



RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree

Third Year - Semester II - Examination - September 2013

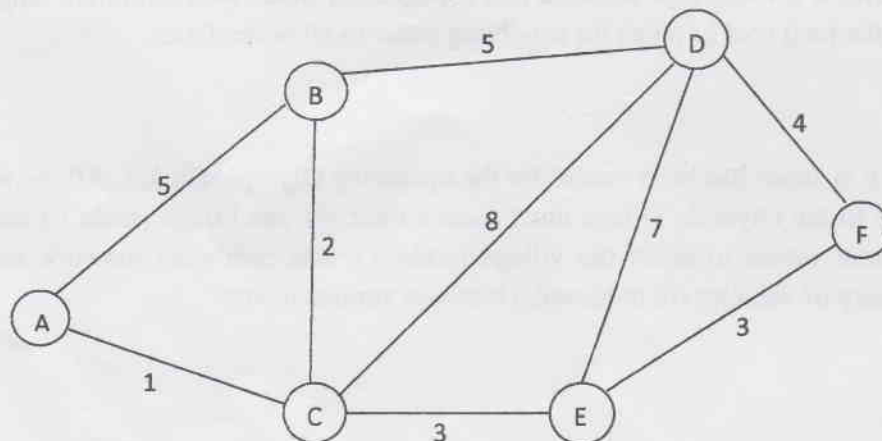
MAT 3302 – Network Optimization

Answer ALL FIVE questions.

Time allowed: THREE HOURS

1. (a) Define the following terms, as used in network optimization theory:
(i) Walk (ii) Path (iii) Tree (iv) Spanning Tree
- (b) (i) Draw the graph to represent the information given below.
- Edge set: $E = \{1,2,3,4,5\}$
- Vertex set: $V = \{(1,2), (1,3), (2,5), (3,4), (3,5), (4,1), (4,2), (4,5), (5,1)\}$
- (ii) For the above graph determine
- a walk; a path; a tree; a spanning tree.
- (c) Explain briefly, the difference between a graph and a network.

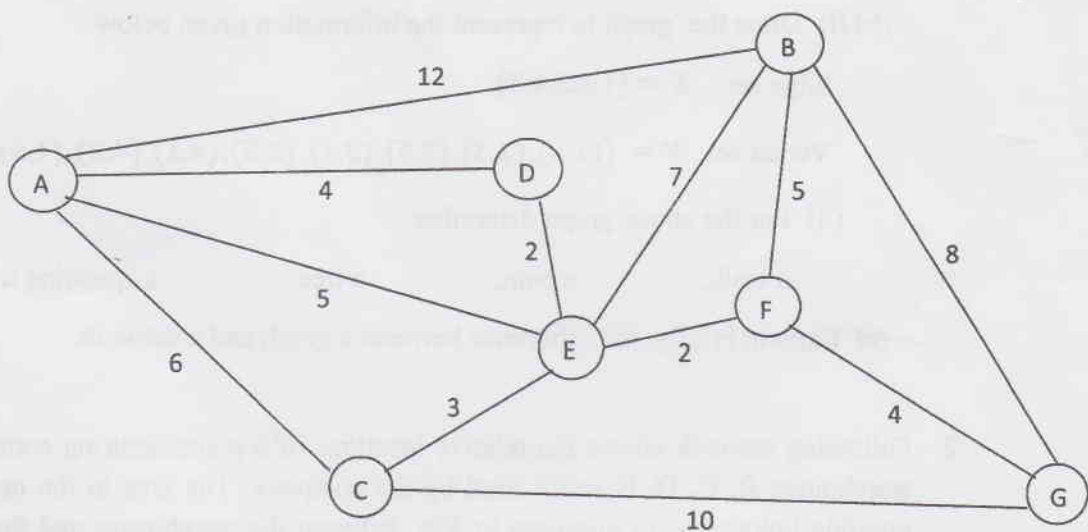
2. Following network shows the relative locations of a manufacturing company A and the warehouses B, C, D, E and F used by the company. The arcs in the network represent possible linkages with distances in *km* between the warehouses and the company. The production managers need to determine the shortest route from the company to the each of the warehouses.



- (i) What is the most appropriate algorithm (either Dijistra's algorithm or Floyed's algorithm) to solve the given problem?
- (ii) Explain briefly, why you use the above mentioned algorithm over the other.
- (iii) Determine the shortest route from the company to the each of the warehouses.

3. (a) What is meant by a minimum spanning tree?

