	1151.1494	926.6000	148.9942	20.1437	25.8	1.9318	24161.5684	366.6393	510.3000	9.3542	333.5632
10	8	8	3000	2.849	1500	0	3	18.0	1.0119	27532.5313	1205.5896	922.7000	158.1550	28.6733	25.8	1.9318	24037.5020	382.3795	512.1000	10.3167	332.3232
10	8	8	3000	2.849	1500	0	4	17.6	0.9659	26930.2559	816.0317	880.7000	182.9870	18.3470	25.6	2.1387	23776.9961	387.7553	506.0000	10.9197	322.4912
10	8	8	3000	2.849	1500	0	5	17.8	1.0006	27798.9727	1153.9872	971.7000	113.7144	30.7463	25.8	1.9318	24003.5820	379.9142	513.8000	10.3956	329.3104
10	8	8	3000	2.849	1500	0	6	17.6	0.9659	27539.6563	968.1272	989.8000	157.8222	107.1488	26.0	1.8165	23843.3867	396.1973	502.9000	9.9633	325.7064
10	8	8	4000	3.125	1500	0	1	17.2	0.4526	24778.0000	1048.3208	467.6000	127.0409	19.7195	21.6	1.5160	21924.4492	360.8172	165.9000	7.1670	271.0110
10	8	8	4000	3.125	1500	0	2	17.4	0.6034	24104.3496	724.6646	363.0000	72.3775	148.8314	22.3781	1.3826	22208.0254	350.2530	169.4000	7.6860	280.7138
10	8	8	4000	3.125	1500	0	3	18.0	0.7543	24029.8242	1032.0659	348.6000	100.9798	31.0575	21.8	1.9318	21879.5000	377.2146	168.9000	8.0846	278.1988
10	8	8	4000	3.125	1500	0	4	17.2	0.4526	24012.2754	606.0181	380.8000	62.0230	13.7808	22.0	1.3908	21860.6992	387.0561	168.2000	8.2542	272.4120
10	8	8	4000	3.125	1500	0	5	17.6	0.6913	23919.5508	655.6061	343.5000	62.2221	124.1860	22.0	1.8165	22171.2500	354.0035	169.8000	7.1856	283.1844
10	8	8	4000	3.125	1500	0	6	17.2	0.4526	24958.3750	1582.6681	491.5000	175.4538	126.9592	22.2	1.8102	21927.0000	366.8336	165.7000	8.1728	274.6936
10	8	8	5000	3.358	1500	0	1	17.6	0.6913	22304.8379	732.5834	123.1000	79.9105	136.1226	20.2	1.5384	21227.1289	337.1293	24.3000	3.0367	240.3756
10	8	8	5000	3.358	1500	0	2	17.6	0.6913	22583.2051	814.1146	104.2000	67.4462	155.0912	20.4	1.3577	21601.0273	328.4125	26.6000	1.3577	255.4652
10	8	8	5000	3.358	1500	0	3	17.6	0.6913	22621.8242	739.8791	107.7000	66.7852	120.3840	20.4	1.1782	21537.8867	343.9118	26.5000	1.2733	260.3704
10	8	8	5000	3.358	1500	0	4	17.6	0.6913	21920.1680	480.6263	84.1000	31.3236	163.9256	20.2	1.0006	21181.5977	331.4892	27.5000	3.5257	250.8716
10	8	8	5000	3.358	1500	0	5	17.6	0.6913	22624.3164	1007.3980	127.4000	104.2818	127.8596	20.2	1.2068	21513.7988	348.2582	25.0000	2.3370	246.9732
10	8	8	5000	3.358	1500	0	6	17.6	0.6913	22414.6250	945.8110	136.3000	83.0637	163.8076	22.2	1.3151	21230.0371	354.8658	25.4000	4.6764	249.9092
10	8	8	6000	3.561	1500	0	1	17.6	0.6913	22379.5664	606.4019	51.4000	55.3718	122.7040	21.2	1.4231	21688.8008	315.3030	7.8000	2.0739	257.2152
10	8	8	6000	3.561	1500	0	2	17.4	0.6034	23025.5195	639.1927	79.6000	65.2445	148.4368	20.6	1.7592	22051.8496	320.8671	6.8000	3.0508	246.9072
10	8	8	6000	3.561	1500	0	3	17.4	0.6034	22586.9746	438.6810	39.2000	33.4089	119.6048	21.2	1.4231	21952.1836	322.6087	6.5000	3.2045	249.4544
10	8	8	6000	3.561	1500	0	4	17.6	0.6913	22249.1289	600.6092	51.1000	44.2206	145.0640	21.0	1.3492	21570.3867	313.6567	7.3000	2.1347	249.9776
10	8	8	6000	3.561	1500	0	5	17.4	0.6034	22867.8730	716.3897	93.1000	70.2269	122.7840	20.8	1.2531	21853.4980	321.3101	7.5000	2.5298	246.8416
10	8	8	6000	3.561	1500	0	6	17.6	0.6913	22276.7598	652.2390	62.6000	44.2434	156.8544	20.2	0.7390	21494.3496	330.2719	5.2000	4.0167	224.2800
10	8	8	7000	3.742	1500	0	1	17.6	0.6913	22668.1445	555.1249	33.6000	42.3312	134.8604	20.0	1.3908	22117.6523	409.7741	0.0000	0.0000	239.6516
10	8	8	7000	3.742	1500	0	2	17.6	0.6913	22915.3555	483.5714	17.4000	15.4814	159.6886	21.0	0.9541	22492.8867	399.7219	0.0000	0.0000	278.5102
10	8	8	7000	3.742	1500	0	3	17.6	0.6913	22857.6992	401.7222	20.9000	25								

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	Weighted port count @F _{opt}	±CI	F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	
10	8	8	8000	3.906	1500	0	2	17.6	0.6913	23376.0820	446.7392	92000	8.4382	161.7936	21.7964	22958.1055	405.5549	0.0000	274.4400	16.75	
10	8	8	8000	3.906	1500	0	3	17.6	0.6913	23493.1563	603.9607	323000	45.4947	124.4352	24.7403	22883.5625	378.8958	0.0000	284.1216	20.86	
10	8	8	8000	3.906	1500	0	4	17.6	0.6913	22975.0430	396.2497	143000	8.3858	165.7696	25.5334	22535.9941	382.1548	0.0000	255.5296	17.88	
10	8	8	8000	3.906	1500	0	5	17.6	0.6913	23294.5371	468.8929	242000	31.4439	134.8880	18.2170	22850.0938	381.2441	0.0000	265.8944	21.51	
10	8	8	8000	3.906	1500	0	6	17.6	0.6913	23590.1875	1223.0288	851000	104.2601	170.2352	27.8456	22598.0879	392.8096	0.0000	251.7504	16.07	
10	8	8	9000	4.057	1500	0	1	17.6	0.6913	23607.4785	543.4016	303000	38.8144	135.6864	25.3332	23049.8945	416.0776	0.0000	261.6800	19.71	
10	8	8	9000	4.057	1500	0	2	17.6	0.6913	23794.1172	453.8072	78000	13.2534	157.2576	19.6251	23407.0566	413.0376	0.0000	268.6528	20.70	
10	8	8	9000	4.057	1500	0	3	17.6	0.6913	23816.6875	446.0932	167000	24.1480	124.1248	24.0166	23336.6152	393.9673	0.0000	284.1920	20.45	
10	8	8	9000	4.057	1500	0	4	17.6	0.6913	23383.2617	424.5266	102000	8.5454	163.3696	27.5824	22976.4863	383.7113	0.0000	252.4032	18.36	
10	8	8	9000	4.057	1500	0	5	17.6	0.6913	23665.1367	449.1992	192000	26.4156	135.3280	22.2815	23288.0352	399.9908	0.0000	269.6640	23.68	
10	8	8	9000	4.057	1500	0	6	17.6	0.6913	24057.7012	1219.2253	822000	102.3705	169.7344	27.1856	23043.9473	397.0578	0.0000	251.5488	15.93	
10	8	8	10000	4.197	1500	0	1	17.6	0.6913	24068.5781	631.2052	354000	52.5873	93.3832	17.1376	23512.9824	438.8153	0.0000	174.0547	14.59	
10	8	8	10000	4.197	1500	0	2	17.6	0.6913	24277.2461	703.8391	199000	41.8082	117.4590	13.9760	23839.4980	397.9106	0.0000	188.2118	14.62	
10	8	8	10000	4.197	1500	0	3	17.6	0.6913	24274.9336	524.5358	183000	39.1631	93.5014	20.7155	23774.2930	408.6566	0.0000	186.6586	18.40	
10	8	8	10000	4.197	1500	0	4	17.6	0.6913	23752.0996	430.9330	70000	8.4866	114.6928	19.6682	23414.6758	407.7788	0.0000	169.0472	15.22	
10	8	8	10000	4.197	1500	0	5	17.6	0.6913	23981.8691	487.2572	174000	27.2393	103.5132	18.1352	23648.7754	411.6252	0.0000	187.3868	15.61	
10	8	8	10000	4.197	1500	0	6	17.6	0.6913	24685.1836	1567.7838	995000	131.3751	120.7940	19.9416	23427.4688	389.7701	0.1000	178.5716	13.87	
10	8	8	2000	2.5	1500	80	1	12.8	1.0560	11256.5000	645.8707	5197000	65.8096	29.0619	14.2663	11030.0000	441.8723	4864000	28.2421	30.5430	16.94
10	8	8	2000	2.5	1500	80	2	12.6	1.3151	11705.7998	594.2784	5496000	70.0977	29.6325	14.5457	11381.0000	428.2766	4985000	26.2242	31.0826	17.33
10	8	8	2000	2.5	1500	80	3	12.8	1.0560	11583.5996	624.1428	5307000	59.4340	31.4292	15.5739	11335.2998	423.2189	4987000	28.8674	36.0020	17.19
10	8	8	2000	2.5	1500	80	4	12.6	1.3151	11504.5000	715.1140	5645000	106.0497	35.0322	12.3932	11122.4004	469.4928	4906000	29.1051	37.7149	15.11
10	8	8	2000	2.5	1500	80	5	13.0	0.9541	11572.2002	655.9527	5353000	75.0669	31.8076	15.5400	11330.9004	436.2012	4992000	28.5598	39.6689	15.78
10	8	8	2000	2.5	1500	80	6	12.6	1.3151	11582.7998	704.7799	5708000	119.2591	33.5772	14.3336	11202.4004	463.2277	4885000	28.4889	38.3269	15.39
10	8	8	3000	2.849	1500	80	1	5.4	0.6034	8595.3232	412.0244	2489000	33.5696	29.7120	6.4925	7836.4282	297.1044	1596000	17.3616	67.2816	6.49
10	8	8	3000	2.849	1500	80	2	5.6	0.9659	8691.0625	403.7939	2372000	34.7313	39.2176	10.6358	8123.7500	303.8409	1695000	20.0870	120.8224	12.02
10	8	8	3000	2.849	1500	80	3	5.6	0.9659	8856.5918	442.4515	2489000	35.2736	34.5632	11.5781	8743.5322	332.5324	1652000	17.5525	122.9168	12.07
10	8	8	3000	2.849	1500	80	4	5.4	0.6034	7818.4863	371.8682	2354000	23.2628	33.1696	6.9295	7878.6265	332.0836	1591000	16.6976	65.9008	6.326
10	8	8	3000	2.849	1500	80	5	5.4	0.6034	8826.8359	462.3002	2595000	41.0763	31.7248	6.4672	8083.9014	315.2670	1708000	18.1861	114.7952	12.27
10	8	8	3000	2.849	1500	80	6	5.4	0.6034	8500.5400	322.4684	2458000	34.9729	32.4576	6.6614	7862.0078	306.0455	1568000	15.9674	119.5904	11.45
10	8	8	4000	3.125	1500	80	1	5.4	0.6034	7880.7749	311.6203	985000	10.9522	31.2488	6.9838	7340.2251	271.8858	526000	9.2451	144.9424	123.2
10	8	8	4000	3.125	1500	80	2	5.2	0.4526	8133.7500	231.8444	1045000	22.6784	37.1752	8.1363	7577.9751	278.4864	555000	7.3844	110.7280	101.4
10	8	8	4000	3.125	1500	80	3	5.4	0.6034	8113.6001	328.1734	988000	13.2448	32.2992	6.8796	7616.4502	283.9930	549000	8.7665	201.2256	152.9
10	8	8	4000	3.125	1500	80	4	5.4	0.6034	7799.8999	293.2027	966000	19.0997	36.1872	8.9147	7349.6748	278.7578	522000	8.2058	141.8808	122.0
10	8	8	4000	3.125	1500	80	5	5.4	0.6034	8132.9751	297.7672	1072000	21.0213	33.5336	6.8565	7599.5498	259.5089	564000	8.9829	198.8232	150.5
10	8	8	4000	3.125	1500	80	6	5.4	0.6034	7778.9248	291.0561	967000	16.7948	35.0768	7.9648	7328.0249	284.0708	524000	9.5953	193.4408	160.9
10	8	8	5000	3.358	1500	80	1	5.4	0.6034	7455.5938	292.6017	261000	9.8715	34.0488	7.9617	7226.0283	237.7451	76000	4.0925	69.7440	9.768
10	8	8	5000	3.358	1500	80	2	5.2	0.4526	7745.7109	301.9297	301000	17.1248	37.1440	7.4225	7441.2432	274.9535	90000	3.8311	66.9320	5.889
10	8	8	5000	3.358	1500	80	3	5.4	0.6034	7796.2549	282.8922	288000	12.5795	35.5688	9.1381	7522.8618	250.1723	86000	3.9366	123.1080	109.8
10	8	8	5000	3.358	1500	80	4	5.4	0.6034	7454.4229	321.1955	286000	20.3262	37.3072	9.5554	7155.6846	270.3202	78000	3.8871	62.3240	7.844
10	8	8	5000	3.358	1500	80	5	5.4	0.6034	7818.5273	324.0655	310000	16.3065	38.5696	9.0042	7510.0615	255.6085	100000	3.8607	119.9856	109.7
10	8	8	5000	3.358	1500	80	6	5.4	0.6034	7370.0322	306.8285	257000	18.0802	37.4576	8.5915	7147.1392	258.4839	75000	3.8791	61.6592	8.128
10	8	8	6000	3.561	1500	80	1	5.8	0.7390	7448.2173	231.5202	20000	2.5909	36.0384	8.1663	7346.2954	254.7715	27000	1.9392	237.1968	165.6
10	8	8	6000	3.561	1500	80	2	5.2	0.4526	7858.5210	425.2791	216000	42.6232	36.7152	10.2500	7556.7461	261.1458	28000	2.1280	120.6960	129.4
10	8	8	6000	3.561	1500	80	3	5.8	0.7390	7776.8877	286.2985	48000	6.1812	40.0960	8.8457	7659.8960	270.5256	26000	2.1912	240.9616	164.9
10	8	8	6000	3.561	1500	80	4	5.4	0.6034	7712.8789	740.4777	357000	73.0115	32.3248	10.3206	7300.9429	268.6051	22000	2.2577	156.8656	

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	Weighted			# of OEOs @ F _{min}	Solve time [sec]	Weighted			# of OEOs @ F _{opt}	Solve time [sec]						
								F _{min}	±CI	port count @ F _{min}			F _{opt}	±CI	port count @ F _{opt}								
10	8	8	7000	3.742	1500	80	3	5.4	0.6034	8005.9233	329.9457	5.2000	5.7620	36.0944	9.0915	8.4	0.9659	7812.1553	295.9747	0.0000	0.0000	215.3392	161.8
10	8	8	7000	3.742	1500	80	4	5.4	0.6034	7602.4829	297.2414	5.7000	11.1724	38.0672	9.8661	7.6	0.9659	7444.4697	299.7174	0.0000	0.0000	145.6256	126.0
10	8	8	7000	3.742	1500	80	5	5.4	0.6034	7952.0459	294.7462	1.3000	2.4568	36.6736	8.7792	8.0	1.0119	7809.3726	272.3659	0.0000	0.0000	161.7608	138.5
10	8	8	7000	3.742	1500	80	6	5.4	0.6034	7503.6221	279.2245	1.3000	1.7543	37.9944	8.4657	7.2	0.8124	7403.5635	269.8651	0.2000	0.3017	58.6104	6.411
10	8	8	8000	3.906	1500	80	1	5.2	0.4526	7837.8062	301.7400	3.1000	3.9402	30.6464	8.0961	7.2	1.2531	7658.5562	275.6027	0.2000	0.4526	59.4352	16.12
10	8	8	8000	3.906	1500	80	2	5.2	0.4526	8040.7686	278.0112	5.7000	8.5470	38.1664	9.6047	6.8	0.8124	7877.5625	279.2863	0.2000	0.3017	60.5568	9.670
10	8	8	8000	3.906	1500	80	3	5.4	0.6034	8159.1938	337.1233	5.1000	5.8077	36.4016	9.0285	8.4	0.9659	7962.3311	290.0887	0.0000	0.0000	215.2416	161.7
10	8	8	8000	3.906	1500	80	4	5.4	0.6034	7777.4375	307.9771	7.8000	15.4347	38.3648	9.6471	7.2	0.8124	7598.4688	301.0919	0.1000	0.2263	97.4960	87.69
10	8	8	8000	3.906	1500	80	5	5.4	0.6034	8097.8374	310.8675	1.2000	2.2577	37.1152	8.9328	8.2	1.0006	7967.1187	280.4656	0.0000	0.0000	164.0368	138.2
10	8	8	8000	3.906	1500	80	6	5.4	0.6034	7653.7061	279.7281	1.3000	1.7543	37.9296	8.4328	7.4	0.9051	7555.2124	277.2248	0.1000	0.2263	60.7472	8.861
10	8	8	9000	4.057	1500	80	1	5.2	0.4526	7976.1016	310.1741	2.3000	3.6337	30.5922	8.1570	7.0	1.1685	7799.9609	284.9719	1.4000	2.7027	57.0813	14.85
10	8	8	9000	4.057	1500	80	2	5.2	0.4526	8156.1563	258.5301	3.5000	5.7070	39.2094	9.1284	7.4	0.6034	8024.3906	270.8602	0.0000	0.0000	68.6046	7.943
10	8	8	9000	4.057	1500	80	3	5.4	0.6034	8293.2832	334.2171	4.0000	5.6845	36.7470	9.2423	8.0	0.7543	8121.7710	313.1791	0.0000	0.0000	75.6787	10.37
10	8	8	9000	4.057	1500	80	4	5.4	0.6034	7905.9194	318.5972	7.8000	15.4347	38.8847	9.6005	7.4	0.9051	7739.8062	306.4500	0.1000	0.2263	64.0744	10.78
10	8	8	9000	4.057	1500	80	5	5.4	0.6034	8234.3721	309.2471	0.7000	1.1709	37.1526	9.0865	8.0	1.2162	8106.3462	280.2916	0.0000	0.0000	73.8946	14.45
10	8	8	9000	4.057	1500	80	6	5.4	0.6034	7779.5947	276.2110	1.1000	1.7673	38.2948	8.4319	7.4	0.9051	7683.6748	273.6628	0.1000	0.2263	61.1136	8.849
10	8	8	10000	4.197	1500	80	1	5.2	0.4526	8123.7046	319.1652	2.3000	3.5706	21.5272	5.6802	7.8	1.3826	7925.0415	285.4618	1.2000	2.7153	132.3884	133.7
10	8	8	10000	4.197	1500	80	2	5.2	0.4526	8324.2090	304.2737	3.3000	4.2939	26.6728	6.5362	7.6	0.6913	8153.7876	271.5152	0.0000	0.0000	131.3400	129.2
10	8	8	10000	4.197	1500	80	3	5.4	0.6034	8421.9238	330.8589	3.9000	5.6084	25.0184	6.5039	8.4	0.9659	8248.6035	309.3341	0.0000	0.0000	191.3968	160.6
10	8	8	10000	4.197	1500	80	4	5.4	0.6034	8040.1548	327.8955	7.8000	15.4347	26.6664	6.5798	7.2	0.8124	7858.4155	309.8864	0.1000	0.2263	42.8408	6.639
10	8	8	10000	4.197	1500	80	5	5.4	0.6034	8366.9863	312.5298	0.5000	0.7729	26.0192	6.3126	8.0	1.2162	8243.5098	293.5017	0.0000	0.0000	218.3256	160.1
10	8	8	10000	4.197	1500	80	6	5.4	0.6034	7906.6157	291.4303	1.2000	1.7462	26.8768	5.7186	7.4	0.9051	7812.1719	283.2719	0.1000	0.2263	111.2184	107.2

Table C.6: Comparison of no-bifurcation-based heuristics with the optical-reach customization for the NSF network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	2000	2.5	500	0	1	17.6	0.6913	26607.6563	1281.9000	33.3128	16.6360	0.6247	17.6	0.6913	26607.6563	1281.9000	33.3128	16.6360	0.6247
10	8	8	2000	2.5	500	0	2	17.6	0.6913	26816.9375	1287.2000	33.4072	16.9345	0.6949	17.8	0.7390	26813.0215	1286.9000	33.2461	17.1147	0.7066
10	8	8	2000	2.5	500	0	3	17.6	0.6913	26892.3125	1290.9069	34.2707	17.0445	0.7312	17.6	0.6913	26892.3125	1290.9000	34.2707	17.0445	0.7312
10	8	8	2000	2.5	500	0	4	17.6	0.6913	26722.7402	1282.7000	33.4178	16.8414	0.6850	17.8	0.7390	26719.3496	1281.8000	32.9355	17.0247	0.6900
10	8	8	2000	2.5	500	0	5	17.6	0.6913	26960.5156	1287.5000	32.6518	16.8384	0.6756	17.6	0.6913	26960.5156	1287.5000	32.6518	17.0384	0.6756
10	8	8	2000	2.5	500	0	6	17.6	0.6913	26783.3164	1281.5000	31.8635	16.8120	0.7047	17.6	0.6913	26783.3164	1281.5000	31.8635	16.8120	0.7047
10	8	8	3000	2.849	500	0	1	7.0	0.0000	19161.2891	476.1000	48.5828	47.8707	4.3495	9.0	0.6746	18652.2422	418.0000	14.1309	139.8551	145.21
10	8	8	3000	2.849	500	0	2	7.0	0.0000	19308.5078	481.3000	45.9587	50.0170	2.8449	9.2	0.4526	18896.4180	422.7000	14.0948	148.4094	153.33
10	8	8	3000	2.849	500	0	3	7.2	0.4526	19296.0840	477.7021	44.5413	52.0489	5.9396	9.0	0.6746	18916.1816	426.0000	13.5765	80.3254	83.254
10	8	8	3000	2.849	500	0	4	7.0	0.0000	19195.8477	493.0000	70.8860	50.7089	4.7147	9.4	0.6034	18596.9258	418.4000	13.3832	82.2262	3.6602
10	8	8	3000	2.849	500	0	5	7.2	0.4526	19275.8184	441.7083	26.6182	52.0289	4.9813	9.4	0.6034	18819.2129	427.1000	13.6786	82.7337	3.6511
10	8	8	3000	2.849	500	0	6	7.0	0.0000	19057.5918	488.7024	42.3893	49.8846	3.9276	9.0	0.6746	18628.4512	418.9000	14.9313	192.1336	176.51
10	8	8	4000	3.125	500	0	1	7.0	0.0000	17218.1016	301.2186	21.7455	56.4600	3.4969	7.6	0.6913	17120.3359	304.6541	12.0255	64.7976	7.0600
10	8	8	4000	3.125	500	0	2	7.0	0.0000	17396.4512	381.6248	19.4099	59.2056	2.1175	7.8	0.7390	17297.8633	342.0819	11.6128	69.1328	7.8790
10	8	8	4000	3.125	500	0	3	7.0	0.0000	17398.1602	372.3951	17.3117	58.0072	3.7748	7.6	0.6913	17334.0840	313.4619	10.9044	67.0856	7.3351
10	8	8	4000	3.125	500	0	4	7.0	0.0000	17123.1992	364.9037	151.2000	56.7336	2.0666	7.6	0.6913	17032.0469	295.2501	139.9000	10.4482	7.3611
10	8	8	4000	3.125	500	0	5	7.0	0.0000	17375.9980	394.4209	22.8732	57.9216	2.9886	7.4	0.6034	17288.6055	309.9356	143.5000	11.6275	7.1733
10	8	8	4000	3.125	500	0	6	7.0	0.0000	17137.3086	386.1753	155.9000	57.2600	3.0279	8.0	0.7543	17042.8477	309.5469	140.8000	68.8920	7.6651
10	8	8	5000	3.358	500	0	1	7.0	0.0000	16327.9238	313.0743	19.3000	58.2386	2.9923	7.4	0.6034	16314.2969	304.0180	19.8000	63.1898	5.9711
10	8	8	5000	3.358	500	0	2	7.0	0.0000	16560.4102	324.2843	4.5904	58.3208	3.1489	7.6	0.6913	16536.4316	312.3385	20.1000	3.3638	66.5407
10	8	8	5000	3.358	500	0	3	7.0	0.0000	16593.4414	336.5548	20.5000	59.2271	3.0435	7.6	0.6913	16576.9785	326.8065	20.1000	3.6400	68.0967
10	8	8	5000	3.358	500	0	4	7.0	0.0000	16297.1621	296.7523	21.1000	57.8290	2.0346	7.2	0.4526	16296.2598	295.6693	21.2000	5.2884	60.3145
10	8	8	5000	3.358	500	0	5	7.0	0.0000	16521.6133	291.6277	21.7000	59.4524	3.1677	7.2	0.4526	16501.9219	280.5645	20.4000	3.9221	62.6210
10	8	8	5000	3.358	500	0	6	7.0	0.0000	16286.9453	310.6035	22.7000	57.4216	3.1940	7.8	0.7390	16269.3027	301.3535	19.9000	3.7780	66.9964
10	8	8	6000	3.561	500	0	1	7.0	0.0000	16299.2607	332.5788	5.7000	56.2264	3.8443	7.4	0.6034	16281.8613	316.2590	6.1000	1.9215	62.6880
10	8	8	6000	3.561	500	0	2	7.0	0.0000	16520.0605	270.7683	8.3000	57.6568	3.2999	7.8	0.7390	16490.1641	265.4366	6.7000	1.8180	68.7064
10	8	8	6000	3.561	500	0	3	7.0	0.0000	16583.2871	303.9049	6.1000	56.4080	5.1330	7.4	0.6034	16564.7246	296.1584	6.9000	1.6679	64.0840
10	8	8	6000	3.561	500	0	4	7.0	0.0000	16297.4082	312.6036	11.1000	57.4376	2.6712	7.6	0.6913	16213.2969	278.3057	6.9000	1.6334	64.9624
10	8	8	6000	3.561	500	0	5	7.0	0.0000	16464.9590	316.0521	8.8000	60.3064	2.1534	7.4	0.6034	16438.9160	297.2857	6.8000	1.7133	66.1352
10	8	8	6000	3.561	500	0	6	7.0	0.0000	16170.7324	302.7795	7.1000	57.7736	2.2929	7.6	0.6913	16146.8457	283.2321	6.2000	1.6106	64.6928
10	8	8	7000	3.742	500	0	1	7.0	0.0000	16267.6895	348.3006	0.0000	57.2552	2.7475	7.4	0.6034	16251.2813	330.0980	0.0000	0.0000	62.5589
10	8	8	7000	3.742	500	0	2	7.0	0.0000	16528.3477	301.6031	1.0000	58.0635	2.9703	8.0	0.7543	16498.8242	288.2993	0.0000	0.0000	72.5683
10	8	8	7000	3.742	500	0	3	7.0	0.0000	16508.9258	250.3916	0.0000	59.1092	3.0541	7.4	0.6034	16485.0000	249.9435	0.0000	0.0000	64.9655
10	8	8	7000	3.742	500	0	4	7.0	0.0000	16259.1777	295.1433	4.7000	57.4715	2.2906	7.8	0.7390	16187.6094	245.3848	0.0000	0.0000	67.6392
10	8	8	7000	3.742	500	0	5	7.0	0.0000	16411.7539	277.6096	0.3000	59.7701	2.8831	7.0	0.0000	16411.7539	277.6096	0.3000	0.6788	59.7701
10	8	8	7000	3.742	500	0	6	7.0	0.0000	16180.3125	290.2857	1.8000	57.6181	2.8152	7.6	0.6913	16138.4082	278.3087	0.0000	0.0000	64.9915
10	8	8	8000	3.906	500	0	1	7.0	0.0000	16282.9121	352.4105	0.0000	56.6144	3.3204	7.6	0.6913	16255.7734	325.7900	0.0000	0.0000	230.6920
10	8	8	8000	3.906	500	0	2	7.0	0.0000	16541.7461	327.7939	0.6000	57.1096	3.3726	8.0	0.7543	16491.6777	304.5928	0.0000	0.0000	242.0944
10	8	8	8000	3.906	500	0	3	7.0	0.0000	16508.9258	250.3916	0.0000	59.2888	3.0264	7.4	0.6034	16506.0586	250.2317	0.0000	0.0000	180.1384
10	8	8	8000	3.906	500	0	4	7.0	0.0000	16234.9746	273.1112	3.5000	57.9112	2.1951	7.6	0.6913	16185.9658	243.4151	0.0000	0.0000	118.7016
10	8	8	8000	3.906	500	0	5	7.0	0.0000	16414.4512	277.5451	0.3000	59.8504	2.8966	7.2	0.4526	16411.4512	277.8612	0.3000	0.6788	62.6632
10	8	8	8000	3.906	500	0	6	7.0	0.0000	16166.1953	308.4606	0.9000	57.9056	2.7289	7.6	0.6913	16127.6738	287.8866	0.0000	0.0000	173.7776
10	8	8	9000	4.057	500	0	1	7.0	0.0000	16270.9893	361.2260	0.0000	55.3529	2.5373	7.6	0.6913	16239.6768	329.5613	0.0000	0.0000	63.6532
10	8	8	9000	4.057	500	0	2	7.0	0.0000	16551.3555	326.3419	0.1000	56.8053	2.6434	7.4	0.6034	16529.3477	314.9462	0.1000	0.2263	62.6960
10	8	8	9000	4.057	500	0	3	7.0	0.0000	16515.2754	253.5187	0.0000	57.4738	2.9249	7.4	0.6034	16513.1387	252.9547	0.0000	0.0000	114.5943
10	8	8	9000	4.057	500	0	4	7.0	0.0000	16240.5938	268.6417	1.9000	55.8396	2.1434	7.8	0.7390	16199.6738	237.8570	0.0000	0.0000	65.2755
10	8	8	9000	4.057	500	0	5	7.0	0.0000	16423.6074	281.1203	0.0000	57.2314	3.8789	7.4	0.6034	16418.4199	277.3089	0.0000	0.0000	116.0680

C	W	B	R _{max}	E/O	cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	9000	4.057	500	0	6		7.0	0.0000	16171.4453	279.6468	0.2000	0.4526	55.8798	16143.0439	273.4270	0.0000	0.0000	62.9392
10	8	8	10000	4.197	500	0	1		7.0	0.0000	16267.3486	345.9660	0.0000	0.0000	54.6544	16246.0049	327.0573	0.0000	0.0000	211.4000
10	8	8	10000	4.197	500	0	2		7.0	0.0000	16560.2676	338.1397	0.6000	1.3577	55.0336	16497.7734	304.1647	0.0000	0.0000	269.6416
10	8	8	10000	4.197	500	0	3		7.0	0.0000	16529.0371	259.7823	0.0000	0.0000	56.9400	16524.5332	258.9021	0.0000	0.0000	272.3752
10	8	8	10000	4.197	500	0	4		7.0	0.0000	16200.5801	259.1679	1.5000	3.1508	55.9632	16181.5049	247.4010	0.1000	0.2263	206.3856
10	8	8	10000	4.197	500	0	5		7.0	0.0000	16414.4551	251.9412	0.0000	0.0000	57.1312	16403.7012	246.1780	0.0000	0.0000	163.8768
10	8	8	10000	4.197	500	0	6		7.0	0.0000	16174.1904	279.5870	0.1000	0.2263	55.9392	16142.2373	273.6435	0.0000	0.0000	258.3520
10	8	8	2000	2.5	500	80	1		5.0	0.0000	7876.8608	469.8616	371.5000	31.0863	2.5016	7871.0752	467.1064	371.0000	30.9648	2.5888
10	8	8	2000	2.5	500	80	2		5.0	0.0000	7994.5078	392.7857	372.7000	26.6477	2.5348	7991.2725	391.1647	372.2000	26.4651	2.6249
10	8	8	2000	2.5	500	80	3		5.0	0.0000	8006.4390	441.3536	382.1000	28.1982	2.5876	7991.3389	434.9910	380.2000	27.2718	2.7710
10	8	8	2000	2.5	500	80	4		5.0	0.0000	7907.1743	449.8040	369.1000	28.3491	2.5736	7907.1743	449.8040	369.1000	28.3491	2.5736
10	8	8	2000	2.5	500	80	5		5.0	0.0000	8042.7031	448.0047	381.5000	28.0765	2.5906	8010.5947	441.9583	378.3000	26.6221	2.7750
10	8	8	2000	2.5	500	80	6		5.0	0.0000	7867.1226	411.1156	366.5000	27.4080	2.5576	7866.3931	410.7755	366.3000	27.3598	2.6427
10	8	8	3000	2.849	500	80	1		3.0	0.0000	5368.6221	316.8679	119.3000	22.8005	12.3304	5315.6587	278.8195	112.4000	15.7174	15.3520
10	8	8	3000	2.849	500	80	2		3.0	0.0000	5548.5913	284.5322	118.0000	16.6893	13.2496	5530.7798	277.5771	115.4000	15.2732	14.4128
10	8	8	3000	2.849	500	80	3		3.0	0.0000	5667.6733	300.4872	123.0000	17.2227	13.3560	5627.9463	278.2352	119.8000	15.3534	15.6240
10	8	8	3000	2.849	500	80	4		3.0	0.0000	5417.2451	288.3568	116.4000	18.7571	12.6808	5381.0059	256.8736	111.6000	14.7425	14.7736
10	8	8	3000	2.849	500	80	5		3.0	0.0000	5595.1240	295.0526	121.6000	17.2267	13.1224	5584.3027	289.1114	119.1000	15.8696	15.5672
10	8	8	3000	2.849	500	80	6		3.0	0.0000	5331.7275	304.6328	112.2000	17.6946	12.4728	5302.7124	279.6678	109.6000	16.2338	14.6592
10	8	8	4000	3.125	500	80	1		3.0	0.0000	5031.4946	234.3091	37.8000	12.2449	13.4320	5023.4141	232.1317	36.6000	11.5684	14.6080
10	8	8	4000	3.125	500	80	2		3.0	0.0000	5100.6753	223.3119	6.2000	3.7592	15.0808	5100.6753	223.3119	6.2000	3.7592	15.0808
10	8	8	4000	3.125	500	80	3		3.0	0.0000	5184.1133	216.2801	6.7000	3.7569	15.5164	5184.1133	216.2801	6.7000	3.7569	15.5164
10	8	8	4000	3.125	500	80	4		3.0	0.0000	4947.8291	206.4304	6.5000	3.6212	14.4404	4947.8291	206.4304	6.5000	3.6212	14.4404
10	8	8	4000	3.125	500	80	5		3.0	0.0000	5152.6826	215.5961	6.7000	3.6649	15.4040	5152.3174	215.0634	6.7000	3.6649	16.5148
10	8	8	4000	3.125	500	80	6		3.0	0.0000	4812.7837	205.6259	6.2000	3.7833	13.8404	4812.7837	205.6259	6.2000	3.7833	13.8404
10	8	8	6000	3.561	500	80	1		3.0	0.0000	4888.2554	213.0008	2.0000	1.7849	14.3136	4888.2554	213.0008	2.0000	1.7849	14.3136
10	8	8	6000	3.561	500	80	2		3.0	0.0000	5090.2183	211.3576	2.2000	1.6456	15.1056	5090.2183	211.3576	2.2000	1.6456	15.1056
10	8	8	6000	3.561	500	80	3		3.0	0.0000	5208.9795	214.2294	2.2000	1.6456	15.6368	5208.9795	214.2294	2.2000	1.6456	15.6368
10	8	8	6000	3.561	500	80	4		3.0	0.0000	4940.8970	194.3698	2.3000	1.6542	14.5296	4940.8970	194.3698	2.3000	1.6542	14.5296
10	8	8	6000	3.561	500	80	5		3.0	0.0000	5159.2339	204.5485	2.3000	1.6194	15.5280	5159.2339	204.5485	2.3000	1.6194	15.5280
10	8	8	6000	3.561	500	80	6		3.0	0.0000	4812.5630	205.5133	2.1000	1.7017	13.8672	4812.5630	205.5133	2.1000	1.7017	13.8672
10	8	8	7000	3.742	500	80	1		3.0	0.0000	4910.6035	207.4092	0.0000	0.0000	14.4432	4910.6035	207.4092	0.0000	0.0000	14.4432
10	8	8	7000	3.742	500	80	2		3.0	0.0000	5079.1406	195.7902	0.0000	0.0000	15.1964	5079.1406	195.7902	0.0000	0.0000	15.1964
10	8	8	7000	3.742	500	80	3		3.0	0.0000	5204.3916	211.3737	0.0000	0.0000	15.7092	5204.3916	211.3737	0.0000	0.0000	15.7092
10	8	8	7000	3.742	500	80	4		3.0	0.0000	4925.3232	192.4055	0.0000	0.0000	14.5352	4925.3232	192.4055	0.0000	0.0000	14.5352
10	8	8	7000	3.742	500	80	5		3.0	0.0000	5180.9800	195.8662	0.0000	0.0000	15.6244	5180.9800	195.8662	0.0000	0.0000	15.6244
10	8	8	7000	3.742	500	80	6		3.0	0.0000	4781.9951	196.7518	0.0000	0.0000	13.8624	4781.9951	196.7518	0.0000	0.0000	13.8624
10	8	8	8000	3.906	500	80	1		3.0	0.0000	4912.6182	204.5638	0.0000	0.0000	14.4160	4912.6182	204.5638	0.0000	0.0000	14.4160
10	8	8	8000	3.906	500	80	2		3.0	0.0000	5083.4810	195.0629	0.0000	0.0000	15.2112	5083.4810	195.0629	0.0000	0.0000	15.2112
10	8	8	8000	3.906	500	80	3		3.0	0.0000	5207.2300	200.9514	0.0000	0.0000	15.7040	5207.2300	200.9514	0.0000	0.0000	15.7040
10	8	8	8000	3.906	500	80	4		3.0	0.0000	4934.9204	198.8738	0.0000	0.0000	14.5776	4934.9204	198.8738	0.0000	0.0000	14.5776
10	8	8	8000	3.906	500	80	5		3.0	0.0000	5195.7285	189.4451	0.0000	0.0000	15.6512	5195.7285	189.4451	0.0000	0.0000	15.6512
10	8	8	8000	3.906	500	80	6		3.0	0.0000	4785.2368	195.0749	0.0000	0.0000	13.9008	4785.2368	195.0749	0.0000	0.0000	13.9008

