Paper IV (b) : Linear Programming

Section—A

$1 \times 10 = 10$

1. Any L.P.P. can be solved easily by graphical method. True/False

2. If there is no feasible region in a L.P.P., then the problem has :

(a) Finite solutions (b) Infinite solutions

(c) No solution (d) None of these.

3. Which of the following sets in E^2 is not a convex set ?

(a) $\{(x_1, x_2) : x_1^2 + x_2^2 \leq 1$ (b) $\{x_1, x_2) : x_1^2 + x_2^2 \leq 4$

(c) $\{x_1, x_2) : x_1^2 + x_2^2 \geq 1, x_1^2 + x_2^2 \leq 4\}$ (d) None of these.

4. If a constraint has $\leq$ sign, we introduce :

(a) Surplus variable (b) Slack variable

(c) Artificial variable (d) None of these.

5. The number of additional constraints from II of revised simplex method is :

(a) 0 (b) 1 (c) 2 (d) None of these.

6. By the addition of a new variable with non-zero cost to the problem the optimal solution :

(a) Changes (b) Does not change

(c) May change (d) None of these.

7. If the standdard primal problem is of minimization, all the constraints involve the sign :

(a) $=$ (b) $\leq$ (c) $\geq$ (d) None of these.

8. If the primal is a maximization problem, the dual is also a maximization problem. True/False

9. In a transportation problem a loop may be defined as an ordered set of at least :

(a) 3 cells (b) 4 cells (c) 5 cells (d) 6 cells.

10. If a salesman wants to visit n cities, then the number of possible routes is :

(a) n (b) $(n-1)!$ (c) $n!$ (d) None of these.

Section—B

$2 \times 5 = 10$

1. Show feasible region to solve the following linear programming problem :

$$\text{Minimize : } Z = 1{\cdot}5x + 2{\cdot}5y$$

$$\text{such that : } x + 3y \geq 3$$

$$x + y \geq 2$$

$$\text{and} \qquad x, y \geq 0$$

2. How many basic solutions of the following system of equations will have ?

$$2x_1 + 3x_2 + 4x_3 = 5$$

$$3x_1 + 4x_2 + 5x_3 = 6$$

3. Show that $S = \{(x_1, x_2, x_3) : 2x_1 - x_2 + x_3 \leq 4\} \subset R^3$, is a convex set.

4. If $x_1 = 1, x_2 = 2, x_3 = 1$ be a feasible solution of the L.P.P. :

$$\text{Minimize } Z = 2x_1 + 3x_2 + 4x_3$$
$$\text{subject to } x_1 + x_2 + x_3 = 2$$
$$x_1 - x_2 + x_3 = 0$$
$$x_1, x_2, x_3 \geq 0$$

then show that the given feasible solution is not basic.

5. Discuss the Charne's perturbation method.

6. Explain advantages and disadvantages of revised simplex method.

7. Find the dual of the following L.P.P. :

$$\text{Minimize } Z = 10x_1 + 20x_2$$
$$\text{subject to } 3x_1 + 2x_2 \geq 18$$
$$x_1 + 3x_2 \geq 8$$
$$2x_1 - x_2 \leq 6$$
$$x_1, x_2 \geq 0$$

8. Explain the method of dual simplex method.

9. Write a short note on degeneracy in transportation problems.

10. Solve the following minimum assignment problem :

Man → / Job ↓	1	2	3	4
I	12	30	21	15
II	18	33	9	31
III	44	25	24	21
Iς	23	30	28	14

Section—C

$10 \times 3 = 30$

1. Convert the following L.P.P. into standard form :

$$\text{Max } Z = 2x_1 + 3x_2 + 5x_3$$
$$\text{subject to. } 5x_1 - 4x_2 + 3x_3 \leq 7$$
$$2x_1 + 5x_2 - 4x_3 \geq 2$$
$$4x_1 + 3x_2 + 7x_3 \geq 8$$
$$\text{and } x_1, x_2, x_3 \geq 0$$

Also express the L.P.P. in the matrix form.

2. Consider the set of equations :

$$5x_1 - 4x_2 + 3x_3 + x_4 = 3$$
$$2x_1 + x_2 + 5x_3 - 3x_4 = 0$$
$$x_1 + 6x_2 - 4x_3 + 2x_4 = 15$$
$$x_1, x_2, x_3, x_4 \geq 0$$

3. Discuss the revised simplex method in standard form T with notation.

4. Write the dual of the following linear programming problem and hence solve it :

$$\text{Max. } Z = 3x_1 - 2x_2$$

subject to $x_1 \leq 4, x_2 \leq 6, x_1 + x_2 \leq 5, -x_2 \leq -1$ and $x_1, x_2 \geq 0$.

5. Determine the optimum basic feasible solution to the following transportation problem :

	D_1	D_2	D_3	D_4	$a_i \downarrow$
O_1	5	3	6	2	19
O_2	4	7	9	1	37
O_3	3	4	7	5	324
b_j	16	18	31	25	