RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree in Applied Sciences
Third Year - Semester II Examination –February / March 2019

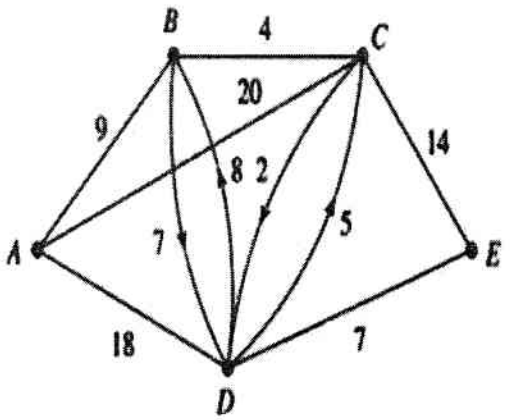
MAT 3302 – NETWORK OPTIMIZATION

Time allowed: **Three (3) hours**

Answer **all questions.**

1) a. Explain the circumstances in which Floyd's algorithm is preferred over to Dijkstra's algorithm. (10 marks)

b. A vehicle travels motorways between five cities. The network shows the tolls payable on each road. Arrows indicate one-way roads between cities and the others are bi–way roads:

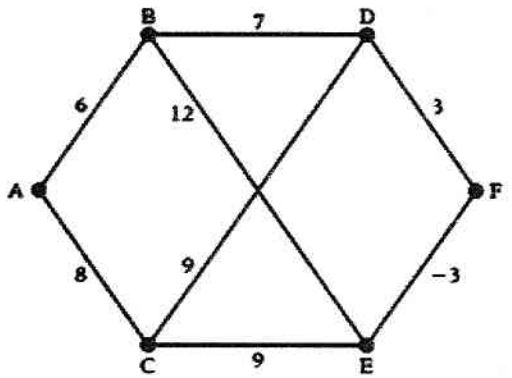


i) Use Floyd's algorithm to produce a table of least cost routes. (35 marks)

ii) A driver starts from **A** and must make a delivery at each city before returning to **A**. In each stage, driver uses the least cost option to choose the next place to visit. Find the total cost and the order in which he will go to or through the cities. (15 marks)

iii) State two other considerations that might affect his choice of route. (05 marks)

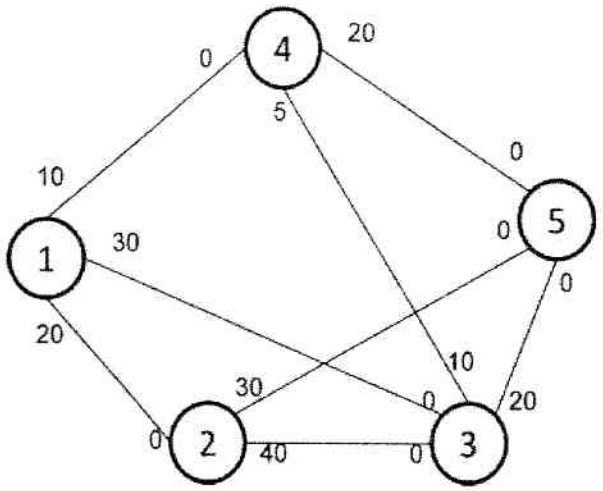
b. The following network shows the cost in some units of travelling along a series of roads. Use Dijkstra's algorithm to find the minimum cost of travelling from A to F.



(35 marks)

2) a. What is the objective of the maximum flow problem? Write down the general mathematical formulation for a maximum flow problem. (20 marks)

b. Consider the following network of pipelines:

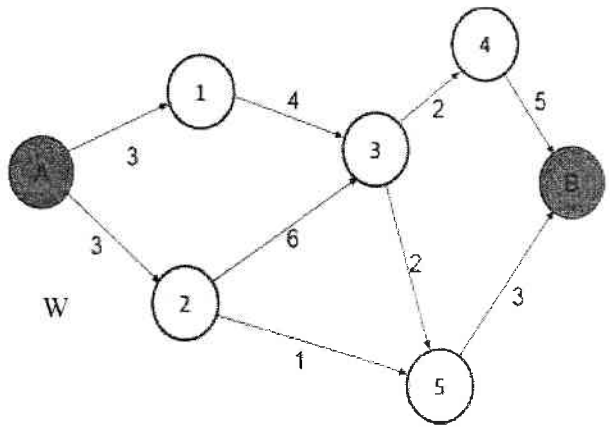


i) Find the maximum flow of the above pipeline from node 1 to node 5 using **maximum flow algorithm**. (80 marks)

3) a. A company plans to hold a Super Light-and-Sound Show in the Galle-face ground on New Year eve. The organizing committee has asked the Electricity Board about the maximum electricity that can be supplied from the Mount Lavinia sub-station for use in the celebration events. The power generator for this is located at Norochchole. It will supply electricity to the Mount Lavinia sub-station for utilization for the event.

