University of the Western Cape
Department of Computer Science

CSC212 Term 4: Assignment 2 **Due Date: 13 October 2023; 11:55PM**

IMPORTANT: SUBMISSION IS VIA IKAMVA.
You must submit the Java Code, Two Graph input (.txt) files, and the output of both questions.

Question 1

Imagine you are working with Civil Engineers to repair a road network connecting 22 cities together which has been damaged by floods. The cost associated with maintaining the road network is shown in Fig. 1.

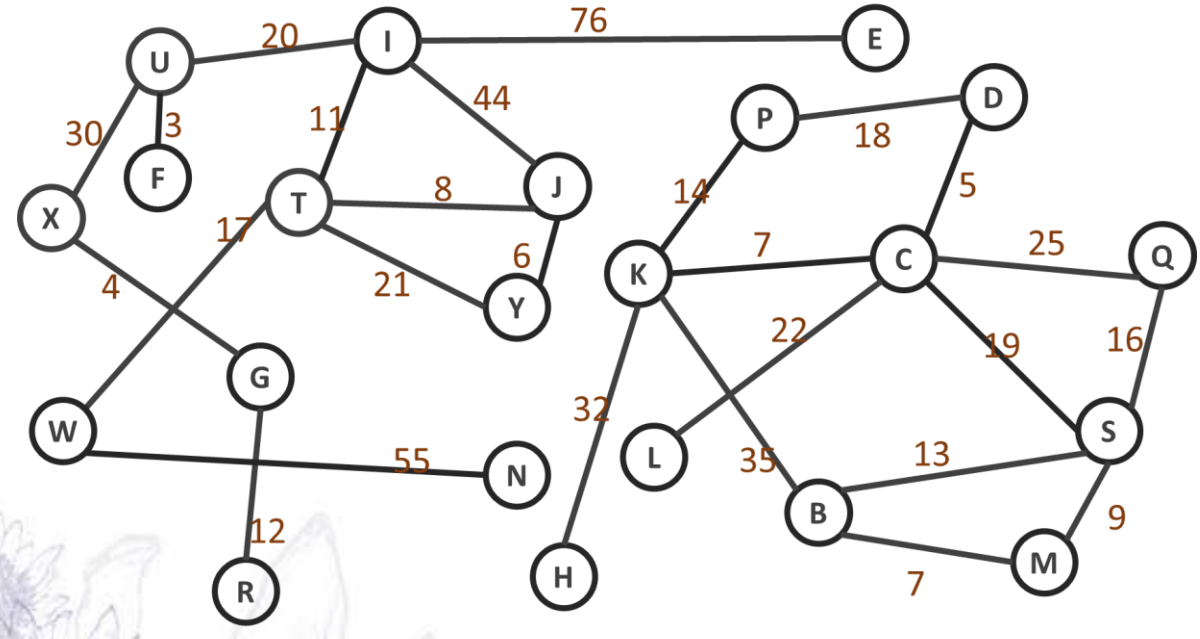
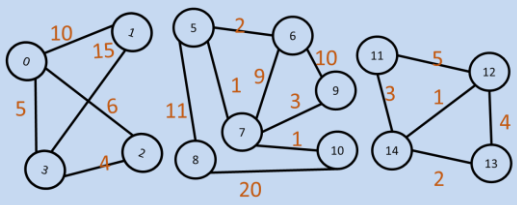


Fig. 1: Damaged Road network and the cost of visiting each city

Using Fig. 1 as reference, implement an algorithm which estimates the minimum cost of keeping the cities connected despite the damage. (**Note**: Treat the damaged road network as **one** disconnected graph; **NOT** as two separate graphs.)

Code Input:	Fig. 1 (using any graph representation)
Code Output:	Number of sections and list of edges in each section whose sum make up the minimum cost of keeping the cities connected

Example Input:



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Example Output:

```
Number of sections: 3
Edge list:
0 - 3
0 - 1
2 - 3
5 - 7
7 - 10
5 - 6
7 - 9
5 - 8
12 - 14
14 - 13
14 - 11
```

Question 2

[Continuing from Question 1] After visiting the cities and assessing the extent of the road damage in Fig. 1, the Civil Engineers determine that the cost of fixing the road between certain cities is as follows:

Table 1: Cost of repairing the road network between two cities

		Cost of repair
Y	K	24
J	P	10
J	H	52
N	H	25
J	E	31
G	K	34

Estimate the minimum cost of keeping the cities connected after the road network is fixed. (**Note**: Connect the graph in Fig. 1 at those nodes in Table 1 with the associated costs.)

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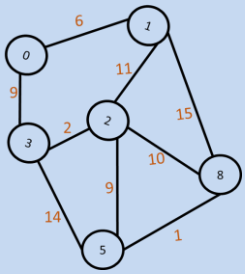
Code Input:	Fig. 1 modified using the costs provided in Table 1 (using any graph representation)
Code Output:	Minimum cost of connecting all the cities in the network
Example input:	
Example Output:	`Minimum cost of connecting the cities: 27`

Additional Instructions:

- Students can use any graph representation methods as input.
- Reading the input graph from file is optional; students can hardcode the two graphs if desired, however, the graph representations used to implement the code must be submitted separately in 2 text files named ***graph1_input.txt*** and ***graph2_input.txt***
- ***graph2_input.txt*** must include the additional fixed routes and associated cost in Table 1.
- The algorithm implemented in Question 1 **must** be different from that used in Question 2.

Mark Allocation:

Input text files	10 marks (5 marks each question)
Algorithm Implementation:	50 marks (25 marks each question)
Output:	30 marks (Q1: 20 marks Q2: 10 marks)
Format: Comments	10 marks