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Your Roll No.....

Sr. No. of Question Paper : 8396 HC
Unique Paper Code : 32377907
Name of the Paper : Operational Research
Name of the Course : STATISTICS : DSE for Honours
Semester : V
Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any five questions.
3. Use of simple calculator is allowed.

(a) A firm manufacturing office furniture provided the following information regarding resource consumption, availability and profit contribution :

Resources	Usage per unit			Availability
	Tables	Chairs	Book case	
Timber (cu. ft.)	8	4	3	640
Assembly dept.(man hours)	4	6	2	540
Finishing dept.(man hours)	1	1	1	100
Profit contribution per unit(in ₹)	30	20	12	

(i) Formulate the problem as a linear programming problem.

(ii) Find the optimal product mix and the total maximum profit contribution.

(b) Consider the following L.P.P. :

$$\text{Max. } Z = 4x_1 + 10x_2$$

subject to constraints:

$$2x_1 + x_2 \leq a_1$$

$$2x_1 + 5x_2 \leq a_2$$

$$2x_1 + 3x_2 \leq a_3$$

$$x_1, x_2 \geq 0$$

where a_1 , a_2 and a_3 are constants. For specific values of a_1 , a_2 and a_3 the optimal solution is :

Basis	x_B	x_1	x_2	x_3	x_4	x_5
x_3	30	b_1	0	1	$-\frac{1}{5}$	0
x_2	20	b_2	1	0	$\frac{1}{5}$	0
x_5	30	b_3	0	0	$-\frac{3}{5}$	1
$Z_j - c_j$	$Z=200$	0	0	0	d	e

Evaluate the following :

(i) The values of a_1 , a_2 and a_3 that yield the given optimal solution.

(ii) The values of b_1 , b_2 and b_3 , d and e in the above given optimal table. (7,8)

2. (a) Discuss the effect of adding a new non-negative variable x_k in the given LPP :

$$\text{Max. } z = 3x_1 + 4x_2 + x_3 + 7x_4$$

subject to the constraints:

$$8x_1 + 3x_2 + 4x_3 + x_4 \leq 7$$

$$2x_1 + 6x_2 + x_3 + 5x_4 \leq 3$$

$$x_1 + 4x_2 + 5x_3 + 2x_4 \leq 8$$

$$x_j \geq 0; j = 1, 2, 3, 4.$$

It is given that the coefficient of X^k in the constraint are 2,7 and 3 respectively and the cost component associated with x^k is 5.

(b) Use dual simplex method to solve the following problem

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

subject to the constraints:

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

$$2x_1 + x_2 + x_3 \leq 8$$

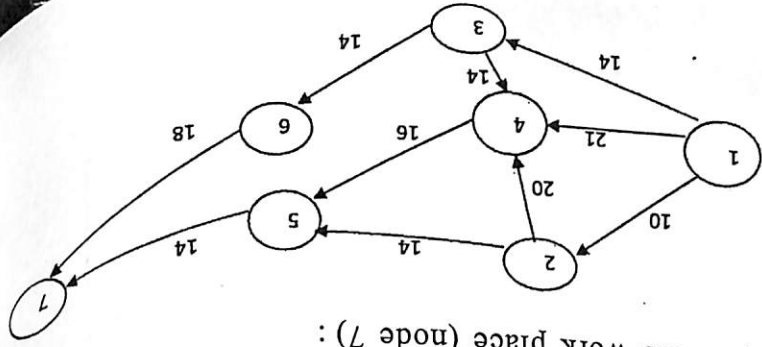
$$x_1 - x_3 \geq 0$$

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

3. (a) XYZ company buys in lots of 500 boxes which is a month supply. The cost per box is ₹ 125 and the ordering cost is ₹ 150. The inventory carrying cost is estimated at 20% of unit value. What is the total cost of the existing inventory policy? How much money could be saved by employing economic order quantity?
- (b) Obtain an expression for the economic order quantity for an inventory model with finite rate of replenishment when shortages are not allowed.

(7,8)

4. (a) A hotel manager had to drive daily between his residence and distant place of work. Due to heavy traffic on roads during the peak hours it became difficult for him to drive. He decided to approach a radio taxi company but before doing that he decided to determine the shortest route to the work place from his residence and their distances in kms. between his routes and six places (node 2 to node 7). Determine the shortest route and the shortest distance from his residence (node 1) to the work place (node 7) :



- (b) Five salesmen are to be assigned to five territories. Based on the past performance, the following table shows the quarterly sales (in million rupees) that can be generated by each salesman in each territory. Find the optimal assignment.

Salesman	Territory				
	T1	T2	T3	T4	T5
S1	3	8	2	10	3
S2	8	7	2	9	7
S3	6	4	2	7	5
S4	8	4	2	3	5
S5	9	10	6	9	10

(7,8)

- (a) Two players A and B plays a game, each has coins of denominations Rs. 1, Rs. 2, Rs. 5 and Rs. 10. Each selects a coin without the knowledge of other's choice. If the sum of the coins is an odd amount, A wins B's coin, if the sum is even, B wins A's coin. Find the best strategy for each of the player and comment on value of the game.

- (b) A state has four government hospitals A, B, C and D. Their monthly requirements of medicines are met by four distribution centres X, Y, Z and W. The data in respect of a particular item vis-a-vis availabilities at the

centres, requirements at the hospitals and the distribution cost per unit (in paise) are given below :

Warehouse	Hospital				Availability
	A	B	C	D	
X	44	84	84	80	2000
Y	92	30	64	80	12000
Z	32	100	96	72	5000
W	80	36	120	60	6000
Requirement	8000	8000	6000	3000	25000

Determine the optimum distribution.

(7,8)

6. Write short notes on the following :

- (i) Assignment problem as a special case of Transportation problem
- (ii) Two person zero sum game
- (iii) Canonical and standard form of linear programming

(5,5,5)