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	Solve time [sec]	±CI
10	8	8	9000	4.057	500	80	1	3.0	0.0000	4911.3862	209.9864	0.0000	13.3328	0.5220	3.0	0.0000	4911.3862	209.9864	0.0000	13.3328	0.5220
10	8	8	9000	4.057	500	80	2	3.0	0.0000	5092.5615	199.9782	0.0000	14.0608	0.4777	3.0	0.0000	5092.5615	199.9782	0.0000	14.0608	0.4777
10	8	8	9000	4.057	500	80	3	3.0	0.0000	5209.8325	202.3345	0.0000	14.5088	0.5478	3.0	0.0000	5209.8325	202.3345	0.0000	14.5088	0.5478
10	8	8	9000	4.057	500	80	4	3.0	0.0000	4933.0757	197.3945	0.0000	13.4536	0.4929	3.0	0.0000	4933.0757	197.3945	0.0000	13.4536	0.4929
10	8	8	9000	4.057	500	80	5	3.0	0.0000	5184.9131	192.2183	0.0000	14.4376	0.5204	3.0	0.0000	5184.9131	192.2183	0.0000	14.4376	0.5204
10	8	8	9000	4.057	500	80	6	3.0	0.0000	4785.3896	195.0064	0.0000	12.8480	0.4694	3.0	0.0000	4785.3896	195.0064	0.0000	12.8480	0.4694
10	8	8	10000	4.197	500	80	1	3.0	0.0000	4910.9653	205.9854	0.0000	13.4112	0.5546	3.0	0.0000	4910.9653	205.9854	0.0000	13.4112	0.5546
10	8	8	10000	4.197	500	80	2	3.0	0.0000	5073.1831	188.7313	0.0000	14.0672	0.4837	3.0	0.0000	5073.1831	188.7313	0.0000	14.0672	0.4837
10	8	8	10000	4.197	500	80	3	3.0	0.0000	5215.3838	212.7365	0.0000	14.5440	0.5636	3.0	0.0000	5215.3838	212.7365	0.0000	14.5440	0.5636
10	8	8	10000	4.197	500	80	4	3.0	0.0000	4933.5132	197.8272	0.0000	13.5104	0.5146	3.0	0.0000	4933.5132	197.8272	0.0000	13.5104	0.5146
10	8	8	10000	4.197	500	80	5	3.0	0.0000	5196.8525	184.1218	0.0000	14.4688	0.5233	3.0	0.0000	5196.8525	184.1218	0.0000	14.4688	0.5233
10	8	8	10000	4.197	500	80	6	3.0	0.0000	4786.9150	196.3949	0.0000	12.8592	0.5033	3.0	0.0000	4786.9150	196.3949	0.0000	12.8592	0.5033
10	8	8	2000	2.5	1500	0	1	49.8	1.8102	31274.0566	513.2103	1550.9000	58.9878	2.5062	50.0	1.6866	31127.5625	454.9481	1533.2000	23.4978	59.5166
10	8	8	2000	2.5	1500	0	2	49.8	1.8102	31642.4629	551.1045	1560.9000	60.5383	2.3124	50.0	1.6866	31500.0059	418.6307	1541.3000	22.2448	61.1531
10	8	8	2000	2.5	1500	0	3	49.8	1.8102	31673.5215	598.4158	1563.7000	60.5852	2.4907	50.0	1.6798	31519.2070	498.3881	1541.4000	21.4457	61.3714
10	8	8	2000	2.5	1500	0	4	49.8	1.8102	31661.4160	663.7401	1589.9000	60.5852	2.9204	50.6	1.4780	31388.1816	494.7205	1534.8000	20.4785	60.9964
10	8	8	2000	2.5	1500	0	5	49.8	1.8102	31865.1758	549.8325	1566.5000	60.3457	2.5489	50.2	1.6798	31682.9102	431.8206	1544.5000	24.3034	61.0958
10	8	8	2000	2.5	1500	0	6	49.8	1.8102	31596.9219	587.5243	1570.9000	56.1484	59.9240	50.6	1.3151	31404.0566	512.1629	1532.9000	22.3046	60.8884
10	8	8	3000	2.849	1500	0	1	17.8	1.0006	24598.1133	851.9229	880.8000	73.5386	11.4381	25.8	1.8102	21897.2246	324.6915	504.1000	10.4537	220.3536
10	8	8	3000	2.849	1500	0	2	17.6	0.6913	25063.7266	1016.0783	926.6000	94.6368	14.0316	25.6	2.1387	22267.9609	328.2534	512.1000	8.9971	225.1640
10	8	8	3000	2.849	1500	0	3	18.0	1.0119	25267.9297	1027.8235	922.7000	83.3560	20.2478	25.8	1.9318	22154.7715	347.8730	512.1000	10.3167	227.1120
10	8	8	3000	2.849	1500	0	4	17.6	0.9659	24624.9570	717.5251	880.7000	88.6388	11.9509	25.6	2.1387	21900.9961	350.5904	506.0000	10.9197	220.2292
10	8	8	3000	2.849	1500	0	5	17.8	1.0006	25445.7344	1007.5464	971.7000	152.6089	21.1803	25.8	1.9318	22117.4824	344.1272	513.8000	10.3956	225.5764
10	8	8	3000	2.849	1500	0	6	17.6	0.9659	25105.3086	754.1205	989.8000	157.8222	76.8944	26.0	1.8165	21972.3633	362.2489	502.9000	9.9633	223.9032
10	8	8	4000	3.125	1500	0	1	17.2	0.4526	22267.1465	788.5107	467.6000	72.1360	14.0621	21.6	1.5160	19952.1094	320.4225	165.9000	7.1670	188.8440
10	8	8	4000	3.125	1500	0	2	17.4	0.6034	21809.9297	607.7336	363.0000	72.3775	17.0216	22.0	1.3908	20205.7637	301.6837	169.5000	7.7159	199.0208
10	8	8	4000	3.125	1500	0	3	18.0	0.7543	21803.4824	862.2629	348.0000	107.9798	94.9704	21.8	1.9318	20200.4453	335.0045	168.9000	8.0846	193.3560
10	8	8	4000	3.125	1500	0	4	17.2	0.4526	21646.3145	502.8015	380.8000	62.0230	97.2696	22.0	1.3908	19879.0117	338.1888	168.2000	8.2542	190.2944
10	8	8	4000	3.125	1500	0	5	17.6	0.6913	21704.0059	553.7116	343.5000	62.2221	89.4304	22.0	1.8165	20187.5410	311.4479	169.8000	7.1856	197.7856
10	8	8	4000	3.125	1500	0	6	17.2	0.4526	22301.5781	1167.6470	491.5000	175.4538	91.0224	22.2	1.8102	19948.5039	325.6830	165.7000	8.1728	192.4752
10	8	8	5000	3.358	1500	0	1	17.6	0.6913	19854.9629	557.6323	123.1000	79.9105	97.0356	20.2	1.5384	18954.2109	292.7410	24.3000	3.0367	167.0700
10	8	8	5000	3.358	1500	0	2	17.6	0.6913	20148.0195	661.8817	104.2000	67.4462	109.3842	20.2	1.5384	19319.4688	277.8134	27.5000	2.9066	171.4322
10	8	8	5000	3.358	1500	0	3	17.6	0.6913	20248.0367	622.9468	107.7000	66.7852	85.4756	20.2	1.3826	19265.9570	294.1852	26.1000	1.1414	173.7998
10	8	8	5000	3.358	1500	0	4	17.6	0.6913	19582.0625	403.4832	84.1000	31.3236	115.8770	20.2	1.0006	18924.3008	276.5574	27.5000	3.5257	174.1628
10	8	8	5000	3.358	1500	0	5	17.6	0.6913	20154.1621	728.9821	127.4000	104.2818	90.8728	20.4	1.1782	19244.6758	296.8542	25.9000	1.8613	176.7780
10	8	8	5000	3.358	1500	0	6	17.6	0.6913	19894.5605	713.7657	136.3000	83.0637	115.7812	20.6	1.3151	18967.5566	312.3352	25.4000	4.6764	172.2932
10	8	8	6000	3.561	1500	0	1	17.6	0.6913	19598.8574	483.9767	51.4000	55.3718	87.5408	21.8	1.5384	18922.1289	272.0231	8.4000	2.1912	189.0544
10	8	8	6000	3.561	1500	0	2	17.4	0.6034	20137.5000	459.5532	79.6000	65.2445	105.5288	21.0	1.5085	19279.6309	264.1635	7.2000	2.6517	176.3768
10	8	8	6000	3.561	1500	0	3	17.6	0.6913	19655.1523	426.2225	17.4000	15.4104	112.1768	21.0	0.9541	19200.3242	333.5760	0.0000	0.0000	189.1454
10	8	8	6000	3.561	1500	0	4	17.6	0.6913	19874.2637	393.4138	39.2000	33.4089	85.5520	21.6	1.7912	19171.5430	269.9471	7.8000	2.7153	181.7600
10	8	8	6000	3.561	1500	0	5	17.6	0.6913	19441.5176	506.3441	51.1000	44.2226	107.5864	20.8	1.2531	18816.2578	260.8147	6.9000	2.4510	169.1920
10	8	8	6000	3.561	1500	0	6	17.4	0.6034	19971.4121	556.9764	93.1000	70.2269	87.6296	21.6	1.5160	19076.4590	275.7471	7.9000	2.6442	187.3768
10	8	8	7000	3.742	1500	0	1	17.6	0.6913	19419.8281	519.6685	62.6000	44.2434	111.8336	20.4	0.9659	18736.1953	301.2024	5.2000	4.0167	160.5728
10	8	8	7000	3.742	1500	0	2	17.6	0.6913	19378.8789	451.2830	33.6000	42.3312	94.9988	20.8	1.2531	18847.8516	350.7055	0.0000	0.0000	180.5480
10	8	8	7000	3.742	1500	0	3	17.6	0.6913	19655.1523	426.2225	17.4000	15.4104	112.1768	21.0	0.9541	19200.3242	333.5760	0.0000	0.0000	189.1454
10	8	8	7000	3.742	1500	0	4	17.6	0.6913	19626.0840	339.6572	20.9000	25.2881	89.1450	20.6	1.7592	19130.7617	311.6502	0.0000	0.0000	180.7416
10	8	8	7000	3.742	1500	0	5	17.6	0.6913	19249.1445	321.4510	15.5000	8.4883	116.4624	20.4	1.1782	18813.9355	317.1832	0.0000	0.0000	167.9536
10	8	8	7000	3.742	1500	0	6	17.6	0.6913	19468.3438	375.6267	23.5000	31.1502	101.7780	20.8	1.2531	19080.7656	322.7209	0.0000	0.0000	184.3044
10	8	8	8000	3.906	1500	0	1	17.6	0.6913	19576.4492	787.6241	86.7000	105.3013	121.4808	20.6	1.1289	18823.9570	335.7209	0.0000	0.0000	175.7748
10	8	8	8000	3.906	1500	0	2	17.6	0.6913	19417.1387	425.1674	31.4000	41.1094	96.1136	20.8	1.2531	18873.5195	346.2990	0.0000	0.0000	181.2080

C [Gb/s]	W	B	R_{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	$\pm CI$	Weighted port count @ F_{min}	# of OEos @ F_{min}	$\pm CI$	Solve time [sec]	$\pm CI$	F_{opt}	Weighted port count @ F_{opt}	# of OEos @ F_{opt}	$\pm CI$	Solve time [sec]
10	8	8	7000	3.742	1500	80	3	5.4	0.6034	7030.4282	295.5594	5.7620	24.5424	6.2634	8.4	6816.4854	0.0000	0.0000	194.7808
10	8	8	7000	3.742	1500	80	4	5.4	0.6034	6629.9336	250.3737	11.1724	25.7040	6.7271	7.6	6456.2529	0.0000	0.0000	126.7536
10	8	8	7000	3.742	1500	80	5	5.4	0.6034	7010.8853	262.3235	2.4568	24.7544	6.0057	8.0	6814.3232	0.0000	0.0000	140.6664
10	8	8	7000	3.742	1500	80	6	5.4	0.6034	6542.5776	236.6826	1.7543	25.7040	5.8454	7.2	6421.3984	0.0000	0.3017	40.5688
10	8	8	8000	3.906	1500	80	1	5.2	0.4526	6744.3662	261.7222	3.9402	20.6800	5.4889	7.2	6530.1187	1.4000	2.7027	85.7632
10	8	8	8000	3.906	1500	80	2	5.2	0.4526	6902.4790	240.2600	8.5470	25.8032	6.5723	7.2	6727.1382	0.1000	0.2263	45.3968
10	8	8	8000	3.906	1500	80	3	5.4	0.6034	7034.8726	298.2549	5.1000	24.7264	6.2980	8.4	6815.4985	0.0000	0.0000	194.8816
10	8	8	8000	3.906	1500	80	4	5.4	0.6034	6647.9219	248.4807	15.4347	25.9712	6.5930	7.2	6464.7549	0.1000	0.2263	79.6592
10	8	8	8000	3.906	1500	80	5	5.4	0.6034	7007.9766	270.6415	1.2000	2.2577	6.1932	8.0	6823.0313	0.0000	0.0000	140.9744
10	8	8	8000	3.906	1500	80	6	5.4	0.6034	6545.6826	231.6440	1.7543	25.7120	5.8482	7.2	6427.0249	0.2000	0.3017	40.6624
10	8	8	9000	4.057	1500	80	1	5.2	0.4526	6749.2446	265.5332	3.6337	20.3008	5.3580	7.2	6532.2803	1.4000	2.7027	78.2792
10	8	8	9000	4.057	1500	80	2	5.2	0.4526	6884.3218	212.8798	5.7070	25.7232	5.8802	7.4	6732.8452	0.0000	0.0000	45.8520
10	8	8	9000	4.057	1500	80	3	5.4	0.6034	7033.8726	292.1345	5.6845	24.2280	6.1164	8.0	6838.9492	0.0000	0.0000	92.3640
10	8	8	9000	4.057	1500	80	4	5.4	0.6034	6640.6265	251.9850	15.4347	25.5360	6.3179	7.4	6469.4121	0.1000	0.2263	43.2792
10	8	8	9000	4.057	1500	80	5	5.4	0.6034	7005.9775	264.1343	1.1709	24.4944	5.9568	8.0	6824.4360	0.0000	0.0000	163.1440
10	8	8	9000	4.057	1500	80	6	5.4	0.6034	6540.7295	217.4042	1.7673	25.2784	5.5272	7.4	6420.3037	0.1000	0.2263	112.1528
10	8	8	10000	4.197	1500	80	1	5.2	0.4526	6766.2212	267.8096	3.5706	20.2288	5.3427	7.2	6528.9453	1.4000	2.7027	77.2704
10	8	8	10000	4.197	1500	80	2	5.2	0.4526	6928.7954	257.0636	4.2939	25.0816	6.3548	7.6	6730.4272	0.0000	0.0000	88.0592
10	8	8	10000	4.197	1500	80	3	5.4	0.6034	7036.6563	281.9873	5.6084	23.7136	6.3281	8.4	6834.8936	0.0000	0.0000	139.9680
10	8	8	10000	4.197	1500	80	4	5.4	0.6034	6645.5454	255.1470	15.4347	25.3360	6.4378	7.2	6462.0005	0.1000	0.2263	41.3792
10	8	8	10000	4.197	1500	80	5	5.4	0.6034	7009.4053	262.6144	0.7729	24.5776	5.9315	8.4	6834.6304	0.0000	0.0000	91.3936
10	8	8	10000	4.197	1500	80	6	5.4	0.6034	6540.0146	228.9687	1.7462	25.2352	5.5096	7.6	6423.1943	0.0000	0.0000	42.6624
10	8	8	10000	4.197	1500	80	6	5.4	0.6034	6540.0146	228.9687	1.7462	25.2352	5.5096	7.6	6423.1943	0.0000	0.0000	42.6624

Table C.7: Comparison of fiber-bifurcation-based heuristics without the optical-reach customization for the NSF network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	2000	2.5	500	0	1	17.6	0.6913	28525.0000	541.8353	33.3128	16.6721	0.6489	17.6	0.6913	28525.0000	541.8353	33.3128	16.6721	0.6489
10	8	8	2000	2.5	500	0	2	17.6	0.6913	28743.9004	530.4114	33.4072	16.9355	0.7052	17.6	0.6913	28739.8008	530.1270	33.2461	17.1379	0.721
10	8	8	2000	2.5	500	0	3	17.6	0.6913	28820.0996	567.3130	34.2707	17.0366	0.7258	17.6	0.6913	28820.0996	567.3130	34.2707	17.0366	0.725
10	8	8	2000	2.5	500	0	4	17.6	0.6913	28645.1992	602.4603	33.4178	16.8582	0.6938	17.8	0.7390	28641.0996	601.6375	32.9355	17.0435	0.693
10	8	8	2000	2.5	500	0	5	17.6	0.6913	28886.5996	571.0972	32.6518	17.0475	0.6704	17.6	0.6913	28886.5996	571.0972	32.6518	17.0475	0.676
10	8	8	2000	2.5	500	0	6	17.6	0.6913	28709.0000	560.7681	31.8635	16.8451	0.7110	17.8	0.7390	28707.6992	561.0290	32.2164	17.0723	0.765
10	8	8	3000	2.849	500	0	1	7.0	0.0000	20813.6152	601.7568	48.5828	67.0894	6.7264	9.0	0.6746	20261.3594	381.5324	14.1309	219.9191	175.7
10	8	8	3000	2.849	500	0	2	7.0	0.0000	20975.9883	509.1589	45.9587	70.8341	4.2124	9.2	0.4526	20517.4375	428.2357	14.0948	113.2227	5.747
10	8	8	3000	2.849	500	0	3	7.2	0.4526	20930.4473	519.4048	34.2142	115.8415	100.7324	9.0	0.6746	20530.8613	393.2808	13.5765	217.1428	159.8
10	8	8	3000	2.849	500	0	4	7.0	0.0000	20883.0430	718.2958	493.0000	70.8860	6.9205	9.4	0.6034	20206.6309	380.1597	13.3832	329.1862	201.4
10	8	8	3000	2.849	500	0	5	7.2	0.4526	20917.0391	476.4366	26.6182	73.0518	6.9295	9.4	0.6034	20439.1289	396.0517	13.6786	167.4690	119.8
10	8	8	3000	2.849	500	0	6	7.0	0.0000	20730.4824	552.4974	42.3893	70.2724	5.7173	9.2	0.4526	20236.2539	402.4526	14.2434	212.2034	153.1
10	8	8	4000	3.125	500	0	1	7.0	0.0000	18949.0254	330.7685	21.7455	79.9821	4.3653	7.6	0.6913	18841.6250	332.5257	12.0255	90.8098	9.421
10	8	8	4000	3.125	500	0	2	7.0	0.0000	19145.4492	418.3200	152.6000	83.2848	3.0415	7.8	0.7390	19027.8242	365.2711	11.6128	96.8662	10.65
10	8	8	4000	3.125	500	0	3	7.0	0.0000	19135.1758	397.6035	17.3117	81.7106	5.3668	7.6	0.6913	19069.0254	339.9354	10.9044	94.4701	10.20
10	8	8	4000	3.125	500	0	4	7.0	0.0000	18860.0508	402.4366	20.6362	79.8870	3.1858	7.6	0.6913	18752.4258	334.4614	10.4482	90.9029	9.869
10	8	8	4000	3.125	500	0	5	7.0	0.0000	19116.4004	425.6232	154.5000	84.2261	4.4115	7.6	0.6913	19017.9004	337.1597	11.6040	93.2188	10.91
10	8	8	4000	3.125	500	0	6	7.0	0.0000	18886.9492	423.6703	155.9000	80.1642	4.4231	8.0	0.7543	18762.7500	328.6770	10.0505	96.0332	10.42
10	8	8	5000	3.358	500	0	1	7.0	0.0000	18277.5430	349.9962	19.3000	81.9939	4.1380	7.4	0.6034	18264.1133	343.6569	19.8000	89.0991	7.654
10	8	8	5000	3.358	500	0	2	7.0	0.0000	18530.2598	350.5247	21.4000	82.6770	4.5984	7.6	0.6913	18502.9277	340.2477	20.1000	93.5196	11.20
10	8	8	5000	3.358	500	0	3	7.0	0.0000	18559.5896	363.4926	20.5000	83.9776	4.4159	7.6	0.6913	18543.3711	355.2570	20.1000	95.7696	7.666
10	8	8	5000	3.358	500	0	4	7.0	0.0000	18249.4141	331.5960	21.1000	81.7352	2.8878	7.2	0.4526	18248.4863	330.4587	21.2000	85.0630	8.276
10	8	8	5000	3.358	500	0	5	7.0	0.0000	18491.4883	323.8626	21.7000	84.2261	4.6532	7.4	0.6034	18472.3574	337.7979	20.5000	92.5952	8.280
10	8	8	5000	3.358	500	0	6	7.0	0.0000	18243.9707	345.2157	22.7000	81.0488	4.7286	7.8	0.7390	18224.8965	335.3787	19.9000	93.9269	10.09
10	8	8	6000	3.561	500	0	1	7.0	0.0000	18689.3770	361.1829	5.7000	79.3776	5.5707	7.4	0.6034	18674.6523	345.2520	6.1000	87.6632	10.83
10	8	8	6000	3.561	500	0	2	7.0	0.0000	18933.4688	307.8651	8.3000	81.1992	4.7230	7.8	0.7390	18907.3633	302.8504	6.7000	95.2200	13.59
10	8	8	6000	3.561	500	0	3	7.0	0.0000	18983.7305	327.4258	6.1000	79.6568	7.3731	7.4	0.6034	18976.2051	327.2484	6.9000	89.7392	10.61
10	8	8	6000	3.561	500	0	4	7.0	0.0000	18690.0176	345.1067	11.1000	81.1104	4.0241	7.6	0.6913	18609.0352	316.5528	6.9000	91.2208	9.400
10	8	8	6000	3.561	500	0	5	7.0	0.0000	18873.2031	348.2100	8.8000	85.3000	3.1048	7.4	0.6034	18849.7461	336.3318	6.8000	92.7704	8.509
10	8	8	6000	3.561	500	0	6	7.0	0.0000	18579.7031	357.1432	7.1000	81.5136	3.2668	7.6	0.6913	18555.6816	334.9408	6.2000	90.6336	9.971
10	8	8	7000	3.742	500	0	1	7.0	0.0000	19088.9336	391.2102	0.0000	82.1885	4.2343	7.4	0.6034	19076.8398	377.2544	0.0000	90.2872	11.03
10	8	8	7000	3.742	500	0	2	7.0	0.0000	19357.8184	343.0908	1.0000	82.9670	4.3979	8.0	0.7543	19331.0313	333.1755	0.0000	102.6255	11.83
10	8	8	7000	3.742	500	0	3	7.0	0.0000	19321.5352	292.4189	0.0000	84.5445	4.3387	7.6	0.6913	19315.4355	292.5667	0.0000	95.6385	11.81
10	8	8	7000	3.742	500	0	4	7.0	0.0000	19074.2148	333.1140	4.7000	81.8088	3.4049	7.6	0.6913	18999.7852	294.1745	0.0000	91.8701	9.570
10	8	8	7000	3.742	500	0	5	7.0	0.0000	19238.7676	325.0001	0.3000	85.1840	4.3236	7.0	0.0000	19238.7676	325.0001	0.3000	85.1840	4.323
10	8	8	7000	3.742	500	0	6	7.0	0.0000	19008.8496	346.0574	1.8000	82.1368	3.9019	7.6	0.6913	18972.4277	337.1640	0.0000	91.9096	9.361
10	8	8	8000	3.906	500	0	1	7.0	0.0000	19509.8555	401.9544	0.0000	80.4400	4.9034	7.6	0.6913	19485.3691	381.2494	0.0000	256.2904	198.1
10	8	8	8000	3.906	500	0	2	7.0	0.0000	19773.0000	369.2882	0.6000	81.3296	5.0061	8.0	0.7543	19730.5117	354.8904	0.0000	269.4216	200.2
10	8	8	8000	3.906	500	0	3	7.0	0.0000	19754.0684	302.2208	0.0000	84.4944	4.3168	7.6	0.6913	19748.9688	302.4271	0.0000	265.6832	207.1
10	8	8	8000	3.906	500	0	4	7.0	0.0000	19455.8945	322.7475	3.5000	82.2304	3.3849	7.6	0.6913	19404.8945	298.9485	0.0000	144.8576	123.6
10	8	8	8000	3.906	500	0	5	7.0	0.0000	19655.2441	331.8110	0.3000	85.2960	4.2697	7.2	0.4526	19653.2441	331.9946	0.3000	89.0432	8.222
10	8	8	8000	3.906	500	0	6	7.0	0.0000	19401.8184	372.6303	0.9000	80.3536	4.1154	7.6	0.6913	19369.4434	353.8603	0.0000	199.2912	169.7
10	8	8	9000	4.057	500	0	1	7.0	0.0000	19869.2773	417.4142	0.0000	82.3712	4.9038	7.6	0.6913	19842.3105	391.3723	0.0000	255.9104	197.7
10	8	8	9000	4.057	500	0	2	7.0	0.0000	20165.1445	375.4624	0.1000	83.6992	4.0006	7.4	0.6034	20149.0430	368.1993	0.1000	204.2464	179.0
10	8	8	9000	4.057	500	0	3	7.0	0.0000	20144.0742	308.5500	0.0000	84.3276	4.3104	7.4	0.6034	20140.0742	309.3018	0.0000	205.0592	180.7
10	8	8	9000	4.057	500	0	4	7.0	0.0000	19825.8730	320.5584	1.9000	82.3776	3.2451	7.6	0.6913	19786.8008	301.6442	0.1000	199.2768	168.1
10	8	8	9000	4.057	500	0	5	7.0	0.0000	20037.0352	340.3539	0.0000	84.4864	5.8702	7.2	0.4526	20035.8340	338.6772	0.0000	146.0160	139.3

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	±CI	Solve time	±CI	F _{opt}	±CI	Weighted port count	# of OEOs	±CI	Solve time	±CI
[Gb/s]			[km]	ratio	[Gb/s]	[%]				@F _{min}	@F _{min}		[sec]				@F _{opt}	@F _{opt}		[sec]	
10	8	8	9000	4.057	500	0	6	7.0	0.0000	1975.7480	349.8791	±0.2000	82.3264	4.0288	7.6	0.6913	1975.7480	349.8791	±0.0000	199.5904	170.3
10	8	8	10000	4.197	500	0	1	7.0	0.0000	2029.5234	412.8401	±0.0000	57.1195	2.7124	7.6	0.6913	2019.4863	398.7298	±0.0000	65.5567	7.493
10	8	8	10000	4.197	500	0	2	7.0	0.0000	20519.7871	401.8832	±0.6000	56.6755	4.1102	7.8	0.7390	20470.4902	373.1578	±0.0000	69.6182	8.186
10	8	8	10000	4.197	500	0	3	7.0	0.0000	20504.8379	322.9265	±0.0000	58.9168	3.1623	7.6	0.6913	20498.1367	323.4951	±0.0000	67.5411	9.006
10	8	8	10000	4.197	500	0	4	7.0	0.0000	20130.2949	332.0278	±1.5000	57.6059	2.2242	7.6	0.6913	20113.5820	322.1302	±0.0000	65.3438	7.073
10	8	8	10000	4.197	500	0	5	7.0	0.0000	20381.4043	313.7643	±0.0000	59.0307	4.4758	7.4	0.6034	20374.8262	311.9892	±0.0000	65.7334	6.375
10	8	8	10000	4.197	500	0	6	7.0	0.0000	20126.1914	356.1992	±0.1000	57.9353	2.7559	7.8	0.7390	20104.4355	354.8493	±0.0000	67.0403	7.575
10	8	8	2000	2.5	500	80	1	5.0	0.0000	8406.7998	506.8704	±0.15000	2.5358	0.1742	5.2	0.4526	8401.0000	504.0366	±0.0000	2.5897	0.243
10	8	8	2000	2.5	500	80	2	5.0	0.0000	8530.9004	425.0790	±0.72000	2.5016	0.0818	5.2	0.4526	8527.4004	423.2655	±0.0000	2.6451	0.211
10	8	8	2000	2.5	500	80	3	5.0	0.0000	8544.5996	473.4550	±0.82000	2.5725	0.0806	5.4	0.6034	8528.5996	466.8972	±0.0000	2.7499	0.234
10	8	8	2000	2.5	500	80	4	5.0	0.0000	8439.2002	484.6077	±0.36900	2.5507	0.0651	5.0	0.0000	8439.2002	484.6077	±0.0000	2.5507	0.065
10	8	8	2000	2.5	500	80	5	5.0	0.0000	8580.0996	480.8262	±0.3815000	2.5705	0.0867	5.4	0.6034	8546.2002	474.9602	±0.0000	2.7509	0.229
10	8	8	2000	2.5	500	80	6	5.0	0.0000	8398.7002	445.0009	±0.3665000	2.5399	0.0671	5.2	0.4526	8397.9004	444.6175	±0.0000	2.6250	0.216
10	8	8	3000	2.849	500	80	1	3.0	0.0000	5806.0171	364.8026	±0.1193000	15.2696	0.9169	3.6	0.6913	5742.7764	313.9300	±0.0000	15.7174	5.802
10	8	8	3000	2.849	500	80	2	3.0	0.0000	5991.5923	320.3373	±0.1180000	16.6893	0.8631	3.2	0.4526	5971.2798	312.5175	±0.0000	15.2732	3.970
10	8	8	3000	2.849	500	80	3	3.0	0.0000	6101.4629	338.7871	±0.1230000	17.2227	0.7809	3.4	0.6034	6059.4136	314.0305	±0.0000	15.3534	5.480
10	8	8	3000	2.849	500	80	4	3.0	0.0000	5848.4326	328.3304	±0.1164000	18.7571	0.8063	3.4	0.6034	5807.4961	293.0455	±0.0000	14.7425	5.449
10	8	8	3000	2.849	500	80	5	3.0	0.0000	6029.8828	333.3235	±0.1216000	17.2267	0.1265	3.4	0.6034	6016.9282	325.9323	±0.0000	15.8696	5.620
10	8	8	3000	2.849	500	80	6	3.0	0.0000	5758.7314	343.0324	±0.1122000	17.6946	0.7830	3.4	0.6034	5728.1489	315.6000	±0.0000	16.2338	5.201
10	8	8	4000	3.125	500	80	1	3.0	0.0000	5494.6748	276.8776	±0.378000	12.2449	1.0284	3.2	0.4526	5486.0000	274.0957	±0.0000	11.5684	3.741
10	8	8	4000	3.125	500	80	2	3.0	0.0000	5725.8501	307.5716	±0.399000	12.1547	0.9306	3.2	0.4526	5713.2749	302.1140	±0.0000	11.3198	4.197
10	8	8	4000	3.125	500	80	3	3.0	0.0000	5783.1748	282.7298	±0.418000	10.8403	0.8562	3.2	0.4526	5774.2998	278.3904	±0.0000	9.9621	4.453
10	8	8	4000	3.125	500	80	4	3.0	0.0000	5555.1001	298.0586	±0.388000	12.6517	0.7624	3.2	0.4526	5541.7749	291.0928	±0.0000	11.6363	4.257
10	8	8	4000	3.125	500	80	5	3.0	0.0000	5771.3999	292.6527	±0.414000	12.6625	0.9325	3.2	0.4526	5749.2749	283.5981	±0.0000	11.5811	4.454
10	8	8	4000	3.125	500	80	6	3.0	0.0000	5445.5752	278.0579	±0.365000	11.6177	0.8998	3.2	0.4526	5431.2998	275.6692	±0.0000	11.1016	3.593
10	8	8	5000	3.358	500	80	1	3.0	0.0000	5435.7847	247.9549	±0.62000	18.2896	0.8734	3.0	0.0000	5435.7847	247.9549	±0.0000	18.2896	0.873
10	8	8	5000	3.358	500	80	2	3.0	0.0000	5652.7124	257.9002	±0.64000	3.7592	0.8037	3.0	0.0000	5652.7124	257.9002	±0.0000	3.7592	0.803
10	8	8	5000	3.358	500	80	3	3.0	0.0000	5731.5337	249.4515	±0.67000	3.7569	0.7929	3.0	0.0000	5731.5337	249.4515	±0.0000	3.7569	0.792
10	8	8	5000	3.358	500	80	4	3.0	0.0000	5477.0581	238.7396	±0.65000	3.6212	0.7493	3.0	0.0000	5477.0581	238.7396	±0.0000	3.6212	0.749
10	8	8	5000	3.358	500	80	5	3.0	0.0000	5696.1455	252.9998	±0.67000	3.6649	0.7775	3.2	0.4526	5695.5454	252.0918	±0.0000	3.6649	4.608
10	8	8	5000	3.358	500	80	6	3.0	0.0000	5341.5200	235.7117	±0.62000	3.7833	0.7840	3.0	0.0000	5341.5200	235.7117	±0.0000	3.7833	0.784
10	8	8	6000	3.561	500	80	1	3.0	0.0000	5546.6582	245.9759	±0.20000	1.7849	0.8341	3.0	0.0000	5546.6582	245.9759	±0.0000	1.7849	0.834
10	8	8	6000	3.561	500	80	2	3.0	0.0000	5765.4971	251.0882	±0.22000	1.6456	0.7861	3.0	0.0000	5765.4971	251.0882	±0.0000	1.6456	0.786
10	8	8	6000	3.561	500	80	3	3.0	0.0000	5877.3643	254.3029	±0.22000	1.6456	0.8383	3.0	0.0000	5877.3643	254.3029	±0.0000	1.6456	0.838
10	8	8	6000	3.561	500	80	4	3.0	0.0000	5592.7671	231.1514	±0.23000	1.6542	0.7770	3.0	0.0000	5592.7671	231.1514	±0.0000	1.6542	0.777
10	8	8	6000	3.561	500	80	5	3.0	0.0000	5822.0703	245.5338	±0.23000	1.6194	0.8547	3.0	0.0000	5822.0703	245.5338	±0.0000	1.6194	0.854
10	8	8	6000	3.561	500	80	6	3.0	0.0000	5461.7319	237.8510	±0.21000	1.7017	0.7031	3.0	0.0000	5461.7319	237.8510	±0.0000	1.7017	0.703
10	8	8	7000	3.742	500	80	1	3.0	0.0000	5686.2280	247.2464	±0.0000	18.8144	0.8111	3.0	0.0000	5686.2280	247.2464	±0.0000	18.8144	0.811
10	8	8	7000	3.742	500	80	2	3.0	0.0000	5872.2788	237.4452	±0.0000	19.8120	0.7175	3.0	0.0000	5872.2788	237.4452	±0.0000	19.8120	0.717
10	8	8	7000	3.742	500	80	3	3.0	0.0000	5991.1846	251.2612	±0.0000	20.5112	0.8339	3.0	0.0000	5991.1846	251.2612	±0.0000	20.5112	0.833
10	8	8	7000	3.742	500	80	4	3.0	0.0000	5692.0864	234.3336	±0.0000	18.9112	0.8030	3.0	0.0000	5692.0864	234.3336	±0.0000	18.9112	0.803
10	8	8	7000	3.742	500	80	5	3.0	0.0000	5959.9082	243.2050	±0.0000	20.4136	0.8203	3.0	0.0000	5959.9082	243.2050	±0.0000	20.4136	0.820
10	8	8	7000	3.742	500	80	6	3.0	0.0000	5544.7095	235.3943	±0.0000	18.0672	0.7433	3.0	0.0000	5544.7095	235.3943	±0.0000	18.0672	0.743
10	8	8	8000	3.906	500	80	1	3.0	0.0000	5801.3501	250.9303	±0.0000	18.8576	0.7795	3.0	0.0000	5801.3501	250.9303	±0.0000	18.8576	0.779
10	8	8	8000	3.906	500	80	2	3.0	0.0000	5992.9248	242.0627	±0.0000	19.7904	0.7281	3.0	0.0000	5992.9248	242.0627	±0.0000	19.7904	0.728
10	8	8	8000	3.906	500	80	3	3.0	0.0000	6111.9375	247.2094	±0.0000	20.5204	0.8546	3.0	0.0000	6111.9375	247.2094	±0.0000	20.5204	0.854
10	8	8	8000	3.906	500	80	4	3.0	0.0000	5815.3438	245.3636	±0.0000	18.9552	0.8235	3.0	0.0000	5815.3438	245.3636	±0.0000	18.9552	0.823
10	8	8	8000	3.906	500	80	5	3.0	0.0000	6089.8999	243.2788	±0.0000	20.3920	0.8017	3.0	0.0000	6089.8999	243.2788	±0.0000	20.3920	0.801
10	8	8	8000	3.906	500	80	6	3.0	0.0000	5659.0688	238.1352	±0.0000	18.0304	0.7481	3.0	0.0000	5659.0688	238.1352	±0.0000	18.0304	0.748

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	
10	8	8	9000	4.057	500	80	1	3.0	0.0000	5905.7017	260.6822	0.0000	18.8251	0.0000	3.0	0.0000	5905.7017	260.6822	0.0000	0.0000	18.8251	
10	8	8	9000	4.057	500	80	2	3.0	0.0000	6108.0537	251.7662	0.0000	19.8575	0.0000	3.0	0.0000	6108.0537	251.7662	0.0000	0.0000	19.8575	
10	8	8	9000	4.057	500	80	3	3.0	0.0000	6225.1182	256.2493	0.0000	20.6057	0.0000	3.0	0.0000	6225.1182	256.2493	0.0000	0.0000	20.6057	
10	8	8	9000	4.057	500	80	4	3.0	0.0000	5918.0439	248.9115	0.0000	18.9742	0.0000	3.0	0.0000	5918.0439	248.9115	0.0000	0.0000	18.9742	
10	8	8	9000	4.057	500	80	5	3.0	0.0000	6189.3574	250.1982	0.0000	20.4833	0.0000	3.0	0.0000	6189.3574	250.1982	0.0000	0.0000	20.4833	
10	8	8	9000	4.057	500	80	6	3.0	0.0000	5761.9746	243.0956	0.0000	18.0952	0.0000	3.0	0.0000	5761.9746	243.0956	0.0000	0.0000	18.0952	
10	8	8	10000	4.197	500	80	1	3.0	0.0000	6002.1714	260.6956	0.0000	14.3952	0.0000	3.0	0.0000	6002.1714	260.6956	0.0000	0.0000	14.3952	
10	8	8	10000	4.197	500	80	2	3.0	0.0000	6189.3994	245.0852	0.0000	15.1272	0.0000	3.0	0.0000	6189.3994	245.0852	0.0000	0.0000	15.1272	
10	8	8	10000	4.197	500	80	3	3.0	0.0000	6331.2871	270.7005	0.0000	15.6464	0.0000	3.0	0.0000	6331.2871	270.7005	0.0000	0.0000	15.6464	
10	8	8	10000	4.197	500	80	4	3.0	0.0000	6016.2739	254.2527	0.0000	14.5100	0.0000	3.0	0.0000	6016.2739	254.2527	0.0000	0.0000	14.5100	
10	8	8	10000	4.197	500	80	5	3.0	0.0000	6301.8350	246.9933	0.0000	15.5564	0.0000	3.0	0.0000	6301.8350	246.9933	0.0000	0.0000	15.5564	
10	8	8	10000	4.197	500	80	6	3.0	0.0000	5858.0767	248.6933	0.0000	13.7736	0.0000	3.0	0.0000	5858.0767	248.6933	0.0000	0.0000	13.7736	
10	8	8	2000	2.5	1500	0	1	49.8	1.8102	33539.3008	561.7399	1550.9000	57.2622	2.5523	50.0	1.6866	33375.5000	490.2373	1533.2000	23.4978	57.8076	
10	8	8	2000	2.5	1500	0	2	49.8	1.8102	33922.1992	601.4388	1560.9000	58.6523	2.4535	50.0	1.6866	33762.6016	452.2643	1541.3000	22.2448	59.3024	
10	8	8	2000	2.5	1500	0	3	49.8	1.8102	33948.8984	644.7278	1563.7000	58.5634	2.5318	50.2	1.6798	33774.5000	527.1653	1541.4000	21.4457	59.4618	
10	8	8	2000	2.5	1500	0	4	49.8	1.8102	33984.5000	769.8406	1589.9000	90.3514	2.9804	50.6	1.4780	33639.6992	524.9636	1534.8000	20.4785	59.1274	
10	8	8	2000	2.5	1500	0	5	49.8	1.8102	34140.3008	603.1827	1566.5000	51.7763	2.6842	50.2	1.6798	33938.6992	466.4764	1544.5000	24.3034	59.3577	
10	8	8	2000	2.5	1500	0	6	49.8	1.8102	33908.8008	655.0533	1570.9000	56.1484	2.2982	50.6	1.3151	33661.8008	545.4269	1532.9000	22.3046	59.1985	
10	8	8	3000	2.849	1500	0	1	17.8	1.0006	26868.4160	935.5723	880.8000	98.2532	15.7889	25.8	1.8102	23770.7695	364.6880	504.1000	10.4537	288.5264	
10	8	8	3000	2.849	1500	0	2	17.8	0.7390	27121.3848	998.9810	892.3000	126.4600	19.6048	25.8	1.9318	24161.5684	366.6393	510.3000	9.3542	295.6612	
10	8	8	3000	2.849	1500	0	3	18.0	1.0119	27532.5313	1205.5896	922.7000	158.1550	105.0336	26.4679	25.8	1.9318	24037.5020	382.3795	512.1000	10.3167	295.0260
10	8	8	3000	2.849	1500	0	4	17.6	0.9659	26930.2559	816.0317	880.7000	111.8696	17.1619	25.6	2.1387	23776.9961	387.7553	506.0000	10.9197	288.4784	
10	8	8	3000	2.849	1500	0	5	17.8	1.0006	27798.9727	1153.9872	971.7000	152.6089	103.0424	27.8148	25.8	1.9318	24003.5820	379.9142	513.8000	10.3956	294.6720
10	8	8	3000	2.849	1500	0	6	17.6	0.9659	27561.8164	963.2101	992.6000	155.6862	96.1456	18.8300	26.0	1.8165	23843.3867	396.1973	502.9000	9.9633	289.7352
10	8	8	4000	3.125	1500	0	1	17.2	0.4526	24778.0000	1048.3208	467.6000	127.0409	89.4672	21.6	1.5160	21924.4492	360.8172	165.9000	7.1670	244.7656	
10	8	8	4000	3.125	1500	0	2	17.4	0.6034	24140.9746	751.1839	364.9000	132.9096	20.5404	21.8	1.3826	22208.0254	350.2530	169.4000	7.6860	253.3484	
10	8	8	4000	3.125	1500	0	3	18.0	0.7543	24029.8242	1032.0659	348.0000	109.9798	119.6852	28.4007	21.8	1.9318	22189.5000	377.2146	168.9000	8.0846	250.9396
10	8	8	4000	3.125	1500	0	4	17.2	0.4526	24012.2754	606.0181	380.8000	62.0230	121.0080	11.4864	22.0	1.3908	21860.6992	387.0561	168.2000	8.2542	247.0420
10	8	8	4000	3.125	1500	0	5	17.6	0.6913	23897.1504	674.7701	342.8000	62.7298	112.7216	22.0	1.8165	22171.2500	354.0035	169.8000	7.1856	255.5940	
10	8	8	4000	3.125	1500	0	6	17.2	0.4526	24958.3750	1582.6681	491.5000	175.4538	112.8808	22.2	1.8102	21927.0000	366.8336	165.7000	8.1728	248.4240	
10	8	8	5000	3.358	1500	0	1	17.6	0.6913	22304.8379	732.5834	123.1000	79.9105	122.0044	20.2	1.5384	21227.1289	337.1293	24.3000	3.0367	215.8092	
10	8	8	5000	3.358	1500	0	2	17.6	0.6913	22686.3086	851.0414	107.9000	69.9118	137.8476	20.4	1.3577	21601.0273	328.4125	26.6000	1.3577	227.8172	
10	8	8	5000	3.358	1500	0	3	17.6	0.6913	22524.2910	715.8787	102.6000	63.5644	111.0604	20.4	1.1782	21537.8867	343.9118	26.5000	1.2733	231.5016	
10	8	8	5000	3.358	1500	0	4	17.6	0.6913	21952.5410	485.3469	84.3000	31.3918	145.4452	21.6	1.0006	21181.5977	331.4892	27.5000	3.5257	224.7032	
10	8	8	5000	3.358	1500	0	5	17.6	0.6913	22624.3164	1007.3980	127.4000	104.2818	114.0024	20.2	1.2068	21513.7988	348.2582	25.0000	2.3370	219.9364	
10	8	8	5000	3.358	1500	0	6	17.6	0.6913	22384.0977	940.2733	136.4000	83.1049	146.5624	20.1811	20.6	1.3151	21230.0318	354.8658	25.4000	4.6764	222.9944
10	8	8	6000	3.561	1500	0	1	17.6	0.6913	22379.5664	606.4019	51.4000	55.3718	109.4374	18.9854	21.2	1.4231	21688.8008	315.3030	7.8000	2.0739	230.7758
10	8	8	6000	3.561	1500	0	2	17.4	0.6034	23025.5195	639.1927	79.6000	65.2445	132.8008	27.5113	20.6	1.7592	22051.8496	320.8671	6.8000	2.0739	230.7758
10	8	8	6000	3.561	1500	0	3	17.4	0.6034	22586.9746	438.6810	39.2000	33.4089	107.1200	21.0655	21.2	1.4231	21952.1836	322.6087	6.5000	3.2045	223.5872
10	8	8	6000	3.561	1500	0	4	17.6	0.6913	22249.1289	600.6092	51.1000	44.2206	129.9748	28.0253	21.0	1.3492	21570.3867	313.6567	7.3000	2.1347	223.4288
10	8	8	6000	3.561	1500	0	5	17.4	0.6034	22867.8730	716.3897	93.1000	70.2269	109.7560	23.9246	20.8	1.2531	21853.4980	321.3101	7.5000	2.5298	223.8728
10	8	8	6000	3.561	1500	0	6	17.6	0.6913	22462.4160	884.8658	82.4000	73.2838	136.7712	25.6520	20.2	0.7390	21494.3496	330.2719	5.2000	4.0167	201.2120
10	8	8	7000	3.742	1500	0	1	17.6	0.6913	22668.1445	555.1249	33.6000	42.3312	119.6016	23.3162	20.0	1.3908	22117.6523	409.7741	0.0000	0.0000	215.7776
10	8	8	7000	3.742	1500	0	2	17.6	0.6913	22906.3945	487.2772	14.8000	15.4200	138.1848	20.5507	21.0	0.9541	22492.8867	399.7219	0.0000	0.0000	245.8000
10	8	8	7000	3.742	1500	0	3	17.6	0.6913	22797.1602	407.5024	12.4000	18.9862	113.0440	16.7641	21.0	1.5085	22407.2637	371.9022	0.0000	0.0000	247.5192
10	8	8	7000	3.742	1500	0	4	17.6	0.6913	22483.7773	375.9593	14.3000	7.8966	145.0888	24.1791	20.6	1.1289	22068.8555	387.3913	0.0000	0.0000	223.0692
10	8	8	7000	3.742	1500	0	5	17.6	0.6913	22754.4648	466.6467	23.5000	31.1502	125.5616	19.2452	20.8	1.2531	22347.9258	370.6791	0.0000	0.0000	239.1452
10	8	8	7000	3.742	1500	0	6	17.6	0.6913	23218.9785	1192.6427	95.2000	106.5135	153.6008	23.3237	20.6	1.1289	22107.0918	384.5383	0.0000	0.0000	227.1816
10	8	8	8000	3.906	1500	0	1	17.6	0.6913	23188.2500	550.5627	31.4000	41.1094	119.4960	22.6409	20.8	1.2531	22621.5879	418.0380	0.0000		