The following figure shows the maximum available capacity (after subtracting other normal usage) for transferring electricity between different sub-stations in Norochchole. What is the maximum power that Electricity Board can provide to the event organizer?

(**Hint :** use the **Ford-Fulkerson algorithm.**)



A = Norochchole plant
B = Mount – Lavinia sub station

(60 marks)

b. Verify your answer obtained in part (a) using **maximum flow-minimum cut theorem.**

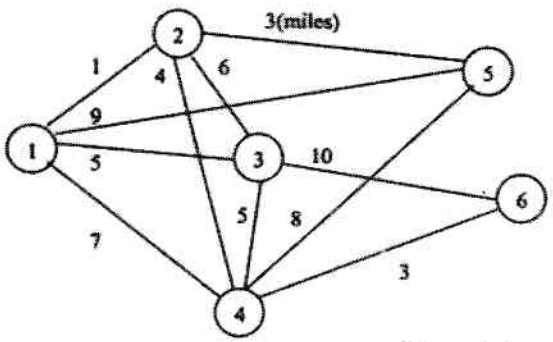
(40 marks)

4) a. Define each of the following terms:

i) Walk
ii) Cycle
iii) Minimum spanning tree
iv) Path

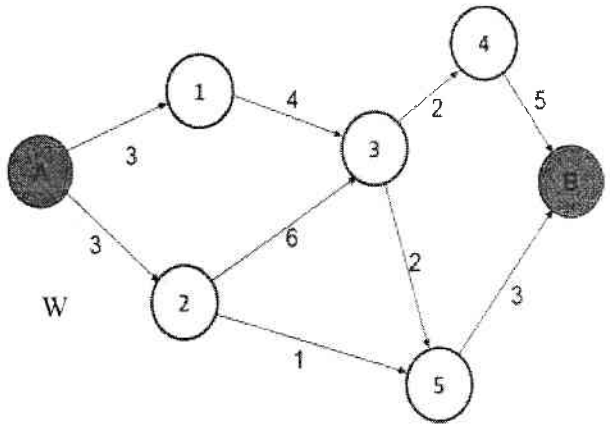
(20 marks)

b. A TV cable company is in the process of providing cable service to five new housing development areas near Mihintale town. Below figure shows possible TV links among the five areas. The length of the cable in miles is shown on each respective arc:



Determine the most economical cable network. (80 marks)

The following figure shows the maximum available capacity (after subtracting other normal usage) for transferring electricity between different sub-stations in Norochchole. What is the maximum power that Electricity Board can provide to the event organizer?
(**Hint :** use the **Ford-Fulkerson algorithm**.)



A = Norochchole plant
B = Mount – Lavinia sub station

(60 marks)

b. Verify your answer obtained in part (a) using **maximum flow-minimum cut theorem**.
(40 marks)

4) a. Define each of the following terms:

i) Walk
ii) Cycle
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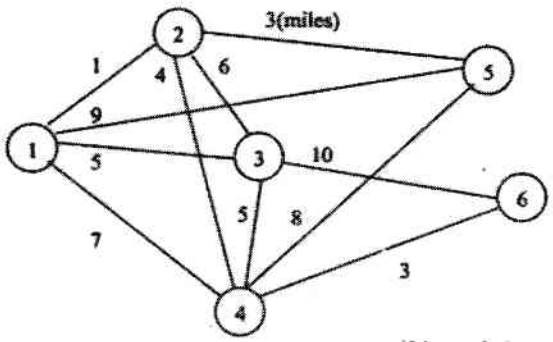
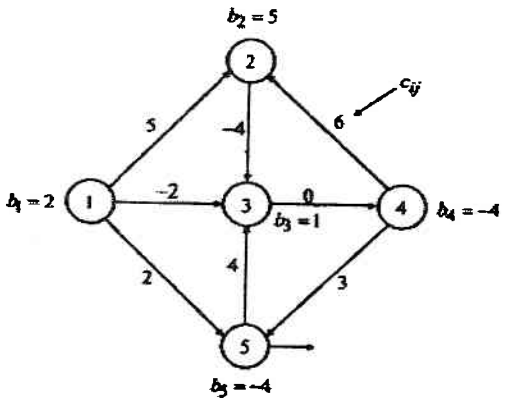


Determine the most economical cable network. (80 marks)

5) a. Consider the following **minimum cost network problem**:



Construct a Linear Programming model for the above network diagram. (25 marks)

b. Consider the following transportation problem:

Node	*3*	*4*	*5*	*Supply(S_i)*
1	4	7	5	*30*
2	2	4	3	*20*
Demand(d_j)	*15*	*10*	*25*	

i) Draw the corresponding network. (15 marks)

ii) Solve the above transportation problem by using the **network simplex method**. (60 marks)

*** END***