B.SC. FIFTH SEMESTER (PROGRAMME) EXAMINATION, 2021

Subject: Mathematics

Course Code: SP/MTH/501/DSE-1A

Time 2 Hours

The figures in the margin indicate full marks

Notations and symbols have their usual meaning

- 1. Answer any five questions:
 - (a) Define feasible solution and optimal solution of an LPP.
 - (b) Convert the following constraints into equations by using slack or surplus variables
 - $|2x_1 3x_2 + x_3| \le 24$
 - (c) Prove that $x_1 = 2, x_2 = -1, x_3 = 0$ is a basic solution to set of equations
 - $4x_1 x_2 + 2x_3 = 9$ $2x_1 - 3x_2 + 7x_3 = 7$
 - (d) Determine the position of the points (1,0,2,-2) and (0,4,1,0) with respect for the hyperplane
 - $2x_1 + 3x_2 + x_3 3x_4 = 13$

(e) Find the dual of the LPP

Maximize $z = 4x_1 + 3x_2$ Subject to $x_1 + x_2 \le 5$ $2x_1 - 3x_2 \le 2$, $x_1, x_2 \ge 0$

(f) Write down the mathematical formulation of an assignment problem.

(g) In a transportation problem with 3 origins and 4 destinations, can the variables $x_{11}, x_{12}, x_{23}, x_{24}, x_{31}, x_{34}$ be considered as basic variables? Give reason.

(h) Solve the following game problem and find the value of the game

-4	6
2	-3

2. Answer any four questions:

 $5 \times 4 = 20$

(a) Following is the starting tableau of an LPP by the simplex method (for a maximization problem), in an incomplete form

Course ID: 52118

Full Marks: 40

Course Title: Linear Programming

 $2 \times 5 = 10$

			c_{j}							
C _B	В	X _B	b	a_1	a_2	<i>a</i> ₃	<i>a</i> ₄	<i>a</i> ₅	a_6	<i>a</i> ₇
0	<i>a</i> ₅	<i>x</i> ₅	20	-4	6	5	-4			
0	<i>a</i> ₆	<i>x</i> ₆	10	3	-2	4	1			
0	<i>a</i> ₇	<i>x</i> ₇	20	8	-3	3	2			
$(z_j -$	(c_j)		<u>.</u>	-4	-1	-3	-5	0	0	0

(i) Complete the objective row and the tableau.

(ii) Write down the LPP in its standard form from the tableau.

(iii) Write down the actual problem.

(iv) Find the departing and the entering vectors and write down the next tableau. 1+1+1+2

(b) (i) Solve the LPP by graphical method

$$Min z = 4x_1 + 2x_2$$

S.to $3x_1 + x_2 \ge 27$
 $-x_1 - x_2 \le -21$
 $x_1 + 2x_2 \ge 30$
 $x_1, x_2 \ge 0$

(ii) Prove that the set $S = \{(x, y) : x^2 + y^2 = 4\}$ is not a convex set.

(c) Solve by "Big M-method" Max $z = x_1 - 2x_2 + 3x_3$

Sub. to $x_1 + 2x_2 + 3x_3 = 15$ $2x_1 + x_2 + 5x_3 = 20$

$$2x_1 + x_2 + 5x_3 = 20$$

where
$$x_1, x_2 \ge 0$$
.

(d) Find the optimal solution of the following problem by solving its dual.

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

S.to $x_1 + x_2 \le 10$
 $2x_1 + 3x_2 \le 18$
 $x_1 \le 8$
 $x_2 \le 6$
 $x_1, x_2 \ge 0$

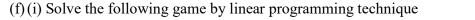
(e) Find the optimal assignment to find the minimum cost for the assignment problems with the following cost matrix

3

2

I II III IV

A	8	26	17	11	
В	13	28	4	26	
С	38	19	18	15	
D	19	26	24	10	



		Player	В
	1	-1	3
PlayerA	3	5	-3
	6	2	-2

(ii) Define saddle point of a game.

- 3. Answer any one:
 - (a) (i) Show that $X = \{(X_1, X_2): 9X_1^2 + 4X_2^2 \le 36\}$ is a Convex set.
 - (ii) Solve by simplex method

Maximize $z = 4x_1 + 14x_2$ Subject to $2x_1 + 7x_2 \le 21$ $7x_1 + 2x_2 \le 21$, $x_1, x_2 \ge 0$

Will the above LPP admit an alternative solution? Give reason.

If yes then find another solution of the above LPP.

(b) (i) Transform the games with the following pay off matrix to corresponding LPP

What is a zero sum game?

(ii) Show that the 2×2 game $\begin{pmatrix} p & q \\ r & s \end{pmatrix}$ is non-strictly determined, if p < q, p < r, s < q and s < r.

(iii) Prove that in LPP, the dual of the dual is Primal. 4+3+3=10

 $10 \times 1 = 10$

4

1

2+(5+3)=10