

MANDATORY TASK

Task 1

Consider the bidirectional network topology described by the links given in Tab. 1. The bidirectional traffic matrix of Tab. 2 should be served by the network. Each link has 80 wavelengths and each wavelength can carry a line rate of 100 Gb/s. The network nodes have O-E-O architecture and therefore, optical reach is not a limiting factor for grooming, routing, and wavelength assignment. Further, grooming facilities are available at all network nodes to groom various sub-rate 10 Gb/s traffic requests. Use different grooming operations to groom the given traffic matrix over the network. Route the groomed traffic requests over suitably selected wavelengths. Report line rate utilization and number of wavelength-links before and after each grooming operation. Feel free to employ Python or MATLAB for coding.

Begin Node ID	01	02	01	02	03	04	09	05	05	06
End Node ID	02	03	08	04	05	09	10	10	06	07
Link Length (km)	067	093	089	090	098	125	110	125	010	010
Begin Node ID	07	08	05	07	07	11	12	13	16	14
End Node ID	12	13	11	20	21	14	15	17	17	19
Link Length (km)	015	071	010	015	010	007	025	057	005	006
Begin Node ID	15	17	18	19	20	17	17	19	21	24
End Node ID	21	18	19	20	21	22	23	25	26	25
Link Length (km)	005	110	050	005	006	130	088	138	085	005
Begin Node ID	22	23	25	26	27	28	29	30	31	32
End Node ID	28	29	30	33	30	29	30	31	32	33
Link Length (km)	055	053	120	090	005	115	132	070	039	045

Table 1: Bidirectional network topology description.

Source Node ID	11	19	19	06	11	19	20	06	11	20
Destination Node ID	06	06	11	14	14	14	14	07	07	07
Number of 10Gs	04	03	05	02	02	01	03	05	05	29
Source Node ID	21	21	20	06	11	06	11	20	21	19
Destination Node ID	07	19	19	20	20	12	12	12	12	12
Number of 10Gs	19	08	07	02	02	02	02	02	02	01
Source Node ID	07	06	11	20	21	06	11	19	07	06
Destination Node ID	12	15	15	15	15	05	05	05	05	21
Number of 10Gs	02	01	01	02	02	03	03	02	04	02
Source Node ID	11	20	19	20	18	21	20	19	07	12
Destination Node ID	21	21	18	18	17	17	17	17	17	17
Number of 10Gs	02	11	03	02	01	06	05	05	02	01
Source Node ID	06	11	20	21	17	17	13	17	19	17
Destination Node ID	17	17	17	17	13	13	08	08	08	22
Number of 10Gs	01	01	13	02	05	02	02	02	01	07
Source Node ID	17	07	20	21	06	11	12	23	17	30
Destination Node ID	22	22	22	22	22	22	22	29	29	29
Number of 10Gs	03	02	01	01	03	03	01	03	04	03
Source Node ID	17	07	21	20	06	11	25	21	20	19
Destination Node ID	23	23	23	23	23	23	30	30	30	30
Number of 10Gs	05	02	01	04	06	06	03	06	05	03
Source Node ID	07	06	11	12	21	20	21	20	11	07
Destination Node ID	30	30	30	30	30	30	25	25	25	25
Number of 10Gs	03	01	01	01	02	12	05	14	04	03
Source Node ID	06	30	33	26	21	20	19	07	06	11
Destination Node ID	25	31	31	33	33	33	33	33	33	33
Number of 10Gs	02	02	01	02	06	02	02	03	03	03
Source Node ID	12	21	20	07	06	11	15	21	20	19
Destination Node ID	33	26	26	26	26	26	26	03	03	03
Number of 10Gs	02	04	01	03	02	02	02	02	04	02
Source Node ID	07	06	11	05	03	21	20	19	07	06
Destination Node ID	03	03	03	03	02	02	02	02	02	02
Number of 10Gs	02	01	02	03	02	02	04	02	02	01
Source Node ID	11	12	02	08	21	20	07	06	11	05
Destination Node ID	02	02	01	01	01	01	01	01	01	10
Number of 10Gs	01	02	01	01	01	03	02	01	01	02
Source Node ID	21	20	07	09	02	20	07	10	20	07
Destination Node ID	10	10	10	04	04	04	04	09	09	09
Number of 10Gs	01	01	02	02	02	01	02	02	01	02
Source Node ID	11	11	07	17	17	11	19	12	19	22
Destination Node ID	29	09	11	23	08	25	25	25	07	28
Number of 10Gs	01	02	04	02	03	01	03	01	04	04
Source Node ID	17	17	29	31	30	33				
Destination Node ID	28	28	28	32	32	32				
Number of 10Gs	01	01	01	00	02	01				

Table 2: Bidirectional traffic matrix description.

(a) Prepare a short report and describe your work concisely. Use suitable figures to better describe the developed codes and to make your report more readable and understandable. Attach a copy of the developed codes to your sent report. Make sure to provide descriptive comments for the codes.

BONUS

Task 2

Repeat grooming, routing, and wavelength assignment if each request requires a maximally disjoint protection path. Again, report line rate utilization and number of wavelength-links before and after each grooming operation.

Task 3

Return your report by filling the \LaTeX template of the project. If you want to add a figure or diagram, you can draw it directly using TikZ package, or draw it in a secondary application such as Microsoft Visio and then, import it as a figure. Another option is the website [mathcha](#), where you can draw a desired diagram and receive its corresponding \LaTeX code.