

Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Computer Science and Technology
300 Level 1st Semester Examination – Sept. /Oct. 2015
IIT 372-2 Operation Research



Instructions to candidates

Duration: Two(02) hours

Number of questions: Four(04) Essay Questions

Mark allocation: 100

Answer all questions

Use standard symbols without definition.

Scientific calculators are allowed.

- 1.
- a. A computer company produces two types of computers: PCs and laptops. Each PC generates a profit of \$80 and requires three(03) hours of assembling time and four(04) hours of finishing time. Each laptop generates \$50 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** to solve this model. What is the total estimated profit? (06 mark)
- b. Solve the following LP problem using **simplex method**. (15 mark)

$$\text{Minimize } z = x_1 - 3x_2 + 2x_3$$

subject to

$$3x_1 - x_2 + 2x_3 \leq 7$$

$$-2x_1 + 4x_2 \leq 12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2, x_3 \geq 0$$

2. A company supplies its three retail outlets from its three plants. The shipping cost per shipment from each plant to each retail outlet is given below.

Plant \ Retail Outlet	Unit Shipping Costs (in \$)		
	A	B	C
1	6	7	4
2	5	3	6
3	8	5	7

Plants 1, 2 and 3 supply 100, 180 and 200 shipments per month respectively. Retail outlets A, B and C need to receive 135, 175 and 170 shipments per month respectively. The distribution manager now wants to determine the best plan for how many shipments to send from each plant to the respective retail outlets each month. Manager's objective is to minimize the total shipping cost.

- a. Formulate this as a balanced transportation problem. (05 mark)
- b. Use the **north - west corner rule** or **minimum cost method** to obtain an initial basic feasible solution for the problem as formulated in part (a). (08 mark)
- c. Starting with the initial basic feasible solution from part (b), find the optimal solution. (12 mark)

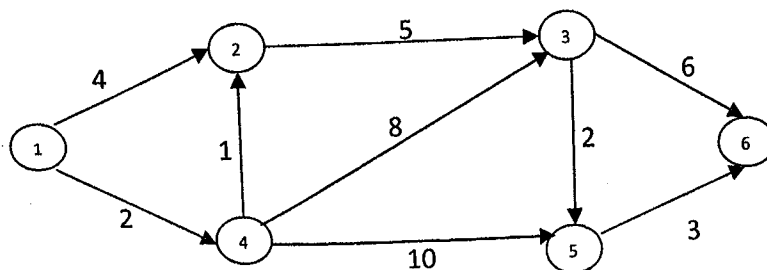
3. The manager of an IT unit at a bank has four programming jobs that he wishes to assign to four programmers. The estimated costs of assigning a particular programmer to a particular job are shown in the following table in units of Rs. 1000s.

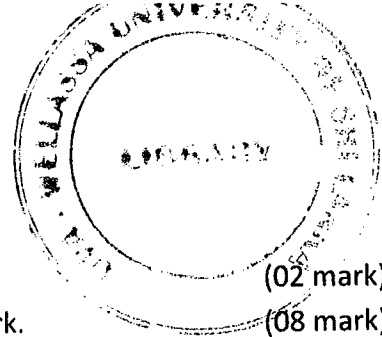
Job \ Programmer	Costs of Assigning (in Rs. '000)			
	1	2	3	4
Amal	30	22	24	25
Hammed	26	22	36	23
Ravi	43	21	23	39
Kumar	40	22	23	39

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

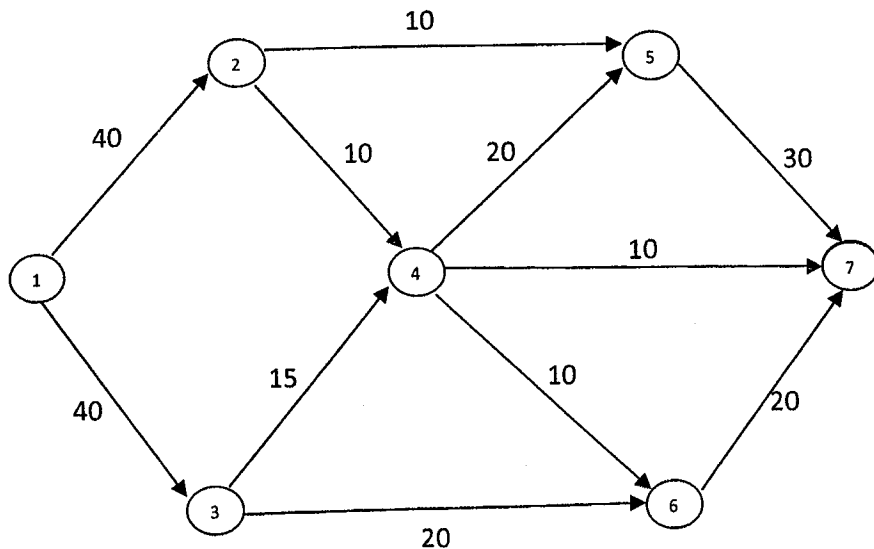
- a. Formulate the mathematical model to minimize the total cost. (05 mark)
- b. Determine the optimal assignment and calculate the total minimum cost using **Hungarian algorithm**. (15 mark)

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**. (02 mark)
 - ii. Verify, the above theorem using the following network. (08 mark)



- c. Use **Prim's algorithm** or **Kruskal's algorithm** to find a "*minimum spanning tree*" of the following network. (10 mark)