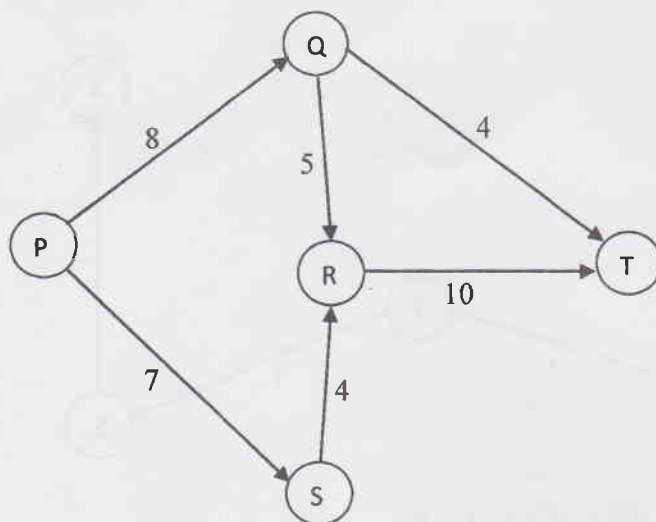
- (b) A crop producer has a large land for his farm. The farm has 7 fields in which corn is to be planted. The producer needs to provide adequate water supply to the fields. The cost of 1m length pipe is Rs.50. Length of pipes (in meters) between two fields is given in the network below.



Determine a water pipe network that connects all fields with minimum length, and hence find the total cost of pipes for supplying water to all seven fields.

4. A city in Japan has been named for the upcoming Olympic Games. All the vehicles which come to the Olympic village must cross a river via one bridge (node P) and then choose different routes to reach the village (node T). The following network shows the flow capacity of vehicles (in thousands) between various towns:

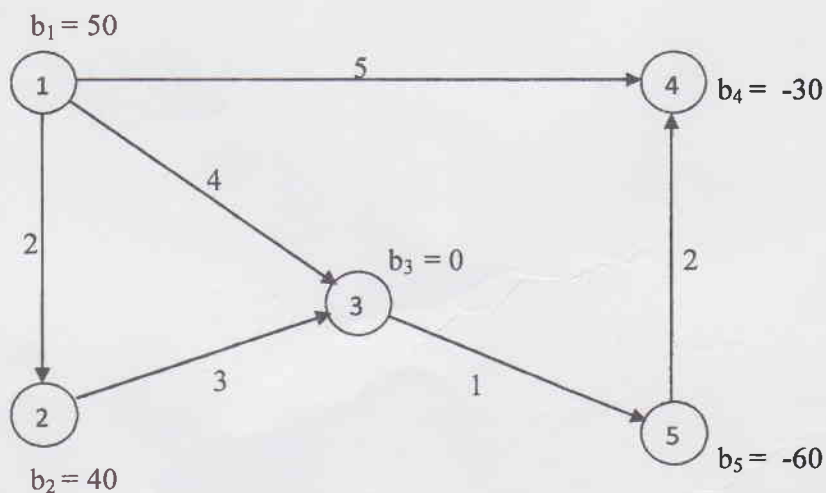
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(i) Identify the source nodes and the sink nodes.

(ii) Determine the maximum number of vehicles that can reach across the bridge to the Olympic ground through the given routes.

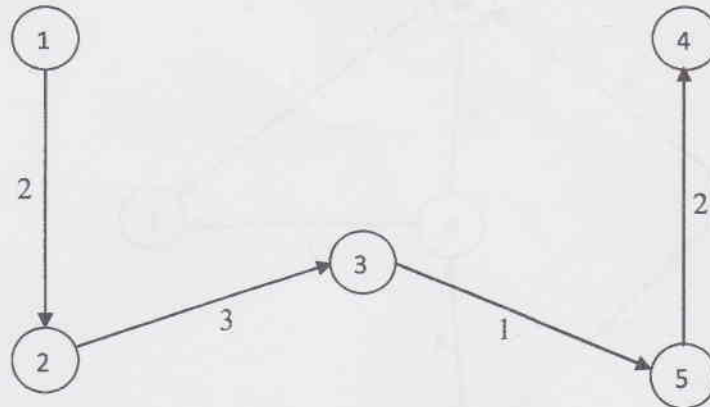
5. Consider the following network, where b_i ($i = 1, 2, 3, 4, 5$) denotes supply/demand and the labels along side of the arcs represent the cost per unit flow on the given arc.



(a) Determine the supply nodes and the demand nodes.

(b) Find the optimal flow for the above minimum cost flow problem.

Consider the following spanning tree to start with.



(c) Suppose b_3 is changed to 20.

(i) Draw the modified network.

(ii) Explain briefly, how you solve the problem to find the minimum cost.

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