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	8000	3.906	1500	0	2	17.6	0.6913	23358.9434	456.6467	7.6000	8.4812	22.0726	21.0	22958.1055	405.5549	0.0000	0.0000	244.0704
10	8	8	8000	3.906	1500	0	3	17.6	0.6913	23356.5059	499.7458	18.8000	29.0123	19.8549	21.4	22883.5625	378.8958	0.0000	0.0000	252.7536
10	8	8	8000	3.906	1500	0	4	17.6	0.6913	22992.2559	395.0115	13.3000	7.8822	23.5065	20.6	22535.9941	382.1548	0.0000	0.0000	226.6784
10	8	8	8000	3.906	1500	0	5	17.6	0.6913	23294.5371	468.8929	24.2000	31.4439	15.8099	20.8	22850.0938	381.2441	0.0000	0.0000	237.6496
10	8	8	8000	3.906	1500	0	6	17.6	0.6913	23669.4434	1223.1658	91.1000	105.2669	23.6314	20.6	22598.0879	392.8096	0.0000	0.0000	223.5840
10	8	8	9000	4.057	1500	0	1	17.6	0.6913	23607.4785	543.4016	30.3000	38.8144	22.0440	20.8	23049.8945	416.0776	0.0000	0.0000	233.6288
10	8	8	9000	4.057	1500	0	2	17.6	0.6913	23774.3164	464.7095	7.8000	13.2534	18.6690	20.8	23407.0566	413.0376	0.0000	0.0000	239.3248
10	8	8	9000	4.057	1500	0	3	17.6	0.6913	23774.9590	428.1612	14.5000	22.1813	20.1486	21.4	23336.6152	393.9673	0.0000	0.0000	233.0880
10	8	8	9000	4.057	1500	0	4	17.6	0.6913	23377.0801	424.2851	8.5000	6.6121	24.6489	20.4	22976.6483	383.7113	0.0000	0.0000	223.8848
10	8	8	9000	4.057	1500	0	5	17.6	0.6913	23665.1367	449.1992	19.2000	26.4156	19.1998	20.8	23288.0352	399.9908	0.0000	0.0000	241.9648
10	8	8	9000	4.057	1500	0	6	17.6	0.6913	24140.2598	1219.2478	89.5000	103.4460	23.5521	20.6	23043.9473	397.0578	0.0000	0.0000	223.4496
10	8	8	10000	4.197	1500	0	1	17.6	0.6913	24068.5781	631.2052	35.4000	52.5873	16.1216	20.4	23512.9824	438.8153	0.0000	0.0000	168.0804
10	8	8	10000	4.197	1500	0	2	17.6	0.6913	24284.7461	699.7663	19.7000	41.8594	16.1144	21.0	23839.4980	397.9106	0.0000	0.0000	181.5312
10	8	8	10000	4.197	1500	0	3	17.6	0.6913	24162.5547	387.1021	6.5000	12.4999	20.0894	21.0	23774.2930	408.6566	0.0000	0.0000	180.4236
10	8	8	10000	4.197	1500	0	4	17.6	0.6913	23733.2305	427.4408	4.8000	4.3825	19.8800	20.2	23414.6758	407.7788	0.0000	0.0000	164.3572
10	8	8	10000	4.197	1500	0	5	17.6	0.6913	23981.8691	487.2572	17.4000	27.2393	17.1614	20.8	23648.7754	411.6252	0.0000	0.0000	181.0708
10	8	8	10000	4.197	1500	0	6	17.6	0.6913	24771.0410	1561.8744	106.8000	131.6704	18.0386	20.8	23427.4688	389.7701	0.1000	0.2263	173.2072
10	8	8	2000	2.5	1500	80	1	12.8	1.0560	11256.5000	645.8707	519.7000	65.8096	13.2509	13.6	11030.0000	441.8723	486.4000	28.2421	35.8682
10	8	8	2000	2.5	1500	80	2	12.6	1.3151	11705.7998	594.2784	549.7000	70.0977	11.5047	13.8	11381.0000	428.2766	498.5000	26.2242	33.2760
10	8	8	2000	2.5	1500	80	3	12.8	1.0560	11583.5996	624.1428	530.7000	59.4340	14.4910	13.6	11335.2998	423.2189	498.7000	28.8674	37.3776
10	8	8	2000	2.5	1500	80	4	12.6	1.3151	11504.5000	715.1140	564.5000	106.0497	12.7342	13.4	11122.4004	469.4928	490.6000	29.1051	38.0198
10	8	8	2000	2.5	1500	80	5	13.0	0.9541	11572.2002	655.9527	535.3000	75.0669	11.4179	13.6	11330.9004	436.2012	499.2000	28.5598	39.8010
10	8	8	2000	2.5	1500	80	6	12.6	1.3151	11582.7998	704.7799	570.8000	119.2591	11.5611	13.4	11202.4004	465.2277	488.5000	28.4889	38.5198
10	8	8	3000	2.849	1500	80	1	5.4	0.6034	8599.0449	413.1800	277.9000	32.9436	6.0137	8.2	7836.4282	297.1044	159.6000	17.3616	61.5232
10	8	8	3000	2.849	1500	80	2	5.6	0.9659	8695.2627	406.8513	237.1000	34.6077	9.9005	8.2	8123.7500	303.8409	169.5000	20.0870	64.8280
10	8	8	3000	2.849	1500	80	3	5.6	0.9659	8850.5918	442.4515	248.9000	35.2736	10.6853	8.4	8143.5322	322.5324	165.2000	17.5525	66.2344
10	8	8	3000	2.849	1500	80	4	5.4	0.6034	8494.1094	361.3244	235.0000	23.0090	9.4740	8.0	7878.6265	332.0836	159.1000	16.6976	60.0168
10	8	8	3000	2.849	1500	80	5	5.4	0.6034	8836.3506	471.2176	262.2000	45.4656	5.9357	7.8	12068.8083.9014	315.2670	170.8000	18.1861	58.6032
10	8	8	3000	2.849	1500	80	6	5.4	0.6034	8432.0166	298.6166	232.6000	17.1738	6.3511	8.6	7862.0078	306.0455	156.8000	15.9674	65.5920
10	8	8	4000	3.125	1500	80	1	5.4	0.6034	7877.0249	311.9908	97.6000	10.7422	27.9360	7.8	7340.2251	271.8858	52.6000	9.2451	133.6456
10	8	8	4000	3.125	1500	80	2	5.4	0.6034	8048.2500	276.5620	97.1000	21.0501	34.9872	7.6	7567.6250	284.4959	54.6000	8.3324	132.1904
10	8	8	4000	3.125	1500	80	3	5.4	0.6034	8113.6001	328.1734	98.8000	13.2448	28.9136	7.8	7615.8999	284.2552	54.2000	9.3406	63.4488
10	8	8	4000	3.125	1500	80	4	5.4	0.6034	7799.8999	293.2027	96.6000	19.0997	32.3672	7.6	7349.6748	278.7578	52.2000	8.2058	58.1600
10	8	8	4000	3.125	1500	80	5	5.4	0.6034	8143.8501	308.2058	106.5000	19.6779	29.9080	7.8	7592.2500	262.6687	55.8000	9.5036	100.7376
10	8	8	4000	3.125	1500	80	6	5.4	0.6034	7778.9248	291.0561	96.7000	16.7948	7.0922	7.8	7328.0249	284.0708	52.4000	9.5953	170.6520
10	8	8	5000	3.358	1500	80	1	5.4	0.6034	7458.7939	293.9875	26.1000	9.8715	30.3968	8.0	7226.0283	237.7451	7.6000	4.0925	172.1992
10	8	8	5000	3.358	1500	80	2	5.4	0.6034	7715.8374	321.6125	27.9000	14.7627	36.0264	7.2	7424.2134	283.1871	8.3000	4.0484	57.3792
10	8	8	5000	3.358	1500	80	3	5.4	0.6034	7796.2549	282.8922	28.8000	12.5795	31.9720	7.8	7516.5610	251.1703	7.7000	4.1456	179.6392
10	8	8	5000	3.358	1500	80	4	5.4	0.6034	7454.4229	321.1955	28.6000	20.3262	33.3712	7.4	7155.6846	270.3202	7.8000	3.8871	180.5984
10	8	8	5000	3.358	1500	80	5	5.4	0.6034	7804.1836	313.9728	30.2000	14.9250	34.4168	7.6	7506.2319	256.7482	9.2000	4.2640	170.9664
10	8	8	5000	3.358	1500	80	6	5.4	0.6034	7773.0322	306.8285	25.7000	18.0802	7.6842	7.4	7147.1392	258.4839	7.5000	3.8791	82.4992
10	8	8	6000	3.561	1500	80	1	5.8	0.7390	7448.2173	231.5202	2.0000	2.5909	32.4128	8.0	7346.2954	254.7715	2.7000	1.9392	176.8960
10	8	8	6000	3.561	1500	80	2	5.6	0.6913	7669.1709	291.4652	3.0000	2.5016	38.0232	7.4	7556.7461	261.1458	2.8000	2.1280	179.6392
10	8	8	6000	3.561	1500	80	3	5.8	0.7390	7776.8877	286.2985	4.8000	6.1812	35.8632	7.8	7659.8960	270.5256	2.6000	2.1912	180.5984
10	8	8	6000	3.561	1500	80	4	5.6	0.6913	7396.9502	306.2913	4.2000	3.3358	35.0920	7.6	7300.9429	268.6051	2.2000	2.2577	100.9664
10	8	8	6000	3.561	1500	80	5	5.4	0.6034	7863.8110	343.9387	15.2000	22.9441	32.6072	7.6	7656.2373	250.5703	2.5000	2.2183	168.1456
10	8	8	6000	3.561	1500	80	6	5.4	0.6034	7423.1602	315.1498	9.0000	12.2040	32.0632	7.2	7267.1733	276.7613	2.1000	1.3681	128.1968
10	8	8	7000	3.742	1500	80	1	5.2	0.4526	7721.1943	281.3691	5.0000	6.8964	27.0664	8.0	7518.5376	263.6820	0.0000	0.0000	100.5168
10	8	8	7000	3.742	1500	80	2	5.2	0.4526	7874.5820	253.5244	5.8000	7.4270	34.0616	6.8	7813.2173	280.4682	0.0000	0.3017	53.3328

C [Gb/s]	W	B	R_{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F_{min}	Weighted port count @ F_{min}	$\pm CI$	# of OEOs @ F_{min}	Solve time [sec]	$\pm CI$	F_{opt}	Weighted port count @ F_{opt}	# of OEOs @ F_{opt}	$\pm CI$	Solve time [sec]	$\pm CI$
10	8	8	7000	3.742	1500	80	3	5.4	0.6034	8005.9233	329.9457	5.2000	5.7620	7.9915	7812.1553	295.9747	0.0000	146.9728	118.2
10	8	8	7000	3.742	1500	80	4	5.4	0.6034	7602.4829	297.2414	5.7000	11.1724	8.6973	7444.4697	299.7174	0.0000	59.0176	10.76
10	8	8	7000	3.742	1500	80	5	5.4	0.6034	7949.8945	294.7723	1.6000	3.1317	32.8664	7809.3726	272.3659	0.0000	173.3032	130.8
10	8	8	7000	3.742	1500	80	6	5.4	0.6034	7503.6221	279.2245	1.3000	1.7543	33.8600	7401.7632	270.3361	0.0000	82.9896	77.93
10	8	8	8000	3.906	1500	80	1	5.2	0.4526	7841.6064	300.2109	3.1000	3.9402	7.2685	7662.3564	275.3387	0.2000	86.9008	82.95
10	8	8	8000	3.906	1500	80	2	5.2	0.4526	8050.5313	256.9904	5.7000	7.1080	8.7879	7873.6436	280.7845	0.2000	52.8592	8.969
10	8	8	8000	3.906	1500	80	3	5.4	0.6034	8159.1938	337.1233	5.1000	5.8077	7.9957	7962.3311	290.0887	0.0000	146.5600	117.4
10	8	8	8000	3.906	1500	80	4	5.4	0.6034	7777.4375	307.9771	7.8000	15.4347	8.5633	7598.4688	301.0919	0.1000	53.9584	8.487
10	8	8	8000	3.906	1500	80	5	5.4	0.6034	8096.9189	310.8476	1.3000	2.4799	7.7728	7967.1187	280.4656	0.0000	174.9008	129.6
10	8	8	8000	3.906	1500	80	6	5.4	0.6034	7653.7061	279.7281	1.3000	1.7543	7.4761	7553.4126	277.7151	0.1000	121.9312	112.4
10	8	8	9000	4.057	1500	80	1	5.2	0.4526	7979.9014	308.6676	2.3000	3.6337	7.2391	7802.4150	284.7487	1.2000	92.9035	87.42
10	8	8	9000	4.057	1500	80	2	5.2	0.4526	8173.4688	238.9134	3.4000	3.8341	8.2835	8020.5024	272.4857	0.0000	59.8814	8.403
10	8	8	9000	4.057	1500	80	3	5.4	0.6034	8293.2832	334.2171	4.0000	5.6845	8.1259	8122.9712	312.7950	0.0000	66.8428	9.651
10	8	8	9000	4.057	1500	80	4	5.4	0.6034	7905.9194	318.5972	7.8000	15.4347	8.4039	7739.8062	306.4500	0.1000	56.8158	9.687
10	8	8	9000	4.057	1500	80	5	5.4	0.6034	8231.0830	309.6191	0.7000	1.1709	7.8280	8106.3462	280.2916	0.0000	66.0760	13.00
10	8	8	9000	4.057	1500	80	6	5.4	0.6034	7779.5947	276.2110	1.1000	1.7673	7.3265	7681.8750	274.1488	0.1000	52.3888	8.524
10	8	8	10000	4.197	1500	80	1	5.2	0.4526	8128.3047	317.4805	2.3000	3.5706	5.3722	7925.0415	285.4618	1.2000	118.6536	115.4
10	8	8	10000	4.197	1500	80	2	5.2	0.4526	8349.8857	285.0667	3.8000	3.7227	6.5976	8148.6265	273.7050	0.0000	84.1192	92.76
10	8	8	10000	4.197	1500	80	3	5.4	0.6034	8421.9238	330.8589	3.9000	5.6084	6.3394	8248.6035	309.3341	0.0000	137.4672	129.4
10	8	8	10000	4.197	1500	80	4	5.4	0.6034	8040.1548	327.8955	7.8000	15.4347	25.2824	7858.4155	309.8864	0.1000	41.3128	6.584
10	8	8	10000	4.197	1500	80	5	5.4	0.6034	8363.8467	313.1629	0.3000	0.4830	24.4872	8243.5098	293.5017	0.0000	86.5280	83.01
10	8	8	10000	4.197	1500	80	6	5.4	0.6034	7906.6157	291.4303	1.2000	1.7462	5.5183	7811.0718	283.5823	0.1000	39.5440	6.816

Table C.8: Comparison of fiber-bifurcation-based heuristics with the optical-reach customization for the NSF network.

C	W	B	R _{max}	E/O	cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	2000	2.5	500	0	1	1	17.6	0.6913	26607.6563	1281.9000	33.3128	16.6360	17.6	0.6913	26607.6563	1281.9000	33.3128	16.6360	0.624
10	8	8	2000	2.5	500	0	2	2	17.6	0.6913	26816.9375	1287.2000	33.4072	16.9345	17.8	0.7390	26813.0215	1286.9000	33.2461	17.1147	0.706
10	8	8	2000	2.5	500	0	3	3	17.6	0.6913	26892.3125	1290.9000	34.2707	17.0445	17.6	0.6913	26892.3125	1290.9000	34.2707	17.0445	0.731
10	8	8	2000	2.5	500	0	4	4	17.6	0.6913	26722.7402	1282.7000	33.4178	16.8414	17.8	0.7390	26721.3496	1281.8000	32.9355	17.0247	0.690
10	8	8	2000	2.5	500	0	5	5	17.6	0.6913	26960.5156	1287.5000	32.6518	17.0384	17.6	0.6913	26960.5156	1287.5000	32.6518	17.0384	0.675
10	8	8	2000	2.5	500	0	6	6	17.6	0.6913	26783.3164	1281.5000	31.8635	16.8120	17.6	0.6913	26783.3164	1281.5000	31.8635	16.8120	0.704
10	8	8	3000	2.849	500	0	1	1	7.0	0.0000	19161.2891	476.1000	48.5828	47.8707	9.0	0.6746	18652.2422	428.0000	14.1309	139.8551	145.2
10	8	8	3000	2.849	500	0	2	2	7.0	0.0000	19308.5078	485.4513	45.9587	50.0170	9.2	0.4526	18896.4180	422.7000	14.0948	148.4094	153.3
10	8	8	3000	2.849	500	0	3	3	7.2	0.4526	19296.0840	461.3000	34.2142	52.0489	9.0	0.6746	18916.1816	426.0000	13.5765	80.3125	82.54
10	8	8	3000	2.849	500	0	4	4	7.0	0.0000	19195.8477	493.0000	70.8860	50.7089	9.4	0.6034	18596.9258	418.4000	13.3832	82.2362	3.660
10	8	8	3000	2.849	500	0	5	5	7.2	0.4526	19275.8184	472.4000	26.6182	52.0289	9.4	0.6034	18819.2129	427.1000	13.6786	82.7337	3.651
10	8	8	3000	2.849	500	0	6	6	7.0	0.0000	19057.5918	477.1000	42.3893	49.8846	9.0	0.6746	18628.4512	418.9000	14.9313	192.1336	176.5
10	8	8	4000	3.125	500	0	1	1	7.0	0.0000	17218.1016	151.0000	21.7455	56.4600	7.6	0.6913	17120.3359	141.0000	12.0255	64.7976	7.060
10	8	8	4000	3.125	500	0	2	2	7.0	0.0000	17396.4512	152.6000	19.4099	59.2056	7.8	0.7390	17297.8633	138.5000	11.6128	69.1328	7.879
10	8	8	4000	3.125	500	0	3	3	7.0	0.0000	17398.1602	148.0000	17.3117	58.0072	7.6	0.6913	17334.0840	141.3000	10.9044	67.0856	7.355
10	8	8	4000	3.125	500	0	4	4	7.0	0.0000	17123.9992	151.2000	20.6362	56.7336	7.6	0.6913	17032.0469	139.9000	10.4482	64.6816	7.361
10	8	8	4000	3.125	500	0	5	5	7.0	0.0000	17375.9980	154.5000	22.8732	57.9216	7.4	0.6034	17288.6055	140.8000	11.6275	64.2024	7.173
10	8	8	4000	3.125	500	0	6	6	7.0	0.0000	17137.3086	155.9000	26.4687	57.2600	8.0	0.7543	17042.8477	140.8000	10.0505	68.8920	7.665
10	8	8	5000	3.358	500	0	1	1	7.0	0.0000	16327.9238	19.3000	3.3571	58.2386	7.4	0.6034	16314.2969	19.8000	3.3866	63.1898	5.971
10	8	8	5000	3.358	500	0	2	2	7.0	0.0000	16560.4102	21.4000	4.5904	58.3208	7.6	0.6913	16536.4316	20.1000	3.3638	66.5407	8.484
10	8	8	5000	3.358	500	0	3	3	7.0	0.0000	16593.4414	20.5000	4.2433	59.2271	7.6	0.6913	16576.9785	20.1000	3.6400	68.0967	7.614
10	8	8	5000	3.358	500	0	4	4	7.0	0.0000	16297.1621	21.1000	5.3594	57.8290	7.2	0.4526	16296.2598	21.2000	5.2884	60.3145	6.161
10	8	8	5000	3.358	500	0	5	5	7.0	0.0000	16521.6133	21.7000	5.8136	59.4524	7.2	0.4526	16501.9219	20.4000	3.9221	62.6210	5.140
10	8	8	5000	3.358	500	0	6	6	7.0	0.0000	16286.9453	22.7000	7.2428	57.4216	7.8	0.7390	16269.3027	19.9000	3.7780	66.9964	7.716
10	8	8	6000	3.561	500	0	1	1	7.0	0.0000	16299.2607	5.7000	2.0253	56.2264	7.4	0.6034	16281.8613	6.1000	1.9215	62.6880	8.420
10	8	8	6000	3.561	500	0	2	2	7.0	0.0000	16520.0605	8.3000	3.5546	57.6568	7.8	0.7390	16490.1641	6.7000	1.8180	68.7064	10.75
10	8	8	6000	3.561	500	0	3	3	7.0	0.0000	16583.2871	6.1000	1.7992	56.4080	7.4	0.6034	16564.7246	6.9000	1.6679	64.0840	8.302
10	8	8	6000	3.561	500	0	4	4	7.0	0.0000	16297.4082	11.1000	10.6851	57.4376	7.6	0.6913	16213.2969	6.9000	1.6334	64.9624	7.299
10	8	8	6000	3.561	500	0	5	5	7.0	0.0000	16464.9590	8.8000	5.5405	60.3064	7.4	0.6034	16438.9160	6.8000	1.7133	66.1352	6.927
10	8	8	6000	3.561	500	0	6	6	7.0	0.0000	16170.7324	7.1000	4.0259	57.7736	7.6	0.6913	16146.8457	6.2000	1.6106	64.6928	7.743
10	8	8	7000	3.742	500	0	1	1	7.0	0.0000	16267.6895	0.0000	0.0000	57.2552	7.4	0.6034	16251.2813	0.0000	0.0000	62.5589	7.512
10	8	8	7000	3.742	500	0	2	2	7.0	0.0000	16528.3477	1.0000	2.2628	58.0635	8.0	0.7543	16498.8242	0.0000	0.0000	72.5683	8.932
10	8	8	7000	3.742	500	0	3	3	7.0	0.0000	16489.0566	0.0000	0.0000	59.1902	7.4	0.6034	16485.0000	0.0000	0.0000	64.9655	8.061
10	8	8	7000	3.742	500	0	4	4	7.0	0.0000	16259.1777	4.7000	9.6535	57.4715	7.8	0.7390	16187.6094	0.0000	0.0000	67.6392	7.990
10	8	8	7000	3.742	500	0	5	5	7.0	0.0000	16411.7539	0.3000	0.6788	59.7701	7.0	0.6913	16411.7539	0.3000	0.6788	59.7701	2.883
10	8	8	7000	3.742	500	0	6	6	7.0	0.0000	16180.3125	290.2857	1.8000	2.7979	7.6	0.6913	16138.4082	0.0000	0.0000	64.9915	7.205
10	8	8	8000	3.906	500	0	1	1	7.0	0.0000	16282.9121	0.0000	0.0000	56.6144	7.6	0.6913	16255.7734	0.0000	0.0000	230.6920	197.5
10	8	8	8000	3.906	500	0	2	2	7.0	0.0000	16541.7461	0.6000	1.3577	57.1096	8.0	0.7543	16491.6777	0.0000	0.0000	242.0944	200.9
10	8	8	8000	3.906	500	0	3	3	7.0	0.0000	16508.9258	0.0000	0.0000	59.2888	7.4	0.6034	16506.0586	0.0000	0.0000	180.1384	181.0
10	8	8	8000	3.906	500	0	4	4	7.0	0.0000	16234.9746	3.5000	7.4304	57.9112	7.6	0.6913	16185.9658	0.0000	0.0000	118.7016	124.3
10	8	8	8000	3.906	500	0	5	5	7.0	0.0000	16414.4512	0.3000	0.6788	59.8504	7.2	0.4526	16411.4512	0.3000	0.6788	62.6632	6.041
10	8	8	8000	3.906	500	0	6	6	7.0	0.0000	16166.1953	0.9000	2.0365	57.9056	7.6	0.6913	16127.6738	0.0000	0.0000	173.7776	169.9
10	8	8	9000	4.057	500	0	1	1	7.0	0.0000	16270.9893	0.0000	0.0000	55.3529	7.6	0.6913	16239.6768	0.0000	0.0000	63.6532	7.478
10	8	8	9000	4.057	500	0	2	2	7.0	0.0000	16551.3555	0.1000	0.2263	56.8053	7.4	0.6034	16529.3477	0.1000	0.2263	62.6960	7.194
10	8	8	9000	4.057	500	0	3	3	7.0	0.0000	16515.2754	0.0000	0.0000	59.2949	7.4	0.6034	16513.1387	0.0000	0.0000	114.5943	120.2
10	8	8	9000	4.057	500	0	4	4	7.0	0.0000	16240.5938	1.9000	4.0541	55.8396	7.8	0.7390	16199.6738	0.0000	0.0000	65.2755	7.686
10	8	8	9000	4.057	500	0	5	5	7.0	0.0000	16423.6074	0.0000	0.0000	57.2314	7.4	0.6034	16418.4199	0.0000	0.0000	116.0680	123.7

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count	±CI	# of OEOs @ F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count	±CI	# of OEOs @ F _{opt}	±CI	Solve time [sec]
10	8	8	9000	4.057	500	0	6	7.0	0.0000	16171.4453	279.6468	0.2000	0.4526	55.8798	7.6	0.6913	16143.0439	273.4270	0.0000	0.0000	62.9392
10	8	8	10000	4.197	500	0	1	7.0	0.0000	16267.3486	345.9660	0.0000	0.0000	54.6544	7.6	0.6913	16246.0049	327.0573	0.0000	0.0000	211.4000
10	8	8	10000	4.197	500	0	2	7.0	0.0000	16560.2676	338.1397	0.0000	1.3577	55.0336	7.8	0.7390	16497.7734	304.1647	0.0000	0.0000	269.6416
10	8	8	10000	4.197	500	0	3	7.0	0.0000	16529.0371	259.7823	0.0000	0.0000	56.9400	7.8	0.7390	16524.5332	258.9021	0.0000	0.0000	272.3752
10	8	8	10000	4.197	500	0	4	7.0	0.0000	16200.5801	259.1679	1.5000	3.1508	55.9630	7.6	0.6913	16181.5049	247.4810	0.0000	0.2263	206.3856
10	8	8	10000	4.197	500	0	5	7.0	0.0000	16414.4551	251.9412	0.0000	0.0000	57.1312	7.4	0.6034	16403.7012	246.1780	0.0000	0.0000	163.8768
10	8	8	10000	4.197	500	0	6	7.0	0.0000	16174.1904	279.5870	0.1000	0.2263	55.9392	7.8	0.7390	16142.2373	273.6435	0.0000	0.0000	258.3520
10	8	8	2000	2.5	500	80	1	5.0	0.0000	7876.8608	469.8616	371.5000	31.0863	2.5016	5.2	0.4526	7871.0752	467.1064	371.0000	30.9648	2.5888
10	8	8	2000	2.5	500	80	2	5.0	0.0000	7994.5078	392.7857	372.7000	26.6477	2.5348	5.2	0.4526	7991.2725	391.1647	372.2000	26.4651	2.6249
10	8	8	2000	2.5	500	80	3	5.0	0.0000	8006.4390	441.3536	382.1000	28.1982	2.5876	5.4	0.6034	7991.3389	434.9910	380.2000	27.2718	2.7710
10	8	8	2000	2.5	500	80	4	5.0	0.0000	7907.1743	449.8040	369.1000	28.3491	2.5736	5.0	0.0000	7907.1743	449.8040	369.1000	28.3491	2.7736
10	8	8	2000	2.5	500	80	5	5.0	0.0000	8042.7031	448.0047	381.5000	28.0765	2.5906	5.4	0.6034	8010.5947	441.9583	378.3000	26.0221	2.7750
10	8	8	2000	2.5	500	80	6	5.0	0.0000	7867.1226	411.1156	366.5000	27.4080	2.5576	5.2	0.4526	7866.3931	410.7755	366.3000	27.3598	2.6427
10	8	8	3000	2.849	500	80	1	3.0	0.0000	5368.0221	316.8679	119.3000	22.8005	12.3304	3.6	0.6913	5315.6587	278.8195	112.4000	15.7174	15.3520
10	8	8	3000	2.849	500	80	2	3.0	0.0000	5548.5913	284.5322	118.0000	16.6893	13.2496	3.2	0.4526	5530.7798	277.5771	115.4000	15.2732	14.4128
10	8	8	3000	2.849	500	80	3	3.0	0.0000	5667.6733	300.4872	123.0000	17.2227	13.3560	3.4	0.6034	5627.9463	278.2352	119.8000	15.3534	15.0240
10	8	8	3000	2.849	500	80	4	3.0	0.0000	5417.2451	288.3568	116.4000	18.7571	12.6808	3.4	0.6034	5381.0059	256.8736	111.6000	14.7425	14.7736
10	8	8	3000	2.849	500	80	5	3.0	0.0000	5595.1240	295.0526	121.6000	17.2267	13.1224	3.4	0.6034	5584.3027	289.1114	119.1000	15.8696	15.5672
10	8	8	3000	2.849	500	80	6	3.0	0.0000	5331.7275	304.6328	112.2000	17.6946	12.4728	3.2	0.4526	5302.7124	278.6678	109.6000	16.2338	14.6592
10	8	8	4000	3.125	500	80	1	3.0	0.0000	5031.4946	234.3091	37.8000	12.2449	13.4320	3.2	0.4526	5023.4141	232.1317	36.6000	11.5684	14.6080
10	8	8	4000	3.125	500	80	2	3.0	0.0000	5249.8745	264.6807	39.9000	12.1547	14.2608	3.2	0.4526	5239.1123	260.4113	38.6000	11.3198	15.4720
10	8	8	4000	3.125	500	80	3	3.0	0.0000	5310.7363	246.7061	41.8000	10.8403	14.6064	3.2	0.4526	5301.3159	241.5593	40.5000	9.9621	15.8704
10	8	8	4000	3.125	500	80	4	3.0	0.0000	5094.7080	254.5951	38.8000	12.6517	13.8944	3.2	0.4526	5082.6636	248.7100	37.3000	11.6363	15.1040
10	8	8	4000	3.125	500	80	5	3.0	0.0000	5302.0400	247.8968	41.4000	12.6625	14.4576	3.2	0.4526	5284.9707	238.8586	39.8000	11.5811	15.7904
10	8	8	4000	3.125	500	80	6	3.0	0.0000	4989.4453	238.4436	36.5000	11.6177	13.3632	3.2	0.4526	4977.3745	237.4852	35.6000	11.1016	14.3824
10	8	8	5000	3.358	500	80	1	3.0	0.0000	4897.8481	215.9718	6.2000	3.9596	14.1780	3.0	0.0000	4897.8481	215.9718	6.2000	3.9596	14.1780
10	8	8	5000	3.358	500	80	2	3.0	0.0000	5100.6753	223.3119	6.4000	3.7592	15.0808	3.0	0.0000	5100.6753	223.3119	6.4000	3.7592	15.0808
10	8	8	5000	3.358	500	80	3	3.0	0.0000	5184.1133	216.2801	6.7000	3.7569	15.5164	3.0	0.0000	5184.1133	216.2801	6.7000	3.7569	15.5164
10	8	8	5000	3.358	500	80	4	3.0	0.0000	4947.8291	206.4304	6.5000	3.6212	14.4404	3.0	0.0000	4947.8291	206.4304	6.5000	3.6212	14.4404
10	8	8	5000	3.358	500	80	5	3.0	0.0000	5152.6826	215.5961	6.7000	3.6649	15.4040	3.2	0.4526	5152.3174	215.0634	6.7000	3.6649	16.5148
10	8	8	5000	3.358	500	80	6	3.0	0.0000	4812.7837	205.6259	6.2000	3.7833	13.8404	3.0	0.0000	4812.7837	205.6259	6.2000	3.7833	13.8404
10	8	8	6000	3.561	500	80	1	3.0	0.0000	4888.2554	213.0008	2.0000	1.7849	14.3136	3.0	0.0000	4888.2554	213.0008	2.0000	1.7849	14.3136
10	8	8	6000	3.561	500	80	2	3.0	0.0000	5090.2183	211.3576	2.2000	1.6456	15.1056	3.0	0.0000	5090.2183	211.3576	2.2000	1.6456	15.1056
10	8	8	6000	3.561	500	80	3	3.0	0.0000	5208.9795	214.2294	2.2000	1.6456	15.6368	3.0	0.0000	5208.9795	214.2294	2.2000	1.6456	15.6368
10	8	8	6000	3.561	500	80	4	3.0	0.0000	4940.8970	194.3698	2.3000	1.6542	14.5296	3.0	0.0000	4940.8970	194.3698	2.3000	1.6542	14.5296
10	8	8	6000	3.561	500	80	5	3.0	0.0000	5159.2339	204.5485	2.3000	1.6194	15.5280	3.0	0.0000	5159.2339	204.5485	2.3000	1.6194	15.5280
10	8	8	6000	3.561	500	80	6	3.0	0.0000	4812.5630	205.5133	2.1000	1.7017	13.8672	3.0	0.0000	4812.5630	205.5133	2.1000	1.7017	13.8672
10	8	8	7000	3.742	500	80	1	3.0	0.0000	4910.6035	207.4092	0.0000	0.0000	14.4432	3.0	0.0000	4910.6035	207.4092	0.0000	0.0000	14.4432
10	8	8	7000	3.742	500	80	2	3.0	0.0000	5079.1406	195.7902	0.0000	0.0000	15.1964	3.0	0.0000	5079.1406	195.7902	0.0000	0.0000	15.1964
10	8	8	7000	3.742	500	80	3	3.0	0.0000	5204.3916	211.3737	0.0000	0.0000	15.7092	3.0	0.0000	5204.3916	211.3737	0.0000	0.0000	15.7092
10	8	8	7000	3.742	500	80	4	3.0	0.0000	4925.3232	192.4055	0.0000	0.0000	14.5352	3.0	0.0000	4925.3232	192.4055	0.0000	0.0000	14.5352
10	8	8	7000	3.742	500	80	5	3.0	0.0000	5180.9800	195.8662	0.0000	0.0000	15.6244	3.0	0.0000	5180.9800	195.8662	0.0000	0.0000	15.6244
10	8	8	7000	3.742	500	80	6	3.0	0.0000	4781.9951	196.7518	0.0000	0.0000	13.8624	3.0	0.0000	4781.9951	196.7518	0.0000	0.0000	13.8624
10	8	8	8000	3.906	500	80	1	3.0	0.0000	4912.6182	204.5638	0.0000	0.0000	14.4160	3.0	0.0000	4912.6182	204.5638	0.0000	0.0000	14.4160
10	8	8	8000	3.906	500	80	2	3.0	0.0000	5083.4810	195.0629	0.0000	0.0000	15.2112	3.0	0.0000	5083.4810	195.0629	0.0000	0.0000	15.2112
10	8	8	8000	3.906	500	80	3	3.0	0.0000	5207.2300	200.9514	0.0000	0.0000	15.7040	3.0	0.0000	5207.2300	200.9514	0.0000	0.0000	15.7040
10	8	8	8000	3.906	500	80	4	3.0	0.0000	4934.9204	198.8738	0.0000	0.0000	14.5776	3.0	0.0000	4934.9204	198.8738	0.0000	0.0000	14.5776
10	8	8	8000	3.906	500	80	5	3.0	0.0000	5195.7285	189.4451	0.0000	0.0000	15.6512	3.0	0.0000	5195.7285	189.4451	0.0000	0.0000	15.6512
10	8	8	8000	3.906	500	80	6	3.0	0.0000	4785.2368	195.0749	0.0000	0.0000	13.9008	3.0	0.0000	4785.2368	195.0749	0.0000	0.0000	13.9008

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	9000	4.057	500	80	1	3.0	0.0000	4911.3862	209.9864	0.0000	13.3328	0.0000	3.0	0.0000	4911.3862	209.9864	0.0000	0.0000	13.3328	0.5220
10	8	8	9000	4.057	500	80	2	3.0	0.0000	5092.5615	199.9782	0.0000	14.0608	0.0000	3.0	0.0000	5092.5615	199.9782	0.0000	0.0000	14.0608	0.4777
10	8	8	9000	4.057	500	80	3	3.0	0.0000	5209.8325	202.3345	0.0000	14.5088	0.0000	3.0	0.0000	5209.8325	202.3345	0.0000	0.0000	14.5088	0.5471
10	8	8	9000	4.057	500	80	4	3.0	0.0000	4933.0757	197.3945	0.0000	13.4536	0.0000	3.0	0.0000	4933.0757	197.3945	0.0000	0.0000	13.4536	0.4920
10	8	8	9000	4.057	500	80	5	3.0	0.0000	5184.9131	192.2183	0.0000	14.4376	0.0000	3.0	0.0000	5184.9131	192.2183	0.0000	0.0000	14.4376	0.5200
10	8	8	9000	4.057	500	80	6	3.0	0.0000	4785.3896	195.0064	0.0000	12.8480	0.0000	3.0	0.0000	4785.3896	195.0064	0.0000	0.0000	12.8480	0.4600
10	8	8	10000	4.197	500	80	1	3.0	0.0000	4910.9653	205.9854	0.0000	13.4112	0.0000	3.0	0.0000	4910.9653	205.9854	0.0000	0.0000	13.4112	0.5544
10	8	8	10000	4.197	500	80	2	3.0	0.0000	5073.1831	188.7313	0.0000	14.0672	0.0000	3.0	0.0000	5073.1831	188.7313	0.0000	0.0000	14.0672	0.4837
10	8	8	10000	4.197	500	80	3	3.0	0.0000	5215.3838	212.7365	0.0000	14.5440	0.0000	3.0	0.0000	5215.3838	212.7365	0.0000	0.0000	14.5440	0.5630
10	8	8	10000	4.197	500	80	4	3.0	0.0000	4933.5132	197.8272	0.0000	13.5104	0.0000	3.0	0.0000	4933.5132	197.8272	0.0000	0.0000	13.5104	0.5140
10	8	8	10000	4.197	500	80	5	3.0	0.0000	5196.8525	184.1218	0.0000	14.4688	0.0000	3.0	0.0000	5196.8525	184.1218	0.0000	0.0000	14.4688	0.5233
10	8	8	10000	4.197	500	80	6	3.0	0.0000	4786.9150	196.3949	0.0000	12.8592	0.0000	3.0	0.0000	4786.9150	196.3949	0.0000	0.0000	12.8592	0.5033
10	8	8	2000	2.5	1500	0	1	49.8	1.8102	31274.0566	513.2103	1550.9000	42.5420	57.4655	2.5831	50.0	1.6866	31127.5625	454.9484	1533.2000	23.4978	1.9894
10	8	8	2000	2.5	1500	0	2	49.8	1.8102	31642.4629	551.1045	1560.9000	47.2447	58.9051	2.3960	50.0	1.6866	31500.0059	418.6307	1541.3000	22.2448	1.8071
10	8	8	2000	2.5	1500	0	3	49.8	1.8102	31673.5215	598.4158	1563.7000	51.1403	58.9174	2.4150	50.2	1.6798	31519.2070	498.3881	1541.4000	21.4457	1.6891
10	8	8	2000	2.5	1500	0	4	49.8	1.8102	31661.4160	663.7401	1589.9000	90.3514	57.9964	2.9165	50.6	1.4780	31388.1816	494.7205	1534.8000	20.4785	1.5211
10	8	8	2000	2.5	1500	0	5	49.8	1.8102	31865.1758	549.8325	1566.5000	51.7763	58.8787	2.6044	50.2	1.6798	31682.9102	431.8206	1544.5000	24.3034	1.8584
10	8	8	2000	2.5	1500	0	6	49.8	1.8102	31596.9219	587.5243	1570.9000	56.1484	58.4737	2.2098	50.6	1.3151	31404.0566	512.1629	1532.9000	22.3046	1.4231
10	8	8	3000	2.849	1500	0	1	17.8	1.0006	24598.1133	851.9229	880.8000	98.2532	70.6340	11.2681	25.8	1.8102	21897.2246	324.6915	504.1000	10.4537	213.7983
10	8	8	3000	2.849	1500	0	2	17.8	0.7390	24814.8887	898.2629	892.3000	126.4600	95.6217	15.1479	25.6	2.1387	22267.9609	328.2534	512.1000	8.9971	217.8386
10	8	8	3000	2.849	1500	0	3	18.0	1.0119	25267.9297	1027.8235	922.7000	158.1550	80.4294	20.1055	25.8	1.9318	22154.7715	347.8730	512.1000	10.3167	220.1722
10	8	8	3000	2.849	1500	0	4	17.6	0.9659	24624.9570	717.5251	880.7000	82.9870	85.2468	11.5466	25.6	2.1387	21900.9961	350.5904	506.0000	10.9197	214.1112
10	8	8	3000	2.849	1500	0	5	17.8	1.0006	25445.7344	1007.5464	971.7000	152.6089	78.4592	20.3825	25.8	1.9318	22117.4824	344.1272	513.8000	10.9356	218.6220
10	8	8	3000	2.849	1500	0	6	17.6	0.9659	25126.5703	752.1793	992.6000	155.6862	73.4628	13.2146	26.0	1.8165	21972.3633	362.2489	502.9000	9.9633	217.7584
10	8	8	4000	3.125	1500	0	1	17.2	0.4526	22267.1465	788.5107	467.6000	127.4000	68.7416	12.8993	21.6	1.5160	19952.1094	320.4225	165.9000	7.1670	183.2472
10	8	8	4000	3.125	1500	0	2	17.4	0.6034	21833.1582	619.9278	364.9000	74.4905	101.5184	15.7689	22.0	1.3908	20205.7637	301.6837	169.5000	7.7159	192.5040
10	8	8	4000	3.125	1500	0	3	18.0	0.7543	21803.4824	862.2629	348.6000	100.9798	91.8368	21.6157	21.8	1.9318	20200.4453	335.0045	168.9000	8.0846	187.4408
10	8	8	4000	3.125	1500	0	4	17.2	0.4526	21646.3145	502.8015	380.8000	62.0230	92.9344	8.8809	22.0	1.3908	19879.0117	338.1888	168.2000	8.2542	184.3928
10	8	8	4000	3.125	1500	0	5	17.6	0.6913	21679.7129	574.5258	342.8000	62.7298	86.8120	18.7243	22.0	1.8165	20187.5410	311.4479	169.8000	7.1856	191.6896
10	8	8	4000	3.125	1500	0	6	17.2	0.4526	22301.5781	1167.6470	491.5000	175.4538	86.7240	16.7272	22.2	1.8102	19948.5039	325.6830	165.7000	8.1728	187.1256
10	8	8	5000	3.358	1500	0	1	17.6	0.6913	19854.9629	557.6323	123.1000	79.9105	93.4448	8.8247	20.2	1.5384	18954.2109	292.7410	24.3000	3.0367	162.2448
10	8	8	5000	3.358	1500	0	2	17.6	0.6913	20252.5313	703.8272	107.9000	69.9118	105.1472	11.6616	20.2	1.5384	19319.4688	277.8134	27.5000	2.9066	166.6960
10	8	8	5000	3.358	1500	0	3	17.6	0.6913	20155.1855	596.7568	102.6000	63.5644	85.3088	11.9328	20.2	1.3826	19265.9570	294.1852	26.1000	1.1414	167.9968
10	8	8	5000	3.358	1500	0	4	17.6	0.6913	19615.1016	410.5864	84.3000	31.3918	111.3360	17.7032	20.2	1.0006	18924.3008	276.5574	27.5000	3.5257	169.7376
10	8	8	5000	3.358	1500	0	5	17.6	0.6913	20154.1621	728.9821	127.4000	104.2818	87.2448	8.4333	20.4	1.1782	19244.6758	296.8542	25.9000	1.8613	171.6128
10	8	8	5000	3.358	1500	0	6	17.6	0.6913	19860.6016	707.3979	136.4000	83.1049	111.9232	15.5493	20.6	1.3151	18967.5566	312.3352	25.4000	4.6764	166.3120
10	8	8	6000	3.561	1500	0	1	17.6	0.6913	19598.8574	483.9767	51.4000	55.3718	84.0554	14.7000	21.8	1.5384	18922.1289	272.0231	8.4000	2.1912	183.2315
10	8	8	6000	3.561	1500	0	2	17.4	0.6034	20137.5000	459.5532	79.6000	65.2445	100.8131	20.7983	21.0	1.5085	19279.6309	264.1635	7.2000	2.6517	170.6775
10	8	8	6000	3.561	1500	0	3	17.4	0.6034	19874.2637	393.4138	39.2000	33.4089	82.2609	16.4819	21.6	1.7912	19171.5430	269.9471	7.8000	2.7153	176.2094
10	8	8	6000	3.561	1500	0	4	17.6	0.6913	19441.5176	506.3441	51.1000	44.2026	100.0204	21.9559	20.8	1.2531	18816.2578	260.8147	6.8000	2.6442	164.1554
10	8	8	6000	3.561	1500	0	5	17.4	0.6034	19971.4121	556.9764	93.1000	70.2269	84.1391	18.3431	21.6	1.5160	19076.4590	275.7471	7.9000	2.4510	181.5930
10	8	8	6000	3.561	1500	0	6	17.6	0.6913	19535.0625	651.4168	82.4000	73.2838	105.3164	19.8346	20.4	0.9659	18736.1953	301.2024	5.2000	4.0167	155.5312
10	8	8	7000	3.742	1500	0	1	17.6	0.6913	19378.8789	451.2830	33.6000	42.3312	91.0264	17.5245	20.8	1.2531	18847.8516	350.7055	0.0000	0.0000	175.8292
10	8	8	7000	3.742	1500	0	2	17.6	0.6913	19658.0039	425.2925	14.8000	15.4200	105.2340	15.4966	21.0	0.9541	19200.3242	333.5760	0.0000	0.0	

