CBCS SCHEME

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18AU742

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Operations Research

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define Operation Research. List the advantages and application of Operations Research. **(08 Marks)**

b. A manufacturer produces two different models X and Y of the same product. Model X makes a contribution of Rs 50 per unit and model Y Rs 30 per unit, towards total profit. Raw materials r_1 and r_2 are required for production. At least 18 kg of r_1 and 12 kg of r_2 must be used daily. Also at most 34 hours of labour are to be utilized. A quantity of 2kg of r_1 is needed for model X and 1kg of r_1 for model Y. For each of X and Y, 1kg of r_2 is required. It takes 3 hours to manufacture model X and 2 hours to manufacture model Y. How many units of each model should be produced in order to maximize the profit? **(12 Marks)**

OR

2 a. Explain the steps of the simplex algorithm for obtaining an optimal solution to a linear programming problem. **(10 Marks)**

b. Use penalty (Big – M) method to solve the following LP problem.
Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$
Subject to the constraints i) $x_1 + 2x_2 + 3x_3 = 15$
ii) $2x_1 + x_2 + 5x_3 = 20$ and $x_1, x_2, x_3, x_4 \geq 0$ iii) $x_1 + 2x_2 + x_3 + x_4 = 10$
(10 Marks)

Module-2

3 a. ABC limited has three production shops that supply a product to five warehouses. The cost of production varies from shop to shop and cost of transportation form one shop to a warehouse also varies. Each shop has a specific production capacity and each warehouse has certain amount of requirement. The costs of transportation are given below :

		Warehouse					
		I	II	III	IV	V	Supply
Shop	A	6	4	4	7	5	100
	B	5	6	7	4	8	125
	C	3	4	6	3	4	175
	Demand	60	80	85	105	70	400

The cost of manufacturing the product at different production shop is

Shop	Variable cost	Fixed cost
A	14	7000
B	16	4000
C	15	5000

Find the optimum quantity to be supplied from each shop to different warehouses at the minimum total cost. **(10 Marks)**

b. Explain the Vogel's Approximation Method (VAM). **(10 Marks)**

OR

4 a. Explain the Hungarian method for solving assignment problem. **(10 Marks)**

b. A Marketing Manager has five salesman and five sales districts. Considering the capabilities of the salesman and the nature of districts , the marketing Manager estimates that the sales per month (in hundred rupees) for each salesman in each district would be as follows :

Salesman	Districts A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

Find the assignment of salesman to districts that will result in maximum sales. **(10 Marks)**

Module-3

5 a. Explain Gomory's all integer cutting plane method. **(10 Marks)**

b. Explain Branch and Bound method. **(10 Marks)**

OR

6 a. Explain the Pure – Birth and Pure – Death models. **(10 Marks)**

b. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the interval time follows an exponential distribution and the service time (the time taken to hump a train) distribution is also exponential with an average of 36 minutes. Calculate

i) Expected queue size (line length).

ii) Probability that the queue size exceeds 10.

If the input of trains increases to an average of 33 per day, what will be the change in (i) and (ii)? **(10 Marks)**

Module-4

7 a. Differentiate between PERT and CPM. Mention the significance of using PERT / CPM. **(10 Marks)**

b. Explain the rules for AoA Network construction. **(10 Marks)**

OR

8 A small project involves 7 activities and their time estimates are listed in the following table. Activities are identified by their beginning (i) and ending (j) node numbers.

Activity (i – j)	Estimated duration (weeks)		
	Optimistic	Most likely	Pessimistic
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8
2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

(20 Marks)

Module-5

9 a. Define the following :
i) Competitive game ii) Payoff matrix iii) Pure and mixed strategies
iv) Saddle point v) Optimal strategies. **(10 Marks)**

b. Find the range of values of p and q that will render the entry (2, 2) a saddle point for the game.

	Player B		
Player A	B_1	B_2	B_3
A_1	2	4	5
A_2	10	7	q
A_3	4	p	6

(10 Marks)

OR

10 a. Explain the Johnson's procedure. **(10 Marks)**

b. Find an optimal sequence for the following sequencing problems of four jobs and five machines, when passing is not allowed. Its processing time (in hours) is given below :

Job	Machine				
	M_1	M_2	M_3	M_4	M_5
A	7	5	2	3	9
B	6	6	4	5	10
C	5	4	5	6	8
D	8	3	3	2	6

(10 Marks)

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