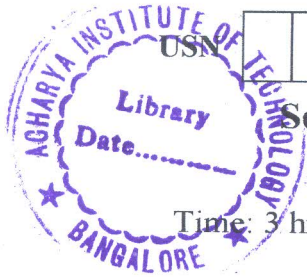


CBCS SCHEME

15MA71



Seventh Semester B.E. Degree Examination, July/August 2021 Operation Research

Max. Marks: 80

Note : 1. Answer any FIVE full questions.

2. Use of Normal distribution table, statistical table is permitted.

3. Missing data, if any, may be suitably assumed and stated.

- 1 a. List and briefly explain the major phases in OR study. (06 Marks)
- b. A manufacturer has 5 lathes and 3 milling machines in his workshop and produces an assembly that consists of 2 units of part 'A' and 3 units of part 'B'. The processing time for each part on the two types of machines is given below.

Part	Processing time in minutes on	
	Lathe	Milling machine
A	10	18
B	25	12

In order to maintain a uniform work load on the two types of machine, the manufacturer has formed a policy that no type of machine should run more than 40 minutes per day longer than the other machine. Formulate this as a linear programming problem, if the objective is to produce the maximum number of assemblies in an 8 hour working day. (10 Marks)

- 2 a. What is a 'Model'? List the characteristics of a good model. (06 Marks)
- b. A publisher of a text books is in the process of presenting a new book to the market. The book may be bound either by cloth or hard paper. Each of the cloth and paper bound books earns a profit of Rs.30 and Rs.25 respectively. It takes 8 minutes to bind a cloth cover and 6 minutes to bind a paperback. The total available binding time is 800 hours. It is estimated that the cloth cover book sales will be at least 2000 copies and paperback book sales will be at the most 5000 copies. Formulate this as a linear programming problem and solve it graphically. (10 Marks)

- 3 a. Express the following Linear Programming Problem in standard form.

$$\text{Min } Z = 2x_1 - x_2 + x_3$$

$$\text{Subject to } 2x_1 + 3x_2 + 4x_3 \geq -4$$

$$3x_1 + 5x_2 + 2x_3 \geq 7$$

$$x_1, x_2 \geq 0 \text{ and } x_3 \text{ is unrestricted in sign.}$$

(04 Marks)

- b. Solve the following Linear Programming Problem using Big-M method.

$$\text{Max } Z = 2x_1 + 3x_2 + 4x_3$$

$$\text{Subject to } 3x_1 + x_2 + 4x_3 \leq 600$$

$$2x_1 + 4x_2 + 2x_3 \geq 480$$

$$2x_1 + 3x_2 + 3x_3 = 540$$

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

(10 Marks)

- c. Explain the concept of degeneracy in Simplex method. (02 Marks)

- 4 a. Write a note on duality in Linear Programming Problem. (03 Marks)

- b. Write the dual of the following Linear Programming Problem

$$\text{Min } Z = 2x_1 + 3x_2 + 4x_3$$

$$\text{Subjected to } 2x_1 + 3x_2 + 5x_3 \geq 2$$

$$3x_1 + x_2 + 7x_3 = 3$$

$$x_1 + 4x_2 + 6x_3 \leq 5 \quad ; \quad x_1, x_2 \geq 0 \text{ and } x_3 \text{ is unrestricted.}$$

(05 Marks)

- c. Solve by the dual Simplex method.

$$\text{Min } Z = 2x_1 + 2x_2 + 4x_3$$

$$\text{Subjected to } 2x_1 + 3x_2 + 5x_3 \geq 2$$

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

$$x_1 + 4x_2 + 6x_3 \leq 5$$

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

(08 Marks)

- 5 a. Determine the optimum schedule and minimum total shipping cost for the following transportation problem :

		To (Market)				Supply
		I	II	III	IV	
From (Ware house)	A	50	20	40	30	22
	B	40	80	10	60	15
	C	40	60	70	50	8
Demand		7	12	17	9	

The transportation cost/unit is in rupees.

(10 Marks)

- b. Show that assignment model is a special case of transportation model.

(06 Marks)

- 6 a. A product is produced by four factories A, B, C and D. the unit production costs in them are Rs.2, Rs.3 Rs.1 and Rs.5 respectively. Their production capacities are at A – 50 units, B – 70 units, c – 30 units and D – 50 units. These factories supply the product to four stores, demands of which are 25, 35, 105 and 20 units respectively. The unit transportation cost in rupees from each factory to each store is given below. Determine the optimum schedule which minimizes the total production and transportation cost.

		Stores			
		1	2	3	4
Factories	A	2	4	6	11
	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

(10 Marks)

- b. A project consists of four jobs for which four contractors have submitted tenders. The tender amounts quoted in lakhs of rupees are given in the matrix. Find the optimal assignment, which minimizes the total cost of the project.

		Jobs			
		A	B	C	D
Contractors	1	10	24	30	15
	2	16	22	28	12
	3	12	20	32	10
	4	9	26	34	16

(06 Marks)

- 7 a. With neat sketches, explain : i) Looping ii) Dangling as applied to project network.

(04 Marks)

- b. Based on the following data, construct a project network and determine the 'Critical path' and its duration. Estimate the probability of completing the project within 20 days.

Activity	t_o	t_m	t_p
1 – 2	2	2	8
2 – 3	1	1.5	11
2 – 4	0.06	1	8.5
3 – 4	0	0	0
3 – 5	1	2.5	7
3 – 6	1	2	3
4 – 5	6	7	8
4 – 6	3	4	11
5 – 6	4	6	8

(12 Marks)