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	8000	3.906	1500	0	2	17.6	0.6913	19659.0684	394.3211	7.6000	8.4812	21.0	0.9541	19184.1523	0.0000	0.0000	183.3960
10	8	8	8000	3.906	1500	0	3	17.6	0.6913	19626.7715	390.5042	18.8000	29.0123	21.0	1.7849	19127.8164	0.0000	0.0000	178.0720
10	8	8	8000	3.906	1500	0	4	17.6	0.6913	19301.1992	328.2039	13.3000	7.8822	20.4	1.1782	18804.9980	0.0000	0.0000	165.6816
10	8	8	8000	3.906	1500	0	5	17.6	0.6913	19529.3398	372.5208	24.2000	31.4439	21.0	1.5085	19096.2422	0.0000	0.0000	182.9128
10	8	8	8000	3.906	1500	0	6	17.6	0.6913	19605.3594	782.2008	91.1000	105.2669	20.6	1.1289	18841.0840	0.0000	0.0000	169.4496
10	8	8	9000	4.057	1500	0	1	17.6	0.6913	19385.6621	410.1031	30.3000	38.8144	20.8	1.2531	18860.3184	0.0000	0.0000	176.4114
10	8	8	9000	4.057	1500	0	2	17.6	0.6913	19624.7168	376.3847	7.8000	13.2534	20.8	1.0560	19192.7168	0.0000	0.0000	179.7712
10	8	8	9000	4.057	1500	0	3	17.6	0.6913	19619.9160	328.0206	14.5000	22.1813	21.4	1.4780	19141.8242	0.0000	0.0000	189.7790
10	8	8	9000	4.057	1500	0	4	17.6	0.6913	19267.7852	352.1660	8.5000	6.6121	20.4	1.1782	18804.6953	0.0000	0.0000	168.9018
10	8	8	9000	4.057	1500	0	5	17.6	0.6913	19470.2266	332.7888	19.2000	26.4156	20.8	1.4231	19090.0918	0.0000	0.0000	181.6146
10	8	8	9000	4.057	1500	0	6	17.6	0.6913	19621.0957	755.7363	89.5000	103.4460	20.8	1.2531	18848.4785	0.0000	0.0000	171.7370
10	8	8	10000	4.197	1500	0	1	17.6	0.6913	19401.1895	411.0862	35.4000	52.5873	21.0	1.3492	18912.0664	0.0000	0.0000	176.0232
10	8	8	10000	4.197	1500	0	2	17.6	0.6913	19652.6191	498.6468	19.7000	41.8594	21.0	1.1685	19221.3555	0.0000	0.0000	182.0480
10	8	8	10000	4.197	1500	0	3	17.6	0.6913	19644.8027	314.4763	6.5000	12.4999	21.2	1.4231	19183.5684	0.0000	0.0000	185.2760
10	8	8	10000	4.197	1500	0	4	17.6	0.6913	19224.9707	361.3924	4.8000	4.3825	20.2	1.2068	18837.2852	0.0000	0.0000	164.6168
10	8	8	10000	4.197	1500	0	5	17.6	0.6913	19376.1289	358.4407	17.4000	27.2393	20.8	1.4231	19042.1953	0.0000	0.0000	181.6704
10	8	8	10000	4.197	1500	0	6	17.6	0.6913	19730.3906	918.2100	106.8000	131.6704	20.8	1.4231	18825.3613	0.0000	0.0000	173.1512
10	8	8	2000	2.5	1500	80	1	12.8	1.0560	10545.3105	585.5417	519.7000	65.8096	13.6	0.9659	10350.1270	486.4000	28.2421	36.0149
10	8	8	2000	2.5	1500	80	2	12.6	1.3151	10952.5127	534.4041	549.6000	70.0977	13.8	0.7390	10682.6377	397.8920	26.2242	33.7040
10	8	8	2000	2.5	1500	80	3	12.8	1.0560	10858.2910	568.9128	59.4300	59.4300	13.6	0.9659	10640.9609	498.5000	28.8674	37.3539
10	8	8	2000	2.5	1500	80	4	12.6	1.3151	10741.9102	644.1082	564.5000	106.0497	13.4	1.1289	10429.6377	498.7000	28.8674	37.3539
10	8	8	2000	2.5	1500	80	5	13.0	0.9541	10845.6348	615.1347	535.3000	75.0669	13.6	0.9659	10636.7285	490.6000	29.1051	38.4369
10	8	8	2000	2.5	1500	80	6	12.6	1.3151	10812.3691	658.6349	570.8000	119.2591	13.4	1.1289	10509.6670	498.5000	28.4889	39.8955
10	8	8	3000	2.849	1500	80	1	5.4	0.6034	7960.8999	364.2801	247.9000	32.9436	8.2	0.7390	7276.8735	259.7004	17.3616	46.2476
10	8	8	3000	2.849	1500	80	2	5.6	0.9659	8052.5518	359.8258	237.1000	34.6077	8.2	1.2068	7534.8813	265.8437	169.5000	48.4504
10	8	8	3000	2.849	1500	80	3	5.6	0.9659	7821.6797	392.7891	248.9000	35.2736	8.4	0.9659	7569.9858	287.3603	165.2000	130.8856
10	8	8	3000	2.849	1500	80	4	5.4	0.6034	7860.2241	323.7764	235.0000	23.0090	8.0	0.7390	7311.4961	296.5720	159.1000	146.9784
10	8	8	3000	2.849	1500	80	5	5.4	0.6034	8180.0615	415.9303	262.2000	45.4656	8.0	1.2162	7504.3843	279.2154	170.8000	163.1016
10	8	8	3000	2.849	1500	80	6	5.4	0.6034	7796.4795	266.4073	232.6000	17.1738	8.6	0.9051	7293.5283	268.5544	156.8000	92.5176
10	8	8	4000	3.125	1500	80	1	5.4	0.6034	7236.9766	276.7048	97.6000	10.7422	7.8	0.7390	6737.0337	235.6387	52.6000	45.1032
10	8	8	4000	3.125	1500	80	2	5.4	0.6034	7391.5415	239.5354	97.1000	21.0501	7.6	0.6913	6952.0859	246.4507	54.6000	45.4944
10	8	8	4000	3.125	1500	80	3	5.4	0.6034	7476.9609	299.1711	98.8000	13.2448	7.8	1.0006	7002.8462	244.9086	54.2000	47.1792
10	8	8	4000	3.125	1500	80	4	5.4	0.6034	7140.4009	251.8255	96.6000	19.0997	7.6	0.6913	6747.4619	242.3660	52.2000	43.6496
10	8	8	4000	3.125	1500	80	5	5.4	0.6034	7496.1392	273.5491	106.5000	19.6779	7.8	0.7390	6985.2476	225.7995	55.8000	46.7984
10	8	8	4000	3.125	1500	80	6	5.4	0.6034	7123.8477	250.9290	96.7000	16.7948	7.8	1.2068	6729.4351	245.2094	52.4000	43.9056
10	8	8	5000	3.358	1500	80	1	5.4	0.6034	6774.6821	264.0142	26.1000	9.8715	7.8	1.0006	6543.0747	205.5816	4.0925	45.9504
10	8	8	5000	3.358	1500	80	2	5.4	0.6034	7006.5845	283.1067	27.9000	14.7627	7.2	0.4526	6728.7212	252.5680	8.3000	42.9984
10	8	8	5000	3.358	1500	80	3	5.4	0.6034	7108.1968	250.0204	28.8000	12.5795	7.8	0.7390	6827.8804	220.1341	7.7000	41.4560
10	8	8	5000	3.358	1500	80	4	5.4	0.6034	6749.1650	263.1965	28.6000	20.3262	7.4	0.6034	6480.2798	234.9221	7.8000	3.8871
10	8	8	5000	3.358	1500	80	5	5.4	0.6034	7134.2344	280.9558	30.2000	14.9250	7.4	0.9051	6819.7148	223.3571	9.2000	44.9264
10	8	8	5000	3.358	1500	80	6	5.4	0.6034	6667.8672	264.5657	25.7000	18.0802	7.4	0.9051	6463.7046	222.7426	7.5000	4.2640
10	8	8	6000	3.561	1500	80	1	5.8	0.7390	6645.8047	206.2552	2.0000	2.5909	8.2	1.0006	6505.9531	218.8215	2.7000	1.9392
10	8	8	6000	3.561	1500	80	2	5.6	0.6913	6854.9727	260.5067	3.0000	2.5016	7.6	1.1782	6704.3335	220.2478	2.9000	2.0642
10	8	8	6000	3.561	1500	80	3	5.6	0.7390	6956.6733	259.1885	4.8000	6.1812	7.8	1.0006	6807.2280	234.6456	2.6000	2.1912
10	8	8	6000	3.561	1500	80	4	5.6	0.6913	6594.2031	264.0354	4.0000	3.3358	7.6	0.9659	6468.3125	229.5438	2.2000	2.2577
10	8	8	6000	3.561	1500	80	5	5.4	0.6034	7033.2559	292.9116	15.2000	22.9441	8.0	1.2162	6816.2358	215.8246	2.7000	2.1873
10	8	8	6000	3.561	1500	80	6	5.4	0.6034	6595.9517	268.4772	9.0000	12.2040	7.4	1.1289	6430.5879	240.3973	2.1000	1.3681
10	8	8	7000	3.742	1500	80	1	5.2	0.4526	6769.6592	252.0511	5.0000	6.8964	7.6	0.9659	6533.7876	219.2914	0.2000	4.4526
10	8	8	7000	3.742	1500	80	2	5.2	0.4526	6890.3477	217.5071	5.8000	7.4270	7.4	0.6034	6711.9854	238.4012	0.0000	45.2352

C	W	B	R _{max}	E/O	cost	IN	FR	Policy	F _{min}	Weighted port count	# of OEOs	Solve time	±CI	F _{opt}	Weighted port count	# of OEOs	Solve time	±CI
[Gb/s]			[km]	ratio		[Gb/s]	[%]			@F _{min}	@F _{min}	[sec]			@F _{opt}	@F _{opt}	[sec]	
10	8	8	7000	3.742	1500	80	3		5.4	0.6034	7030.4282	295.5594	5.7620	8.4	0.9659	6816.4854	256.1533	0.0000
10	8	8	7000	3.742	1500	80	4		5.4	0.6034	6629.9336	250.3737	11.1724	7.6	0.9659	6456.2529	254.2406	0.0000
10	8	8	7000	3.742	1500	80	5		5.4	0.6034	7005.2227	261.6663	3.1317	8.0	1.0119	6814.3232	228.1997	0.0000
10	8	8	7000	3.742	1500	80	6		5.4	0.6034	6542.5776	236.6826	1.7543	7.0	0.6746	6419.1045	225.9040	0.2000
10	8	8	8000	3.906	1500	80	1		5.2	0.4526	6749.2017	259.2494	3.9402	7.2	1.2531	6534.9546	223.6547	1.4000
10	8	8	8000	3.906	1500	80	2		5.2	0.4526	6914.0454	218.8868	7.1080	7.2	0.8124	6721.8633	231.4931	0.1000
10	8	8	8000	3.906	1500	80	3		5.4	0.6034	7034.8726	298.2549	5.8077	8.4	0.9659	6815.4985	244.1613	0.0000
10	8	8	8000	3.906	1500	80	4		5.4	0.6034	6647.9219	248.4807	15.4347	7.2	0.8124	6464.7549	250.6386	0.1000
10	8	8	8000	3.906	1500	80	5		5.4	0.6034	7002.2256	269.6190	2.4799	8.0	1.0119	6823.0313	230.4939	0.0000
10	8	8	8000	3.906	1500	80	6		5.4	0.6034	6545.6826	231.6440	1.7543	7.0	0.6746	6424.7310	229.0507	0.2000
10	8	8	9000	4.057	1500	80	1		5.2	0.4526	6754.0796	263.0453	3.6337	7.2	1.2531	6537.1157	226.4991	1.4000
10	8	8	9000	4.057	1500	80	2		5.2	0.4526	6903.2344	191.7790	3.8341	7.4	0.6034	6727.5713	223.0190	0.0000
10	8	8	9000	4.057	1500	80	3		5.4	0.6034	7033.8726	292.1345	5.6845	8.0	0.7543	6838.2485	261.0463	0.0000
10	8	8	9000	4.057	1500	80	4		5.4	0.6034	6640.6265	251.9850	15.4347	7.4	0.9051	6469.4121	249.5962	0.1000
10	8	8	9000	4.057	1500	80	5		5.4	0.6034	6997.8047	263.6483	1.1709	8.0	1.0119	6824.4360	223.3306	0.0000
10	8	8	9000	4.057	1500	80	6		5.4	0.6034	6540.7295	217.4042	1.7673	7.2	0.8124	6418.0093	220.2586	0.1000
10	8	8	10000	4.197	1500	80	1		5.2	0.4526	6771.8486	265.1767	3.5706	7.2	1.2531	6534.5728	218.7261	1.4000
10	8	8	10000	4.197	1500	80	2		5.2	0.4526	6952.7861	237.3412	3.7227	7.4	0.6034	6724.1953	216.4565	0.0000
10	8	8	10000	4.197	1500	80	3		5.4	0.6034	7036.6563	281.9873	5.6084	8.4	0.9659	6834.8936	247.6271	0.0000
10	8	8	10000	4.197	1500	80	4		5.4	0.6034	6645.5454	255.1470	15.4347	7.2	0.8124	6462.0005	248.8056	0.1000
10	8	8	10000	4.197	1500	80	5		5.4	0.6034	7003.4102	262.8383	0.4830	8.4	0.6913	6834.6304	230.8785	0.0000
10	8	8	10000	4.197	1500	80	6		5.4	0.6034	6540.0146	228.9687	1.7462	7.4	0.6034	6421.7598	226.0569	0.0000

Table C.9: Comparison of no-bifurcation-based heuristics without the optical-reach customization for the EON network.

C	W	B	R _{max}	E/O cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	1000	2	500	0	1	3.8	0.7390	13247.2998	916.8071	105.6369	62.4749	31.1637	3.8	0.7390	13247.2998	916.8071	105.6369	62.4749	31.16
10	8	8	1000	2	500	0	2	3.4	0.6034	13381.5000	637.5978	788.6000	59.4781	56.1421	3.4	0.6034	13381.5000	637.5978	788.6000	59.4781	22.42
10	8	8	1000	2	500	0	3	4.0	0.7543	13344.5000	887.2719	717.8000	87.5562	69.5094	4.0	0.7543	13344.5000	887.2719	717.8000	87.5562	25.97
10	8	8	1000	2	500	0	4	3.8	0.7390	13628.7998	710.9341	789.1000	58.9355	69.6784	3.8	0.7390	13628.7998	710.9341	789.1000	58.9355	29.46
10	8	8	1000	2	500	0	5	3.6	0.6913	12800.5996	811.2733	677.9000	85.1112	56.1388	3.6	0.6913	12800.5996	811.2733	677.9000	85.1112	22.05
10	8	8	1000	2	500	0	6	4.2	0.7390	14125.5996	559.7343	844.3000	58.8066	86.1176	4.2	0.7390	14125.5996	559.7343	844.3000	58.8066	38.88
10	8	8	2000	2.5	500	0	1	4.2	0.7390	11934.7998	741.2302	266.4000	63.4516	76.2954	4.2	0.7390	11934.7998	741.2302	266.4000	63.4516	31.40
10	8	8	2000	2.5	500	0	2	3.6	0.6913	12450.0996	693.0638	328.1000	51.6268	69.5142	3.6	0.6913	12450.0996	693.0638	328.1000	51.6268	26.17
10	8	8	2000	2.5	500	0	3	3.8	0.7390	11841.0996	596.5339	258.7000	52.0708	67.3284	3.8	0.7390	11841.0996	596.5339	258.7000	52.0708	29.87
10	8	8	2000	2.5	500	0	4	4.0	0.7543	12444.9004	949.2932	320.3000	91.6465	68.1632	5.0	2.2375	12398.5996	889.7153	304.0000	73.5316	65.11
10	8	8	2000	2.5	500	0	5	3.6	0.6913	11734.2002	907.0121	252.5000	82.1638	62.0024	3.6	0.6913	11734.2002	907.0121	252.5000	82.1638	26.28
10	8	8	2000	2.5	500	0	6	4.6	0.6034	12910.9004	570.4464	357.2000	48.7095	89.5160	4.6	0.6034	12910.9004	570.4464	357.2000	48.7095	21.69
10	8	8	3000	2.849	500	0	1	4.2	0.7390	11418.0332	473.0032	110.7000	34.1603	80.7644	6.0	2.5466	11303.7275	365.2964	88.4000	16.2373	125.9091
10	8	8	3000	2.849	500	0	2	4.0	0.7543	12243.6719	423.1789	185.4000	33.1703	84.0548	7.0	2.9561	11994.3574	281.4817	140.2000	27.3385	266.9752
10	8	8	3000	2.849	500	0	3	4.0	0.7543	11337.7344	449.0396	105.1000	23.5695	81.0040	4.4	1.1782	11261.6436	335.5835	94.6000	12.9512	40.35
10	8	8	3000	2.849	500	0	4	3.8	0.7390	11501.0498	349.1031	68.5000	15.5831	76.2068	6.4	3.0208	11547.9629	323.0331	118.7000	21.0922	137.9344
10	8	8	3000	2.849	500	0	5	4.2	0.7390	11673.4463	686.6960	122.9000	52.8907	89.3296	5.2	1.8414	11532.8662	550.7538	100.7000	28.2800	109.0072
10	8	8	3000	2.849	500	0	6	5.0	0.0000	12298.0752	255.2673	173.5000	27.2101	101.9984	9.8	2.0462	11994.5410	179.3666	118.1000	14.8051	240.0832
10	8	8	4000	3.125	500	0	1	4.4	0.6913	11551.4004	421.2108	78.9000	31.2017	84.4311	8.6	2.7651	11175.5254	213.6338	19.1000	12.8021	305.3512
10	8	8	4000	3.125	500	0	2	3.8	0.7390	12431.7500	531.7995	154.7000	38.7278	76.9744	11.4	1.3151	11657.7754	190.8885	10.0000	3.6641	315.4716
10	8	8	4000	3.125	500	0	3	4.0	0.7543	11501.0498	349.1031	68.5000	15.5831	76.2068	7.0	3.2354	11335.7500	263.3859	34.6000	18.4420	165.2956
10	8	8	4000	3.125	500	0	4	4.6	0.6034	12140.5752	433.6710	114.3000	34.9310	90.8864	11.2	1.2531	11157.3496	231.2197	9.0000	1.0866	284.3552
10	8	8	4000	3.125	500	0	5	3.8	0.7390	11650.1250	598.4688	85.9000	39.4575	70.7808	6.8	2.4741	11358.3252	286.3916	27.9000	12.3865	159.3040
10	8	8	4000	3.125	500	0	6	4.8	0.4526	12397.7758	226.9745	131.8000	20.9182	92.5248	10.4	1.7912	11422.7754	237.7849	11.2000	3.4859	259.1392
10	8	8	5000	3.358	500	0	1	4.4	0.6913	11853.0898	383.1945	70.7000	27.5670	85.3125	8.4	2.8662	11486.3643	219.5273	13.4000	14.9456	311.1219
10	8	8	5000	3.358	500	0	2	4.0	0.7543	12930.8838	519.0037	157.5000	37.7642	84.7406	11.0	1.9081	11904.8027	190.5428	1.0000	2.2628	302.0252
10	8	8	5000	3.358	500	0	3	4.0	0.7543	11955.9316	295.6501	74.4000	24.6219	77.1704	8.0	3.2529	11636.3418	198.3048	23.1000	18.4890	200.0548
10	8	8	5000	3.358	500	0	4	4.8	0.4526	12481.1318	490.3096	105.5000	40.4750	98.7152	11.8	1.3826	11416.5166	223.6467	0.0000	0.0000	416.5808
10	8	8	5000	3.358	500	0	5	3.8	0.7390	12090.4355	729.1124	91.0000	53.2803	72.6328	6.0	2.9599	11690.6523	280.0397	32.9000	19.9854	251.0776
10	8	8	5000	3.358	500	0	6	5.0	0.0000	12507.7969	172.5661	103.2000	16.1375	95.8320	10.6	1.3151	11702.0049	215.6505	1.8000	2.4741	263.1504
10	8	8	6000	3.561	500	0	1	4.4	0.6913	12308.4980	362.3275	81.4000	28.4548	84.1255	8.6	2.6816	11829.8564	205.9972	12.0000	14.3387	317.7997
10	8	8	6000	3.561	500	0	2	4.0	0.7543	13231.6221	567.6150	149.7000	41.3163	82.5008	11.0	1.9081	12213.3535	208.8329	1.0000	2.2628	301.9352
10	8	8	6000	3.561	500	0	3	4.0	0.7543	12176.6084	296.6085	67.7000	18.8142	72.7060	8.0	3.0358	11937.4561	159.2756	21.2000	19.7286	193.6424
10	8	8	6000	3.561	500	0	4	4.6	0.6034	12756.2100	516.5164	102.1000	40.5146	90.7944	11.6	1.3577	11715.9941	232.8697	0.0000	0.0000	407.5456
10	8	8	6000	3.561	500	0	5	4.0	0.7543	12541.8643	806.6730	99.7000	66.3956	79.9152	6.2	2.0462	11971.9863	296.3464	21.3000	12.0965	141.2256
10	8	8	6000	3.561	500	0	6	5.0	0.0000	12843.0176	168.3597	103.7000	17.0703	96.5449	10.0	1.6866	12298.2754	229.3959	4.6000	4.0506	262.3872
10	8	8	7000	3.742	500	0	1	4.4	0.6913	12573.9404	402.6353	78.6000	30.2439	83.1861	8.2	2.7979	12088.9824	221.6563	14.4000	14.6029	304.4406
10	8	8	7000	3.742	500	0	2	4.0	0.7543	13559.6924	588.7278	150.1000	41.2714	82.5282	11.0	1.9081	12485.5664	202.1831	1.0000	2.2628	302.2768
10	8	8	7000	3.742	500	0	3	4.0	0.7543	12531.4922	320.4036	71.4000	24.9250	75.3452	7.6	3.0208	12221.1719	145.4960	22.4000	18.1403	185.1840
10	8	8	7000	3.742	500	0	4	4.6	0.6034	13022.5576	506.9990	99.2000	39.9352	91.9584	11.4	1.4780	11976.4482	243.2318	0.0000	0.0000	404.1936
10	8	8	7000	3.742	500	0	5	4.0	0.7543	12771.5742	884.8295	90.3000	63.8607	80.0744	5.8	2.1546	12298.4580	311.3954	30.6000	13.5816	127.0016
10	8	8	7000	3.742	500	0	6	5.0	0.0000	13132.0576	174.0913	102.5000	16.0719	96.5408	10.0	1.6866	12298.2754	229.3959	4.8000	4.5730	244.7600
10	8	8	8000	3.906	500	0	1	4.4	0.6913	12845.6309	410.6335	78.6000	30.2439	83.2174	8.2	2.7979	12339.2686	224.0152	14.4000	14.6029	304.5782
10	8	8	8000	3.906	500	0	2	4.0	0.7543	13858.0371	597.5544	150.2000	41.3545	82.4836	11.0	1.9081	12735.3438	207.2460	1.0000	2.2628	303.3968
10	8	8	8000	3.906	500	0	3	4.0	0.7543	12803.1504	325.5778	71.4000	24.9250	75.3452	8.0	3.2529	12477.0186	145.4960	21.6000	18.5865	199.9320
10	8	8	8000	3.906	500	0	4	4.6	0.6034	13301.5879	516.4803	99.2000	39.9352	91.8896	11.4	1.4780	12221.6436	247.8370	0.0000	0.0000	402.6920
10	8	8	8000	3.906	500	0	5	4.0	0.7543	13048.4561	905.8414	90.3000	63.8607	79.9416	5.8	2.1546	12556.6377	313.2209	30.6000	13.5816	127.0816

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	8000	3.906	500	0	6	5.0	0.0000	13410.4873	178.5073	16.0719	96.4912	11.5547	10.4	1.5160	12530.9189	2.8000	3.0321	257.4192
10	8	8	9000	4.057	500	0	1	4.4	0.6913	13109.3252	410.6936	30.0374	61.5566	19.5563	8.6	2.5061	12566.1934	2.8000	10.4798	242.7390
10	8	8	9000	4.057	500	0	2	4.0	0.7543	14123.9238	613.1335	41.3980	62.0480	18.3568	11.0	1.9081	12963.9277	1.0000	2.2628	195.3438
10	8	8	9000	4.057	500	0	3	4.0	0.7543	13055.4336	327.7914	21.2000	24.8166	56.1336	8.8	3.0508	12710.6689	17.5000	18.4669	151.1760
10	8	8	9000	4.057	500	0	4	4.6	0.6034	13477.9346	497.1618	34.9424	67.0200	17.4688	10.8	1.2531	12453.9707	0.0000	0.0000	173.9692
10	8	8	9000	4.057	500	0	5	4.0	0.7543	13323.2471	920.2625	63.4162	61.6864	23.3071	7.6	2.9445	12807.2041	22.0000	14.6643	231.8696
10	8	8	9000	4.057	500	0	6	5.0	0.0000	13657.3564	194.0952	16.1867	69.8176	19.4950	10.4	1.5160	12752.3203	2.7000	2.9026	166.3936
10	8	8	10000	4.197	500	0	1	4.4	0.6913	13343.6426	419.7370	30.0374	61.4613	19.4950	9.0	2.4324	12788.1426	7.9000	10.8594	247.4469
10	8	8	10000	4.197	500	0	2	4.2	0.7390	14468.0469	628.7880	43.1725	67.9746	19.1293	10.4	1.7912	13193.0732	1.4000	2.3418	181.0522
10	8	8	10000	4.197	500	0	3	4.2	0.7390	13331.7939	438.5616	22.6205	61.0880	19.6603	8.0	3.5857	12958.1611	25.2000	21.1401	238.7080
10	8	8	10000	4.197	500	0	4	4.6	0.6034	13715.6270	581.8533	42.5278	67.4704	17.1812	10.8	2.0739	12656.2539	0.5000	1.1314	283.2548
10	8	8	10000	4.197	500	0	5	4.0	0.7543	13592.5527	949.4827	63.3484	61.0528	23.2626	6.8	2.2828	12997.9307	20.4000	11.3700	106.4696
10	8	8	10000	4.197	500	0	6	4.8	0.4526	13941.2998	186.1026	16.0854	65.8544	12.1513	10.4	1.5160	12961.7061	2.7000	2.9026	166.1928
10	8	8	1000	2	500	80	1	1.0	0.0000	3459.3999	221.5168	18.6311	15.6032	5.7036	1.0	0.0000	3459.3999	221.5168	18.6311	15.6032
10	8	8	1000	2	500	80	2	1.0	0.0000	3709.8999	16.8894	4.7786	15.5584	4.7786	1.2	0.4526	3709.8999	215.4935	19.1000	17.4147
10	8	8	1000	2	500	80	3	1.2	0.4526	3629.6001	362.9563	30.0552	14.6272	5.1071	1.2	0.4526	3629.6001	362.9563	30.0552	14.6272
10	8	8	1000	2	500	80	4	1.0	0.0000	3679.3000	283.5553	21.6000	33.3328	17.2704	1.0	0.0000	3679.3000	283.5553	21.6000	33.3328
10	8	8	1000	2	500	80	5	1.0	0.0000	3460.6001	169.8766	17.6500	14.1408	5.9340	1.0	0.0000	3460.6001	169.8766	17.6500	14.1408
10	8	8	1000	2	500	80	6	1.0	0.0000	3666.2000	301.1846	20.9427	13.9360	5.5126	1.0	0.0000	3666.2000	301.1846	20.9427	13.9360
10	8	8	2000	2.5	500	80	1	1.0	0.0000	3448.8000	203.7265	10.8311	22.4376	10.8311	1.0	0.0000	3448.8000	203.7265	10.8311	22.4376
10	8	8	2000	2.5	500	80	2	1.0	0.0000	3594.2000	188.8572	22.8273	17.2953	2.2343	1.0	0.0000	3594.2000	188.8572	22.8273	17.2953
10	8	8	2000	2.5	500	80	3	1.0	0.0000	3430.7000	176.7971	10.1407	18.2562	4.2538	1.0	0.0000	3430.7000	176.7971	10.1407	18.2562
10	8	8	2000	2.5	500	80	4	1.2	0.4526	3593.8999	285.6759	15.4546	32.6249	6.1234	1.2	0.4526	3593.8999	285.6759	15.4546	32.6249
10	8	8	2000	2.5	500	80	5	1.2	0.4526	3490.5000	237.6677	20.3894	18.9938	4.8535	1.2	0.4526	3490.5000	237.6677	20.3894	18.9938
10	8	8	2000	2.5	500	80	6	1.0	0.0000	3543.7000	232.2117	83.8000	19.3912	13.7578	1.0	0.0000	3543.7000	232.2117	83.8000	19.3912
10	8	8	3000	2.849	500	80	1	1.0	0.0000	3263.0110	215.8801	26.5000	16.8768	6.1981	1.6	0.6913	3249.2642	210.8319	7.9179	21.0048
10	8	8	3000	2.849	500	80	2	1.0	0.0000	3412.7231	217.4055	20.1395	20.2560	4.1772	1.4	0.6034	3393.3091	203.7311	25.9000	6.6908
10	8	8	3000	2.849	500	80	3	1.0	0.0000	3382.1340	194.2763	32.1000	21.5680	5.1314	1.4	0.6034	3367.9604	204.5397	26.2000	8.6183
10	8	8	3000	2.849	500	80	4	1.0	0.0000	3302.0513	215.1384	32.9000	23.0592	3.8134	1.6	0.6913	3292.2231	215.6565	29.2000	12.9010
10	8	8	3000	2.849	500	80	5	1.2	0.4526	3355.7722	190.5957	26.5000	19.7248	5.4302	1.6	0.9659	3346.1987	184.4207	24.6000	26.9440
10	8	8	3000	2.849	500	80	6	1.0	0.0000	3366.3821	233.1215	36.1000	14.1312	2.8722	1.6	0.6913	3301.2319	211.5505	25.8000	8.4247
10	8	8	4000	3.125	500	80	1	1.0	0.0000	3298.8999	235.3892	19.0000	17.8205	5.9367	2.6	1.1289	3225.0500	190.0538	5.5000	3.6369
10	8	8	4000	3.125	500	80	2	1.0	0.0000	3482.3999	180.1759	33.2000	18.0511	18.9267	2.0	0.7543	3416.0000	176.8898	9.5000	7.7453
10	8	8	4000	3.125	500	80	3	1.0	0.0000	3449.0750	212.6234	22.6000	8.9639	6.1490	1.8	1.0006	3425.1499	203.8988	13.0000	6.6099
10	8	8	4000	3.125	500	80	4	1.0	0.0000	3341.8250	205.4807	22.5000	24.7016	5.7642	2.6	0.9051	3263.5000	197.4132	7.3000	9.7998
10	8	8	4000	3.125	500	80	5	1.2	0.4526	3417.6499	169.7630	22.3000	11.2788	18.7404	2.0	1.0119	3390.1001	175.0472	11.1000	6.9165
10	8	8	4000	3.125	500	80	6	1.0	0.0000	3440.5249	228.8902	33.4000	12.4814	2.8551	3.0	1.1685	3259.5750	166.5535	6.0000	5.5835
10	8	8	5000	3.358	500	80	1	1.0	0.0000	3389.1226	218.7320	17.2000	9.5215	17.4251	2.2	1.0006	3309.4348	164.5412	6.1000	5.3168
10	8	8	5000	3.358	500	80	2	1.0	0.0000	3597.6558	196.2375	30.9000	18.3376	3.9964	2.2	0.7390	3508.2446	191.0646	5.0000	6.5233
10	8	8	5000	3.358	500	80	3	1.0	0.0000	3456.7356	226.4747	22.5000	21.5249	6.1209	2.0	1.2162	3513.6528	212.8582	11.8000	7.6235
10	8	8	5000	3.358	500	80	4	1.0	0.0000	3423.5227	211.1026	17.7000	21.7940	4.4757	2.4	0.9659	3343.8508	190.9909	6.6000	6.8566
10	8	8	5000	3.358	500	80	5	1.2	0.4526	3520.8599	206.2923	21.0000	11.9829	19.1407	1.8	1.0006	3465.2935	185.9600	11.6000	7.7008
10	8	8	5000	3.358	500	80	6	1.0	0.0000	3557.2520	258.3416	33.9000	10.3277	14.7485	3.2	1.0560	3354.8157	192.4990	3.3000	5.4395
10	8	8	6000	3.561	500	80	1	1.0	0.0000	3494.0171	242.7136	18.6000	9.4459	17.3657	2.6	1.1289	3392.3228	177.6040	5.7000	5.6044
10	8	8	6000	3.561	500	80	2	1.0	0.0000	3701.4636	199.1150	31.9000	18.9539	20.2468	2.0	0.7543	3591.7981	193.2920	7.4000	7.3143
10	8	8	6000	3.561	500	80	3	1.0	0.0000	3665.7683	237.0978	25.5000	9.2822	21.5173	2.2	1.2068	3613.6108	218.4323	10.9000	9.0224
10	8	8	6000	3.561	500	80	4	1.0	0.0000	3484.0894	220.5964	18.0000	7.0916	21.7626	2.8	1.0560	3413.2671	196.2141	2.2000	2.6302
10	8	8	6000	3.561	500	80	5	1.2	0.4526	3614.3247	213.8590	20.3000	12.3789	20.5235	1.8	1.0006	3552.2136	196.9396	10.9000	9.7912
10	8	8	6000	3.561	500	80	6	1.0	0.0000	3621.3013	252.7326	30.2000	11.8398	14.7907	2.8	1.0560	3418.3828	183.1995	3.9000	5.4017

C	W	B	R _{max}	E/O	cost	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI	
10	8	8	7000	3.742	500	80	1	1.0	0.0000	3579.7695	247.3409	18.2000	9.0285	17.4844	6.1151	2.6	1.1289	3470.6226	5.4000	177.1078	5.4827	37.4704	16.964
10	8	8	7000	3.742	500	80	2	1.0	0.0000	3773.8809	208.8182	31.1000	18.1003	19.0547	3.9301	2.2	0.7390	3666.3281	5.2000	199.8345	6.3087	28.8517	9.100
10	8	8	7000	3.742	500	80	3	1.0	0.0000	3739.5137	244.2450	23.9000	9.2034	21.2752	6.0862	2.0	1.2162	3688.0664	12.5000	228.0491	8.4816	37.7141	22.44
10	8	8	7000	3.742	500	80	4	1.0	0.0000	3562.8113	225.9922	18.0000	7.0916	21.7829	4.4486	2.4	0.9659	3491.9680	4.8000	206.8152	5.9179	35.4202	12.54
10	8	8	7000	3.742	500	80	5	1.2	0.4526	3709.8140	201.5630	21.1000	12.5779	18.8326	4.4486	2.0	1.0119	3637.1829	8.3000	185.4524	6.9543	30.9390	16.79
10	8	8	7000	3.742	500	80	6	1.0	0.0000	3742.9360	277.2679	34.0000	10.3638	14.7249	2.8112	3.4	0.9051	3509.1616	1.0000	202.2936	2.2628	50.2406	21.51
10	8	8	8000	3.906	500	80	1	1.0	0.0000	3647.9063	255.3536	17.3000	9.2071	17.4093	6.1480	2.6	1.1289	3538.0437	5.4000	180.4938	5.4827	37.4452	17.05
10	8	8	8000	3.906	500	80	2	1.0	0.0000	3851.2625	214.3643	31.1000	18.1003	19.0391	3.9347	2.2	0.7390	3736.6750	5.2000	204.7584	6.3087	28.6453	8.929
10	8	8	8000	3.906	500	80	3	1.0	0.0000	3815.2188	249.9547	23.9000	9.2034	21.2673	6.0861	2.0	1.2162	3760.6812	12.5000	232.7704	8.4816	37.7548	22.52
10	8	8	8000	3.906	500	80	4	1.0	0.0000	3634.5063	230.9398	18.0000	7.0916	21.7611	4.4448	2.4	0.9659	3559.4875	4.8000	211.5546	5.9179	35.3906	12.53
10	8	8	8000	3.906	500	80	5	1.2	0.4526	3784.5000	206.5529	21.1000	12.5779	18.8201	5.4902	2.0	1.0119	3708.4500	8.3000	190.0839	6.9543	30.9670	16.87
10	8	8	8000	3.906	500	80	6	1.0	0.0000	3782.0249	262.5906	30.8000	11.9391	14.7733	2.8387	3.2	1.0560	3556.2625	1.0000	191.1600	2.5061	48.0579	22.40
10	8	8	9000	4.057	500	80	1	1.0	0.0000	3714.2383	260.9446	17.3000	9.2071	17.4047	6.1667	2.6	1.1289	3599.9673	5.4000	183.6088	5.4827	37.3782	16.90
10	8	8	9000	4.057	500	80	2	1.0	0.0000	3935.3145	229.0737	31.4000	18.6323	19.0531	3.9346	2.2	0.7390	3801.2859	5.2000	209.3077	6.3087	28.7156	8.986
10	8	8	9000	4.057	500	80	3	1.0	0.0000	3884.7507	255.2039	23.9000	9.2034	21.2750	6.0984	2.2	1.2068	3827.2153	11.3000	237.1222	8.9439	39.8659	22.18
10	8	8	9000	4.057	500	80	4	1.0	0.0000	3697.8208	232.7059	17.6000	6.7563	21.8188	4.4480	2.4	0.9659	3621.5020	4.8000	215.9295	5.9179	35.3734	12.48
10	8	8	9000	4.057	500	80	5	1.2	0.4526	3883.9395	237.3241	25.2000	11.9200	18.8500	5.6567	2.2	1.0066	3782.1492	9.1000	202.7094	8.2861	33.1671	17.10
10	8	8	9000	4.057	500	80	6	1.0	0.0000	3851.2251	268.3663	30.8000	11.9391	14.8547	2.8025	3.2	1.0560	3616.7065	1.0000	195.0158	2.5061	48.1905	22.42
10	8	8	10000	4.197	500	80	1	1.0	0.0000	3779.6216	265.3483	17.3000	9.2071	17.7833	8.5223	2.8	1.0560	3659.0542	3.1000	186.5733	3.3298	46.0894	16.61
10	8	8	10000	4.197	500	80	2	1.0	0.0000	3996.7710	230.2111	31.5000	18.8117	23.4853	5.6824	2.2	0.7390	3861.1953	5.2000	213.5476	6.3087	33.4026	10.38
10	8	8	10000	4.197	500	80	3	1.0	0.0000	3962.9146	246.4485	25.0000	8.4665	26.0049	6.7403	2.4	1.1782	3900.1484	9.9000	229.5147	8.8826	44.9105	23.36
10	8	8	10000	4.197	500	80	4	1.0	0.0000	3758.7935	236.8320	17.6000	6.7563	27.4351	6.4230	2.4	0.9659	3679.3032	4.8000	219.8523	5.9179	41.3280	13.41
10	8	8	10000	4.197	500	80	5	1.2	0.4526	3926.0559	214.5686	22.8000	12.5886	22.9565	6.3150	2.0	1.0119	3839.1965	9.7000	200.7034	8.0182	36.0455	18.39
10	8	8	10000	4.197	500	80	6	1.0	0.0000	3916.8921	290.3616	29.6000	12.0925	17.7658	3.7106	3.2	1.0560	3666.3345	1.0000	200.2589	1.5458	51.0353	19.22
10	8	8	1000	2	1500	0	1	9.6	0.6913	14046.4004	487.7532	691.8000	56.0636	17.8944	20.1579	9.8	0.7390	14021.9004	503.9898	689.3000	57.6656	81.1008	18.58
10	8	8	1000	2	1500	0	2	9.4	0.6034	14423.7002	722.2628	761.7000	84.2200	117.3216	27.4648	9.6	0.6913	14401.7002	713.4179	745.4000	75.8556	121.1328	24.64
10	8	8	1000	2	1500	0	3	9.0	0.9541	13819.9004	297.6345	674.5000	72.7853	77.3744	19.0365	9.6	0.6913	13787.4004	305.4900	645.4000	45.1797	93.6432	16.80
10	8	8	1000	2	1500	0	4	9.4	0.6034	14055.0996	572.7007	700.5000	66.2002	86.3408	19.6002	9.6	0.6913	14046.0000	573.8841	691.1000	67.7018	89.5968	17.59
10	8	8	1000	2	1500	0	5	9.2	0.8124	13914.5996	434.8114	685.2000	57.1012	84.6896	17.3112	9.4	0.6034	13863.0996	462.7749	671.9000	63.0281	89.1872	14.27
10	8	8	1000	2	1500	0	6	10.0	0.7543	14624.9004	679.9846	812.3000	100.5218	101.8880	23.4258	10.6	0.6034	14577.0996	702.4886	781.5000	105.4908	116.1920	17.69
10	8	8	2000	2.5	1500	0	1	10.8	0.8124	12690.4004	685.4026	211.0000	46.8815	181.0448	153.2518	11.2	1.2531	12681.4004	686.6855	206.9000	46.4002	197.8864	170.71
10	8	8	2000	2.5	1500	0	2	10.4	0.9659	13519.7998	505.7113	304.9000	50.6871	141.6128	21.1564	10.8	1.4231	13443.9004	509.8485	289.6000	38.2937	204.1344	151.31
10	8	8	2000	2.5	1500	0	3	9.8	0.7390	12839.2002	449.0067	219.0000	42.5748	124.3680	22.0868	10.2	1.0006	12761.0000	482.6819	199.9000	33.6999	131.2992	29.90
10	8	8	2000	2.5	1500	0	4	10.4	1.1782	12693.5000	823.9736	209.2000	72.7858	132.5152	29.8981	10.4	1.1782	12693.5000	823.9736	209.2000	72.7858	132.5152	29.89
10	8	8	2000	2.5	1500	0	5	10.6	0.9051	12861.5000	686.0073	218.7000	51.5337	136.5056	29.0891	11.2	1.2531	12810.0996	658.7396	215.1000	48.5758	209.0432	171.51
10	8	8	2000	2.5	1500	0	6	10.8	0.8124	13186.9004	664.8173	263.6000	58.3464	130.8064	21.3358	11.2	1.2531	13151.4004	615.9883	255.0000	47.1513	201.6160	168.9
10	8	8	3000	2.849	1500	0	1	11.2	0.8124	12555.8066	489.1566	95.8000	30.5836	181.1856	127.6492	12.8	1.7133	12455.1074	480.6220	82.9000	26.8506	222.6512	124.7
10	8	8	3000	2.849	1500	0	2	10.8	1.0560	13624.5371	584.6044	197.8000	33.8151	150.1024	27.5087	16.6	0.4988	13350.2188	531.1721	138.8000	25.7769	330.8368	214.2
10	8	8	3000	2.849	1500	0	3	9.8	1.0006	12756.4512	416.7413	112.9000	33.4678	122.6016	27.0669	11.0	1.5085	12558.0527	395.3966	86.2000	28.7385	208.1376	159.6
10	8	8	3000	2.849	1500	0	4	10.8	1.2531	12663.7637	674.3820	105.5000	39.9672	179.0720	133.4379	12.2	2.3564	12533.1582	595.0023	86.7000	26.2520	173.2256	63.89
10	8	8	3000	2.849	1500	0	5	10.8	1.0560	12961.8604	624.0362	125.7000	39.2226	140.9024	38.4221	13.6	2.5287	12783.3857	604.9727	98.9000	31.3345	201.9776	79.42
10	8	8	3000	2.849	1500	0	6	11.4	0.9051	13050.5273	487.0009	134.9000	33.4610	136.5376	32.1564	13.0	2.5242	12910.4873	412.1782	117.9000	25.0167	242.1440	201.1
10	8	8	4000	3.125	1500	0	1	10.8	0.8124	12912.7246	527.4409	80.1000	33.0367	163.7649	58.8557	14.8	4.8390	12572.5498	314.0012	37.4000	7.6934	313.8980	201.31
10	8	8	4000	3.125	1500	0	2	11.0	1.1685	14020.2754	600.7688	176.0000	49.1446	253.2536	168.0217	29.2	4.4469	13156.9502	319.4848	16.8000	8.8206	652.2784	133.6
10	8	8	4000	3.125	1500	0	3	10.2	0.7390	13146.0000	508.3387	91.5000	29.3892	157.0928	171.9716	18.8	6.9930	12736.9746	343.3358	22.9000	8.9273	444.9952	230.9
10	8	8	4000	3.125	1500	0	4	11.2	1.4231	13171.1250	735.9724	99.9000	43.1277	238.8864	172.7912	25.4	10.0017	12643.0498	390.4324	21.3000	10.3090	603.0240	280.2
10	8	8	4000	3.125	1500	0	5	10.8	1.0560	13252.1250	624.5527	99.6000	41.4265	171.4656	67.7497	17.6	5.1841	12846.9502	339.9963	30.9000	13.6203	422.5728	192.6
10	8	8	4000	3.125	1500	0	6	12.2	1.0006	13404.2754	609.1209	110.5000	40.7090	206.3136	118.7218	25.4	6.2489	12738.9502	312.3693	18.3000	5.7645	493.8304	167.9
10	8	8	5000	3.358	1500	0	1	11.0	0.6746	13													

