MATHEMATICAL QUESTIONS

Question 1

Explain why the ROADM architecture shown in Fig. 1 is non-directionless. Propose a solution to make the ROADM directionless.

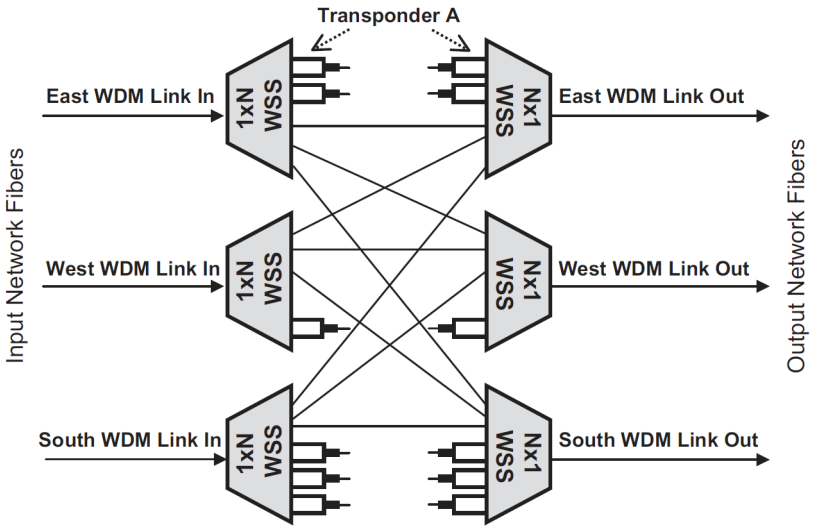

Figure 1: A non-directionless route-and-select ROADM architecture.

Question 2

In Fig. 2, the IP router is connected only to Add/Drop Port 1. It is desired that the router establishes two connections, one on the East link and one on the West link, both of which have only λ_1 available. Is it possible to have the connections established? Why? If the connections cannot be established, propose a solution to fix the problem.

Question 2 continued on next page...

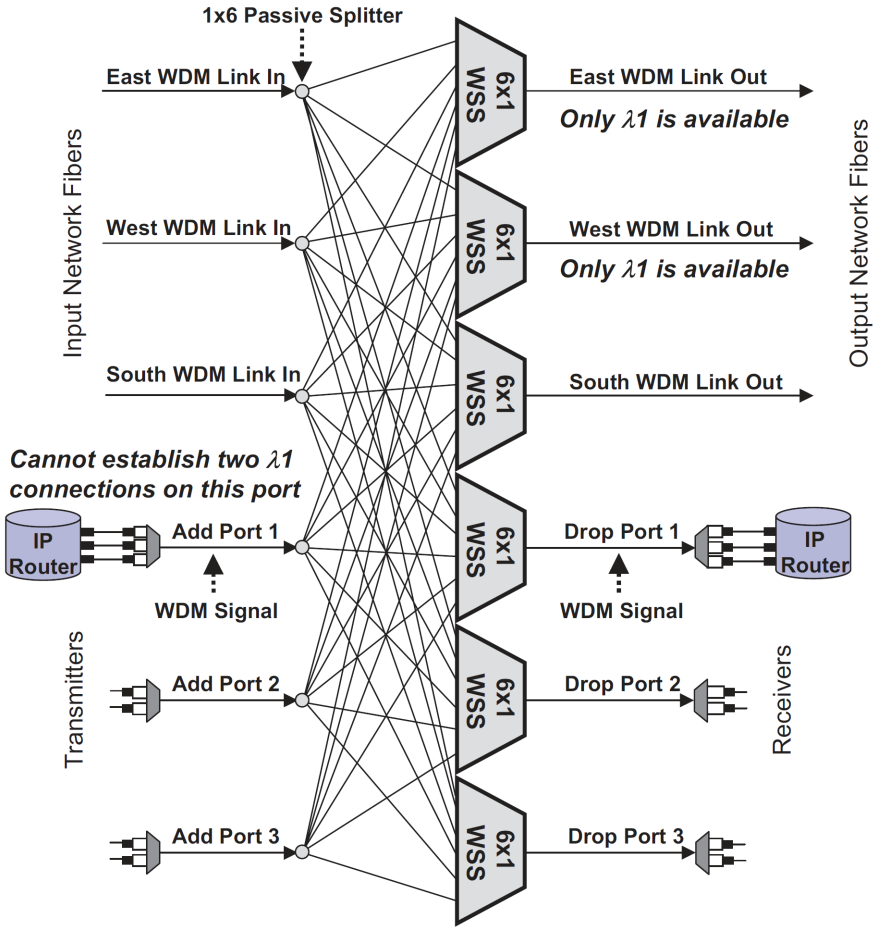

Figure 2: A non-contentionless broadcast-and-select ROADM architecture.

Question 3

In an O-E-O network, there is an additional cost of one regeneration every time a connection is routed through a node. In a pure "all-optical" network (i.e., no regenerations), there is no additional cost incurred for routing a connection through a node. How might this affect the choice of network topology, e.g., in terms of fiber connectivity or network diameter, in the two architectures?

SOFTWARE QUESTIONS

Question 4 continued on next page...

Question 4

Consider the sample optical network of Fig. 3 and assume that the its topology is described by directional graph $G(N, L)$, where each link $l = (b, e) \in L$ begins at node $b \in N$, ends at node $e \in N$, and has weight W_l km.

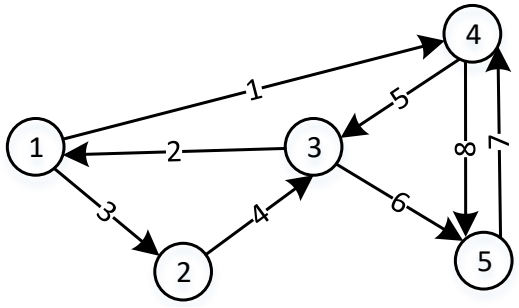

Figure 3: A sample optical network.

(a) Write a MATLAB/Python code to find the shortest spanning tree rooted from node $s \in N$.

(b) Write a MATLAB/Python code to find the shortest path from node $s \in N$ to node $d \in N$. What happens if no path is available from node $s \in N$ to node $d \in N$?

(c) Write a MATLAB/Python code to find the fist K shortest paths from node $s \in N$ to node $d \in N$. What happens if less than K paths are available from node $s \in N$ to node $d \in N$?

BONUS QUESTIONS

Question 5

Write a MATLAB/Python code to find the shortest pair of disjoint paths from node $s \in N$ to node $d \in N$. What happens if no pair of disjoint paths is available from node $s \in N$ to node $d \in N$? Upgrade your code to find a pair of shortest maximally link-disjoint paths.

Question 6 continued on next page...

Question 6

Return your answers by filling the LaTeXtemplate of the assignment.