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5559

Your Roll No.

B.A. Prog./I Sem.

B

OPERATIONAL RESEARCH : Paper – A

(T)

Linear Programming

(Admissions of 2011 and onwards)

Time : 3 Hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Attempt any five questions.

1. (a) Explain the scope of Operational Research and its limitations. (6)
- (b) A company manufactures two kinds of machines, each requiring a different manufacturing technique. The deluxe machine requires 18 hours of labour, 8 hours of testing and yields a profit of Rs. 400. The standard machine requires 3 hours of labour, 4 hours of testing and yields a profit of Rs. 200. There are 800 hours of labour and 600 hours of testing available each month. A marketing forecast has shown that the monthly demand for the standard machine is to be more than 150. The management wants to know the number of each

P.T.O.

model to be produced monthly that would maximize total profit. Formulate and solve this as a linear programming problem. (9)

2. (a) Define a convex set. Prove that the set

$$X = \{(x_1, x_2) \mid x_1^2 + x_2^2 \leq 4\} \text{ is a convex set. (7)}$$

- (b) Define a basic solution to a system of linear equations. Find all the basic solution to the following system of linear equation :

$$\begin{aligned} 2x_1 + 6x_2 + 2x_3 + x_4 &= 3 \\ 6x_1 + 4x_2 + 4x_3 + 6x_4 &= 2 \end{aligned} \quad (8)$$

3. (a) Define slack, surplus and artificial variables and explain their uses in linear programming. (8)

- (b) Explain what is meant by the terms degeneracy and cycling in linear programming ? How can these problems be resolved ? (7)

4. Solve the following linear programming problem by simplex method :

$$\text{Max } Z = 3x_1 + 2x_2 + 5x_3$$

Subject to

$$x_1 + 2x_2 + x_3 \leq 430$$

$$3x_1 + 2x_3 \leq 460$$

$$x_1 + 4x_3 \leq 420$$

$$\text{and } x_1, x_2, x_3 \geq 0 \quad (15)$$

5. Use penalty (Big-M) method to solve the following linear programming problem :

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

Subject to,

$$3x_1 + x_2 = 3$$

$$4x_1 + 3x_2 \geq 6$$

$$x_1 + 2x_2 \leq 4$$

and $x_1, x_2 \geq 0$. (15)

6. (a) What is the principle of duality in linear programming? Explain its advantages. (7)

- (b) The following is the optimum table to the linear programming problem

$$\text{Max } Z = 6x_1 + 8x_2$$

Subject to

$$30x_1 + 20x_2 \leq 300$$

$$5x_1 + 10x_2 \leq 110$$

and $x_1, x_2 \geq 0$

C_B	X_B	C_j	6	8	0	0
		b	x_1	x_2	s_1	s_2
6	x_1	4	1	0	1/20	-1/10
8	x_2	9	0	1	-1/10	3/20
		$Z_j - C_j$	0	0	1/10	6/10

Write the dual for the above linear programming problem and find its optimal solution using the above table. (8)

7. (a) A manufacturer has distribution centres at Agra, Allahabad and Kolkata. These centres have availability of 40, 20 and 40 units of his product, respectively. His retail outlets at A, B, C, D & E require 25, 10, 20, 30 and 15 units of the products, respectively. The transportation cost (in rupees) per unit between each centre outlet is given below :

Distribution Centre	Retail Outlets				
	A	B	C	D	E
Agra	55	30	40	50	40
Allahabad	35	30	100	45	60
Kolkata	40	60	95	35	30

Determine the optimal distribution so as to minimize the cost of transportation. (7)

- (b) What is an assignment problem? Give the linear programming formulation to the following assignment problem.

		Workers		
		W1	W2	W3
Jobs	J1	8	7	9
	J2	7	9	8
	J3	10	8	7

(8)

(400)****