C	W	B	R _{max}	E/O cost ratio	IN [G/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	Solve time [sec]	±CI				
10	8	8	5000	3.358	1500	0	2	11.0	0.9541	14638.9609	649.3292	183.6000	43.1999	20.0827	28.4	5.0507	13438.8252	292.9052	7.2000	11.2775	632.3024	150.6	
10	8	8	5000	3.358	1500	0	3	10.0	1.0119	13680.8750	485.0400	98.0000	25.9445	27.3498	18.6	7.1012	13067.9063	358.0018	13.5000	10.5231	409.6288	235.4	
10	8	8	5000	3.358	1500	0	4	10.6	0.9051	13560.1250	670.0936	97.0000	45.2413	128.8288	27.9965	25.0	8.6657	12972.2754	336.1242	10.4000	11.4298	527.7760	250.3
10	8	8	5000	3.358	1500	0	5	10.4	0.9659	13688.9355	637.0801	98.9000	41.3347	139.1168	30.9576	21.0	5.1378	13178.6250	307.3338	8.0000	9.5227	455.7375	138.2
10	8	8	5000	3.358	1500	0	6	11.6	0.9659	13629.8330	557.0121	92.8000	41.3503	177.7792	104.4232	25.2	6.1257	13079.0254	298.3471	5.7000	8.0888	491.4304	174.1
10	8	8	6000	3.561	1500	0	1	11.4	0.9051	13579.9502	333.4314	65.1000	16.7758	233.1456	148.3840	20.8	6.8947	13290.2549	311.6454	19.2000	17.3209	402.6048	177.3
10	8	8	6000	3.561	1500	0	2	11.0	1.3492	14953.2217	477.4825	169.6000	59.2059	159.3712	37.9423	30.0	4.5381	13851.6592	349.5853	5.2000	7.8948	753.1248	114.3
10	8	8	6000	3.561	1500	0	3	10.8	1.2531	13839.7686	473.9405	70.7000	18.0140	131.8080	31.5123	19.0	7.2030	13562.9502	369.7362	21.9000	16.3846	377.2832	216.6
10	8	8	6000	3.561	1500	0	4	10.8	1.0560	14394.6377	856.3251	134.3000	53.2900	139.2704	36.0044	24.2	7.8442	13329.3252	367.9899	10.9000	11.3612	507.6512	244.4
10	8	8	6000	3.561	1500	0	5	11.2	1.2531	14126.7090	459.5946	99.9000	20.8873	153.4528	41.3869	20.8	4.6958	13651.4238	338.0840	20.7000	15.5787	380.3072	122.4
10	8	8	6000	3.561	1500	0	6	10.8	1.0560	14223.8848	557.1542	117.4000	37.2484	116.1984	25.9976	25.0	3.8162	13470.5488	270.4115	5.1000	3.9546	530.5792	94.17
10	8	8	7000	3.742	1500	0	1	11.0	0.6746	14139.8594	589.1732	79.6000	33.5421	177.4032	134.0942	20.0	7.0835	13631.2861	320.3862	20.0000	12.6211	421.2032	228.6
10	8	8	7000	3.742	1500	0	2	11.0	0.9541	15451.1143	716.8262	181.8000	45.1995	158.5328	20.3996	27.2	4.7917	14125.5020	314.8670	9.2000	11.4577	594.4865	140.8
10	8	8	7000	3.742	1500	0	3	10.0	1.0119	14460.6201	521.4833	99.8000	26.3099	127.3920	27.6135	18.6	7.1012	13776.4902	385.5356	14.9000	11.9850	412.7168	235.5
10	8	8	7000	3.742	1500	0	4	10.6	0.9051	14313.6563	711.5654	96.9000	45.2796	129.3120	28.3273	25.2	8.5985	13659.5762	348.6561	11.1000	11.2100	530.6176	244.4
10	8	8	7000	3.742	1500	0	5	10.6	1.1289	14425.1357	674.5861	97.2000	40.3307	141.6320	31.0556	20.2	6.4642	13870.6123	319.6698	6.2000	6.1350	420.5504	86.23
10	8	8	7000	3.742	1500	0	6	11.6	0.9659	14387.5762	613.2849	93.4000	40.7257	178.6752	105.0226	25.2	6.1257	13771.9717	316.6952	5.7000	8.0888	491.2384	173.4
10	8	8	8000	3.906	1500	0	1	11.0	0.6746	14454.7129	602.3430	79.6000	33.5421	177.2320	133.5432	20.0	7.0835	13926.3809	326.9383	20.0000	12.6211	421.8288	229.2
10	8	8	8000	3.906	1500	0	2	11.0	0.9541	15801.3379	735.2464	181.8000	45.1995	158.2960	20.1209	27.2	4.7917	14421.0684	321.4535	9.2000	11.4577	593.8704	140.8
10	8	8	8000	3.906	1500	0	3	10.0	1.0119	14740.7754	486.0462	94.9000	20.5302	123.5520	27.4050	18.6	7.1012	14074.8125	387.7603	14.3000	11.2384	409.4080	235.5
10	8	8	8000	3.906	1500	0	4	10.6	0.9051	14634.6875	728.7902	96.9000	45.2796	129.0048	28.1675	25.2	8.5985	13951.8125	354.6568	11.1000	11.2100	529.7120	244.0
10	8	8	8000	3.906	1500	0	5	10.6	1.1289	14748.5996	691.6866	97.2000	40.3307	141.6320	31.0556	20.2	6.4642	14104.2441	325.1020	4.4000	5.4827	311.3920	88.69
10	8	8	8000	3.906	1500	0	6	11.6	0.9659	14716.9316	627.3627	93.2000	40.7573	178.2272	105.1699	25.2	6.1257	14061.7002	321.9977	5.7000	8.0888	491.0656	173.8
10	8	8	9000	4.057	1500	0	1	11.0	0.6746	14727.9238	625.4675	79.2000	33.7999	131.1816	116.6612	20.2	7.2408	14177.6221	334.2712	18.4000	12.9336	290.2496	174.6
10	8	8	9000	4.057	1500	0	2	11.2	1.0560	16446.7578	746.3586	179.1000	47.0202	98.6752	14.9920	27.2	4.7917	14691.3018	329.0168	9.2000	11.4577	374.9856	87.12
10	8	8	9000	4.057	1500	0	3	10.0	1.0119	15084.1123	477.5424	98.9000	22.0377	83.2016	19.4072	18.6	7.1012	14366.0674	376.6555	14.5000	11.3452	280.8736	171.8
10	8	8	9000	4.057	1500	0	4	10.6	0.9051	14982.1299	760.5427	99.9000	45.2217	86.3136	19.8858	27.8	8.4314	14220.0654	362.3053	6.1000	8.4020	382.1536	151.0
10	8	8	9000	4.057	1500	0	5	10.8	1.0560	15043.6982	714.7158	96.8000	41.3710	133.8336	44.4250	21.4	4.6642	14436.5049	326.5161	4.4000	5.4827	311.3920	88.69
10	8	8	9000	4.057	1500	0	6	11.6	0.9659	15054.0811	649.3392	97.2000	38.8008	129.4912	75.7534	25.2	6.1257	14331.8564	329.5451	5.7000	8.0888	316.7648	112.7
10	8	8	10000	4.197	1500	0	1	11.0	0.6746	15067.0527	608.9255	86.1000	36.3569	110.8175	52.0362	19.8	6.9522	14417.6543	336.8643	18.4000	12.9336	281.7573	172.4
10	8	8	10000	4.197	1500	0	2	11.2	1.0560	16446.7578	746.3586	179.1000	47.0202	98.6752	14.9920	27.2	4.7917	14691.3018	329.0168	9.2000	11.4577	374.9856	87.12
10	8	8	10000	4.197	1500	0	3	10.0	1.0119	15357.9980	487.6129	98.8000	21.9636	83.2224	19.5023	18.6	7.1012	14605.3730	394.1383	14.3000	11.2384	280.7760	172.3
10	8	8	10000	4.197	1500	0	4	10.4	0.6913	15126.2217	737.5790	90.1000	43.0459	79.7280	14.8079	29.0	8.0391	14478.3096	377.7516	5.6000	8.4139	394.9552	141.9
10	8	8	10000	4.197	1500	0	5	10.6	1.1289	15268.1299	687.3087	92.2000	34.6263	91.6112	20.2126	23.4	5.5138	14675.1797	333.0328	4.4000	5.4827	339.7472	93.31
10	8	8	10000	4.197	1500	0	6	11.6	0.9659	15282.5674	657.1156	93.2000	40.7573	123.6992	80.4692	26.0	6.2289	14574.7129	330.3890	4.8000	8.1361	320.3744	108.8
10	8	8	1000	2	1500	80	1	3.4	0.6034	4953.7002	441.2910	269.4000	54.1490	44.7296	4953.7002	441.2910	269.4000	54.1490	44.7296	4953.7002	441.2910	269.4000	54.1490
10	8	8	1000	2	1500	80	2	3.4	0.6034	5216.1001	405.4993	299.2000	48.3661	52.8352	5216.1001	405.4993	299.2000	48.3661	52.8352	5216.1001	405.4993	299.2000	48.3661
10	8	8	1000	2	1500	80	3	3.4	0.6034	5120.7002	431.4353	276.8000	45.1466	39.8656	5120.7002	431.4353	276.8000	45.1466	39.8656	5120.7002	431.4353	276.8000	45.1466
10	8	8	1000	2	1500	80	4	3.4	0.6034	5042.7002	471.9580	255.0000	39.9625	44.5408	5042.7002	471.9580	255.0000	39.9625	44.5408	5042.7002	471.9580	255.0000	39.9625
10	8	8	1000	2	1500	80	5	3.4	0.6034	5043.7998	366.5049	265.9000	43.1870	43.9968	5043.7998	366.5049	265.9000	43.1870	43.9968	5043.7998	366.5049	265.9000	43.1870
10	8	8	1000	2	1500	80	6	3.8	0.7390	5243.2998	614.3978	292.8000	68.9997	58.6048	5243.2998	614.3978	292.8000	68.9997	58.6048	5243.2998	614.3978	292.8000	68.9997
10	8	8	2000	2.5	1500	80	1	3.0	0.0000	4488.7998	204.2215	86.5000	19.1415	24.2812	4488.7998	204.2215	86.5000	19.1415	24.2812	4488.7998	204.2215	86.5000	19.1415
10	8	8	2000	2.5	1500	80	2	3.0	0.0000	4920.0000	282.4977	119.7000	26.0606	31.8034	4903.2998	267.8289	114.5000	20.0417	40.8234	4903.2998	267.8289	114.5000	20.0417
10	8	8	2000	2.5	1500	80	3	3.2	0.4526	4865.2998	369.4849	121.5000	37.4116	19.6360	4865.2998	369.4849	121.5000	37.4116	19.6360	4865.2998	369.4849	121.5000	37.4116
10	8	8	2000	2.5	1500	80	4	3.0	0.0000	4681.7998	312.3510	104.2000	36.5338	27.7680	4669.5000	306.5864	96.7000	30.4143	41.8960	4669.5000	306.5864	96.7000	30.4143
10	8	8	2000	2.5	1500	80	5	3.2	0.4526	4823.6001	421.9040	119.1000	41.4351	38.4728	4792.8999	397.4375	109.1000	30.4319	54.8384	4792.8999	397.4375	109.1000	30.4319
10	8	8	2000	2.5	1500	80	6	3.0	0.0000	4662.3999	399.5532	99.8000	37.0119	27.6792	4655.0000	391.9621	94.9000	29.5171	39.0616	4655.0000	391.9621	94.9000	29.5171
10	8	8	3000	2.849	1500	80	1	3.0	0.0000	4457.3													

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	3000	2.849	1500	80	3	3.0	0.0000	4598.8604	245.1351	18.6752	30.4832	4.4	1.9141	4358.5005	217.6146	9.4835	65.6256
10	8	8	3000	2.849	1500	80	4	3.0	0.0000	4420.0835	325.3855	21.1884	32.9216	4.8	2.0739	4340.4751	264.9868	9.4868	81.3568
10	8	8	3000	2.849	1500	80	5	3.2	0.4526	4650.9150	323.5565	23.5565	38.6688	4.0	1.3908	4562.9302	249.3990	15.4546	60.7808
10	8	8	3000	2.849	1500	80	6	3.2	0.4526	4585.5352	242.9043	23.8903	36.3328	5.0	2.1333	4449.0518	169.0341	14.4307	76.3968
10	8	8	4000	3.125	1500	80	1	3.2	0.4526	4575.1001	309.5385	19.1022	29.4465	7.2	2.9752	4387.7998	197.3412	7.1856	236.9467
10	8	8	4000	3.125	1500	80	2	3.0	0.0000	4907.0000	356.7634	29.5990	33.6072	7.0	3.2354	4602.9502	209.3063	5.4000	140.8920
10	8	8	4000	3.125	1500	80	3	3.0	0.0000	4739.8501	278.0803	19.3094	30.5416	6.6	2.3174	4578.9248	253.6717	7.4000	207.1176
10	8	8	4000	3.125	1500	80	4	3.0	0.0000	4578.2002	324.7261	22.5026	32.4552	6.4	2.7027	4368.4248	202.5390	4.5000	109.2544
10	8	8	4000	3.125	1500	80	5	3.2	0.4526	4745.6206	345.8246	24.4206	40.2704	5.6	2.7856	4549.9751	207.4521	7.9737	178.0872
10	8	8	4000	3.125	1500	80	6	3.2	0.4526	4536.3999	301.0970	20.3838	35.3352	6.2	2.1546	4385.5000	213.5227	7.1000	108.2648
10	8	8	5000	3.358	1500	80	1	3.2	0.4526	4683.2471	317.1314	17.9379	29.1825	6.8	2.6517	4480.7314	243.0268	7.0819	166.7857
10	8	8	5000	3.358	1500	80	2	3.0	0.0000	4997.9072	401.2805	31.8763	30.4590	7.0	3.6951	4714.8447	222.3249	5.6865	195.1126
10	8	8	5000	3.358	1500	80	3	3.0	0.0000	4822.5771	265.1283	11.7006	29.3872	6.6	2.3174	4691.6162	249.9872	7.4000	210.4456
10	8	8	5000	3.358	1500	80	4	3.0	0.0000	4682.9038	325.2280	20.5041	31.3032	6.6	2.5953	4470.7148	224.3051	1.9000	29.105
10	8	8	5000	3.358	1500	80	5	3.2	0.4526	4673.7979	362.9702	24.9697	41.3760	6.0	2.7195	4658.3174	215.6976	8.1000	194.6080
10	8	8	5000	3.358	1500	80	6	3.2	0.4526	4683.8027	302.0056	20.5629	34.1944	7.4	2.4736	4466.7705	217.5984	2.5287	113.9568
10	8	8	6000	3.561	1500	80	1	3.2	0.4526	4777.1353	339.2298	18.5036	30.0639	6.6	2.5953	4570.8262	261.0730	1.6933	161.9021
10	8	8	6000	3.561	1500	80	2	3.0	0.0000	5133.8398	414.3556	32.0961	30.5338	7.8	2.7979	4933.4648	257.1752	0.7000	264.7171
10	8	8	6000	3.561	1500	80	3	3.0	0.0000	4882.6865	255.7444	12.5308	29.8536	5.4	2.5061	4791.9619	238.7063	11.6000	160.9376
10	8	8	6000	3.561	1500	80	4	3.0	0.0000	4808.3584	323.5644	21.6149	29.7128	6.6	2.8462	4567.9482	225.5551	2.1000	186.8960
10	8	8	6000	3.561	1500	80	5	3.2	0.4526	4978.1470	372.3416	26.1885	41.4656	5.4	2.6816	4770.7842	219.0742	8.3000	174.4344
10	8	8	6000	3.561	1500	80	6	3.2	0.4526	4949.9531	328.5017	20.4740	36.7760	7.4	2.4736	4557.5801	229.0562	1.9000	201.9832
10	8	8	7000	3.742	1500	80	1	3.2	0.4526	4909.3037	333.4295	17.8120	28.9969	7.8	2.7979	4933.4648	257.1752	0.7000	264.7171
10	8	8	7000	3.742	1500	80	2	3.0	0.0000	5248.4404	429.9622	31.7225	30.5338	7.0	3.6951	4933.4648	257.1752	0.7000	264.7171
10	8	8	7000	3.742	1500	80	3	3.0	0.0000	5053.0151	270.6837	11.4249	29.9000	5.6	1.7912	4909.4268	258.1173	10.2000	105.8256
10	8	8	7000	3.742	1500	80	4	3.0	0.0000	4907.4102	345.9984	20.4368	31.2960	6.6	2.5953	4672.9873	236.3659	1.9000	116.7248
10	8	8	7000	3.742	1500	80	5	3.2	0.4526	5107.1147	384.1454	25.1659	41.6360	6.0	2.7195	4875.9180	223.9533	7.8000	195.1720
10	8	8	7000	3.742	1500	80	6	3.2	0.4526	4920.2588	313.4020	20.5679	34.3216	6.6	2.1119	4673.1514	225.5781	2.4000	113.7064
10	8	8	8000	3.906	1500	80	1	3.2	0.4526	5007.4937	340.6429	17.8120	29.0297	7.8	2.7979	4782.3188	261.4594	0.7000	265.0313
10	8	8	8000	3.906	1500	80	2	3.0	0.0000	5348.6250	434.0397	31.6441	30.5386	7.0	3.6951	5026.7813	236.3890	6.4000	194.5206
10	8	8	8000	3.906	1500	80	3	3.0	0.0000	5128.6064	262.5704	12.7165	29.0512	5.0	1.6525	4990.3687	253.4364	11.0000	87.3504
10	8	8	8000	3.906	1500	80	4	3.0	0.0000	5005.4688	354.1861	28.2000	31.2592	6.6	2.5953	4762.3999	240.7697	1.9000	116.6120
10	8	8	8000	3.906	1500	80	5	3.2	0.4526	5211.1563	394.1214	25.1659	41.5608	6.0	2.7195	4969.7686	227.7027	7.8000	195.0072
10	8	8	8000	3.906	1500	80	6	3.2	0.4526	5018.3501	319.7897	20.5679	34.3000	6.6	2.1119	4762.2686	229.4604	2.4000	113.4696
10	8	8	9000	4.057	1500	80	1	3.2	0.4526	5097.6772	347.2754	17.8120	29.0397	7.8	2.7979	4863.9282	265.3998	0.7000	264.7905
10	8	8	9000	4.057	1500	80	2	3.0	0.0000	5449.9263	446.0041	31.5924	30.5828	7.0	3.6951	5113.3979	240.7917	6.4000	194.5206
10	8	8	9000	4.057	1500	80	3	3.0	0.0000	5221.5068	267.3164	12.7165	29.1008	5.0	1.6525	5077.0215	258.3856	10.9000	87.5088
10	8	8	9000	4.057	1500	80	4	3.0	0.0000	5086.2314	353.4244	21.1992	31.2232	6.6	2.5953	4847.4229	242.1550	1.9000	116.3064
10	8	8	9000	4.057	1500	80	5	3.2	0.4526	5270.6592	382.8611	23.5623	41.5640	6.0	2.7195	5055.9673	231.1652	7.8000	194.8632
10	8	8	9000	4.057	1500	80	6	3.2	0.4526	5108.4429	325.6753	20.5679	34.2808	7.6	2.3418	4843.9053	232.8936	1.9000	203.4608
10	8	8	10000	4.197	1500	80	1	3.2	0.4526	5147.4180	347.2311	17.4049	35.6166	8.2	2.7153	4937.0586	268.3425	0.4000	157.3102
10	8	8	10000	4.197	1500	80	2	3.0	0.0000	5534.0415	450.3853	30.4823	35.8429	6.8	3.5983	5193.2949	244.2693	6.4000	128.4004
10	8	8	10000	4.197	1500	80	3	3.0	0.0000	5307.6475	271.7270	12.7165	34.2398	5.2	1.8414	5160.0151	266.8195	10.9000	110.5584
10	8	8	10000	4.197	1500	80	4	3.0	0.0000	5169.7402	360.4096	21.1992	37.3452	6.6	2.5953	4921.5679	249.0029	1.9000	127.1412
10	8	8	10000	4.197	1500	80	5	3.2	0.4526	5371.2349	400.3209	23.5623	45.9068	6.0	2.7195	5135.9927	234.7922	7.8000	125.0976
10	8	8	10000	4.197	1500	80	6	3.0	0.0000	5237.0283	360.4042	21.2340	29.9500	7.6	2.3418	4917.1191	236.9593	1.9000	143.5564

Table C.10: Comparison of no-bifurcation-based heuristics with the optical-reach customization for the EON network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	1000	2	500	0	1	3.8	0.7390	12514.3662	894.1945	720.5000	59.6311	105.6369	3.8	0.7390	12514.3662	894.1945	720.5000	105.6369	59.6311
10	8	8	1000	2	500	0	2	3.4	0.6034	12597.0801	610.6592	788.6000	54.7413	59.4781	3.4	0.6034	12597.0801	610.6592	788.6000	59.4781	54.7413
10	8	8	1000	2	500	0	3	4.0	0.7543	12599.6309	873.9380	717.8000	67.0340	87.5562	4.0	0.7543	12599.6309	873.9380	717.8000	87.5562	67.0340
10	8	8	1000	2	500	0	4	3.8	0.7390	12858.1846	709.6624	789.1000	67.3188	58.9355	3.8	0.7390	12858.1846	709.6624	789.1000	58.9355	67.3188
10	8	8	1000	2	500	0	5	3.6	0.6913	12057.7266	792.4338	677.9000	85.1112	85.1112	3.6	0.6913	12057.7266	792.4338	677.9000	85.1112	85.1112
10	8	8	1000	2	500	0	6	4.2	0.7390	13342.6748	555.0676	844.3000	82.8976	58.8066	4.2	0.7390	13342.6748	555.0676	844.3000	58.8066	82.8976
10	8	8	2000	2.5	500	0	1	4.2	0.7390	11002.9238	730.4336	266.4000	72.2405	63.4516	4.2	0.7390	11002.9238	730.4336	266.4000	63.4516	72.2405
10	8	8	2000	2.5	500	0	2	3.6	0.6913	11379.7285	674.3325	328.1000	67.2202	51.6268	3.6	0.6913	11379.7285	674.3325	328.1000	51.6268	67.2202
10	8	8	2000	2.5	500	0	3	3.8	0.7390	10879.7207	583.6978	258.7000	64.3392	52.0708	3.8	0.7390	10879.7207	583.6978	258.7000	52.0708	64.3392
10	8	8	2000	2.5	500	0	4	4.0	0.7543	11457.7139	882.4703	320.3000	64.8864	91.6465	4.8	2.1808	11457.7139	882.4703	320.3000	75.8667	84.8456
10	8	8	2000	2.5	500	0	5	3.6	0.6913	10738.8242	861.4546	252.5000	59.7736	82.1638	3.6	0.6913	10738.8242	861.4546	252.5000	82.1638	59.7736
10	8	8	2000	2.5	500	0	6	4.6	0.6034	11955.6826	548.5941	357.2000	84.3264	48.7095	4.6	0.6034	11955.6826	548.5941	357.2000	48.7095	84.3264
10	8	8	3000	2.849	500	0	1	4.2	0.7390	10200.9102	496.7123	110.7000	78.3860	34.1603	4.4	0.9659	10165.5996	453.4630	101.9000	28.6267	82.7890
10	8	8	3000	2.849	500	0	2	4.0	0.7543	10841.3682	384.6935	185.4000	80.4328	33.1703	5.0	2.0239	10763.8535	303.4434	159.4000	27.0485	104.2700
10	8	8	3000	2.849	500	0	3	4.0	0.7543	10113.8184	463.5337	105.1000	77.2292	23.5695	4.2	1.0006	10080.1709	409.8768	96.6000	13.8347	79.3700
10	8	8	3000	2.849	500	0	4	3.8	0.7390	10527.5684	608.8948	170.8000	60.3256	45.6105	6.2	3.1062	10376.0938	452.6660	124.2000	16.4309	122.2056
10	8	8	3000	2.849	500	0	5	4.2	0.7390	10423.3008	673.2725	122.9000	85.1240	52.8907	4.6	1.1289	10371.1348	617.0920	103.0000	28.9951	90.0864
10	8	8	3000	2.849	500	0	6	5.0	0.0000	11094.6211	188.5596	173.5000	97.4512	27.2101	6.6	1.8841	11035.8750	140.8163	140.8000	21.2902	134.1208
10	8	8	4000	3.125	500	0	1	4.4	0.6913	9960.5420	423.2512	78.9000	80.1952	31.2017	4.8	1.0560	9846.8379	330.1613	53.2000	23.1318	90.3122
10	8	8	4000	3.125	500	0	2	3.8	0.7390	10593.9990	455.9802	154.7000	73.7538	38.7278	5.8	2.7153	10366.0098	199.5819	87.4000	46.7906	126.7300
10	8	8	4000	3.125	500	0	3	4.0	0.7543	9886.0509	386.2472	68.5000	72.7818	15.5831	4.4	1.1782	9847.2676	360.9229	56.6000	16.7410	81.6324
10	8	8	4000	3.125	500	0	4	4.6	0.6034	10518.4551	408.3904	114.3000	85.9136	34.9310	9.2	2.8181	10042.4873	231.9234	23.8000	21.2581	208.4240
10	8	8	4000	3.125	500	0	5	3.8	0.7390	9969.9824	579.5276	85.9000	67.5880	39.4575	4.2	1.2068	9826.4922	397.3994	58.2000	27.2342	75.3216
10	8	8	4000	3.125	500	0	6	4.8	0.4526	10795.9385	207.9035	131.8000	87.2232	20.9182	8.6	2.3174	10380.5742	227.6705	34.3000	33.0101	185.2776
10	8	8	5000	3.358	500	0	1	4.4	0.6913	9910.1689	383.0791	70.7000	80.8377	27.5670	5.4	1.7592	9814.6348	310.0013	42.4000	27.9749	103.9061
10	8	8	5000	3.358	500	0	2	4.0	0.7543	10688.9404	413.2488	157.5000	80.8508	37.7642	7.2	3.0508	10404.9434	166.2045	62.1000	56.0206	168.7040
10	8	8	5000	3.358	500	0	3	4.0	0.7543	9946.0459	349.7058	74.4000	73.6676	24.6219	5.0	2.2375	9856.2041	261.8241	55.2000	22.8572	99.9136
10	8	8	5000	3.358	500	0	4	4.8	0.4526	10510.6182	405.2762	105.5000	93.0832	40.4750	9.0	2.7815	9994.9922	203.5345	19.2000	23.2422	203.3712
10	8	8	5000	3.358	500	0	5	3.8	0.7390	10004.4609	645.9915	91.0000	69.6040	53.2803	4.2	1.2068	9810.3750	395.9703	52.8000	26.2883	76.9608
10	8	8	5000	3.358	500	0	6	5.0	0.0000	10609.4395	128.8814	103.2000	90.5344	16.1375	8.8	2.0739	10366.1191	198.6757	22.3000	25.5201	191.1464
10	8	8	6000	3.561	500	0	1	4.4	0.6913	9987.3408	372.7518	81.4000	80.2908	28.4548	5.4	1.7592	9865.8740	296.9370	45.8000	27.0393	103.7340
10	8	8	6000	3.561	500	0	2	4.0	0.7543	10648.9473	437.7319	149.7000	78.6264	41.3163	6.6	2.8462	10374.1729	163.8136	67.2000	50.2920	149.1234
10	8	8	6000	3.561	500	0	3	4.0	0.7543	9845.5137	320.0534	67.7000	69.2912	18.8142	4.4	1.1782	9829.8115	306.8560	57.5000	23.2971	80.6020
10	8	8	6000	3.561	500	0	4	4.6	0.6034	10426.7500	431.3792	102.1000	85.8616	40.5146	8.6	3.1498	9963.9170	179.3842	28.0000	25.6690	191.6888
10	8	8	6000	3.561	500	0	5	4.0	0.7543	10093.1064	649.3295	99.7000	76.4832	66.3956	5.0	1.9081	9860.2080	386.1928	39.3000	28.2156	98.9472
10	8	8	6000	3.561	500	0	6	5.0	0.0000	10598.1016	123.3294	103.7000	91.1352	17.0703	8.8	2.0739	10367.7373	201.1841	23.1000	25.2926	192.0648
10	8	8	7000	3.742	500	0	1	4.4	0.6913	9964.4121	391.6832	78.6000	78.9794	30.2439	5.4	1.7592	9831.7051	309.4042	43.0000	26.8836	103.4512
10	8	8	7000	3.742	500	0	2	4.0	0.7543	10648.9492	441.4831	150.1000	78.6320	41.2714	6.4	2.7027	10369.3652	151.3952	67.6000	50.6273	145.3044
10	8	8	7000	3.742	500	0	3	4.0	0.7543	9885.9043	338.4634	71.4000	71.8456	24.9250	4.6	1.4780	9842.1670	298.2671	55.8000	23.9605	84.9188
10	8	8	7000	3.742	500	0	4	4.6	0.6034	10403.0996	420.5234	99.2000	86.8160	39.9352	8.4	3.0952	9933.2041	175.3232	26.5000	25.5941	185.9384
10	8	8	7000	3.742	500	0	5	4.0	0.7543	10068.0029	699.7334	90.3000	76.7024	60.6079	4.4	1.1782	9849.0928	415.3523	45.6000	18.1654	83.3992
10	8	8	7000	3.742	500	0	6	5.0	0.0000	10586.6582	126.2451	102.5000	91.1584	16.0719	8.8	2.0739	10362.4150	199.4735	22.6000	25.4468	190.8040
10	8	8	8000	3.906	500	0	1	4.4	0.6913	9964.4121	391.6832	78.6000	78.9794	30.2439	5.4	1.7592	9831.7979	309.4452	43.0000	26.8836	103.2203
10	8	8	8000	3.906	500	0	2	4.0	0.7543	10651.0654	433.8814	150.2000	78.5486	41.3545	6.4	2.7027	10373.2900	152.4633	67.5000	50.5667	144.8094
10	8	8	8000	3.906	500	0	3	4.0	0.7543	9885.9043	338.4634	71.4000	71.7784	24.9250	4.6	1.4780	9842.1670	298.2671	55.8000	23.9605	84.2988
10	8	8	8000	3.906	500	0	4	4.6	0.6034	10404.0625	417.7205	99.2000	87.2288	39.9352	8.4	3.0952	9935.4678	175.0207	26.5000	25.5941	187.1456
10	8	8	8000	3.906	500	0	5	4.0	0.7543	10068.0410	699.7955	90.3000	76.4464	63.8607	4.4	1.1782	9849.0928	415.3523	45.6000	18.1654	83.1440

C	W	B	R _{max}	E/O	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	±CI	Solve time	F _{opt}	±CI	Weighted port count	# of OEOs	±CI	Solve time
[Gb/s]			[km]	ratio	[Gb/s]	[%]				@F _{min}	@F _{min}		[sec]			@F _{opt}	@F _{opt}		[sec]
10	8	8	8000	3.906	500	0	6	5.0	0.0000	10586.6582	126.2451	16.0719	91.1424	8.8	2.0739	10365.2930	22.3000	25.5201	190.5136
10	8	8	9000	4.057	500	0	1	4.4	0.6913	9974.5244	382.2434	30.0374	60.8245	5.4	1.7592	9841.9092	43.6000	27.1032	77.2548
10	8	8	9000	4.057	500	0	2	4.0	0.7543	10646.2656	435.0683	41.3980	17.9617	6.4	2.7027	10369.2676	67.2000	50.3226	50.798
10	8	8	9000	4.057	500	0	3	4.0	0.7543	9889.3027	335.1216	71.2000	55.4764	4.6	1.4780	9845.5654	294.7565	23.7732	64.2984
10	8	8	9000	4.057	500	0	4	4.6	0.6034	10359.2861	399.6217	34.9426	66.1032	8.0	2.8820	9942.4395	171.1324	25.9404	120.3048
10	8	8	9000	4.057	500	0	5	4.0	0.7543	10085.2764	699.8487	91.2000	63.4162	4.4	1.1782	9869.0068	423.9689	17.8656	66.9080
10	8	8	9000	4.057	500	0	6	5.0	0.0000	10579.7500	133.6767	102.2000	68.9312	8.8	2.0739	10362.2090	198.2103	25.5486	133.2200
10	8	8	10000	4.197	500	0	1	4.4	0.6913	9977.3887	384.4743	79.2000	60.6614	5.4	1.7592	9852.9629	307.1903	27.6379	77.1902
10	8	8	10000	4.197	500	0	2	4.2	0.7390	10749.4121	429.0045	43.1725	66.8306	6.8	2.3804	10477.1953	211.3842	51.9118	107.9838
10	8	8	10000	4.197	500	0	3	4.2	0.7390	9954.7881	433.7051	69.6000	22.6205	5.8	2.7153	9901.5762	396.2691	20.2044	173.2576
10	8	8	10000	4.197	500	0	4	4.6	0.6034	10338.7910	436.6674	96.8000	66.4244	8.2	3.1786	9922.8672	158.5550	25.8672	124.0596
10	8	8	10000	4.197	500	0	5	4.0	0.7543	10103.6504	708.0797	93.5000	63.3484	4.4	1.1782	9887.4189	442.6673	20.6775	66.1328
10	8	8	10000	4.197	500	0	6	4.8	0.4526	10576.6641	139.0493	108.3000	64.7296	8.2	2.4510	10352.9551	197.2891	35.1340	121.7936
10	8	8	1000	2	500	80	1	1.0	0.0000	3274.5938	206.0327	180.8000	15.4304	1.0	0.0000	3274.5938	206.0327	180.8000	15.4304
10	8	8	1000	2	500	80	2	1.0	0.0000	3521.3352	196.5957	200.7000	15.4080	1.2	0.4526	3514.0820	198.9014	199.1000	17.4147
10	8	8	1000	2	500	80	3	1.2	0.4526	3442.7097	339.7831	190.6000	14.4800	1.2	0.4526	3442.7097	339.7831	190.6000	14.4800
10	8	8	1000	2	500	80	4	1.0	0.0000	3483.8235	265.4423	211.6000	17.1264	1.0	0.0000	3483.8235	265.4423	211.6000	17.1264
10	8	8	1000	2	500	80	5	1.0	0.0000	3274.2571	157.4095	176.5000	11.6714	1.0	0.0000	3274.2571	157.4095	176.5000	11.6714
10	8	8	1000	2	500	80	6	1.0	0.0000	3478.5249	281.1819	205.9000	13.7056	1.0	0.0000	3478.5249	281.1819	205.9000	13.7056
10	8	8	2000	2.5	500	80	1	1.0	0.0000	3202.7122	183.7799	81.7000	10.8311	1.0	0.0000	3202.7122	183.7799	81.7000	10.8311
10	8	8	2000	2.5	500	80	2	1.0	0.0000	3333.5129	156.6105	89.8000	17.1188	1.0	0.0000	3333.5129	156.6105	89.8000	17.1188
10	8	8	2000	2.5	500	80	3	1.0	0.0000	3184.2612	163.3197	70.2000	10.1407	1.0	0.0000	3184.2612	163.3197	70.2000	10.1407
10	8	8	2000	2.5	500	80	4	1.2	0.4526	3359.9407	267.8900	86.4000	15.4546	1.2	0.4526	3359.9407	267.8900	86.4000	15.4546
10	8	8	2000	2.5	500	80	5	1.2	0.4526	3247.7617	219.5655	75.8000	20.3894	1.2	0.4526	3247.7617	219.5655	75.8000	20.3894
10	8	8	2000	2.5	500	80	6	1.0	0.0000	3304.9673	203.5245	83.8000	19.3912	1.0	0.0000	3304.9673	203.5245	83.8000	19.3912
10	8	8	3000	2.849	500	80	1	1.0	0.0000	2956.0273	177.0079	26.5000	16.6592	1.0	0.0000	2956.0273	177.0079	26.5000	16.6592
10	8	8	3000	2.849	500	80	2	1.0	0.0000	3084.2832	167.8328	37.2000	20.1395	1.0	0.0000	3084.2832	167.8328	37.2000	20.1395
10	8	8	3000	2.849	500	80	3	1.0	0.0000	3050.2791	172.3724	32.1000	8.6028	1.0	0.0000	3050.2791	172.3724	32.1000	8.6028
10	8	8	3000	2.849	500	80	4	1.0	0.0000	2990.0234	174.0675	32.9000	11.9184	1.0	0.0000	2990.0234	174.0675	32.9000	11.9184
10	8	8	3000	2.849	500	80	5	1.2	0.4526	3052.5562	164.7473	26.5000	8.2019	1.4	0.9051	3045.8235	158.8351	26.5000	8.2019
10	8	8	3000	2.849	500	80	6	1.0	0.0000	3054.4167	192.0095	36.1000	15.1845	1.4	0.6034	3028.9226	175.8720	27.3000	17.6576
10	8	8	4000	3.125	500	80	1	1.0	0.0000	2891.5510	192.3960	19.0000	9.3964	1.6	0.6913	2875.3894	177.2443	9.5000	5.9986
10	8	8	4000	3.125	500	80	2	1.0	0.0000	3035.0620	138.9760	33.2000	18.0511	1.2	0.4526	3031.6787	140.8765	28.6000	19.0251
10	8	8	4000	3.125	500	80	3	1.0	0.0000	3010.8865	176.0889	22.6000	8.9639	1.0	0.0000	3010.8865	176.0889	22.6000	8.9639
10	8	8	4000	3.125	500	80	4	1.0	0.0000	2935.9421	169.7360	22.5000	8.8621	1.6	0.6913	2921.4592	163.6396	17.2000	11.2472
10	8	8	4000	3.125	500	80	5	1.2	0.4526	2998.5574	137.1381	22.3000	11.2788	1.4	0.6034	2995.6616	139.0199	18.9000	11.0361
10	8	8	4000	3.125	500	80	6	1.0	0.0000	3010.1863	181.4735	33.4000	12.4814	2.4	1.1782	2948.6880	151.7625	11.1000	6.5555
10	8	8	5000	3.358	500	80	1	1.0	0.0000	2882.7874	169.9077	17.2000	9.5215	1.4	0.6034	2864.6240	149.0439	10.0000	6.7378
10	8	8	5000	3.358	500	80	2	1.0	0.0000	3045.5481	147.7126	30.9000	18.3376	1.2	0.4526	3041.5735	150.0107	26.2000	19.0598
10	8	8	5000	3.358	500	80	3	1.0	0.0000	3014.6479	182.1160	22.5000	8.6410	1.0	0.0000	3014.6479	182.1160	22.5000	8.6410
10	8	8	5000	3.358	500	80	4	1.0	0.0000	2925.3989	177.1371	19.7000	6.5585	1.6	0.6913	2913.5942	168.4174	14.4000	8.6473
10	8	8	5000	3.358	500	80	5	1.2	0.4526	3002.4841	163.6534	21.0000	11.9829	1.8	1.0006	2993.6929	165.9630	11.6000	7.7008
10	8	8	5000	3.358	500	80	6	1.0	0.0000	3022.5044	198.4858	33.9000	10.3277	2.6	1.1289	2965.6682	175.6120	8.1000	8.4426
10	8	8	6000	3.561	500	80	1	1.0	0.0000	2894.3855	183.9075	18.6000	9.4459	1.6	0.6913	2870.7004	156.2056	8.2000	6.7378
10	8	8	6000	3.561	500	80	2	1.0	0.0000	3050.4778	143.0845	31.9000	18.9539	1.4	0.6034	3042.3926	145.6851	18.0000	12.1104
10	8	8	6000	3.561	500	80	3	1.0	0.0000	3021.0073	182.4310	25.5000	9.2822	1.0	0.0000	3021.0073	182.4310	25.5000	9.2822
10	8	8	6000	3.561	500	80	4	1.0	0.0000	2902.1821	182.4738	18.0000	7.0916	1.2	0.4526	2896.0535	176.5747	15.0000	7.4438
10	8	8	6000	3.561	500	80	5	1.2	0.4526	3008.3218	163.9064	20.2000	12.3789	1.8	1.0006	2996.1831	169.6676	10.9000	7.9712
10	8	8	6000	3.561	500	80	6	1.0	0.0000	2999.7231	187.8040	30.3000	11.8398	2.2	1.0006	2937.4788	159.9444	8.7000	8.2213

