[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2348 **I**

Unique Paper Code : 2352203502

Name of the Paper : DSC-5 : LINEAR PROGRAMMING

Name of the Course : **B.A. (Prog.) Mathematics with Major**

Semester : V

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 **all** questions by selecting **two** parts from each question.
3. Parts of questions to be attempted together.
4. **All** questions carry equal marks.
5. Use of Calculator is not allowed.

P.T.O.

1. (a) (i) A person wants to decide the constitue a diet which will fulfill his daily require of proteins, fats and carbohydrates a minimum cost. The choice is to be made four different types of foods. The yield unit of these foods are given in the tab

Food Type	Yield/unit			Cost/Unit R
	Proteins	Fats	Carbohydrates	
1	3	2	6	
2	4	2	4	
3	8	7	7	
4	6	5	4	
Minimum Requirement	800	200	700	

Formulate the LP for the problem to find food type mix to minimize the cost.

(ii) Test the convexity for the set $S = \{(x_1, x$ R^2: $x_1 \leq 1$, $x_2 \leq 4\}$

(b) Find all the basic feasible solutions of the follo system of equations :

$$2x_1 + x_2 - x_3 + 3x_4 = 2$$

$$x_1 + 4x_2 + x_3 + x_4 = 1$$

(c) Solve the following LPP graphically

Maximize $z = 5x_1 + 4x_2$

Subject to

$$x_1 + 2x_2 \leq 6$$
$$-2x_1 + x_2 \leq 4$$
$$5x_1 + 3x_2 \leq 15$$
$$x_1, x_2 \geq 0$$

2. (a) Solve the following LPP using simplex method

Maximize $2x_2 + x_3$

subject to $x_1 + x_2 - 2x_3 \leq 7$

$$-3x_1 + 2x_2 + 2x_3 \leq 3$$
$$x_1, x_2, x_3 \geq 0$$

(b) Solve the following LPP using simplex method

Minimize $-4x_1 + x_2 + x_3 + 7x_4 + 3x_5$

Subject to $-6x_1 + x_3 - 2x_4 + 2x_5 = 6$

$$3x_1 + x_2 - x_3 + 8x_4 + x_5 = 9$$
$$x_1, x_2, x_3, x_4, x_5 \geq 0$$

(c) Solve the following LPP using simplex method

Maximize $3x_1 - x_2$

subject to $x_1 - x_2 \leq 3$

$$2x_1 - x_2 \leq 0$$
$$x_1 + x_2 \geq 12$$
$$x_1, x_2 \geq 0$$

3. (a) Solve the following LPP using Simplex met

Maximize $x_1 - 2x_2$

subject to $x_1 + x_2 \geq 2$

$-x_1 + x_2 \geq 1$

$x_2 \leq 3$

$x_1, x_2 \geq 0$

(b) Write the dual of the following primal probl

Minimize $z = 3x_1 + x_2 + x_3 - 2x_4$

Subject to $x_1 - 2x_2 + 4x_3 - 2x_4 = 2$

$2x_1 - 2x_2 + x_4 \leq 3$

$2x_2 - x_3 + x_4 \geq 5$

$x_1, x_2, x_3, x_4 \geq 0$

(c) Find the dual of the following LPP:

Minimize $8x_1 + 3x_2 - 2x_3$

subject to $3x_1 - 6x_2 + x_3 = 2$

$3x_1 + 7x_2 - 2x_3 \geq 4$

$x_1, x_2 \geq 0$, x_3 unrestricted in sign

4. (a) Find the optimal transportation routes and minim total transport cost. The following table provi all the necessary information on the availabilit supply to each warehouse, the requirement of e

market, and the unit transformations cost (in Rs.) from each warehouse to each market.

	P	Q	R	S	Supply
A	6	3	5	4	22
B	5	9	2	7	15
C	5	7	8	6	8
Demand	7	12	17	9	

(b) A national truck retail service has surplus of one truck in each of cities 1, 2, 3, 4, 5 and 6; and a deficit of one truck in each of the cities A, B, C, D, E and F. The distance (in Km) between the cities a surplus and cities with deficit are displayed in the table below.

	A	B	C	D	E	F
1	31	62	29	42	15	41
2	12	19	39	55	71	40
3	17	29	50	41	22	22
4	35	40	38	42	27	33
5	19	30	29	16	20	23
6	72	30	30	50	41	20

Determine the optimum assignment schedule.

(c) Find initial basic feasible solution by th North-West corner rule, Least Cost method Vogel's approximation method. Compare the th solutions.

	A	B	C	Supply
I	2	4	1	40
II	6	3	2	50
III	4	5	6	20
IV	3	2	1	30
V	5	2	5	10
Demand	50	60	40	

5. (a) Certain equipment needs 5 repair jobs which ha to be assigned to 5 machines. The estimated tim (in hours) that a mechanic requires to comple the repair job is given in the table. Assuming th each mechanic can be assigned only one jo determine the minimum time assignment.

	J1	J2	J3	J4	J5
M1	7	5	9	8	11
M2	9	12	7	11	10
M3	8	5	4	6	9
M4	7	3	6	9	5
M5	4	6	7	5	11

(b) Staring with Initial Basic feasible solution obtained using Least Cost Method, solve the following transportation problem

	Destinations					
Sources	D1	D2	D3	D4	D5	Supply
S1	48	3	5	2	2	15
S2	6	7	5	5	4	15
S3	5	5	7	3	4	10
Demand	8	4	6	10	12	

(c) Find saddle points(s), if any, for the following game with payoff matrix :

$$\begin{bmatrix} 1 & 3 \\ 4 & 0 \end{bmatrix}$$

Hence, or otherwise solve the game.

6. (a) Consider a game with following payoff matrix

Player P2

$$\text{Player P1} \quad \begin{bmatrix} 2 & 6 & 1 & 2 \\ 3 & 5 & 4 & 3 \\ 1 & 0 & 2 & 4 \end{bmatrix}$$

Determine the saddle point(s), the optim strategies for each player, and the value of t game.

(b) Solve the following using Principle of Dominanc

Player P2

$$\text{Player P1} \quad \begin{bmatrix} 1 & 2 & 4 \\ 1 & 0 & 5 \\ 0 & 1 & -1 \end{bmatrix}$$

(c) Transform the following game theory problem int its equivalent pair of linear programming proble for players P1 and players P2 :

Player P2

$$\text{Player P1} \quad \begin{bmatrix} 1 & 5 & -2 \\ 4 & 1 & -3 \\ 2 & -1 & 2 \end{bmatrix}$$ 7