[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 10369 **K**

Unique Paper Code : 2373570005 (NEP-UGCF)

Name of the Paper : DSE: Linear Programming Techniques

Name of the Course : **B.A. (P) / B.Sc. (P) Mathematical Sciences**

Semester : VII

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Q. No. **1** is compulsory.
4. Use of a non-programmable scientific calculator is allowed.

1. Answer the following :

   (a) Optimum solution to a Transportation problem is obtained by _____ method. (1)

   (b) Given a system of m simultaneous equations in n unknowns (m<n), the number of basic variables will be _____ . (1)

   (c) The general LPP is in standard form, if the constraints are _____ . (1)

   (d) The feasible solution to a transportation problem is basic, iff the corresponding cells in the transportation table do not form a _____ . (1)

   (e) The initial solution of a transportation problem obtained by VAM is near to _____ solution. (1)

   (f) Cost or profit associated with slack variables are assumed to be _____ . (1)

   (g) Mathematically express transportation problem as LPP. (3)

   (h) What are the computational steps of Big M method in LPP? (3)

P.T.O.

(i) Obtain all the basic solutions to the following system of linear equations:

$$x_1 + 2x_2 + x_3 = 4$$
$$2x_1 + x_2 + 5x_3 = 5 \quad (3)$$

(j) Reduce the following LPP in its standard form :

Max $z = 3x_1 + 4x_2 + 6x_3$

subject to the constraints:

$$2x_1 + 2x_2 + x_3 \geq 4$$
$$3x_1 + 2x_2 = 5$$
$$7x_1 - 3x_2 + 5x_3 \geq 9$$
$x_1, x_2 \geq 0$ and x_3 unrestricted in sign. (3)

2. (a) Old hens can be bought at Rs. 2 each and young ones at Rs. 5 each. The old hens lay 3 eggs per week and the young ones lay 5 eggs per week, each egg being worth 30 paisa hen (young or old) costs Rs. 1 per week to feed. Mr. X has only Rs. 80 to spend for hens, how many of each kind should he buy to give a profit of more than Rs. 6 per week, assuming that he cannot house more than 20 hens. Formulate the problem as a linear programming problem and solve it graphically.

(b) Axis bank has three new clients for home loan. Customer relationship manager will be assigned to three clients and based on their different backgrounds and experiences, the various manager-client assignments differ in terms of closure of formalities. The possible assignments and the estimated completion times in days are given in the following table :

	Clients		
Customer relationship manager ↓	I	II	III
Raj	9	26	15
Vijay	13	27	6
Sudha	35	20	15
Jay	18	30	20

Assign customer relationship manger to clients so as to minimize total days required in the completion of formalities? (9,9)

3. (a) Consider the following L.P.P. :

Max. $Z = 10x_1 + x_2 + 2x_3$

subject to constraints

$$x_1 + x_2 - 2x_3 \leq a_1$$

$$4x_1 + x_2 + x_3 \leq a_2$$

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

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

Basic variable.	Solution	x_1	x_2	x_3	x_4	x_5
x_4	5	0	b	-9/4	1	-1/4
x_1	5	1	c	1/4	0	1/4
Z-equation	50	0	a	1/2	d	e

Evaluate the following :

(i) The values of aq and a_2 that yield the given optimal solution.

(ii) The values of a, b, c, d and e in the above given optimal table.

(b) In a linear programming problem define the following :

(i) Unbounded solution,

(ii) Infeasible solution,

(iii) Alternate solution. (9,9)

4. (a) Consider the following L.P.P. :

Maximize $Z = 3x_1 + 2x_2$

subject to constraints:

$$2x_1 + x_2 \leq 2,$$

$$3x_1 + 4x_2 \geq 12;$$

$$x_1, x_2 \geq 0$$

Solve the above problem by simplex method.

(b) Consider the problem of assigning five plots to five farmers .The assignment costs are given in the following table.

Farmer	Plot				
	1	2	3	4	5
A	8	4	2	6	1
B	0	9	5	5	4
C	3	8	9	2	6
D	4	3	1	0	3
E	9	5	8	9	5

Determine the optimum assignment schedule. (9,9)

5. (a) Consider the following unbalanced transportation problem:

		To			
		1	2	3	Supply
From	1	5	1	7	10
	2	6	4	6	80
	3	3	2	5	15
	Demand	75	20	50	

Further, suppose that there are penalty costs for every unsatisfied unit which are given by 5, 3 and 2 for destinations 1, 2 and 3 respectively. Find the optimal solution.

(b) Define Transportation problem. Find the initial basic feasible solution to the following transportation problem by North-west comer method and Matrix-Minima method . Also, compute transportation cost on the basis of initial basic feasible solution and compare the results.

	Destination1	Destination2	Destination3	Destination4	Supply
Source1	4	7	6	4	6
Source2	2	4	3	2	2
Source3	5	3	8	5	5
Demand	3	4	2	4	

(9,9)

6. (a) Explain briefly the graphical method of solving linear programming problem. State its advantages and limitations.

(b) Define an assignment problem. Express assignment problem mathematically as a linear programming problem.

(c) Differentiate between canonical and standard forms of linear programming problem. (6,6,6)

(1000)