C	W	B	R _{max}	E/O	IN	FR	Policy	F _{min}	±CI	Weighted port count	±CI	# of OEOs	±CI	Solve time	F _{opt}	±CI	Weighted port count	±CI	# of OEOs	±CI	Solve time	±CI
[Gb/s]			[km]	ratio	[Gb/s]	[%]				@F _{min}		@F _{min}		[sec]			@F _{opt}		@F _{opt}		[sec]	
10	8	8	7000	3.742	500	80	1	1.0	0.0000	2900.5259	182.7326	18.2000	9.6285	17.2783	1.6	6.1460	2875.7114	153.2249	7.8000	5.3098	21.4813	8.5115
10	8	8	7000	3.742	500	80	2	1.0	0.0000	3041.1685	146.6862	31.1000	18.1003	18.8845	1.2	3.9458	3036.2686	149.3573	26.4000	18.8599	20.7861	5.3939
10	8	8	7000	3.742	500	80	3	1.0	0.0000	180.6674	23.9000	23.9000	7.0916	21.1063	1.0	6.0892	3015.2991	180.6674	23.9000	9.2034	21.1063	6.0892
10	8	8	7000	3.742	500	80	4	1.0	0.0000	2902.6279	182.3143	18.0000	7.0916	21.5938	1.2	4.4554	2896.1968	176.1507	15.0000	7.4438	23.4642	5.9582
10	8	8	7000	3.742	500	80	5	1.2	0.4526	3014.7532	150.2610	21.1000	12.5779	18.6248	1.8	5.4153	3005.6819	153.3302	11.8000	8.8334	28.2750	15.942
10	8	8	7000	3.742	500	80	6	1.0	0.0000	3029.9407	201.9022	34.0000	10.3638	14.5576	2.6	2.8117	2965.3845	175.6050	8.1000	8.4426	38.1328	22.440
10	8	8	8000	3.906	500	80	1	1.0	0.0000	2902.1836	181.9432	17.3000	9.2071	17.2672	1.6	6.1497	2875.7114	153.2249	7.8000	5.3098	21.4812	8.4672
10	8	8	8000	3.906	500	80	2	1.0	0.0000	3041.1685	146.6862	31.1000	18.1003	18.8685	1.2	3.9421	3036.2686	149.3573	26.4000	18.8599	20.7702	5.3913
10	8	8	8000	3.906	500	80	3	1.0	0.0000	180.6674	23.9000	23.9000	7.0916	21.5938	1.0	6.0904	3015.2991	180.6674	23.9000	9.2034	21.0905	6.0904
10	8	8	8000	3.906	500	80	4	1.0	0.0000	2902.6279	182.3143	18.0000	7.0916	21.5938	1.2	4.4465	2896.1968	176.1507	15.0000	7.4438	23.4626	5.9492
10	8	8	8000	3.906	500	80	5	1.2	0.4526	3014.7532	150.2610	21.1000	12.5779	18.6248	1.8	5.4190	3005.6819	153.3302	11.8000	8.8334	28.2655	15.945
10	8	8	8000	3.906	500	80	6	1.0	0.0000	3001.2827	185.0080	30.8000	11.9391	14.6049	2.4	2.8371	2935.3088	157.8678	8.7000	8.2213	36.1048	22.440
10	8	8	9000	4.057	500	80	1	1.0	0.0000	2902.1836	181.9432	17.3000	9.2071	17.2435	1.6	6.1715	2875.7114	153.2249	7.8000	5.3098	21.4577	8.4876
10	8	8	9000	4.057	500	80	2	1.0	0.0000	3051.8394	149.3197	31.4000	18.6323	18.8906	1.4	3.9403	3039.1248	149.7739	17.7000	11.9736	22.1859	6.1981
10	8	8	9000	4.057	500	80	3	1.0	0.0000	180.6674	23.9000	23.9000	9.2034	21.0939	1.0	6.0902	3015.2991	180.6674	23.9000	9.2034	21.0939	6.0902
10	8	8	9000	4.057	500	80	4	1.0	0.0000	2902.0154	181.6860	17.6000	6.7563	18.2523	1.2	4.4532	2896.1968	176.1507	15.0000	7.4438	23.4767	5.9621
10	8	8	9000	4.057	500	80	5	1.2	0.4526	3030.1282	165.4608	25.2000	11.9200	18.5219	1.8	5.4223	3023.9448	167.1389	15.9000	10.2614	28.1546	15.885
10	8	8	9000	4.057	500	80	6	1.0	0.0000	3007.3645	203.3000	29.6000	12.0925	12.2724	2.4	2.4607	2931.1060	160.0021	8.1000	8.2793	29.0558	17.345
10	8	8	10000	4.197	500	80	1	9.6	0.6913	13230.0674	463.0768	691.8000	56.0636	72.5136	9.8	19.2301	13211.0449	475.5479	689.3000	57.6656	75.5392	17.708
10	8	8	10000	4.197	500	80	2	9.4	0.6034	13581.0723	681.6774	761.7000	84.2200	107.9872	9.6	25.6785	13578.7842	680.8199	745.4000	75.8856	111.5816	23.101
10	8	8	10000	4.197	500	80	3	9.0	0.9541	13000.5752	290.5049	674.5000	72.7853	72.1808	9.4	17.5032	12982.5615	652.0601	39.4136	81.3562	17.166	
10	8	8	10000	4.197	500	80	4	9.4	0.6034	13241.2793	540.6397	700.5000	66.2002	79.9616	9.4	18.2990	13241.2793	540.6397	700.5000	66.2002	79.9616	18.299
10	8	8	10000	4.197	500	80	5	9.2	0.8124	13070.9248	404.9036	685.2000	57.1012	78.8816	9.4	16.3482	13030.4512	428.7070	671.9000	63.0281	82.8752	13.712
10	8	8	10000	4.197	500	80	6	10.0	0.7543	13772.5293	652.2911	812.3000	100.5218	93.9632	10.6	21.5095	13750.2363	662.7759	781.5000	105.4908	106.9328	15.901
10	8	8	2000	2.5	1500	0	1	10.8	0.8124	11627.4189	652.2481	211.0000	46.8815	137.2678	10.8	51.1410	11627.4189	652.2481	211.0000	46.8815	137.2678	51.141
10	8	8	2000	2.5	1500	0	2	10.4	0.9659	12303.2676	454.0903	304.9000	50.6871	130.1744	10.6	19.5272	12258.5635	459.2666	295.1000	48.6670	132.1584	21.075
10	8	8	2000	2.5	1500	0	3	9.8	0.7390	11719.5176	412.0738	219.0000	42.5748	115.1216	10.0	21.0883	11681.8301	443.7473	208.5000	44.6633	116.4432	20.626
10	8	8	2000	2.5	1500	0	4	10.4	1.1782	11621.0088	755.0233	209.2000	72.7858	123.4528	10.4	1.1782	11621.0088	755.0233	209.2000	72.7858	123.4528	29.410
10	8	8	2000	2.5	1500	0	5	10.6	0.9051	11729.6563	641.5552	218.7000	51.5337	127.0560	11.2	27.6194	11704.0352	616.6548	215.1000	48.5758	136.2336	32.342
10	8	8	2000	2.5	1500	0	6	10.8	0.8124	12073.6650	602.3130	263.6000	58.3464	109.7888	11.2	15.7744	12073.4229	601.9760	255.0000	47.1513	119.5296	34.306
10	8	8	3000	2.849	1500	0	1	11.2	0.8124	11056.1807	456.0319	95.8000	30.5836	150.5856	11.8	53.7491	11035.3418	442.9854	93.6000	29.9015	167.7008	64.980
10	8	8	3000	2.849	1500	0	2	10.8	1.0560	11855.9658	535.8394	197.8000	33.8151	138.9120	11.8	19.3118	11756.9746	515.3863	166.2000	37.9649	163.8560	55.833
10	8	8	3000	2.849	1500	0	3	9.8	1.0006	11144.9688	390.3765	112.9000	33.4678	113.6800	10.8	25.3235	11058.8955	366.9876	86.2000	28.7385	133.2384	28.054
10	8	8	3000	2.849	1500	0	4	10.8	1.2531	11120.9150	611.7857	105.5000	39.9672	161.5904	11.4	1.6247	11057.3037	596.6830	90.7000	29.7697	140.5632	41.980
10	8	8	3000	2.849	1500	0	5	10.8	1.0560	11324.8428	564.3212	125.7000	39.2226	131.5968	11.8	1.6096	11281.6914	596.9297	119.0000	43.7310	147.0848	30.514
10	8	8	3000	2.849	1500	0	6	11.4	0.9051	11489.1973	451.8562	134.9000	33.4610	126.9120	11.8	31.1165	11437.3770	434.4430	124.8000	28.2735	174.2400	105.41
10	8	8	4000	3.125	1500	0	1	10.8	0.8124	10905.7139	457.1091	80.1000	33.0367	174.9103	11.8	116.8494	10744.0547	314.4029	52.0000	13.8954	208.1429	156.53
10	8	8	4000	3.125	1500	0	2	11.0	1.1685	11731.7324	479.6947	176.0000	49.1446	145.3120	13.8	3.3866	11528.5166	359.9065	91.7000	40.6584	211.7752	80.026
10	8	8	4000	3.125	1500	0	3	10.2	0.7390	11057.5107	421.0019	91.5000	29.3892	119.2688	11.0	1.6746	10943.4287	379.3772	73.3000	23.6776	128.7776	15.445
10	8	8	4000	3.125	1500	0	4	11.2	1.4231	11127.8838	635.9106	99.9000	43.1277	180.6976	12.0	1.8165	10918.9570	484.9677	59.9000	20.9960	205.2992	134.59
10	8	8	4000	3.125	1500	0	5	10.8	1.0560	11442.5732	495.7386	99.6000	41.4265	135.7664	13.2	3.3358	11052.7998	404.9898	55.4000	25.0707	228.4640	130.40
10	8	8	4000	3.125	1500	0	6	12.2	1.0006	11398.3701	521.9211	110.5000	40.7090	188.3232	17.4	6.8400	11223.0869	448.8194	57.7000	27.2994	356.6752	200.30
10	8	8	5000	3.358	1500	0	1	11.0	0.6746	10947.2402	414.3695	77.7000	27.1992	138.2944	12.0	1.2162	10750.6748	306.0656	47.1000	12.5372	211.0400	157.21

C	W	B	R _{max}	E/O	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	Solve time	±CI	F _{opr}	±CI	Weighted port count	# of OEOs	±CI	Solve time
[Gb/s]			[km]	ratio	[Gb/s]	[%]				@F _{min}	@F _{min}	[sec]				@F _{opr}	@F _{opr}		[sec]
10	8	8	5000	3.358	1500	0	2	11.0	0.9541	11835.7793	183.6000	146.2192	19.4132	16.0	3.0358	11581.4072	77.1000	37.4636	310.2224
10	8	8	5000	3.358	1500	0	3	10.0	1.0119	11102.5371	98.0000	118.5216	25.8257	11.4	1.1289	10927.9824	55.4000	32.6221	192.5248
10	8	8	5000	3.358	1500	0	4	10.6	0.9051	11034.4014	540.3505	120.1184	26.8885	13.4	3.2213	10909.2539	46.9000	22.4824	190.3072
10	8	8	5000	3.358	1500	0	5	10.4	0.9659	11099.7932	489.9804	129.3824	29.2922	13.2	4.0730	11005.0918	61.9000	25.1754	185.8880
10	8	8	5000	3.358	1500	0	6	11.6	0.9659	11184.3818	417.9432	162.1376	89.6336	13.4	2.3174	11124.2803	59.0000	27.3431	206.8544
10	8	8	6000	3.561	1500	0	1	11.4	0.9051	10791.7422	298.9231	116.0768	25.3304	11.8	0.7390	10764.3486	59.7000	20.0099	128.0800
10	8	8	6000	3.561	1500	0	2	11.0	1.3492	11790.2607	655.6468	131.5568	59.2059	15.0	6.6443	11499.7217	98.1000	44.7170	341.9440
10	8	8	6000	3.561	1500	0	3	10.8	1.2531	11003.8848	423.5907	188.4736	121.8054	11.8	2.1546	10969.8457	53.7000	19.8185	220.6816
10	8	8	6000	3.561	1500	0	4	10.8	1.0560	11340.6885	658.2474	208.6752	150.6881	16.8	6.4160	11026.9912	40.8000	29.4869	312.9728
10	8	8	6000	3.561	1500	0	5	11.2	1.2531	11163.1035	421.9369	144.1376	39.4922	12.8	2.7362	11147.5576	43.4052	28.4000	177.4144
10	8	8	6000	3.561	1500	0	6	10.8	1.0560	11253.3779	443.5261	111.0656	25.9097	12.8	3.3358	11135.3535	66.9000	25.1505	163.1168
10	8	8	7000	3.742	1500	0	1	11.0	0.6746	10961.4424	462.4388	138.6896	46.0657	12.6	1.6247	10742.8965	305.1467	13.6609	225.3152
10	8	8	7000	3.742	1500	0	2	11.0	0.9541	11835.8857	530.4649	146.7648	19.2531	16.8	3.1245	11569.4463	62.5000	34.0489	331.8992
10	8	8	7000	3.742	1500	0	3	10.0	1.0119	11120.3027	388.9719	118.8128	25.9931	11.4	1.1289	10933.4609	419.3544	32.0993	190.4768
10	8	8	7000	3.742	1500	0	4	10.6	0.9051	11038.1074	541.9047	120.4992	26.8566	13.4	3.2213	10909.8232	439.5839	22.4326	190.0800
10	8	8	7000	3.742	1500	0	5	10.6	1.1289	11090.5918	489.4125	131.7632	29.8599	13.0	4.1587	11010.4395	409.0604	25.1184	181.2160
10	8	8	7000	3.742	1500	0	6	11.6	0.9659	11193.8145	436.2239	162.7136	89.5293	13.4	2.3174	11128.4346	58.6000	27.5735	206.4320
10	8	8	8000	3.906	1500	0	1	11.0	0.6746	10961.4424	462.4388	138.6896	46.0657	12.6	1.6247	10742.8965	305.1467	13.6609	225.3152
10	8	8	8000	3.906	1500	0	2	11.0	0.9541	11835.8857	530.4649	146.7648	19.2531	16.8	3.1245	11570.0137	62.5000	34.0489	329.9040
10	8	8	8000	3.906	1500	0	3	10.0	1.0119	11101.3965	370.2717	114.7840	25.8110	11.4	1.1289	10934.6660	415.5845	31.4751	186.8768
10	8	8	8000	3.906	1500	0	4	10.6	0.9051	11038.1074	541.9047	119.8464	26.8869	13.4	3.2213	10909.8232	439.5839	22.4326	189.9936
10	8	8	8000	3.906	1500	0	5	10.6	1.1289	11090.5918	489.4125	131.792	29.6808	13.0	4.1587	11010.6436	409.1910	25.1184	181.5296
10	8	8	8000	3.906	1500	0	6	11.6	0.9659	11204.5869	433.5159	161.7280	89.0069	13.6	2.2426	11129.0850	55.5000	26.8968	213.3568
10	8	8	9000	4.057	1500	0	1	11.0	0.6746	10947.8682	471.5144	86.3216	21.0722	12.6	1.6247	10725.6660	312.4394	13.6267	156.6352
10	8	8	9000	4.057	1500	0	2	11.0	0.9541	11842.6328	522.9736	147.2448	14.5768	16.2	3.5825	11544.8428	377.8914	36.0170	182.2624
10	8	8	9000	4.057	1500	0	3	10.0	1.0119	11126.9561	353.1017	82.4672	19.4315	11.4	1.1289	10957.7920	398.7800	31.3650	143.5952
10	8	8	9000	4.057	1500	0	4	10.6	0.9051	11074.4385	553.8986	85.1584	19.4315	11.4	3.2213	10944.3584	453.8076	25.8012	131.8080
10	8	8	9000	4.057	1500	0	5	10.8	1.0560	11098.3730	489.2792	164.4544	118.2206	13.2	4.0730	11017.6064	408.6010	23.9558	197.9776
10	8	8	9000	4.057	1500	0	6	11.6	0.9659	11231.5664	452.6643	164.0032	132.6886	13.6	2.2426	11160.5176	404.0293	27.1913	262.8672
10	8	8	10000	4.197	1500	0	1	11.0	0.6746	10983.1855	459.3878	86.5184	20.8678	12.6	1.6247	10723.6133	313.3362	13.6267	156.5816
10	8	8	10000	4.197	1500	0	2	11.2	1.0560	11881.6172	473.6721	101.7888	17.8806	15.8	3.1786	11586.7754	348.8083	32.6723	216.6208
10	8	8	10000	4.197	1500	0	3	10.0	1.0119	11125.7139	354.1439	81.8256	19.2732	11.4	1.1289	10940.7813	417.2024	31.4751	143.3120
10	8	8	10000	4.197	1500	0	4	10.4	0.6913	10979.5029	522.1942	78.4480	14.7139	11.6	2.0295	10890.5449	444.9854	21.5538	98.0544
10	8	8	10000	4.197	1500	0	5	10.6	1.1289	11061.6611	468.8643	89.7184	19.7231	12.8	3.4696	11000.6504	409.3961	30.0249	170.6208
10	8	8	10000	4.197	1500	0	6	11.6	0.9659	11204.5869	433.5159	121.4880	79.2069	13.6	2.2426	11126.9619	384.0513	26.8968	158.0928
10	8	8	1000	2	1500	80	1	3.4	0.6034	4694.4326	416.1696	43.0048	28.8305	3.4	0.6034	4694.4326	416.1696	54.1490	43.0048
10	8	8	1000	2	1500	80	2	3.4	0.6034	4945.8428	383.0933	50.9824	27.3039	3.4	0.6034	4945.8428	383.0933	48.3661	50.9824
10	8	8	1000	2	1500	80	3	3.4	0.6034	4853.3506	408.9148	38.4864	21.1113	3.4	0.6034	4853.3506	408.9148	45.1466	38.4864
10	8	8	1000	2	1500	80	4	3.4	0.6034	4778.6157	451.8916	42.8512	31.9836	3.4	0.6034	4778.6157	451.8916	39.9625	42.8512
10	8	8	1000	2	1500	80	5	3.4	0.6034	4788.8140	342.9705	42.8512	28.5401	3.4	0.6034	4788.8140	342.9705	43.1870	42.3264
10	8	8	1000	2	1500	80	6	3.8	0.7390	4971.8608	589.1138	55.7984	34.6750	3.8	0.7390	4971.8608	589.1138	68.9997	55.7984
10	8	8	2000	2.5	1500	80	1	3.0	0.0000	4176.3135	194.8555	23.8813	2.5005	3.0	0.0000	4176.3135	194.8555	19.1415	23.8813
10	8	8	2000	2.5	1500	80	2	3.0	0.0000	4577.8608	256.0804	31.3138	5.4124	3.2	0.4526	4570.3799	249.4031	20.4417	39.6810
10	8	8	2000	2.5	1500	80	3	3.2	0.4526	4492.4326	334.6625	40.1456	18.4788	3.2	0.4526	4492.4326	334.6625	37.4116	40.1456
10	8	8	2000	2.5	1500	80	4	3.0	0.0000	4346.8330	284.4207	27.3248	5.7443	3.2	0.4526	4346.8330	284.4207	33.9102	33.5460
10	8	8	2000	2.5	1500	80	5	3.2	0.4526	4470.7910	376.9183	37.3248	19.5364	3.4	0.6034	4451.4248	366.4979	38.8911	42.6464
10	8	8	2000	2.5	1500	80	6	3.0	0.0000	4322.6733	368.7419	27.3432	6.3699	3.0	0.0000	4322.6733	368.7419	37.0119	27.3432
10	8	8	3000	2.849	1500	80	1	3.0	0.0000	4024.3384	189.8137	25.3696	2.9317	4.2	1.8102	4016.4773	191.9505	10.7963	48.3264
10	8	8	3000	2.849	1500	80	2	3.0	0.0000	4292.8491	251.4472	33.3504	7.0870	3.4	0.6034	4260.7095	234.4281	27.1765	51.3856

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	Weighted		# of		Solve		F _{opr}	Weighted		# of		Solve time [sec]	±CI	±CI	
									±CI	@F _{min}	±CI	@F _{min}	±CI	[sec]		±CI	@F _{opr}	±CI	@F _{opr}				
10	8	8	3000	2.849	1500	80	3	3.0	0.0000	4131.1821	224.1804	48.5000	18.6752	30.0352	7.9210	4.0	1.8165	4120.6660	218.1358	40.0000	11.0801	53.6320	40.090
10	8	8	3000	2.849	1500	80	4	3.0	0.0000	4003.5806	284.7035	35.8000	21.1884	32.4736	7.8151	4.2	1.8102	3967.4478	257.7586	25.1000	13.6035	60.1088	45.303
10	8	8	3000	2.849	1500	80	5	3.2	0.4526	4192.9072	268.2132	50.7000	23.5565	37.5168	16.5794	4.0	1.3908	4160.0928	249.2454	35.4000	15.4546	56.8448	37.268
10	8	8	3000	2.849	1500	80	6	3.2	0.4526	4130.4814	217.9657	56.5000	23.8903	35.4048	21.4398	4.8	2.0739	4058.4407	166.5173	35.6000	16.9504	70.2912	47.409
10	8	8	4000	3.125	1500	80	1	3.2	0.4526	4008.6824	262.5438	32.7000	19.1022	28.8265	8.0528	4.6	2.4136	3924.7690	175.9909	20.1000	15.2294	100.4455	130.78
10	8	8	4000	3.125	1500	80	2	3.0	0.0000	4264.3252	268.6915	55.0000	29.5990	33.1112	7.7236	6.8	3.5345	4167.1133	216.5329	10.7000	8.6397	116.0398	71.047
10	8	8	4000	3.125	1500	80	3	3.0	0.0000	4120.9014	245.9821	41.0000	19.3094	30.0936	9.5257	4.6	1.6247	4081.6646	233.5302	18.1000	15.5619	70.1572	41.999
10	8	8	4000	3.125	1500	80	4	3.0	0.0000	4001.9426	266.5616	33.1000	22.5026	31.8056	7.5542	5.0	2.4324	3918.9519	203.9361	13.8000	15.9281	73.5632	51.268
10	8	8	4000	3.125	1500	80	5	3.2	0.4526	4136.7773	280.1649	44.1000	24.4206	39.2720	18.6940	4.6	2.6816	4061.6880	208.7795	24.1000	17.2671	147.3360	227.44
10	8	8	4000	3.125	1500	80	6	3.2	0.4526	3985.2915	276.3365	30.2000	20.3838	34.3648	19.6644	4.2	1.5384	3913.7036	227.1776	15.5000	10.2159	55.3448	37.952
10	8	8	5000	3.358	1500	80	1	3.2	0.4526	3986.3777	268.5555	29.0000	17.9379	28.3784	8.3627	4.6	2.4136	3925.1519	218.5834	16.8000	13.6801	102.0688	135.53
10	8	8	5000	3.358	1500	80	2	3.0	0.0000	4219.5142	289.1422	49.1000	31.8763	30.1098	6.2940	6.0	3.4564	4131.5522	224.2377	9.9000	8.3409	98.6322	70.860
10	8	8	5000	3.358	1500	80	3	3.0	0.0000	4079.0161	232.3503	34.5000	11.7006	28.9812	5.4591	4.0	1.2162	4057.9934	227.9553	20.7000	13.2287	58.1748	32.768
10	8	8	5000	3.358	1500	80	4	3.0	0.0000	3982.2097	262.2715	28.3000	20.5041	30.8624	7.5753	5.2	2.3804	3909.2883	216.5082	10.8000	14.5858	79.4600	52.326
10	8	8	5000	3.358	1500	80	5	3.2	0.4526	4125.4722	283.3882	41.8000	24.9697	40.3184	17.9482	4.8	2.4741	4054.7942	213.3267	18.6000	14.3077	142.2880	195.62
10	8	8	5000	3.358	1500	80	6	3.2	0.4526	3991.3716	275.0143	31.5000	20.5629	33.1568	19.0000	4.8	1.8414	3910.2493	226.8093	14.2000	15.0011	68.9360	45.389
10	8	8	6000	3.561	1500	80	1	3.2	0.4526	3963.0156	290.0927	26.4000	18.5036	29.2577	7.8035	5.2	2.5645	3901.4739	242.7247	9.8000	11.1914	114.2403	135.53
10	8	8	6000	3.561	1500	80	2	3.0	0.0000	4226.4971	284.7946	49.0000	32.0961	29.8858	5.2622	6.0	3.4564	4137.5059	220.3647	9.6000	7.6860	98.7780	71.231
10	8	8	6000	3.561	1500	80	3	3.0	0.0000	4047.3521	218.8336	26.3000	12.5308	29.5056	5.8979	3.4	0.9051	4033.0562	210.5963	20.9000	11.6675	39.6136	22.848
10	8	8	6000	3.561	1500	80	4	3.0	0.0000	3976.9473	254.5157	31.5000	21.6149	29.3648	7.1643	6.0	2.8820	3900.0371	219.5719	8.5000	14.2162	151.2096	160.52
10	8	8	6000	3.561	1500	80	5	3.2	0.4526	4111.6133	278.3411	39.8000	26.1885	40.5784	18.5066	4.2	2.2577	4045.7271	209.4375	25.1000	20.5274	129.3560	199.14
10	8	8	6000	3.561	1500	80	6	3.2	0.4526	3943.3765	280.1600	28.6000	20.4740	35.6560	23.5443	4.6	1.7592	3875.6821	236.6073	12.0000	12.0066	68.9272	44.994
10	8	8	7000	3.742	1500	80	1	3.2	0.4526	3983.2710	267.3913	28.9000	17.8120	28.2422	8.2822	4.6	2.4136	3922.7349	217.5418	16.8000	13.7133	102.1346	135.66
10	8	8	7000	3.742	1500	80	2	3.0	0.0000	4221.7109	290.7601	48.9000	31.7225	30.0280	6.3146	6.0	3.4564	4131.0381	223.7459	9.9000	8.3409	98.8284	71.071
10	8	8	7000	3.742	1500	80	3	3.0	0.0000	4076.1934	225.1989	33.4000	11.4249	29.1364	5.6869	3.6	0.9659	4051.4316	222.6348	22.8000	12.2356	47.3060	27.266
10	8	8	7000	3.742	1500	80	4	3.0	0.0000	3977.2690	263.6995	28.2000	20.4368	30.8312	7.6050	6.0	2.6345	3903.5090	218.7203	8.3000	14.2952	93.8976	53.651
10	8	8	7000	3.742	1500	80	5	3.2	0.4526	4117.6675	279.7330	41.5000	25.1659	40.4432	18.3400	4.2	2.2577	4051.7817	212.3552	26.8000	19.9322	128.1536	196.50
10	8	8	7000	3.742	1500	80	6	3.2	0.4526	3995.3223	271.1734	32.3000	20.5679	33.2208	18.9421	4.8	1.8414	3914.4673	223.1226	14.5000	15.1762	68.8736	45.265
10	8	8	8000	3.906	1500	80	1	3.2	0.4526	3983.2710	267.3913	28.9000	17.8120	28.2627	8.3361	4.6	2.4136	3922.7349	217.5418	16.8000	13.7133	101.3235	134.30
10	8	8	8000	3.906	1500	80	2	3.0	0.0000	4217.9316	285.8531	48.8000	31.6441	30.0948	6.3730	6.0	3.4564	4131.0381	223.7459	9.9000	8.3409	98.9832	71.335
10	8	8	8000	3.906	1500	80	3	3.0	0.0000	4061.4387	217.8559	30.5000	12.7165	28.5976	6.0578	3.6	0.9659	4036.6770	214.2363	19.9000	12.0796	46.8124	27.604
10	8	8	8000	3.906	1500	80	4	3.0	0.0000	3977.2690	263.6995	28.2000	20.4368	30.8040	7.5909	6.0	2.6345	3903.5090	218.7203	8.3000	14.2952	93.8536	53.711
10	8	8	8000	3.906	1500	80	5	3.2	0.4526	4117.6675	279.7330	41.5000	25.1659	40.4856	18.4348	4.2	2.2577	4051.7817	212.3552	26.8000	19.9322	129.5000	199.65
10	8	8	8000	3.906	1500	80	6	3.2	0.4526	3995.3223	271.1734	32.3000	20.5679	33.2352	18.9865	4.8	1.8414	3914.4673	223.1226	14.5000	15.1762	68.3800	44.773
10	8	8	9000	4.057	1500	80	1	3.2	0.4526	3983.2710	267.3913	28.9000	17.8120	28.2173	8.2750	4.6	2.4136	3922.7349	217.5418	16.8000	13.7133	101.7439	134.91
10	8	8	9000	4.057	1500	80	2	3.0	0.0000	4221.7842	286.9707	48.7000	31.5924	30.1154	6.3805	6.0	3.4564	4131.6733	223.9387	9.9000	8.3409	98.7082	70.835
10	8	8	9000	4.057	1500	80	3	3.0	0.0000	4061.4387	217.8559	30.5000	12.7165	28.6256	6.0476	3.6	0.9659	4036.6770	214.2363	19.9000	12.0796	46.8628	27.621
10	8	8	9000	4.057	1500	80	4	3.0	0.0000	3967.1145	254.7870	28.8000	21.1992	30.7904	7.5548	5.2	2.3804	3904.7930	217.9680	10.8000	14.5858	79.5976	52.454
10	8	8	9000	4.057	1500	80	5	3.2	0.4526	4098.7803	268.2719	38.1000	23.5623	40.4784	18.737	4.2	2.2577	4046.3000	211.0100	26.7000	19.9415	128.0352	196.28
10	8	8	9000	4.057	1500	80	6	3.2	0.4526	3995.3223	271.1734	32.3000	20.5679	33.2472	19.0277	4.8	1.8414	3914.4673	223.1226	14.5000	15.1762	68.9464	45.371
10	8	8	10000	4.197	1500	80	1	3.2	0.4526	3970.4246	261.5645	26.1000	17.4049	24.2492	6.6703	4.6.							

Table C.11: Comparison of fiber-bifurcation-based heuristics without the optical-reach customization for the EON network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	1000	2	500	0	1	3.8	0.7390	13247.2998	916.8071	105.6369	62.4749	31.1637	3.8	0.7390	13247.2998	916.8071	105.6369	62.4749	31.163
10	8	8	1000	2	500	0	2	3.4	0.6034	13381.5000	637.5978	788.6000	59.4781	22.4267	3.4	0.6034	13381.5000	637.5978	788.6000	59.4781	22.426
10	8	8	1000	2	500	0	3	4.0	0.7543	13344.5000	887.2719	717.8000	69.5094	25.9783	4.0	0.7543	13344.5000	887.2719	717.8000	69.5094	25.978
10	8	8	1000	2	500	0	4	3.8	0.7390	13628.7998	710.9341	789.1000	58.9355	29.4684	3.8	0.7390	13628.7998	710.9341	789.1000	58.9355	29.468
10	8	8	1000	2	500	0	5	3.6	0.6913	12800.5996	811.2733	677.9000	85.1112	36.1388	3.6	0.6913	12800.5996	811.2733	677.9000	85.1112	36.138
10	8	8	1000	2	500	0	6	4.2	0.7390	14125.5996	559.7343	844.3000	58.8066	38.8817	4.2	0.7390	14125.5996	559.7343	844.3000	58.8066	38.881
10	8	8	2000	2.5	500	0	1	4.2	0.7390	11934.7998	741.2302	266.4000	63.4516	76.2954	4.2	0.7390	11934.7998	741.2302	266.4000	63.4516	76.2954
10	8	8	2000	2.5	500	0	2	3.6	0.6913	12450.0996	693.0638	328.1000	51.6268	69.5142	3.6	0.6913	12450.0996	693.0638	328.1000	51.6268	69.5142
10	8	8	2000	2.5	500	0	3	3.8	0.7390	11841.0996	596.5339	258.7000	52.0708	29.8745	3.8	0.7390	11841.0996	596.5339	258.7000	52.0708	29.874
10	8	8	2000	2.5	500	0	4	4.0	0.7543	12444.9004	949.2932	320.3000	91.6465	68.1632	5.0	2.2375	12398.5996	889.7153	304.0000	73.5316	65.117
10	8	8	2000	2.5	500	0	5	3.6	0.6913	11734.2002	907.0121	252.5000	82.1638	62.0024	3.6	0.6913	11734.2002	907.0121	252.5000	82.1638	62.0024
10	8	8	2000	2.5	500	0	6	4.6	0.6034	12910.9004	570.4464	357.2000	48.7095	21.6963	4.6	0.6034	12910.9004	570.4464	357.2000	48.7095	21.696
10	8	8	3000	2.849	500	0	1	4.2	0.7390	11418.0332	473.0032	110.7000	34.1603	80.7644	6.0	2.5466	11303.7275	365.2964	88.4000	16.2373	76.803
10	8	8	3000	2.849	500	0	2	4.0	0.7543	12243.6719	423.1789	185.4000	33.1703	84.0548	6.2	2.9561	11994.3574	281.4817	140.2000	27.3385	266.9752
10	8	8	3000	2.849	500	0	3	4.0	0.7543	11337.7344	449.0396	105.1000	23.5695	81.0040	4.4	1.1782	11261.6436	335.5835	94.6000	12.9512	40.359
10	8	8	3000	2.849	500	0	4	3.8	0.7390	11935.7715	641.4374	170.8000	45.6105	62.9728	6.4	3.0208	11547.9629	323.0331	118.7000	21.0922	137.9344
10	8	8	3000	2.849	500	0	5	4.2	0.7390	11673.4463	686.6960	122.9000	52.8907	89.3296	5.2	1.8414	11532.8662	550.7538	100.7000	28.2800	109.0072
10	8	8	3000	2.849	500	0	6	5.0	0.0000	12298.0752	255.2673	173.5000	27.2101	101.9984	9.8	2.0462	11994.5410	179.3666	118.1000	14.8051	240.0832
10	8	8	4000	3.125	500	0	1	4.4	0.6913	11551.4004	421.2108	78.9000	31.2017	84.431	8.6	2.7651	11175.5254	213.6338	19.1000	12.8021	305.3512
10	8	8	4000	3.125	500	0	2	3.8	0.7390	12431.7500	531.7995	154.7000	38.7278	76.9744	11.4	1.3151	11057.7754	190.8885	10.0000	3.6641	135.4716
10	8	8	4000	3.125	500	0	3	4.0	0.7543	11501.0498	349.1031	68.5000	15.5831	76.2068	7.0	3.2529	11335.7500	263.3859	34.6000	18.4420	165.2956
10	8	8	4000	3.125	500	0	4	4.6	0.6034	12140.5752	433.6780	114.3000	34.9310	90.8864	11.2	1.2531	11157.3496	231.2197	9.0000	1.6866	284.3552
10	8	8	4000	3.125	500	0	5	3.8	0.7390	11650.1250	598.4688	131.8000	29.4575	70.7808	6.8	2.4741	11358.3252	286.3916	27.9000	12.3865	159.3040
10	8	8	4000	3.125	500	0	6	4.8	0.4526	12397.7754	226.9745	103.8000	20.9182	92.5248	10.4	1.7912	11422.7754	237.7849	11.2000	3.4859	259.1392
10	8	8	5000	3.358	500	0	1	4.4	0.6913	11853.0898	383.1945	70.7000	27.5670	85.3125	8.4	2.8662	11486.3643	219.5273	13.4000	14.9456	311.1219
10	8	8	5000	3.358	500	0	2	4.0	0.7543	12930.8838	519.0037	157.5000	37.7642	84.7406	11.0	1.9081	11904.8027	190.5428	1.0000	2.2628	302.0252
10	8	8	5000	3.358	500	0	3	4.0	0.7543	11955.9316	295.6501	74.4000	24.6219	77.1704	8.0	3.2529	11636.3418	198.3048	23.1000	18.4890	200.0548
10	8	8	5000	3.358	500	0	4	4.8	0.4526	12481.1318	490.3096	105.5000	40.4750	98.7152	11.8	1.3826	11416.5166	223.6467	0.0000	0.0000	416.5808
10	8	8	5000	3.358	500	0	5	3.8	0.7390	12090.4355	729.1124	91.0000	53.2803	72.6328	6.0	2.9599	11690.6523	280.0397	32.9000	19.9854	251.0776
10	8	8	5000	3.358	500	0	6	5.0	0.0000	12507.7969	172.5661	103.2000	16.1375	95.8320	10.6	1.3151	11702.0049	215.6505	1.8000	2.4741	263.1504
10	8	8	6000	3.561	500	0	1	4.4	0.6913	12308.4980	362.3275	81.4000	28.4548	84.1255	8.6	2.6816	11829.8564	205.9972	12.0000	14.3387	317.7997
10	8	8	6000	3.561	500	0	2	4.0	0.7543	13231.6221	567.6150	149.7000	41.3163	82.5008	11.0	1.9081	12213.3535	208.8329	1.0000	2.2628	301.9352
10	8	8	6000	3.561	500	0	3	4.0	0.7543	12176.6084	296.6085	67.7000	18.8142	72.7060	8.0	3.0358	11937.4561	159.2756	21.2000	19.7286	193.6424
10	8	8	6000	3.561	500	0	4	4.6	0.6034	12756.2100	516.5164	102.1000	40.5146	90.7944	11.6	1.3577	11715.9941	232.8697	0.0000	0.0000	407.5456
10	8	8	6000	3.561	500	0	5	4.0	0.7543	12541.8643	806.6730	99.7000	66.3956	79.9152	6.2	2.0462	11971.9863	296.3464	21.3000	12.0965	141.2256
10	8	8	6000	3.561	500	0	6	5.0	0.0000	12843.0176	168.3597	103.7000	17.0703	96.5440	10.6	1.6247	12019.3154	241.8878	4.6000	4.0506	262.3872
10	8	8	7000	3.742	500	0	1	4.4	0.6913	12573.9404	402.6353	78.6000	30.2439	83.1861	8.2	2.7979	12088.9824	221.6563	14.4000	14.6029	304.4406
10	8	8	7000	3.742	500	0	2	4.0	0.7543	13559.6924	588.7278	150.1000	41.2714	82.5282	11.0	1.9081	12485.5664	202.1831	1.0000	2.2628	302.2768
10	8	8	7000	3.742	500	0	3	4.0	0.7543	12531.4922	320.4036	71.4000	24.9250	72.7060	7.6	3.0208	12221.1719	145.4960	22.4000	18.1403	185.1840
10	8	8	7000	3.742	500	0	4	4.6	0.6034	13022.5576	506.9990	99.2000	39.9352	91.9584	11.4	1.4780	11976.4482	243.2318	0.0000	0.0000	404.1936
10	8	8	7000	3.742	500	0	5	4.0	0.7543	12717.5742	884.8295	90.3000	63.8607	80.0744	5.8	2.1546	12298.4580	311.3954	30.6000	13.5816	127.0016
10	8	8	7000	3.742	500	0	6	5.0	0.0000	13132.0576	174.0913	102.5000	16.0719	96.5408	10.0	1.6866	12278.2754	229.3959	4.8000	4.5730	244.7600
10	8	8	8000	3.906	500	0	1	4.4	0.6913	12845.6309	410.6335	78.6000	30.2439	83.2174	8.2	2.7979	12339.2686	224.0152	14.4000	14.6029	304.5782
10	8	8	8000	3.906	500	0	2	4.0	0.7543	13858.0371	597.5544	150.2000	41.3545	82.4836	11.0	1.9081	12735.3438	202.2460	1.0000	2.2628	301.9352
10	8	8	8000	3.906	500	0	3	4.0	0.7543	12803.1504	325.5778	71.4000	24.9250	75.1360	8.0	3.2529	12477.0186	150.2247	21.6000	18.5865	199.9320
10	8	8	8000	3.906	500	0	4	4.6	0.6034	13301.5879	516.4803	99.2000	39.9352	91.8896	11.4	1.4780	12221.6436	247.8370	0.0000	0.0000	402.6920
10	8	8	8000	3.906	500	0	5	4.0	0.7543	13048.4561	905.8414	90.3000	63.8607	79.9416	5.8	2.1546	12556.6377	313.2209	30.6000	13.5816	127.0016

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	Weighted		# of OEOs	Solve		F _{opr}	Weighted		# of OEOs	Solve					
									±CI	port count @F _{min}		±CI	time [sec]		±CI	port count @F _{opr}		±CI	time [sec]				
10	8	8	8000	3.906	500	0	6	5.0	0.0000	13410.4873	178.5073	102.5000	16.0719	96.4912	11.5547	10.4	1.5160	12550.9189	238.6946	2.8000	3.0321	257.4192	47.998
10	8	8	9000	4.057	500	0	1	4.4	0.6913	13109.3252	410.6936	79.2000	30.0374	61.5566	19.5563	8.6	2.5061	12566.1934	220.1707	9.5000	10.4798	242.7390	274.04
10	8	8	9000	4.057	500	0	2	4.0	0.7543	14123.9238	613.1335	149.9000	41.3980	62.0480	18.3568	11.0	1.9081	12963.9277	211.6571	1.0000	2.2628	195.3438	36.689
10	8	8	9000	4.057	500	0	3	4.0	0.7543	13055.4336	327.7914	71.2000	24.8166	56.1336	21.2305	8.8	3.0508	12710.6689	154.5113	17.5000	18.4669	151.1760	60.399
10	8	8	9000	4.057	500	0	4	4.6	0.6034	13477.9346	497.1618	92.7000	34.9424	67.0200	17.4688	10.8	1.2531	12453.9707	244.8930	0.0000	0.0000	173.9692	24.710
10	8	8	9000	4.057	500	0	5	4.0	0.7543	13323.2471	920.2625	91.2000	63.4162	61.6864	23.3071	7.6	2.9445	12807.2041	318.6919	22.0000	14.6643	231.8696	285.57
10	8	8	9000	4.057	500	0	6	5.0	0.0000	13657.3564	194.0952	102.2000	16.1867	69.8176	8.6885	10.4	1.5160	12752.3203	238.6064	2.7000	2.9026	166.3936	31.053
10	8	8	10000	4.197	500	0	1	4.4	0.6913	13343.6426	419.7370	79.2000	30.0374	61.4613	19.4950	9.0	2.4324	12788.1426	230.0861	7.9000	10.8594	247.4469	272.73
10	8	8	10000	4.197	500	0	2	4.2	0.7390	14468.0469	628.7880	150.0000	43.1725	67.9746	19.1293	10.4	1.7912	13193.0732	232.2811	1.4000	2.3418	181.0522	34.619
10	8	8	10000	4.197	500	0	3	4.2	0.7390	13331.7939	438.5616	69.6000	22.6205	61.0880	19.6603	8.0	3.5857	12958.1611	235.7309	25.2000	21.1401	238.7080	283.70
10	8	8	10000	4.197	500	0	4	4.6	0.6034	13715.6270	581.8533	96.8000	42.5278	67.4704	17.1812	10.8	2.0739	12656.2539	245.7374	0.5000	1.1314	283.2548	264.72
10	8	8	10000	4.197	500	0	5	4.0	0.7543	13592.5527	949.4827	93.5000	63.3484	61.0528	23.2626	6.8	2.2828	12997.9307	311.8437	20.4000	11.3700	106.4696	43.567
10	8	8	10000	4.197	500	0	6	4.8	0.4526	13941.2998	186.1026	108.3000	16.0854	65.8544	12.1513	10.4	1.5160	12961.7061	242.7952	2.7000	2.9026	166.1928	30.826
10	8	8	1000	2	500	80	1	1.0	0.0000	3459.3999	221.5168	180.8000	18.6311	15.6032	5.7036	1.0	0.0000	3459.3999	221.5168	180.8000	18.6311	15.6032	5.7036
10	8	8	1000	2	500	80	2	1.0	0.0000	3709.8999	212.1797	200.7000	16.8894	15.5584	4.7786	1.2	0.4526	3700.8999	215.4935	199.1000	17.4147	16.3840	6.2597
10	8	8	1000	2	500	80	3	1.2	0.4526	3629.6001	362.9563	190.6000	30.0552	14.6272	5.1071	1.2	0.4526	3629.6001	362.9563	190.6000	30.0552	14.6272	5.1071
10	8	8	1000	2	500	80	4	1.0	0.0000	3679.3000	283.6553	211.6000	33.3328	17.2704	5.1176	1.0	0.0000	3679.3000	283.6553	211.6000	33.3328	17.2704	5.1176
10	8	8	1000	2	500	80	5	1.0	0.0000	3460.6001	169.8766	176.5000	11.6714	14.1408	5.9340	1.0	0.0000	3460.6001	169.8766	176.5000	11.6714	14.1408	5.9340
10	8	8	1000	2	500	80	6	1.0	0.0000	3666.2000	301.1846	205.9000	29.4727	13.9360	5.5126	1.0	0.0000	3666.2000	301.1846	205.9000	29.4727	13.9360	5.5126
10	8	8	2000	2.5	500	80	1	1.0	0.0000	3448.8000	203.7265	81.7000	10.8311	22.4376	10.8311	1.0	0.0000	3448.8000	203.7265	81.7000	10.8311	22.4376	10.512
10	8	8	2000	2.5	500	80	2	1.0	0.0000	3594.2000	188.8572	89.8000	22.8273	17.2953	2.2343	1.0	0.0000	3594.2000	188.8572	89.8000	22.8273	17.2953	2.2343
10	8	8	2000	2.5	500	80	3	1.0	0.0000	3430.7000	176.7971	70.2000	10.1407	18.2562	4.2538	1.0	0.0000	3430.7000	176.7971	70.2000	10.1407	18.2562	4.2538
10	8	8	2000	2.5	500	80	4	1.2	0.4526	3593.8999	285.6759	86.4000	15.4546	23.6249	6.1234	1.0	0.4526	3593.8999	285.6759	86.4000	15.4546	23.6249	6.1234
10	8	8	2000	2.5	500	80	5	1.2	0.4526	3490.5000	237.6677	75.8000	20.3894	18.9938	4.8535	1.2	0.4526	3490.5000	237.6677	75.8000	20.3894	18.9938	4.8535
10	8	8	2000	2.5	500	80	6	1.0	0.0000	3543.7000	232.2117	83.8000	19.3912	13.7578	2.2778	1.0	0.0000	3543.7000	232.2117	83.8000	19.3912	13.7578	2.2778
10	8	8	3000	2.849	500	80	1	1.0	0.0000	3263.0110	215.8801	26.5000	10.5285	16.8768	6.1981	1.6	0.6913	3249.2642	210.8319	19.0000	7.9179	21.0048	8.6991
10	8	8	3000	2.849	500	80	2	1.0	0.0000	3412.7231	217.4055	20.1395	20.2395	20.2560	4.1772	1.4	0.6034	3393.3091	203.7311	25.9000	6.6908	22.6432	6.6063
10	8	8	3000	2.849	500	80	3	1.0	0.0000	3382.1340	194.2763	32.1000	8.6028	21.5680	5.1314	1.4	0.6034	3367.9604	204.5397	26.2000	8.6183	22.9888	6.5876
10	8	8	3000	2.849	500	80	4	1.0	0.0000	3302.0513	215.1384	32.9000	11.9184	23.0592	3.8134	1.6	0.6913	3292.2231	215.6565	29.2000	12.9010	25.9904	3.7975
10	8	8	3000	2.849	500	80	5	1.2	0.4526	3355.7722	190.5957	26.5000	8.2019	19.7248	5.4302	1.6	0.9659	3346.1987	184.4207	24.6000	8.4678	26.9440	17.003
10	8	8	3000	2.849	500	80	6	1.0	0.0000	3366.3821	233.1215	36.1000	15.1845	14.1312	2.8722	1.6	0.6913	3301.2319	211.5505	25.8000	8.4247	19.9808	7.8895
10	8	8	4000	3.125	500	80	1	1.0	0.0000	3298.8999	235.3892	19.0000	9.3964	17.8205	5.9367	2.6	1.1289	3225.0500	190.0538	5.5000	3.6369	38.1110	18.203
10	8	8	4000	3.125	500	80	2	1.0	0.0000	3482.3999	180.1759	33.2000	18.0511	18.9267	3.9613	2.0	0.7543	3416.0000	176.8898	9.5000	7.7453	26.4375	8.4621
10	8	8	4000	3.125	500	80	3	1.0	0.0000	3449.0750	212.6234	22.6000	8.9639	21.6298	6.1490	1.8	1.0006	3425.1499	203.8988	13.0000	6.6099	32.3140	16.856
10	8	8	4000	3.125	500	80	4	1.0	0.0000	3341.8250	205.4807	22.5000	8.8621	24.7016	5.7042	2.6	0.9051	3263.5000	197.4132	7.3000	9.7998	38.3377	11.214
10	8	8	4000	3.125	500	80	5	1.2	0.4526	3417.6499	169.7630	22.3000	11.2788	18.7404	5.4855	2.0	1.0119	3390.1001	175.0472	11.1000	6.9165	30.9843	17.039
10	8	8	4000	3.125	500	80	6	1.0	0.0000	3440.5249	228.8902	33.4000	12.4814	15.1437	2.8551	3.0	1.1685	3259.5750	166.5535	6.0000	5.5835	44.4404	22.545
10	8	8	5000	3.358	500	80	1	1.0	0.0000	3389.1226	218.7320	17.2000	9.5215	17.4251	6.1376	2.2	1.0006	3309.4348	164.5412	6.1000	5.3168	29.8890	12.708
10	8	8	5000	3.358	500	80	2	1.0	0.0000	3597.6558	196.2375	30.9000	18.3376	19.2627	3.9964	2.2	0.7390	3508.2446	191.0646	5.0000	6.5233	28.8953	8.9312
10	8	8	5000	3.358	500	80	3	1.0	0.0000	3556.7356	226.4747	22.5000	8.6410	21.5249	6.1409	2.0	1.2162	3513.6528	212.8582	11.8000			

