



**Instructions to candidates**

**Duration:** Two(02) hours

**Number of questions:** Four(04) Essay Questions

**Mark allocation:** 100 marks

Use standard symbols without definition.

Scientific calculators are allowed.

**Answer all questions**

1. A computer company produces two types of computers: PCs and laptops. Each PC generates a profit of Rs. 8000 and requires three (03) hours of assembling time and four (04) hours of finishing time. Each laptop generates Rs. 5000 of profit and requires three (03) hours of assembling time and two (02) hours of finishing time. There are 360 hours of assembling time and 240 hours finishing time available in each month.

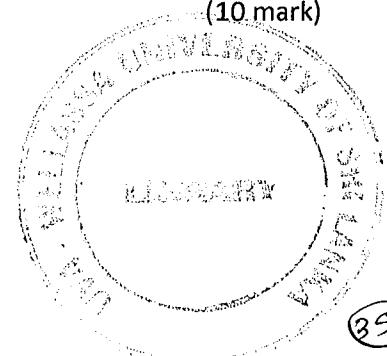
- i. Formulate the mathematical model to maximize the profit. (04 mark)
- ii. Use the **graphical method or simplex method** to solve this model. What is the total estimated profit? (06 mark)

2. A company has factories at A, B and C places which supply warehouses at X, Y and Z. Weekly factory capacities of A, B and C factories are 100, 300 and 300 respectively. Weekly warehouse requirements of X, Y and Z are 300, 200 and 200 respectively. Unit shipping costs (in Rupees) are given in below table.

From \ To	X	Y	Z	Supply
A	5	4	3	100
B	8	4	3	300
C	9	7	5	300
Demand	300	200	200	

The distribution manager wants to determine the best plan for how many shipments to send from each factory to the respective warehouses in each week. Manager's objective is to minimize the total shipping cost.

- a. Formulate a mathematical model for this problem. (10 mark)



b. Use the **north-west corner rule** to obtain an initial basic feasible solution for the model formulated in part (a). (10 mark)

c. Starting with the initial basic feasible solution from part (b), find the optimal solution to this problem. (30 mark)

3. The manager of an IT unit at a bank has four programming jobs that he wishes to assign to four programmers. The estimated costs of assigning a particular programmer to a particular job are shown in the following table in units of Rs. 1000s.

Programmer \ Job	Costs of Assigning (in Rs. '000)			
	1	2	3	4
Amal	30	22	24	25
Hammed	26	22	36	23
Ravi	43	21	23	39
Kumar	40	22	23	39

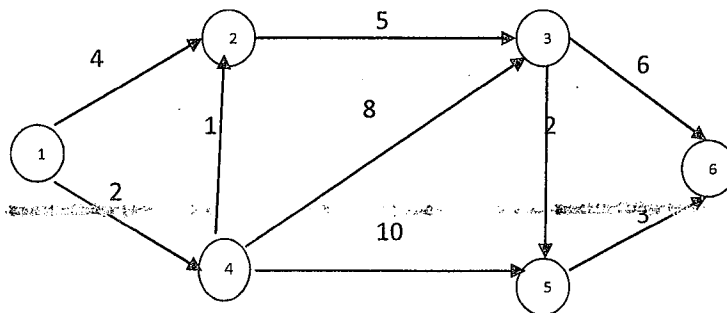
The assignment is to be made so that the total cost is a minimum.

a. Formulate the mathematical model to minimize the total cost. (05 mark)

b. Determine the optimal assignment and calculate the total minimum cost using **Hungarian algorithm**. (15 mark)

4.

a. Use **Dijkstra's algorithm** to find the *shortest path* from node 1 to 6 of the following network, where the numbers on the arcs represent actual distance between the corresponding nodes. (10 mark)

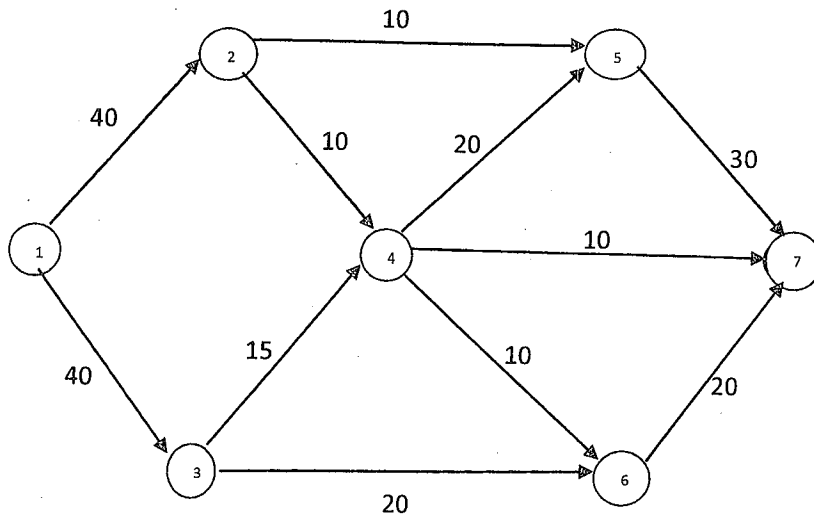


b.

- i. State the maximum flow - minimum cut theorem.
- ii. Verify, the above theorem using the following network.

(02 mark)

(08 mark)



- c. Use Prim's algorithm or Kruskal's algorithm to find a "minimum spanning tree" of the following network.

(10 mark)