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	
10	8	8	7000	3.742	500	80	1	1.0	0.0000	3579.7695	247.3409	18.2000	9.6285	17.4844	2.6	1.1289	3470.6226	177.1078	5.4000	5.4827	37.4704	
10	8	8	7000	3.742	500	80	2	1.0	0.0000	3773.8809	208.8182	31.1000	18.1003	19.0547	2.2	0.7390	3666.3281	199.8345	5.2000	6.3087	28.8517	
10	8	8	7000	3.742	500	80	3	1.0	0.0000	3739.5137	244.2450	23.9000	9.2034	21.2751	2.0	1.2162	3688.0664	228.0491	12.5000	8.4816	37.7141	
10	8	8	7000	3.742	500	80	4	1.0	0.0000	3562.8113	225.9922	18.0000	7.0916	21.7829	2.4	0.9659	3491.9680	206.8152	4.8000	5.9179	35.4202	
10	8	8	7000	3.742	500	80	5	1.2	0.4526	3709.8140	201.5630	21.1000	12.5779	18.8326	2.0	1.0119	3637.1829	185.4524	8.3000	6.9543	30.9390	
10	8	8	7000	3.742	500	80	6	1.0	0.0000	3742.9360	277.2679	34.0000	10.3638	14.7249	3.4	0.9051	3509.1616	202.2936	1.0000	2.2628	50.2406	
10	8	8	8000	3.906	500	80	1	1.0	0.0000	3647.9063	255.3536	17.3000	9.2071	17.4093	2.6	1.1289	3538.0437	180.4938	5.4000	5.4827	37.4452	
10	8	8	8000	3.906	500	80	2	1.0	0.0000	3851.2625	214.3643	31.1000	18.1003	19.0391	2.2	0.7390	3736.6750	204.7584	5.2000	6.3087	28.6453	
10	8	8	8000	3.906	500	80	3	1.0	0.0000	3815.2188	249.9547	23.9000	9.2034	21.2673	2.0	1.2162	3760.6812	232.7704	12.5000	8.4816	37.7548	
10	8	8	8000	3.906	500	80	4	1.0	0.0000	3634.5063	230.9398	18.0000	7.0916	21.7611	2.4	0.9659	3559.4875	211.5546	4.8000	5.9179	35.3906	
10	8	8	8000	3.906	500	80	5	1.2	0.4526	3784.5000	206.5529	21.1000	12.5779	18.8201	2.0	1.0119	3708.4500	190.0839	8.3000	6.9543	30.9670	
10	8	8	8000	3.906	500	80	6	1.0	0.0000	3782.0249	262.5906	30.8000	11.9391	14.7733	3.2	1.0560	3556.2625	191.1600	1.0000	2.5061	48.0579	
10	8	8	9000	4.057	500	80	1	1.0	0.0000	3714.2383	260.9446	17.3000	9.2071	17.4047	2.6	1.1289	3599.9673	183.6088	5.4000	5.4827	37.3782	
10	8	8	9000	4.057	500	80	2	1.0	0.0000	3935.3145	229.0737	31.4000	18.6323	19.0531	2.2	0.7390	3801.2859	209.3077	5.2000	6.3087	28.7156	
10	8	8	9000	4.057	500	80	3	1.0	0.0000	3884.7507	255.2039	23.9000	9.2034	21.8188	2.2	1.2068	3821.2153	237.1222	11.3000	8.9439	39.8659	
10	8	8	9000	4.057	500	80	4	1.0	0.0000	3697.8208	232.7059	17.6000	6.7563	21.8188	2.4	0.9659	3621.5020	215.9295	4.8000	5.9179	35.3734	
10	8	8	9000	4.057	500	80	5	1.2	0.4526	3883.9395	237.3241	25.2000	11.9200	18.8500	2.2	1.0006	3782.1492	202.7094	9.1000	8.2861	33.1671	
10	8	8	9000	4.057	500	80	6	1.0	0.0000	3851.2251	268.3663	30.8000	11.9391	14.8547	3.2	1.0560	3616.7065	195.0153	1.0000	2.5061	48.1905	
10	8	8	10000	4.197	500	80	1	1.0	0.0000	3779.6216	265.3483	17.3000	9.2071	21.7833	2.8	1.0560	3659.0542	186.5733	3.1000	3.3298	46.0894	
10	8	8	10000	4.197	500	80	2	1.0	0.0000	3996.7710	230.2111	31.5000	18.8117	23.7853	2.2	0.7390	3861.1953	213.5476	5.2000	6.3087	33.4026	
10	8	8	10000	4.197	500	80	3	1.0	0.0000	3962.9146	246.4485	25.0000	8.4665	26.0049	6.7403	2.4	1.1782	3900.1484	229.5143	9.9000	8.8826	44.9105
10	8	8	10000	4.197	500	80	4	1.0	0.0000	3758.7935	236.8320	17.6000	6.7563	27.4351	2.4	0.9659	3679.3032	219.8523	4.8000	5.9179	41.3280	
10	8	8	10000	4.197	500	80	5	1.2	0.4526	3926.0559	214.5635	22.8000	12.5886	22.5956	2.0	1.0119	3839.1965	200.7034	9.7000	8.0182	36.0545	
10	8	8	10000	4.197	500	80	6	1.0	0.0000	3916.8921	290.3616	29.6000	12.0925	17.7658	3.2	1.0560	3666.3345	200.2589	1.0000	1.5458	51.0353	
10	8	8	1000	2	1500	0	1	9.6	0.6913	14033.2998	557.4164	686.1000	70.7249	87.2584	9.6	0.6913	14033.2998	557.4164	686.1000	70.7249	87.2584	
10	8	8	1000	2	1500	0	2	9.6	0.6913	14056.9004	771.8396	687.2000	97.0578	109.8016	9.8	0.7390	14037.0996	764.7582	682.9000	94.4144	111.1768	
10	8	8	1000	2	1500	0	3	9.8	0.7390	13937.2002	600.5553	687.9000	87.0814	102.5888	10.0	0.7543	13919.2998	605.9697	658.4000	86.7739	108.1984	
10	8	8	1000	2	1500	0	4	9.6	0.6913	14291.7998	549.7975	734.7000	75.2024	100.9520	10.0	0.7543	14270.7002	558.8983	722.0000	80.6747	105.7344	
10	8	8	1000	2	1500	0	5	9.4	0.6034	13789.7998	394.8627	647.9000	56.0277	99.4672	9.4	0.6034	13789.7998	394.8627	647.9000	56.0277	99.4672	
10	8	8	1000	2	1500	0	6	9.6	0.6913	14621.5996	696.6555	806.8000	102.5998	90.9536	10.0	0.7543	14516.7998	728.4352	769.9000	107.4350	103.2288	
10	8	8	2000	2.5	1500	0	1	10.8	0.4526	12713.4004	509.3883	214.9000	40.6113	144.8297	11.2	0.8124	12703.7998	510.4576	207.4000	38.7457	198.4397	
10	8	8	2000	2.5	1500	0	2	10.6	1.4780	13250.2998	868.3964	268.0000	70.4239	287.9984	11.0	1.5085	13190.5000	894.1347	256.0000	75.1691	300.6016	
10	8	8	2000	2.5	1500	0	3	9.8	0.7390	12636.7998	593.0550	197.8000	49.5490	122.8368	10.0	1.0119	12621.2002	573.8127	189.2000	38.6171	177.5024	
10	8	8	2000	2.5	1500	0	4	10.6	1.1289	12886.9004	814.3555	235.7000	72.5315	121.9008	10.6	1.1289	12886.9004	814.3555	235.7000	72.5315	211.9008	
10	8	8	2000	2.5	1500	0	5	10.6	0.6034	12711.7998	584.4660	203.0000	46.2855	137.6288	10.8	0.8124	12703.7998	590.3759	202.0000	46.4879	186.6592	
10	8	8	2000	2.5	1500	0	6	11.0	0.9541	13202.4004	713.4608	259.0000	64.4910	190.7968	11.4	1.3151	13163.5996	663.7433	247.5000	48.0717	253.9456	
10	8	8	3000	2.849	1500	0	1	11.4	0.9051	12572.9707	501.8962	101.2000	30.2883	238.5779	13.0	1.6525	12416.2393	434.2891	73.6000	22.0087	301.0403	
10	8	8	3000	2.849	1500	0	2	11.0	1.1685	13460.5703	460.9590	184.1000	29.3024	209.1872	13.0	2.5242	13287.3701	484.5273	146.1000	28.1982	307.8032	
10	8	8	3000	2.849	1500	0	3	10.4	0.9659	12535.0469	300.4255	84.5000	19.5852	139.9728	11.0	0.6746	12456.2832	333.5758	70.6000	22.2682	149.2784	
10	8	8	3000	2.849	1500	0	4	10.6	1.1289	12844.0625	743.9805	121.5000	48.3584	133.5648	14.2	6.5128	12585.7451	633.5792	85.2000	28.1586	344.4224	
10	8	8	3000	2.849	1500	0	5	10.8	1.0560	12863.5781	581.9127	120.3000	37.8782	145.3344	12.6	2.3174	12784.5107	566.0892	101.7000	27.0840	190.6304	
10	8	8	3000	2.849	1500	0	6	12.0	0.7543	12978.5625	404.4775	129.4000	32.0769	157.5552	13.2	1.8414	12883.4053	373.3774	115.7000	25.8722	298.4192	
10	8	8	4000	3.125	1500	0	1	11.6	0.9659	12882.1250	603.8016	77.8000	37.0441	212.9749	14.8	4.8390	12571.8496	317.4079	39.6000	9.5060	387.0143	
10	8	8	40																			

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	Weighted			# of OEOs @F _{min}	Solve			Weighted			# of OEOs @F _{opt}	Solve			
								F _{min}	±CI	port count @F _{min}		±CI	F _{min}	±CI	time [sec]	F _{opt}	±CI		port count @F _{opt}	±CI	F _{opt}	±CI
10	8	8	5000	3.358	1500	0	2	11.2	1.0560	14288.7402	504.8758	155.7000	36.5342	297.1728	180.7403	27.2	5.7025	13427.5410	306.3146	13.3826	746.7264	235.69
10	8	8	5000	3.358	1500	0	3	10.6	0.9051	13353.7090	518.2960	66.2000	27.2342	181.2384	123.8404	18.8	7.4956	13095.8252	353.2305	18.6000	15.1197	378.0912
10	8	8	5000	3.358	1500	0	4	11.0	1.1685	13724.5967	710.3740	108.2000	46.8448	249.4688	147.3298	24.6	8.3664	13002.9492	301.1762	12.9000	11.6236	703.5968
10	8	8	5000	3.358	1500	0	5	10.6	0.9051	13545.2314	659.3127	86.1000	40.2144	144.8352	32.3406	16.8	5.0236	13049.6416	335.7180	21.7000	17.5890	333.4784
10	8	8	5000	3.358	1500	0	6	11.4	1.1289	13794.2998	703.4805	113.6000	46.9181	143.0976	31.7181	21.6	7.1411	13054.0967	302.6856	17.9000	15.6530	500.2944
10	8	8	6000	3.561	1500	0	1	11.6	0.9659	13664.4326	521.7686	70.2000	31.2224	140.0915	28.7544	22.6	6.6374	13283.4580	329.5054	10.7000	11.9498	427.1518
10	8	8	6000	3.561	1500	0	2	11.2	1.2531	14900.4795	775.1064	166.2000	42.9458	355.0008	216.6469	27.0	6.7799	13811.1406	308.6066	14.1000	20.6683	622.0400
10	8	8	6000	3.561	1500	0	3	10.6	0.9051	13842.6563	474.3524	78.1000	22.1305	184.3696	120.7148	21.6	6.9473	13546.9639	381.6381	14.1000	12.8065	440.4992
10	8	8	6000	3.561	1500	0	4	11.0	1.1685	14124.3652	836.5217	103.0000	55.0315	262.7392	170.6147	19.0	7.2972	13271.8984	391.5990	14.5000	9.4643	352.4704
10	8	8	6000	3.561	1500	0	5	11.2	1.0560	14030.9004	579.8258	89.7000	29.8269	149.0144	30.6445	19.4	5.3885	13625.3926	355.7709	18.6000	12.1629	410.8351
10	8	8	6000	3.561	1500	0	6	11.0	0.9541	14032.8955	719.0632	100.8000	48.1657	127.4848	22.0788	23.2	5.8599	13434.3389	304.7303	8.0000	12.6526	451.5808
10	8	8	7000	3.742	1500	0	1	11.6	0.9659	14027.9971	630.0120	73.9000	34.7422	209.7028	117.4510	17.6	5.1841	13613.4141	320.0822	24.5000	12.7967	394.5048
10	8	8	7000	3.742	1500	0	2	11.2	1.0560	15094.4121	526.6780	156.7000	36.6741	246.6024	154.6966	26.0	5.3227	14119.7471	314.0872	9.7000	13.4927	624.3952
10	8	8	7000	3.742	1500	0	3	10.4	0.9659	14069.2676	539.6816	64.8000	26.8831	174.0752	124.2778	18.4	7.5741	13789.6924	366.0285	19.2000	15.6216	360.7744
10	8	8	7000	3.742	1500	0	4	11.2	1.2531	14602.8691	872.4079	117.5000	56.5249	169.3888	181.6859	26.8	7.6161	13687.7549	314.2603	9.7000	9.6594	568.2560
10	8	8	7000	3.742	1500	0	5	10.6	0.9051	14309.9297	698.3622	87.0000	39.5418	166.9568	66.9262	18.2	4.9206	13763.8623	344.4885	15.4000	13.6359	369.1712
10	8	8	7000	3.742	1500	0	6	11.4	1.1289	14558.4658	745.1910	113.8000	46.5207	139.5040	31.2454	21.6	7.1411	13763.6670	330.1742	18.2000	16.0243	449.8016
10	8	8	8000	3.906	1500	0	1	11.6	0.9659	14341.1064	645.1468	73.9000	34.7422	94.7699	21.4093	17.6	5.1841	13909.9561	326.7967	24.5000	12.7967	251.0392
10	8	8	8000	3.906	1500	0	2	11.2	1.0560	15407.2188	543.2557	155.7000	37.3535	103.9188	18.9149	26.0	5.3227	14414.6123	320.7567	9.7000	13.4927	412.7892
10	8	8	8000	3.906	1500	0	3	10.6	0.9051	14398.0127	558.5516	64.3000	27.0419	89.4569	20.9839	18.6	7.4454	14098.8311	378.8735	18.7000	15.0550	231.8312
10	8	8	8000	3.906	1500	0	4	11.0	1.1685	14819.8564	772.9570	108.5000	46.8405	94.2064	21.5056	26.8	7.6161	13979.4316	318.7603	9.7000	9.6594	361.7488
10	8	8	8000	3.906	1500	0	5	10.6	0.9051	14617.2314	720.1440	87.3000	41.6495	95.9120	22.5852	18.2	4.9206	14050.2813	354.2555	14.5000	13.3494	249.8640
10	8	8	8000	3.906	1500	0	6	11.4	1.1289	14884.3311	762.5964	113.8000	46.5207	93.1136	21.2385	21.6	7.1411	14057.5371	335.8392	18.2000	16.0243	305.4912
10	8	8	9000	4.057	1500	0	1	11.6	0.9659	14626.4746	659.3322	73.8000	34.7919	94.9315	21.5048	17.8	5.4474	14179.8936	331.7905	23.2000	13.6342	252.7706
10	8	8	9000	4.057	1500	0	2	11.2	1.0560	15799.0996	571.1198	157.4000	39.3994	106.5072	19.0336	26.0	5.3227	14685.4355	326.9315	9.7000	13.4927	412.9528
10	8	8	9000	4.057	1500	0	3	10.6	0.9051	14693.9424	565.8333	65.9000	24.6733	90.4840	20.7449	18.6	7.4454	14387.8955	387.4817	20.9000	15.9054	232.6088
10	8	8	9000	4.057	1500	0	4	11.4	1.4780	15056.3457	760.4085	97.0000	37.6670	144.5008	107.6245	26.4	7.5440	14241.4326	320.3495	8.9000	9.9060	332.3636
10	8	8	9000	4.057	1500	0	5	10.6	0.9051	14845.2705	777.5190	82.6000	41.5020	96.0816	22.2925	18.2	4.9206	14325.5801	356.0216	14.5000	13.3494	249.6016
10	8	8	9000	4.057	1500	0	6	11.4	1.1289	15197.5049	784.8442	114.6000	46.7030	92.7392	21.4655	21.6	7.1411	14326.5859	345.3141	18.1000	15.9126	304.3200
10	8	8	10000	4.197	1500	0	1	11.8	1.0006	14959.6113	630.7457	78.5000	34.1206	257.0099	134.9360	17.2	5.1134	14421.6465	334.6625	22.7000	13.1337	406.3354
10	8	8	10000	4.197	1500	0	2	11.2	1.0560	16102.3281	630.9927	155.6000	41.2821	290.7496	173.2985	24.6	5.5957	14939.8564	347.3884	11.7000	10.7020	663.7784
10	8	8	10000	4.197	1500	0	3	10.4	0.6913	15031.6387	638.7011	70.5000	28.4129	131.9360	21.9296	20.4	7.5138	14644.6094	389.8994	15.3000	13.7805	424.8256
10	8	8	10000	4.197	1500	0	4	11.2	1.2531	15460.4893	970.4013	110.0000	58.5020	292.6144	166.7777	27.6	8.8231	14483.6875	317.4627	9.2000	10.4501	831.8528
10	8	8	10000	4.197	1500	0	5	10.6	0.9051	15195.4502	771.5242	90.4000	43.6075	194.9440	133.0879	19.0	5.4807	14564.0879	355.9998	14.5000	13.3494	394.1824
10	8	8	10000	4.197	1500	0	6	11.4	1.1289	15518.7373	837.4997	118.0000	47.5932	279.6800	152.3361	24.2	7.5486	14574.2441	351.0586	13.4000	15.8328	508.5760
10	8	8	1000	2	1500	80	1	3.6	0.6913	5002.1001	508.2332	275.3000	56.2108	49.2448	32.8828	3.6	0.6913	5002.1001	508.2332	275.3000	56.2108	49.2448
10	8	8	1000	2	1500	80	2	3.4	0.6034	5105.2002	425.7461	276.8000	55.3631	44.7648	30.7856	3.4	0.6034	5105.2002	425.7461	276.8000	55.3631	44.7648
10	8	8	1000	2	1500	80	3	3.2	0.4526	4897.3999	431.0522	250.4000	41.8324	30.9888	17.4596	3.2	0.4526	4897.3999	431.0522	250.4000	41.8324	30.9888
10	8	8	1000	2	1500	80	4	3.6	0.6913	5080.5000	532.3306	260.4000	44.8754	53.3056	36.6116	3.6	0.6913	5080.5000	532.3306	260.4000	44.8754	53.3056
10	8	8	1000	2	1500	80	5	3.4	0.6034	4972.3999	480.1303	262.8000	54.8957	43.5456	31.0739	3.4	0.6034	4972.3999	480.1303	262.8000	54.8957	43.5456
10	8	8	1000	2	1500	80	6	3.6	0.6913	5042.2998	549.0421	269.7000	60.0216	50.4864	34.7135	3.6	0.6913	5042.2998	549.0421	269.7000	60.0216	50.4864
10	8	8	2000	2.5	1500	80	1	3.0	0.0000	4414.0000	287.0933	76.6000	20.8430	24.1536	2.9181	3.0	0.0000	4414.0000	287.0933	76.6000	20.8430	24.1536
10	8	8	2000	2.5	1500	80	2	3.0	0.0000	4651.0000	290.5930	93.7000	24.7092	28.7680	4.0985	3.2	0.4526	4650.6001	290.1195	91.6000	21.8426	39.2064
10	8	8	2000	2.5	1500	80	3	3.2	0.4526	4714.2002	383.8646	100.5000	36.4691	34.3808	19.2025	3.2	0.4526	4714.2002	383.8646	100.5000	36.4691	34.3808
10	8	8	2000	2.5	1500	80	4	3.0	0.0000	4511.8999	329.5754	89.1000	28.7338	26.5856	5.5385	3.0	0.0000	4511.8999	329.5754	89.1000	28.7338	26.5856
10	8	8	2000	2.5	1500	80	5	3.0	0.0000	4610.0000	294.2944	92.9000	34.9039	30.0352	7.5312	3.0	0.0000	4610.0000	294.2944	92.9000	34.9039	30.0352
10	8	8	2000	2.5	1500	80	6	3.0	0.0000	4583.1001	338.2083	89.2000	23.5969	26.4320	5.9269	3.2	0.4526	4580.2998	335.1647	88.3000	22.6277	31.5488
10	8	8	3000	2.849	1500	80	1	3.0	0.0000	4364.8623	211.6778	36.5000	11.4400	23.0208	2.5025	4.8	2.0739	4324.4312	196.7988	30.9000	7.7907	110.5344
10	8	8	3000	2.849	1500	80	2	3.0	0.0000	4620.1572	334.6800											

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]
10	8	8	3000	2.849	1500	80	3	3.0	0.0000	4608.0846	370.3445	50.2000	27.8804	30.0608	4.6	2.1119	4533.3398	333.1071	36.1000	16.8333	71.6736
10	8	8	3000	2.849	1500	80	4	3.0	0.0000	4364.0313	293.8850	32.4000	13.0910	29.9896	4.4	1.7912	4342.4121	272.4555	26.2000	8.8334	74.0096
10	8	8	3000	2.849	1500	80	5	3.2	0.4526	4563.9131	311.2491	41.0000	19.7378	37.5808	3.6	1.3577	4534.3145	261.2578	33.2000	12.9845	47.8592
10	8	8	3000	2.849	1500	80	6	3.0	0.0000	4394.9507	262.4118	37.8000	16.9154	23.2384	3.2	0.4526	4364.7134	229.9457	32.6000	15.4914	31.6928
10	8	8	4000	3.125	1500	80	1	3.0	0.0000	4363.3249	235.7308	19.0000	9.9206	23.6032	5.4	2.5061	4324.2749	224.7344	6.6000	3.6517	88.5376
10	8	8	4000	3.125	1500	80	2	3.0	0.0000	4738.1001	337.9435	41.7000	23.5420	29.9072	5.4	2.2170	4566.4502	232.5774	12.2000	11.5023	151.6608
10	8	8	4000	3.125	1500	80	3	3.0	0.0000	4670.5498	328.3925	36.3000	17.7295	33.0112	5.6	2.0295	4523.4751	262.1391	7.3000	9.1824	150.2656
10	8	8	4000	3.125	1500	80	4	3.0	0.0000	4485.9751	302.4244	26.4000	13.3407	28.9152	6.2	2.3564	4358.2749	226.2594	5.3000	4.3072	152.5632
10	8	8	4000	3.125	1500	80	5	3.0	0.0000	4628.5000	314.2545	34.8000	28.0290	29.0944	4.4	2.1387	4493.7500	205.7683	14.7000	9.5528	109.1277
10	8	8	4000	3.125	1500	80	6	3.0	0.0000	4496.9502	233.9304	26.4000	15.1159	24.1984	5.6	2.1387	4392.7002	197.9533	8.5000	6.2403	133.8112
10	8	8	5000	3.358	1500	80	1	3.0	0.0000	4493.8052	244.0980	17.2000	8.1501	23.3664	5.4	2.5061	4433.4766	231.8881	5.7000	4.1593	88.8320
10	8	8	5000	3.358	1500	80	2	3.0	0.0000	4872.3975	364.0453	40.3000	23.7848	29.3824	4.8	2.0739	4689.3076	250.0125	12.1000	11.6040	88.2432
10	8	8	5000	3.358	1500	80	3	3.0	0.0000	4778.3726	353.0759	32.0000	23.0633	30.0032	6.4	2.4371	4643.7837	271.1097	3.0000	4.8296	122.5664
10	8	8	5000	3.358	1500	80	4	3.0	0.0000	4593.1548	286.4399	23.7000	11.5430	28.4608	6.2	2.3564	4475.9604	237.3655	4.3000	4.3727	155.3024
10	8	8	5000	3.358	1500	80	5	3.0	0.0000	4810.5752	324.7502	35.2000	28.6095	31.5456	5.2	2.7362	4651.5322	214.7710	10.7000	8.8928	86.5856
10	8	8	5000	3.358	1500	80	6	3.0	0.0000	4635.8169	237.3119	29.2000	17.6011	23.9744	5.8	2.3564	4468.9600	204.3600	5.6000	6.4813	94.7200
10	8	8	6000	3.561	1500	80	1	3.0	0.0000	4603.7725	242.6513	15.4000	8.1039	23.2192	5.8	2.4510	4543.6758	235.1612	4.6000	4.4264	95.2768
10	8	8	6000	3.561	1500	80	2	3.0	0.0000	4997.5649	344.6401	40.6000	21.4908	29.4464	6.0	2.7195	4810.7031	245.1480	9.5000	11.6128	110.8480
10	8	8	6000	3.561	1500	80	3	3.0	0.0000	4853.0737	325.5610	27.5000	22.0398	29.1136	6.0	2.5466	4751.1235	270.1711	4.2000	5.2884	107.3536
10	8	8	6000	3.561	1500	80	4	3.0	0.0000	4664.6738	292.5962	20.2000	11.4229	26.8608	5.2	2.0739	4570.9482	239.0321	5.2000	3.9740	83.6160
10	8	8	6000	3.561	1500	80	5	3.0	0.0000	4926.5327	331.4640	32.9000	29.5460	31.3728	4.4	1.9141	4760.4365	218.1275	8.9000	8.4762	68.6720
10	8	8	6000	3.561	1500	80	6	3.0	0.0000	4696.0732	258.1308	21.3000	14.7920	24.2496	7.2	2.5645	4571.0259	212.2530	3.0000	2.9212	122.8160
10	8	8	7000	3.742	1500	80	1	3.0	0.0000	4717.5410	255.8160	16.8000	8.3841	22.9952	5.4	2.5061	4646.3291	242.5161	5.4000	4.3223	86.0992
10	8	8	7000	3.742	1500	80	2	3.0	0.0000	5105.9282	380.3611	39.4000	23.0885	29.1072	6.6	3.4267	4911.0791	261.2960	6.6000	6.6545	126.3808
10	8	8	7000	3.742	1500	80	3	3.0	0.0000	4979.8975	342.4493	28.9000	21.7937	28.7808	6.4	2.4371	4862.2832	281.8952	2.9000	4.8583	118.8416
10	8	8	7000	3.742	1500	80	4	3.0	0.0000	4816.4946	300.3776	23.6000	11.7779	28.0448	6.2	2.3564	4685.6514	246.8266	4.2000	4.2373	108.5888
10	8	8	7000	3.742	1500	80	5	3.0	0.0000	5048.8188	348.3869	34.9000	28.6645	30.8032	5.8	2.7979	4869.4858	225.1153	8.3000	8.4331	104.3456
10	8	8	7000	3.742	1500	80	6	3.0	0.0000	4862.4229	247.3052	29.6000	17.5571	23.6160	6.2	2.2577	4676.0903	212.7520	3.0000	2.7195	101.9328
10	8	8	8000	3.906	1500	80	1	3.0	0.0000	4811.9502	260.7166	16.8000	8.3841	19.0528	5.4	2.5061	4736.9248	246.6121	5.4000	4.3223	55.7632
10	8	8	8000	3.906	1500	80	2	3.0	0.0000	5209.5063	390.0563	39.4000	23.0885	24.5152	6.6	3.4267	5004.7002	265.2825	6.6000	6.6545	81.5200
10	8	8	8000	3.906	1500	80	3	3.0	0.0000	5079.3311	349.9509	28.5000	21.7801	24.0704	6.4	2.4371	4954.8188	285.4733	2.9000	4.8583	78.4896
10	8	8	8000	3.906	1500	80	4	3.0	0.0000	4912.8438	306.4633	23.6000	11.7779	23.4624	6.2	2.3564	4775.7876	250.6462	4.2000	4.2373	70.3296
10	8	8	8000	3.906	1500	80	5	3.0	0.0000	5150.7563	358.1799	34.9000	28.6645	25.9200	6.0	2.7195	4962.9438	229.2390	5.0000	5.8424	72.8768
10	8	8	8000	3.906	1500	80	6	3.0	0.0000	4961.3374	252.2083	29.3000	17.5760	19.5680	7.2	2.5645	4765.4375	216.8040	3.0000	2.7195	64.0928
10	8	8	9000	4.057	1500	80	1	3.0	0.0000	4904.3726	267.3028	16.7000	8.4466	19.0656	6.0	2.5466	4825.2769	253.5278	4.5000	4.3883	64.0736
10	8	8	9000	4.057	1500	80	2	3.0	0.0000	5294.4849	388.3651	38.2000	21.3303	24.4032	6.6	3.4267	5090.6865	268.9565	6.6000	6.6545	81.3216
10	8	8	9000	4.057	1500	80	3	3.2	0.4526	5251.1846	448.5090	34.2000	25.7084	30.4576	6.4	2.4371	5040.2979	287.3218	2.7000	4.9119	78.5920
10	8	8	9000	4.057	1500	80	4	3.0	0.0000	4997.3447	309.4311	22.8000	11.6692	23.4272	6.2	2.3564	4855.6738	254.0257	4.2000	4.2373	70.3584
10	8	8	9000	4.057	1500	80	5	3.0	0.0000	5268.4907	367.3966	37.2000	28.5936	24.2016	6.4	2.6172	5056.3491	234.8676	2.7000	3.7569	78.2400
10	8	8	9000	4.057	1500	80	6	3.0	0.0000	5051.1284	256.8843	29.3000	17.5760	19.5744	7.2	2.5645	4847.2847	220.3836	2.5000	2.7455	76.7200
10	8	8	10000	4.197	1500	80	1	3.0	0.0000	5007.4180	241.4174	18.1000	12.1453	25.4080	5.8	2.6302	4886.0361	256.4616	4.1000	3.4308	95.4688
10	8	8	10000	4.197	1500	80	2	3.0	0.0000	5382.9287	395.8702	38.2000	21.3303	24.4336	6.4	3.3084	5169.8555	270.7449	6.6000	6.6545	125.7280
10	8	8	10000	4.197	1500	80	3	3.2	0.4526	5338.2490	457.4286	34.2000	25.7084	37.8816	6.6	2.5061	5119.7754	295.4178	2.7000	4.9119	211.6352
10	8	8	10000	4.197	1500	80	4	3.0	0.0000	5082.1895	317.4164	23.6000	11.7779	28.3712	6.2	2.3564	4936.8359	247.8615	4.2000	4.2373	111.5840
10	8	8	10000	4.197	1500	80	5	3.0	0.0000	5316.5571	374.1570	34.6000	28.3847	31.3024	5.8	2.7979	5125.7197	242.9982	8.3000	8.4331	186.8864
10	8	8	10000	4.197	1500	80	6	3.0	0.0000	5125.8516	264.5081	28.2000	16.7634	23.8528	7.2	2.5645	4922.7349	221.2110	2.6000	2.7445	193.6704

Table C.12: Comparison of fiber-bifurcation-based heuristics with the optical-reach customization for the EON network.

C	W	B	R _{max} [km]	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	1000	2	500	0	1	3.8	0.7390	12514.3662	894.1945	720.5000	59.6311	105.6369	3.8	0.7390	12514.3662	894.1945	720.5000	105.6369	59.6311	28.941
10	8	8	1000	2	500	0	2	3.4	0.6034	12597.0801	610.6592	788.6000	54.7413	59.4781	3.4	0.6034	12597.0801	610.6592	788.6000	59.4781	54.7413	28.941
10	8	8	1000	2	500	0	3	4.0	0.7543	12599.6309	873.5562	717.8000	67.0340	87.5562	4.0	0.7543	12599.6309	873.5562	717.8000	87.5562	67.0340	20.902
10	8	8	1000	2	500	0	4	3.8	0.7390	12858.1846	709.6624	789.1000	67.3188	58.9355	3.8	0.7390	12858.1846	709.6624	789.1000	58.9355	67.3188	24.352
10	8	8	1000	2	500	0	5	3.6	0.6913	12057.7266	792.4338	677.9000	55.1112	58.9355	3.6	0.6913	12057.7266	792.4338	677.9000	58.9355	55.1112	27.453
10	8	8	1000	2	500	0	6	4.2	0.7390	13342.6748	555.0676	844.3000	82.8976	58.8066	4.2	0.7390	13342.6748	555.0676	844.3000	58.8066	82.8976	20.566
10	8	8	2000	2.5	500	0	1	4.2	0.7390	11002.9238	730.4336	266.4000	72.2405	63.4516	4.2	0.7390	11002.9238	730.4336	266.4000	63.4516	72.2405	37.015
10	8	8	2000	2.5	500	0	2	3.6	0.6913	11379.7285	674.3325	328.1000	67.2202	51.6268	3.6	0.6913	11379.7285	674.3325	328.1000	51.6268	67.2202	29.068
10	8	8	2000	2.5	500	0	3	3.8	0.7390	10879.7207	583.6978	258.7000	64.3392	52.0708	3.8	0.7390	10879.7207	583.6978	258.7000	52.0708	64.3392	27.562
10	8	8	2000	2.5	500	0	4	4.0	0.7543	11457.7139	882.4703	320.3000	64.8864	21.3268	4.8	2.1808	11457.7139	882.4703	320.3000	75.8667	84.8456	59.368
10	8	8	2000	2.5	500	0	5	3.6	0.6913	10738.8242	861.4546	252.5000	59.7736	82.1638	3.6	0.6913	10738.8242	861.4546	252.5000	82.1638	59.7736	24.380
10	8	8	2000	2.5	500	0	6	4.6	0.6034	11955.6826	548.5941	357.2000	84.3264	48.7095	4.6	0.6034	11955.6826	548.5941	357.2000	48.7095	84.3264	19.815
10	8	8	3000	2.849	500	0	1	4.2	0.7390	10200.9102	496.7123	110.7000	78.3860	34.1603	4.4	0.9659	10165.5996	453.4630	101.9000	28.6267	82.7890	33.954
10	8	8	3000	2.849	500	0	2	4.0	0.7543	10841.3682	384.6935	185.4000	80.4328	33.1703	5.0	2.0239	10763.8535	303.4434	159.4000	27.0485	104.2700	53.089
10	8	8	3000	2.849	500	0	3	4.0	0.7543	10113.8184	463.5337	105.1000	77.2292	23.5695	4.2	1.0006	10080.1709	409.8768	96.6000	13.8347	79.3700	33.766
10	8	8	3000	2.849	500	0	4	3.8	0.7390	10527.5684	608.8948	170.8000	60.3256	45.6105	6.2	3.1062	10376.0938	452.6660	124.2000	16.4309	122.2056	87.418
10	8	8	3000	2.849	500	0	5	4.2	0.7390	10423.3008	673.2725	122.9000	85.1240	52.8907	4.6	1.1289	10371.1348	617.0920	103.0000	28.9951	90.0864	32.848
10	8	8	3000	2.849	500	0	6	5.0	0.0000	11094.6211	188.5596	173.5000	97.4512	27.2101	6.6	1.8841	11035.8750	140.8163	140.8000	21.2902	134.1208	49.475
10	8	8	4000	3.125	500	0	1	4.4	0.6913	9960.5420	423.2512	78.9000	80.1952	31.2017	4.8	1.0560	9846.8379	330.1613	53.2000	23.1318	90.3122	34.871
10	8	8	4000	3.125	500	0	2	3.8	0.7390	10593.9990	455.9802	154.7000	73.7538	38.7278	5.8	2.7153	10366.0098	199.5819	87.4000	46.7906	126.7300	77.263
10	8	8	4000	3.125	500	0	3	4.0	0.7543	9986.5059	386.2472	68.5000	72.7812	15.5831	4.4	1.1782	9847.2676	360.9229	56.6000	16.7410	81.6324	36.420
10	8	8	4000	3.125	500	0	4	4.6	0.6034	10518.4551	408.3904	114.3000	85.9136	34.9310	9.2	2.8181	10042.4873	231.9234	23.8000	21.2581	208.4240	78.384
10	8	8	4000	3.125	500	0	5	3.8	0.7390	9969.9824	579.5276	85.9000	89.4575	39.4575	4.2	1.2068	9820.4922	227.3994	58.2000	27.2342	75.3216	36.919
10	8	8	4000	3.125	500	0	6	4.8	0.4526	10795.9385	207.9035	131.8000	87.2232	20.9182	8.6	2.3174	10380.5742	397.6954	34.3000	33.0101	185.2776	64.689
10	8	8	5000	3.358	500	0	1	4.4	0.6913	9910.1689	383.0791	70.7000	80.8377	27.5670	5.4	1.7592	9814.6348	310.0013	42.4000	27.9749	103.9061	52.296
10	8	8	5000	3.358	500	0	2	4.0	0.7543	10688.9404	413.2488	157.5000	78.6264	37.6242	7.2	3.0508	10404.9434	166.2045	62.1000	56.0206	168.7040	88.247
10	8	8	5000	3.358	500	0	3	4.0	0.7543	9946.0459	349.7058	74.4000	73.6676	24.6219	5.0	2.2375	9856.2041	261.8241	55.2000	22.8572	99.9136	67.791
10	8	8	5000	3.358	500	0	4	4.8	0.4526	10510.6182	405.2762	105.5000	93.0832	40.4750	9.0	2.7815	9994.9922	203.5345	19.2000	23.2422	203.3712	77.466
10	8	8	5000	3.358	500	0	5	3.8	0.7390	10004.4609	645.9915	91.0000	69.6040	53.2803	4.2	1.2068	9810.3750	395.9703	52.8000	26.2883	76.9608	38.356
10	8	8	5000	3.358	500	0	6	5.0	0.0000	10609.4395	128.8814	103.2000	90.5344	16.1375	8.8	2.0739	10366.1191	198.6757	22.3000	25.5201	191.1464	61.374
10	8	8	6000	3.561	500	0	1	4.4	0.6913	9987.3408	372.7518	81.4000	80.2908	26.1972	5.4	1.7592	9865.8740	296.9370	45.8000	27.0393	103.7340	51.383
10	8	8	6000	3.561	500	0	2	4.0	0.7543	10648.9473	437.7319	149.7000	78.6264	41.3163	6.6	2.8462	10374.1729	163.8136	67.2000	50.2920	149.1234	81.233
10	8	8	6000	3.561	500	0	3	4.0	0.7543	9845.5137	320.0534	67.7000	69.2912	18.8142	4.4	1.1782	9829.8115	306.8560	57.5000	23.2971	80.6020	37.877
10	8	8	6000	3.561	500	0	4	4.6	0.6034	10426.7500	431.3792	102.1000	85.8616	40.5146	8.6	3.1498	9963.9170	179.3842	28.0000	25.6690	191.6888	89.787
10	8	8	6000	3.561	500	0	5	4.0	0.7543	10093.1064	649.3295	99.7000	76.4832	31.4814	5.0	1.9081	9860.2080	386.1928	39.3000	28.2156	98.9472	56.182
10	8	8	6000	3.561	500	0	6	5.0	0.0000	10598.1016	123.3294	103.7000	91.1352	17.0703	8.8	2.0739	10367.7373	201.1841	23.1000	25.2926	192.0648	61.029
10	8	8	7000	3.742	500	0	1	4.4	0.6913	9964.4121	391.6832	78.6000	78.9794	25.8375	5.4	1.7592	9831.7051	309.4042	43.0000	26.8836	103.4512	51.662
10	8	8	7000	3.742	500	0	2	4.0	0.7543	10648.9492	441.4831	150.1000	78.6320	41.2714	6.4	2.7027	10369.3652	151.3952	67.6000	50.6273	145.3044	78.460
10	8	8	7000	3.742	500	0	3	4.0	0.7543	9885.9043	338.4634	71.4000	71.8456	24.9250	4.6	1.4780	9842.1670	298.2671	55.8000	23.9605	84.9188	43.148
10	8	8	7000	3.742	500	0	4	4.6	0.6034	10403.0996	420.5234	99.2000	86.8160	39.9352	8.4	3.0952	9933.2041	175.3232	26.5000	25.5941	185.9384	87.627
10	8	8	7000	3.742	500	0	5	4.0	0.7543	10068.0029	699.7334	90.3000	76.1584	30.4060	4.4	1.1782	9849.0928	415.3523	45.6000	18.1654	83.3392	36.892
10	8	8	7000	3.742	500	0	6	5.0	0.0000	10586.6582	126.2451	102.5000	91.1524	16.0719	8.8	2.0739	10362.4150	199.4735	22.6000	25.4468	190.8040	60.944
10	8	8	8000	3.906	500	0	1	4.4	0.6913	9964.4121	391.6832	78.6000	78.9794	25.8375	5.4	1.7592	9831.7979	309.4452	43.0000	26.8836	103.2203	51.732
10	8	8	8000	3.906	500	0	2	4.0	0.7543	10651.0654	433.8814	150.2000	78.5486	41.3545	6.4	2.7027	10373.2900	152.4633	67.5000	50.5667	144.8094	77.936
10	8	8	8000	3.906	500	0	3	4.0	0.7543	9885.9043	338.4634	71.4000	71.7784	24.9250	4.6	1.4780	9842.1670	298.2671	55.8000	23.9605	84.2988	42.122
10	8	8	8000	3.906	500	0	4	4.6	0.6034	10404.0625	417.7205	99.2000	87.2288	39.9352	8.4	3.0952	9935.4678	175.0207	26.5000	25.5941	187.1456	88.205
10	8	8	8000	3.906	500	0	5	4.0	0.7543	10068.0410	699.7955	90.3000	76.4464	30.3478	4.4	1.1782	9849.0928	415.3523	45.6000	18.1654	83.1440	36.885

C	W	B	R _{max}	E/O	IN	FR	Policy	F _{min}	±CI	Weighted port count @F _{min}	# of OEOs @F _{min}	Solve time [sec]	±CI	F _{opr}	±CI	Weighted port count @F _{opr}	# of OEOs @F _{opr}	Solve time [sec]	±CI				
10	8	8	8000	3.906	500	0	6	5.0	0.0000	10586.6582	126.2451	102.5000	16.0719	91.1424	11.1639	8.8	2.0739	10365.2930	200.6159	25.5201	190.5136	60.897	
10	8	8	9000	4.057	500	0	1	4.4	0.6913	9974.5244	382.2434	79.2000	30.0374	60.8245	19.2435	5.4	1.7592	9841.9092	299.9607	43.6000	27.1032	77.2548	36.171
10	8	8	9000	4.057	500	0	2	4.0	0.7543	10646.2656	435.0683	149.9000	41.3980	61.2178	17.9617	6.4	2.7027	10369.2676	151.9551	67.2000	50.3226	103.0394	50.798
10	8	8	9000	4.057	500	0	3	4.0	0.7543	9889.3027	335.1216	71.2000	34.8166	55.4764	20.7971	4.6	1.4780	9845.5654	294.7365	55.6000	27.7732	64.2984	29.610
10	8	8	9000	4.057	500	0	4	4.6	0.6034	10359.2861	399.6277	92.7000	34.9424	66.1032	17.2633	8.0	2.8820	9942.4395	171.1324	26.5000	25.5941	120.3048	53.171
10	8	8	9000	4.057	500	0	5	4.0	0.7543	10085.2764	699.8487	91.2000	63.4162	61.0816	22.9771	4.4	1.1782	9869.0068	423.9689	46.5000	17.8656	66.9080	28.559
10	8	8	9000	4.057	500	0	6	5.0	0.0000	10579.7500	133.6767	102.2000	16.1867	68.9312	8.5884	8.8	2.0739	10362.2090	198.2103	22.2000	25.5486	133.2200	39.858
10	8	8	10000	4.197	500	0	1	4.4	0.6913	9977.3887	384.4743	79.2000	30.0374	60.6614	19.2156	5.4	1.7592	9852.9629	307.1903	42.9000	27.6379	77.1902	36.154
10	8	8	10000	4.197	500	0	2	4.2	0.7390	10749.4121	429.0045	150.1000	43.1725	66.8306	18.6343	6.8	2.3804	10477.1953	211.3842	57.2000	51.9118	107.9838	43.619
10	8	8	10000	4.197	500	0	3	4.2	0.7390	9954.7881	433.7051	69.6000	22.6205	60.3188	19.3090	5.8	2.7153	9901.5762	396.2691	43.8000	20.2044	173.2576	243.36
10	8	8	10000	4.197	500	0	4	4.6	0.6034	10338.7910	436.6674	96.8000	42.5278	66.4244	16.8463	8.2	3.1786	9922.8672	158.5550	25.8000	25.8672	124.0596	58.679
10	8	8	10000	4.197	500	0	5	4.0	0.7543	10103.6504	708.0797	93.5000	63.3484	60.2464	22.8523	4.4	1.1782	9887.4189	442.6673	48.8000	20.6775	66.1328	28.556
10	8	8	10000	4.197	500	0	6	4.8	0.4526	10576.6641	139.0493	108.3000	16.0854	64.7296	11.9045	8.2	2.4510	10352.9551	197.2891	34.3000	35.1340	121.7936	45.525
10	8	8	1000	2	500	80	1	1.0	0.0000	3274.5938	206.0327	180.8000	18.6311	15.4304	5.7123	1.0	0.0000	3274.5938	206.0327	180.8000	18.6311	15.4304	5.7123
10	8	8	1000	2	500	80	2	1.0	0.0000	3521.3352	196.5957	200.7000	16.8894	15.4080	4.7703	1.2	0.4526	3514.0820	198.9014	199.1000	17.4147	16.2912	6.3611
10	8	8	1000	2	500	80	3	1.2	0.4526	3442.7097	339.7831	190.6000	30.0552	14.4800	5.0920	1.2	0.4526	3442.7097	339.7831	190.6000	30.0552	14.4800	5.0920
10	8	8	1000	2	500	80	4	1.0	0.0000	3483.8235	265.4423	211.6000	33.3328	17.1264	5.1093	1.0	0.0000	3483.8235	265.4423	211.6000	33.3328	17.1264	5.1093
10	8	8	1000	2	500	80	5	1.0	0.0000	3274.5271	157.4095	176.5000	11.6714	13.9168	5.8538	1.0	0.0000	3274.5271	157.4095	176.5000	11.6714	13.9168	5.8538
10	8	8	1000	2	500	80	6	1.0	0.0000	3478.5249	281.1819	205.9000	29.4727	13.7056	5.5582	1.0	0.0000	3478.5249	281.1819	205.9000	29.4727	13.7056	5.5582
10	8	8	2000	2.5	500	80	1	1.0	0.0000	3202.7122	183.7799	81.7000	10.8311	22.2640	10.5217	1.0	0.0000	3202.7122	183.7799	81.7000	10.8311	22.2640	10.521
10	8	8	2000	2.5	500	80	2	1.0	0.0000	3333.5129	156.6105	89.8000	22.8273	17.1188	2.2300	1.0	0.0000	3333.5129	156.6105	89.8000	22.8273	17.1188	2.2300
10	8	8	2000	2.5	500	80	3	1.0	0.0000	3184.2612	163.3197	70.2000	10.1407	18.0748	4.2468	1.0	0.0000	3184.2612	163.3197	70.2000	10.1407	18.0748	4.2468
10	8	8	2000	2.5	500	80	4	1.2	0.4526	3359.9407	267.8900	86.4000	15.4546	23.4313	6.1219	1.2	0.4526	3359.9407	267.8900	86.4000	15.4546	23.4313	6.1219
10	8	8	2000	2.5	500	80	5	1.2	0.4526	3247.7617	219.5655	75.8000	20.3894	18.7782	4.7944	1.2	0.4526	3247.7617	219.5655	75.8000	20.3894	18.7782	4.7944
10	8	8	2000	2.5	500	80	6	1.0	0.0000	3304.9673	203.5245	83.8000	19.3912	13.5952	2.2685	1.0	0.0000	3304.9673	203.5245	83.8000	19.3912	13.5952	2.2685
10	8	8	3000	2.849	500	80	1	1.0	0.0000	2956.0273	177.0079	26.5000	10.5285	16.6592	6.1664	1.0	0.0000	2956.0273	177.0079	26.5000	10.5285	16.6592	6.1664
10	8	8	3000	2.849	500	80	2	1.0	0.0000	3084.2832	167.8328	37.2000	20.1395	20.0448	4.1737	1.0	0.0000	3084.2832	167.8328	37.2000	20.1395	20.0448	4.1737
10	8	8	3000	2.849	500	80	3	1.0	0.0000	3050.2791	172.3724	32.1000	8.6028	21.3760	5.1184	1.0	0.0000	3050.2791	172.3724	32.1000	8.6028	21.3760	5.1184
10	8	8	3000	2.849	500	80	4	1.0	0.0000	2990.0234	174.0675	32.9000	11.9184	22.8352	3.8061	1.0	0.0000	2990.0234	174.0675	32.9000	11.9184	22.8352	3.8061
10	8	8	3000	2.849	500	80	5	1.2	0.4526	3052.5562	164.7473	26.5000	8.2019	19.4944	5.3436	1.4	0.9051	3045.8235	158.8351	26.5000	8.2019	24.1920	15.219
10	8	8	3000	2.849	500	80	6	1.0	0.0000	3054.4167	192.0095	36.1000	15.1845	13.9648	2.8635	1.4	0.6034	3028.9226	175.8720	27.3000	8.9120	17.6576	6.5492
10	8	8	4000	3.125	500	80	1	1.0	0.0000	2891.5510	192.3960	19.0000	9.3964	17.6938	5.9541	1.6	0.6913	2875.3894	177.2443	9.5000	5.9986	21.3782	7.8227
10	8	8	4000	3.125	500	80	2	1.0	0.0000	3035.0620	138.9760	33.2000	18.0511	18.7593	3.9707	1.2	0.4526	3031.6787	140.8765	28.6000	19.0251	20.7639	5.5879
10	8	8	4000	3.125	500	80	3	1.0	0.0000	3010.8865	176.0889	22.6000	8.9639	21.3437	6.1599	1.0	0.0000	3010.8865	176.0889	22.6000	8.9639	21.3437	6.1599
10	8	8	4000	3.125	500	80	4	1.0	0.0000	2935.9421	169.7360	22.5000	8.8621	24.5548	5.7727	1.6	0.6913	2921.4592	163.6396	17.2000	11.2472	28.9392	5.9732
10	8	8	4000	3.125	500	80	5	1.2	0.4526	2998.5574	137.1381	22.3000	11.2788	18.5346	5.4200	1.4	0.6034	2995.6616	139.0199	18.9000	11.0361	21.0985	6.5829
10	8	8	4000	3.125	500	80	6	1.0	0.0000	3010.1863	181.4735	33.4000	12.4814	15.1440	2.9365	2.4	1.1782	2948.6880	151.6251	11.0000	8.6555	35.1362	21.432
10	8	8	5000	3.358	500	80	1	1.0	0.0000	2882.7874	169.9077	17.2000	9.5215	17.2593	6.1355	1.4	0.6034	2864.6240	149.0439	10.0000	6.7378	19.1952	7.9619
10	8	8	5000	3.358	500	80	2	1.0	0.0000	3045.5481	147.7126	30.9000	18.3376	18.9486	3.9367	1.2	0.4526	3041.5735	150.0107	26.2000	19.0598	20.8471	5.3600
10	8	8	5000	3.358	500	80	3	1.0	0.0000	3014.6479	182.1160	22.5000	8.6410	21.6370	6.1187	1.0	0.0000	3014.6479	182.1160	22.5000	8.6410	21.3470	6.1187
10	8	8	5000	3.358	500	80	4	1.0	0.0000	2925.3989	177.1371	19.7000	6.5585	21.6237	4.4883	1.6	0.6913	2913.5942	168.4174	14.4000	8.6473	25.9847	5.9941
10	8	8	5000	3.358	500	80	5	1.2	0.4526	3002.4841	163.6534	21.0000	11.9829	18.8999	5.4024	1.8	1.0006	2993.6929	165.9630	11.6000	7.7008	28.6046	15.873
10	8	8	5000	3.358	500	80	6	1.0	0.0000	3022.5044	198.4858	33.9000	10.3277	14.5843	2.7656	2.6	1.1289	2965.6682	175.6120	8.1000	8.4426	38.1360	22.491
10	8	8	6000	3.561	500	80	1	1.0	0.0000	2894.3855	183.9075	18.6000	9.4459	17.2265	6.1405	1.6	0.6913	2870.7004	156.2056	8.2000	5.4264	21.3999	8.4884
10	8	8	6000	3.561	500	80	2	1.0	0.0000	3050.4778	143.0845	31.9000	18.9539	20.0891	4.6049	1.4	0.6034	3042.3926	145.6851	18.0000	12.1104	23.4361	6.2857
10	8	8	6000	3.561	500	80	3	1.0	0.0000	3021.0073	182.4310	25.5000	9.2822	21.3516	7.3868	1.0	0.0000	3021.0073	182.4310	25.5000	9.2822	21.3516	7.3868
10	8	8	6000	3.561	500	80	4	1.0	0.0000	2902.1821	182.4738	18.0000	7.0916	21.6314	4.4785	1.2	0.4526	2896.0535	176.5747	15.0000	7.4438	23.4954	5.9621
10	8	8	6000	3.561	500	80	5	1.2	0.4526	3008.3218	163.9064	20.2000	12.3789	20.2437	6.2608	1.8	1.0006	2996.1831	169.6676	10.9000	7.9712	29.8969	15.712
10	8	8	6000	3.561	500	80	6	1.0	0.0000	2999.7231	187.8040	30.3000	11.8398	14.6360									

C	W	B	R _{max}	E/O cost ratio	IN [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @ F _{min}	±CI	# of OEOs @ F _{min}	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count @ F _{opt}	±CI	# of OEOs @ F _{opt}	±CI	Solve time [sec]
10	8	8	7000	3.742	500	80	1	1.0	0.0000	2900.5259	182.7326	18.2000	9.6285	17.2783	1.6	0.6913	2875.7114	153.2249	7.8000	5.3098	21.4813
10	8	8	7000	3.742	500	80	2	1.0	0.0000	3041.1685	146.6862	31.1000	18.1003	18.8845	1.2	0.4526	3036.2686	149.3573	26.4000	18.8599	20.7861
10	8	8	7000	3.742	500	80	3	1.0	0.0000	3015.2991	180.6674	23.9000	9.2034	21.1063	1.0	0.0000	3015.2991	180.6674	23.9000	9.2034	21.1063
10	8	8	7000	3.742	500	80	4	1.0	0.0000	2902.6279	182.3143	18.0000	7.0916	21.5938	1.2	0.4526	2896.1968	176.1507	15.0000	7.4438	23.4626
10	8	8	7000	3.742	500	80	5	1.2	0.4526	3014.7532	150.2610	21.1000	12.5779	18.6219	1.8	1.0006	3053.6819	153.3302	11.8000	8.8334	28.2750
10	8	8	7000	3.742	500	80	6	1.0	0.0000	3029.9407	201.9022	34.0000	10.3638	14.5576	2.6	1.1289	2965.3845	175.6050	8.1000	8.4426	38.1328
10	8	8	8000	3.906	500	80	1	1.0	0.0000	2902.1836	181.9432	17.3000	9.2071	17.2672	1.6	0.6913	2875.7114	153.2249	7.8000	5.3098	21.4812
10	8	8	8000	3.906	500	80	2	1.0	0.0000	3041.1685	146.6862	31.1000	18.1003	18.8685	1.2	0.4526	3036.2686	149.3573	26.4000	18.8599	20.7702
10	8	8	8000	3.906	500	80	3	1.0	0.0000	3015.2991	180.6674	23.9000	9.2034	21.0905	1.0	0.0000	3015.2991	180.6674	23.9000	9.2034	21.0905
10	8	8	8000	3.906	500	80	4	1.0	0.0000	2902.6279	182.3143	18.0000	7.0916	21.5938	1.2	0.4526	2896.1968	176.1507	15.0000	7.4438	23.4626
10	8	8	8000	3.906	500	80	5	1.2	0.4526	3014.7532	150.2610	21.1000	12.5779	18.6248	1.8	1.0006	3053.6819	153.3302	11.8000	8.8334	28.2655
10	8	8	8000	3.906	500	80	6	1.0	0.0000	3001.2827	185.0080	30.8000	11.9391	14.6049	2.4	1.1782	2935.3088	157.8678	8.7000	8.2213	36.1048
10	8	8	9000	4.057	500	80	1	1.0	0.0000	2902.1836	181.9432	17.3000	9.2071	17.2435	1.6	0.6913	2875.7114	153.2249	7.8000	5.3098	21.4577
10	8	8	9000	4.057	500	80	2	1.0	0.0000	3051.8394	149.3197	31.4000	18.6323	18.8906	1.4	0.6034	3039.1248	149.7739	17.7000	11.9736	22.1859
10	8	8	9000	4.057	500	80	3	1.0	0.0000	3015.2991	180.6674	23.9000	9.2034	21.0939	1.0	0.0000	3015.2991	180.6674	23.9000	9.2034	21.0939
10	8	8	9000	4.057	500	80	4	1.0	0.0000	2902.0154	181.6860	17.6000	6.7563	21.6313	1.2	0.4526	2896.1968	176.1507	15.0000	7.4438	23.4767
10	8	8	9000	4.057	500	80	5	1.2	0.4526	3030.1282	165.4608	25.2000	11.9200	18.5219	1.8	1.0006	3023.9448	167.1389	15.9000	10.2614	28.1546
10	8	8	9000	4.057	500	80	6	1.0	0.0000	3001.2827	185.0080	30.8000	11.9391	14.6093	2.4	1.1782	2935.3088	157.8678	8.7000	8.2213	36.0734
10	8	8	10000	4.197	500	80	1	1.0	0.0000	2905.3870	181.5018	17.3000	9.2071	14.4993	1.6	0.6913	2878.9146	153.0162	7.8000	5.3098	18.1161
10	8	8	10000	4.197	500	80	2	1.0	0.0000	3047.0757	147.6785	31.5000	18.8117	15.9113	1.4	0.6034	3039.0850	149.7264	17.7000	11.9736	21.7716
10	8	8	10000	4.197	500	80	3	1.0	0.0000	3021.1970	174.1485	25.0000	8.4665	17.1037	1.0	0.0000	3021.1970	174.1485	25.0000	8.4665	17.1037
10	8	8	10000	4.197	500	80	4	1.0	0.0000	2902.0154	181.6860	17.6000	6.7563	18.2523	1.2	0.4526	2896.1968	176.1507	15.0000	7.4438	19.8211
10	8	8	10000	4.197	500	80	5	1.2	0.4526	3020.4888	149.2135	22.8000	12.5886	15.6209	1.8	1.0006	3011.4177	152.4980	13.5000	9.8125	22.9382
10	8	8	10000	4.197	500	80	6	1.0	0.0000	3007.3645	203.3000	29.6000	12.0925	12.2724	2.4	1.1782	2931.1060	160.0021	8.1000	8.2793	29.0558
10	8	8	1000	2	1500	0	1	9.6	0.6913	13219.5605	530.1420	686.1000	70.7249	81.7312	9.6	0.6913	13219.5605	530.1420	686.1000	70.7249	81.7312
10	8	8	1000	2	1500	0	2	9.6	0.6913	13256.2705	726.9077	687.2000	97.0578	102.1840	9.8	0.7390	13244.6152	723.2686	682.9000	94.4144	103.3320
10	8	8	1000	2	1500	0	3	9.8	0.7390	13145.4199	573.7407	667.9000	87.6014	96.0560	10.0	0.7543	13132.6982	577.9130	658.4000	86.7739	101.3440
10	8	8	1000	2	1500	0	4	9.6	0.6913	13473.1611	519.7830	734.7000	75.2024	93.8864	9.8	0.7390	13457.7012	527.3547	723.6000	80.1335	94.2208
10	8	8	1000	2	1500	0	5	9.4	0.6034	12974.5801	367.1973	647.9000	56.0277	92.8624	9.4	0.6034	12974.5801	367.1973	647.9000	56.0277	92.8624
10	8	8	1000	2	1500	0	6	9.6	0.6913	13771.5342	660.8471	806.8000	102.5998	84.2208	10.0	0.7543	13692.1328	685.6927	769.9000	107.4350	95.4016
10	8	8	2000	2.5	1500	0	1	10.8	0.4526	11629.3203	469.2421	214.9000	40.6113	132.0314	10.8	0.4526	11629.3203	469.2421	214.9000	40.6113	132.0314
10	8	8	2000	2.5	1500	0	2	10.6	1.4780	12066.9268	815.4857	268.0000	70.4239	138.0440	10.8	1.2531	12046.6064	829.2592	258.4000	76.2475	140.3032
10	8	8	2000	2.5	1500	0	3	10.6	0.6913	11535.4248	539.1974	197.8000	49.5490	114.6480	9.8	0.7390	11535.4248	539.1974	197.8000	49.5490	114.6480
10	8	8	2000	2.5	1500	0	4	10.6	1.1289	11766.1211	729.4337	235.7000	72.5315	124.4608	10.6	1.1289	11766.1211	729.4337	235.7000	72.5315	124.4608
10	8	8	2000	2.5	1500	0	5	10.6	0.6034	11597.0400	514.7576	203.0000	46.2855	128.4096	10.8	0.8124	11590.2822	519.0605	202.0000	46.4879	132.6784
10	8	8	2000	2.5	1500	0	6	11.0	0.9541	12099.6680	644.5398	259.0000	64.4910	122.8896	11.4	1.3151	12095.9727	639.7333	247.5000	48.0717	128.2272
10	8	8	3000	2.849	1500	0	1	11.4	0.9051	11052.6230	478.0696	101.2000	30.2883	185.3989	12.0	0.7543	10989.0059	416.8405	83.1000	26.2116	196.1947
10	8	8	3000	2.849	1500	0	2	11.0	1.1685	11745.7988	441.7226	184.1000	29.3024	166.6712	11.6	1.1782	11694.5713	472.0649	163.2000	38.1204	224.3936
10	8	8	3000	2.849	1500	0	3	10.4	0.6913	10911.3320	446.8022	73.7000	28.7607	125.1296	10.8	1.0560	10891.7324	428.0180	66.5000	24.1508	188.0816
10	8	8	3000	2.849	1500	0	4	11.4	1.3151	11141.8076	568.5543	95.1000	35.0341	139.3600	13.0	2.5242	10972.6670	458.0811	56.2000	22.0412	183.6160
10	8	8	3000	2.849	1500	0	5	10.6	0.9051	10949.4678	519.5264	87.1000	35.4136	140.8768	13.0	3.2354	10882.2754	509.7105	50.0000	23.2011	196.4000
10	8	8	3000	2.849	1500	0	6	11.4	1.1289	11262.6074	530.1382	114.6000	44.9704	142.4096	12.0	1.5458	11102.9668	396.2495	84.0000	27.9827	233.2640
10	8	8	4000	3.125	1500	0	1	11.6	0.9659	10897.8086	513.8257	77.8000	37.0441	171.0791	12.6	1.2889	11439.8945	369.8336	119.8000	27.6797	252.2752
10	8	8	4000	3.125	1500	0	2	11.6	1.0560	11500.5996	416.4108	149.2000	43.0450	148.3864	13.6	3.5730	10785.5059	405.4144	41.8000	8.7493	222.6280
10	8	8	4000	3.125	1500	0	3	10.4	0.6913	10911.3320	446.8022	73.7000	28.7607	125.1296	10.8	1.0560	10891.7324	428.0180	66.5000	24.1508	188.0816
10	8	8	4000	3.125	1500	0	4	11.4	1.3151	11141.8076	568.5543	95.1000	35.0341	139.3600	13.0	2.5242	10972.6670	458.0811	56.2000	22.0412	183.6160
10	8	8	4000	3.125	1500	0	5	10.6	0.9051	10949.4678	519.5264	87.1000	35.4136	140.8768	13.0	3.2354	10882.2754	509.7105	50.0000	23.2011	196.4000
10	8	8	4000	3.125	1500	0	6	11.4	1.1289	11262.6074	530.1382	114.6000	44.9704	142.4096	12.0	1.5458	11102.9668	396.2495	84.0000	27.9827	233.2640
10	8	8	5000	3.358	1500	0	1	11.6	0.9659	10897.8086	496.6918	74.8000	34.3310	165.3537	13.6	3.5730	10744.0059	362.7832	35.4000	10.3098	219.5481

C	W	B	R _{max}	E/O cost ratio	IN	FR	Policy	F _{min}	±CI	Weighted port count	# of OEOs	±CI	Solve time [sec]	F _{opt}	±CI	Weighted port count	# of OEOs	±CI	Solve time [sec]
10	8	8	5000	3.358	1500	0	2	11.2	1.0560	11582.6465	412.0459	36.5342	149.1192	24.5498	15.0	5.0933	11409.0332	349.9825	282.4400
10	8	8	5000	3.358	1500	0	3	10.6	0.9051	10894.2988	443.8280	27.2342	127.1712	27.2112	10.8	1.0560	10878.6777	427.4165	131.7520
10	8	8	5000	3.358	1500	0	4	11.0	1.1685	11165.4170	568.0469	46.8448	132.5984	28.4045	13.0	2.6128	10961.4863	432.8074	214.9536
10	8	8	5000	3.358	1500	0	5	10.6	0.9051	11103.8027	580.0403	40.2144	146.5152	32.2455	14.2	3.8282	11029.6328	430.3875	283.1360
10	8	8	5000	3.358	1500	0	6	11.4	1.1289	11257.6248	537.7233	46.9181	131.8688	28.9386	13.6	4.1614	11058.3174	432.5419	255.1488
10	8	8	6000	3.561	1500	0	1	11.6	0.9059	10869.1855	422.3712	31.2224	214.5288	114.8371	13.2	3.0508	10803.3730	365.0428	247.0364
10	8	8	6000	3.561	1500	0	2	11.2	1.2531	11727.3145	646.9376	42.9458	309.5840	181.8434	19.2	7.9092	11470.1582	418.4354	446.7160
10	8	8	6000	3.561	1500	0	3	10.6	0.9051	10973.9863	421.4704	22.1305	165.3952	100.2347	11.2	0.8124	10944.5410	397.7475	223.0160
10	8	8	6000	3.561	1500	0	4	11.0	1.1685	11203.9238	551.0826	73.1000	230.6864	143.0810	16.0	6.3375	10935.6055	539.7366	332.4976
10	8	8	6000	3.561	1500	0	5	11.2	1.0560	11094.5215	466.5818	29.8269	139.3152	29.6459	12.8	2.8977	11077.9258	471.7355	213.7888
10	8	8	6000	3.561	1500	0	6	11.0	0.9541	11136.6240	537.3510	48.1657	117.9680	20.9556	11.6	1.1782	10987.0840	390.0173	130.2272
10	8	8	7000	3.742	1500	0	1	11.6	0.9059	10877.1270	491.2840	34.7422	164.4109	95.5776	13.6	3.5730	10749.9727	378.6045	221.2378
10	8	8	7000	3.742	1500	0	2	11.2	1.0560	11587.1914	404.0084	36.6741	146.1936	26.3840	16.6	5.9505	11412.3232	356.4203	326.2056
10	8	8	7000	3.742	1500	0	3	10.4	0.9659	10881.3613	441.5567	26.8831	120.9936	28.5019	10.6	1.1289	10870.8584	430.7441	125.7184
10	8	8	7000	3.742	1500	0	4	11.2	1.2531	11248.2285	638.5429	56.5249	127.8976	26.4125	13.6	3.5730	10983.0254	439.6897	224.4960
10	8	8	7000	3.742	1500	0	5	10.6	0.9051	11017.4629	531.9650	39.5418	145.4208	33.4885	14.2	3.0321	10926.1816	496.9864	294.8704
10	8	8	7000	3.742	1500	0	6	11.4	1.1289	11259.4043	590.0909	46.5207	130.1376	29.4317	12.4	1.9141	11073.6191	443.6133	235.4816
10	8	8	8000	3.906	1500	0	1	11.6	0.9059	10877.1270	491.2840	34.7422	164.4109	95.5776	13.6	3.5730	10749.9727	378.6045	221.2378
10	8	8	8000	3.906	1500	0	2	11.2	1.0560	11583.6465	403.9509	37.3535	148.9648	25.2604	16.6	5.9505	11388.5059	349.5420	339.7112
10	8	8	8000	3.906	1500	0	3	10.6	0.9051	10906.4268	450.5004	27.0419	126.8560	27.4161	10.8	1.0560	10895.9238	440.2479	131.3920
10	8	8	8000	3.906	1500	0	4	11.0	1.1685	11174.9072	563.7338	108.5000	223.5824	134.3820	15.2	6.8284	11041.1543	465.4318	267.1574
10	8	8	8000	3.906	1500	0	5	10.6	0.9051	11000.9121	526.4941	41.6495	146.3104	32.1328	13.4	2.8462	10913.1006	492.4663	273.1744
10	8	8	8000	3.906	1500	0	6	11.4	1.1289	11259.4043	590.0909	46.5207	130.1376	29.4317	12.4	1.9141	11072.2764	442.5335	230.2688
10	8	8	9000	4.057	1500	0	1	11.6	0.9059	10875.1367	491.3724	34.7919	144.1007	83.9754	13.6	3.5730	10747.9824	378.3390	236.9479
10	8	8	9000	4.057	1500	0	2	11.2	1.0560	11629.0273	407.2569	39.3994	120.5136	129.1234	16.6	5.9505	11410.8984	377.8074	260.3200
10	8	8	9000	4.057	1500	0	3	10.6	0.9051	10906.4980	461.2774	24.6733	120.7648	87.7614	10.8	1.0560	10895.9951	451.2708	240.5300
10	8	8	9000	4.057	1500	0	4	11.4	1.4780	11200.3350	568.2866	97.8000	223.5824	134.3820	15.2	6.8284	11041.1543	465.4318	267.1574
10	8	8	9000	4.057	1500	0	5	10.6	0.9051	10951.7098	555.7270	82.6000	94.8656	22.0183	13.2	2.9752	10898.2549	509.6118	206.8592
10	8	8	9000	4.057	1500	0	6	11.4	1.1289	11270.2334	594.0522	46.7030	91.3824	21.1563	13.0	2.3824	11083.5449	445.1029	186.7168
10	8	8	10000	4.197	1500	0	1	11.8	1.0006	10923.7715	469.1725	78.5000	172.2470	93.3523	14.2	3.5825	10757.7871	353.1938	239.2656
10	8	8	10000	4.197	1500	0	2	11.2	1.0560	11645.0508	430.4414	41.2821	147.8344	23.7597	16.6	5.9505	11405.9629	367.9056	347.6544
10	8	8	10000	4.197	1500	0	3	10.4	0.6913	10934.9805	490.6880	28.4129	122.6272	20.6613	10.8	1.0560	10896.3115	454.0571	131.7312
10	8	8	10000	4.197	1500	0	4	11.2	1.2531	11237.9492	668.1371	110.0000	132.0640	28.5169	15.0	6.4000	10976.3838	476.9759	286.8928
10	8	8	10000	4.197	1500	0	5	10.6	0.9051	10992.3047	536.3229	90.4000	136.2656	29.1502	13.4	2.8462	10923.3223	485.2968	279.1968
10	8	8	10000	4.197	1500	0	6	11.4	1.1289	11296.3984	621.8189	118.0000	130.8000	28.9884	13.2	2.3804	11070.5020	448.0931	249.0144
10	8	8	1000	2	1500	80	1	3.6	0.6913	4740.7642	485.7790	56.2108	47.3280	31.2287	3.6	0.6913	4740.7642	485.7790	47.3280
10	8	8	1000	2	1500	80	2	3.4	0.6034	4838.6499	400.3357	55.3631	43.5536	29.4215	3.4	0.6034	4838.6499	400.3357	43.5536
10	8	8	1000	2	1500	80	3	3.2	0.4526	4638.4077	408.5076	41.8324	29.9872	16.3312	3.2	0.4526	4638.4077	408.5076	29.9872
10	8	8	1000	2	1500	80	4	3.6	0.6913	4810.6104	514.2407	260.4000	51.3376	34.8350	3.6	0.6913	4810.6104	514.2407	260.4000
10	8	8	1000	2	1500	80	5	3.4	0.6034	4715.3467	452.4409	54.8957	41.9008	29.6976	3.4	0.6034	4715.3467	452.4409	29.6976
10	8	8	1000	2	1500	80	6	3.6	0.6913	4773.2305	527.3104	269.7000	60.0216	48.5088	3.6	0.6913	4773.2305	527.3104	48.5088
10	8	8	2000	2.5	1500	80	1	3.0	0.0000	4097.6689	276.1928	76.6000	23.6096	2.8982	3.0	0.0000	4097.6689	276.1928	23.6096
10	8	8	2000	2.5	1500	80	2	3.0	0.0000	4317.0352	259.4706	24.7092	28.1728	4.1425	3.0	0.0000	4317.0352	259.4706	28.1728
10	8	8	2000	2.5	1500	80	3	3.2	0.4526	4375.4829	354.9457	100.5000	33.2864	18.2355	3.2	0.4526	4375.4829	354.9457	18.2355
10	8	8	2000	2.5	1500	80	4	3.0	0.0000	4187.8276	307.3885	89.1000	28.7338	5.4998	3.0	0.0000	4187.8276	307.3885	5.4998
10	8	8	2000	2.5	1500	80	5	3.0	0.0000	4272.7646	246.3425	92.9000	34.9039	7.5914	3.0	0.0000	4272.7646	246.3425	34.9039
10	8	8	2000	2.5	1500	80	6	3.0	0.0000	4251.7422	219.1581	89.2000	23.5969	5.8504	3.0	0.0000	4251.7422	219.1581	5.8504
10	8	8	3000	2.849	1500	80	1	3.0	0.0000	3927.4500	192.7935	36.5000	22.6496	2.4414	3.6	1.3577	3924.9167	190.4021	65.8816
10	8	8	3000	2.849	1500	80	2	3.0	0.0000	4140.0596	275.4644	49.3000	24.3076	6.0360	3.4	0.6034	4114.9502	256.2212	45.3376

C	W	B	R _{max} [km]	E/O cost ratio	I/V [Gb/s]	FR [%]	Policy	F _{min}	±CI	Weighted port count @F _{min}	±CI	# of OEOs @F _{min}	±CI	Solve time [sec]	±CI	F _{opt}	±CI	Weighted port count @F _{opt}	±CI	# of OEOs @F _{opt}	±CI	Solve time [sec]	±CI
10	8	8	3000	2.849	1500	80	3	3.0	0.0000	4125.2676	317.1986	50.2000	27.8804	29.7886	6.4495	4.4	2.1387	4116.5283	312.7504	35.9000	16.7656	92.9884	112.68
10	8	8	3000	2.849	1500	80	4	3.0	0.0000	3942.3660	265.6426	32.0000	13.0910	29.4720	6.9644	3.6	1.3577	3937.8184	261.1085	30.3000	13.0773	86.5536	129.22
10	8	8	3000	2.849	1500	80	5	3.2	0.4526	4116.3423	263.6175	41.0000	19.7378	34.7520	12.5616	3.6	1.3577	4116.3110	263.5609	33.2000	12.9845	82.5984	119.40
10	8	8	3000	2.849	1500	80	6	3.0	0.0000	3952.0144	244.2673	37.8000	16.9154	22.8672	3.7879	3.2	0.4526	3937.1829	235.9177	32.6000	15.4914	30.7520	20.683
10	8	8	4000	3.125	1500	80	1	3.0	0.0000	3803.5977	216.5412	19.0000	9.9206	23.1360	2.4214	3.0	0.0000	3803.5977	216.5412	19.0000	9.9206	23.1360	2.4214
10	8	8	4000	3.125	1500	80	2	3.0	0.0000	4107.5229	259.2887	41.7000	23.5420	29.4912	5.9657	4.0	1.8165	4051.6440	221.8594	23.5000	15.3403	58.6880	47.234
10	8	8	4000	3.125	1500	80	3	3.0	0.0000	4059.6941	273.5031	36.3000	27.7295	32.7424	10.0300	4.6	1.8841	4021.2942	253.5634	13.1000	10.9429	136.2176	146.66
10	8	8	4000	3.125	1500	80	4	3.0	0.0000	3918.3250	277.7557	26.4000	13.3407	28.5120	6.6433	4.4	1.9141	3869.6707	244.1056	16.7000	12.1247	61.0304	43.145
10	8	8	4000	3.125	1500	80	5	3.0	0.0000	4019.8403	231.6831	34.8000	28.0290	28.6400	5.2276	3.8	1.3826	3977.1896	186.1424	17.1000	9.1289	84.3904	108.85
10	8	8	4000	3.125	1500	80	6	3.0	0.0000	3925.0227	216.9196	26.4000	15.1159	23.6800	3.4897	3.2	0.4526	3905.0567	204.9415	21.8000	13.0936	31.3984	20.051
10	8	8	5000	3.358	1500	80	1	3.0	0.0000	3806.9973	220.0041	17.2000	8.1501	22.7840	2.2323	3.0	0.0000	3806.9973	220.0041	17.2000	8.1501	22.7840	2.2323
10	8	8	5000	3.358	1500	80	2	3.0	0.0000	4098.1177	269.4755	40.3000	23.7848	29.0048	6.1597	4.0	1.8165	4036.2410	229.0769	22.4000	16.2932	58.0416	47.203
10	8	8	5000	3.358	1500	80	3	3.0	0.0000	4035.3547	279.2001	32.0000	23.0633	29.5680	5.6548	4.0	1.5458	4016.2996	269.0282	19.6000	15.9866	85.9968	107.63
10	8	8	5000	3.358	1500	80	4	3.0	0.0000	3896.8457	259.8031	23.7000	11.5430	27.9360	6.5687	3.6	0.9659	3864.9531	247.7729	20.1000	13.0267	44.2240	28.216
10	8	8	5000	3.358	1500	80	5	3.0	0.0000	4062.1602	224.7153	35.2000	28.6095	30.7200	6.7283	3.8	1.3826	4006.5938	174.4087	16.6000	9.4820	84.1664	105.03
10	8	8	5000	3.358	1500	80	6	3.0	0.0000	3915.7024	213.0533	29.2000	17.6011	23.4752	3.4041	3.8	1.3826	3889.8352	199.8186	19.8000	16.4240	73.6640	96.273
10	8	8	6000	3.561	1500	80	1	3.0	0.0000	3801.8489	215.3376	15.4000	8.1039	22.9024	2.2933	3.0	0.0000	3801.8489	215.3376	15.4000	8.1039	22.9024	2.2933
10	8	8	6000	3.561	1500	80	2	3.0	0.0000	4095.9917	248.6651	40.6000	21.4908	29.0816	6.2499	4.0	1.8165	4041.2109	214.2755	23.8000	16.2219	57.5168	46.483
10	8	8	6000	3.561	1500	80	3	3.0	0.0000	3995.3157	251.7220	27.5000	22.0398	28.7360	5.2645	4.0	1.5458	3975.0724	238.2703	15.0000	12.1479	51.6480	37.392
10	8	8	6000	3.561	1500	80	4	3.0	0.0000	3870.2278	258.0993	20.2000	11.4229	26.4448	5.6468	3.4	0.6034	3847.0305	249.3907	17.0000	12.0869	38.8352	22.667
10	8	8	6000	3.561	1500	80	5	3.0	0.0000	4064.4246	219.9867	32.9000	29.5460	30.9760	6.5805	3.6	0.9659	4013.4856	176.0263	14.2000	9.0999	49.0240	30.712
10	8	8	6000	3.561	1500	80	6	3.0	0.0000	3892.5586	229.7792	21.3000	14.7920	22.7974	2.2289	3.8	1.3826	3866.9023	216.0673	11.9000	9.7088	44.1600	33.592
10	8	8	7000	3.742	1500	80	1	3.0	0.0000	3811.7742	221.5913	16.8000	8.3841	22.7906	2.2289	3.0	0.0000	3811.7742	221.5913	16.8000	8.3841	22.7906	2.2289
10	8	8	7000	3.742	1500	80	2	3.0	0.0000	4092.7124	265.9843	39.4000	23.0885	29.0560	6.1607	4.0	1.8165	4032.7981	227.0604	21.8000	15.5705	57.5168	46.578
10	8	8	7000	3.742	1500	80	3	3.0	0.0000	4009.9797	261.0147	28.9000	21.7937	28.6528	5.3106	4.0	1.5458	3990.3457	248.7392	16.4000	12.5179	86.7648	111.63
10	8	8	7000	3.742	1500	80	4	3.0	0.0000	3896.2129	258.8393	23.6000	11.7779	27.9424	6.5603	3.6	0.9659	3864.9761	246.9540	20.1000	13.1571	43.6736	27.416
10	8	8	7000	3.742	1500	80	5	3.0	0.0000	4062.1941	225.5113	34.9000	28.6645	30.8992	6.8067	3.6	0.9659	4007.6360	175.9878	16.3000	9.3116	46.6816	27.453
10	8	8	7000	3.742	1500	80	6	3.0	0.0000	3912.8521	210.4762	29.6000	17.5571	23.3984	3.4339	3.8	1.3826	3886.9849	196.8555	20.2000	16.5069	74.4256	98.965
10	8	8	8000	3.906	1500	80	1	3.0	0.0000	3811.7742	221.5913	16.8000	8.3841	22.7584	2.2301	3.0	0.0000	3811.7742	221.5913	16.8000	8.3841	22.7584	2.2301
10	8	8	8000	3.906	1500	80	2	3.0	0.0000	4092.4934	265.8460	39.4000	23.0885	29.1712	6.1873	4.0	1.8165	4032.7981	227.0604	21.8000	15.5705	57.5168	46.578
10	8	8	8000	3.906	1500	80	3	3.0	0.0000	4012.1653	262.5926	28.5000	21.7801	28.5888	5.3102	4.0	1.5458	3992.5308	250.4920	16.0000	12.2644	84.9536	107.54
10	8	8	8000	3.906	1500	80	4	3.0	0.0000	3896.2129	258.8393	23.6000	11.7779	27.9360	6.5960	3.6	0.9659	3864.9761	246.9540	20.1000	13.1571	44.3584	28.441
10	8	8	8000	3.906	1500	80	5	3.0	0.0000	4062.1941	225.5113	34.9000	28.6645	30.7354	6.6857	3.6	0.9659	4007.6360	175.9878	16.3000	9.3116	47.1616	28.391
10	8	8	8000	3.906	1500	80	6	3.0	0.0000	3914.6919	210.2489	29.3000	17.5760	23.3856	3.4128	3.8	1.3826	3888.8242	196.7501	19.9000	16.4297	73.4336	96.039
10	8	8	9000	4.057	1500	80	1	3.0	0.0000	3816.9829	222.9431	16.7000	8.4466	18.8640	1.9169	3.0	0.0000	3816.9829	222.9431	16.7000	8.4466	18.8640	1.9169
10	8	8	9000	4.057	1500	80	2	3.0	0.0000	4089.2292	262.4332	38.2000	21.3303	24.1120	5.1818	4.0	1.8165	4032.7981	227.0604	21.8000	15.5705	43.9872	31.782
10	8	8	9000	4.057	1500	80	3	3.2	0.4526	4069.1177	326.4984	34.2000	25.7084	30.0224	13.9870	4.6	1.8841	4008.8547	263.7767	13.0000	12.3107	48.7584	30.317
10	8	8	9000	4.057	1500	80	4	3.0	0.0000	3895.3796	258.2157	22.8000	11.6692	23.2576	5.6039	4.0	1.2162	3862.8945	246.1704	17.5000	13.7937	40.0448	22.128
10	8	8	9000	4.057	1500	80	5	3.0	0.0000	4072.1577	226.8317	37.2000	28.5936	29.6880	4.5076	3.6	0.9659	4013.1328	176.2967	18.5000	11.4351	36.9888	23.322
10	8	8	9000	4.057	1500	80	6	3.0	0.0000	3914.6919	210.2489	29.3000	17.5760	19.3824	2.9562	3.8	1.3826	3888.8242	196.7501	19.9000	16.4297	33.0080	22.743
10	8	8	10000	4.197	1500	80	1	3.0	0.0000	3842.4734	210.2356	18.1000	12.1453	24.9280	3.3700	3.6	1.3577	3827.2222	215.4778	12.5000	8.1602	36.8192	28.631
10	8	8	10000	4.197	1500	80	2	3.0	0.0000	4089.6079	261.9126	38.2000	21.3303	28.7872	6.0041	3.8	1.3826	4033.7397	226.8672	21.8000	15.5705	54.1248	39.822
10	8	8	10000	4.197	1500	80	3	3.2	0.4526	4069.1177	326.4984	34.2000	25.7084	36.8574	18.8714	4.6	1.8841	4012.0503	265.3360	13.0000	12.3107	69.4863	49.863
10	8	8	10000	4.197	1500	80	4	3.0	0.0000	3894.8926	258.4994	23.6000	11.7779	27.8144	6.5845	3.6	0.9659	3865.8796	247.4227	20.1000	13.1571	44.1024	28.313
10	8	8	10000	4.197	1500	80	5	3.0	0.0000	4052.0676	224.8117	34.6000	28.3847	30.6944	6.5289	4.2	1.9318	4009.3210	181.9438	13.9000	9.7355	58.1888	47.315
10	8	8	10000	4.197	1500	80	6	3.0	0.0000	3911.4304	212.7988	28.2000	16.7634	23.2832	3.4594	4.6	2.1119	3883.9063	198.9739	12.3000	10.2426	103.5520	132.81

Appendix D

Confidence Interval

The reliability of the simulation results is normally described in terms of confidence intervals [MACD87][BCNN01]. A Confidence Interval (CI) generates a lower and upper bound for the mean. The CI indicates the probability that the true mean lies within the interval. The narrower the interval, the more accurate is our mean.

The CI is calculated as follows. Suppose we have N statistically independent simulation runs with the simulation results of $X_1, X_2, \dots, X_N$. The sample mean $\bar{X}$ of these results is given by

$$\bar{X} = \frac{\sum_{i=1}^N X_i}{N} \quad (\text{D.1})$$

The sample variance S_X^2 is defined as follows:

$$S_X^2 = \frac{\sum_{i=1}^N (X_i - \bar{X})^2}{N - 1} \quad (\text{D.2})$$

The upper and lower bounds for the mean calculated as follows:

$$\text{Upper bound} = \bar{X} + \frac{S_X \cdot t_{\frac{\alpha}{2}, N-1}}{\sqrt{N}} \quad (\text{D.3})$$

$$\text{Lower bound} = \bar{X} - \frac{S_X \cdot t_{\frac{\alpha}{2}, N-1}}{\sqrt{N}} \quad (\text{D.4})$$

where $t_{\frac{\alpha}{2}, N-1}$ is the upper $100 \times \frac{\alpha}{2}$ percentage of the t -distribution with $N-1$ degrees of freedom, and its values can be obtained from the t -distribution table in [MACD87][BCNN01].

The intervals thus obtained are referred to as the intervals with $100 \times (1 - \alpha)$ percent confidence and $(N - 1)$ degrees of freedom. These confidence intervals can be made as small as desired by increasing the number of independent simulation runs. In this thesis, the 95% confidence interval for the simulation is calculated based on 10 independent runs. Thus, $t_{\frac{\alpha}{2}, N-1} = 2.26$ according to the t -distribution table with $\alpha = 0.05$ and $N = 10$.

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