Paper IV (b) : Linear Programming

M.M. B.Sc. : 50 / B.A. : 25

Section—A

B.Sc. : $1 \times 10 = 10$
B.A. : $0{\cdot}5 \times 10 = 5$

1. If there is no feasible region in a L.P.P. then we say problem has :

(a) Infinite solution (b) No solution

(c) Unbounded solution (d) None of these.

2. The maximum number of Basic Solutions to a set of m simultaneous equations in a n unknown where $n \geq m$ is :

(a) m (b) $n - m$ (c) ${}^{n}c_{m}$ (d) n.

3. Which of the following set in E^2 is not 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) $[(x_1, x_2) : x_1^2 + x_2^2 \geq 1$ and $x_1^2 + x_2^2 \leq 4]$

(d) $[(x_1, x_2) : x_1 \geq 0]$.

4. A slack variable is introduced if the given constraint :

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

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

(a) Change (b) May Change

(c) Does not change (d) None of these.

6. If one or more of the Basic Variable in B.F.S. is zero, then solution is called :

(a) Degenerate (b) Non-degenerate

(c) Optimal (d) None of these.

7. If Kth slack variable of primal is positive then the Kth variable of the dual is :

(a) + ve (b) – ve (c) zero (d) Unrestricted.

8. If standard primal form of the problem is of Maximization, all the constraints involves the sign :

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

9. An assignment problem is a special case of an $m \times n$ transportation problem in which :

(a) $m = n$ (b) $m = 2n$ (c) $2m = n$ (d) $m \neq n$.

10. To improve the B.F.S. in transportation problem if it is not optimal we allocate to the cell for which $d < j$ is :

(a) Most negative minimum (b) Maximum positive

(c) Zero (d) None of these.

Section—B

B.Sc. : $2 \times 5 = 10$

B.A. : $1 \times 5 = 5$

1. Convert the following L.P.P. into standard form and also in Matrix form :

Minimum $Z = 12x_1 + 5x_2$

Subject to $5x_1 + 3x_2 \geq 15$

$7x_1 - 2x_2 \leq 14$

and $x_1 \geq 0, x_2 \geq 0$

2. Find all the basic solutions of the following equation :

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

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

3. Show that hyper plane is a convex set.

4. What is degeneracy in L.P.P. ? What are the conditions for the occurrence of degeneracy in a LP.P. ?

5. Solve the following L.P.P. :

Maximum $Z = 2x_1 + 3x_2 + 10x_3$

Subject to $x_1 - 2x_3 = 0$

$x_2 + x_3 = 1$

$x_1, x_2, x_3 \geq 0$

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

Minimum $Z = 10x_1 \div 20x_2$

Subject to $3x_1 + 2x_2 \geq 18$

$x_1 + 3x_2 \geq 8$

$2x_1 - x_2 \leq 6$

$x_1, x_2 \geq 0$

7. Determine an initial B.F.S. of the following transportation problem using lowest cost entry method :

	P_1	P_2	P_3	P_4	Required
M_1	19	14	23	11	11 ↓
M_2	15	16	12	21	13
M_3	30	25	16	39	19
Available →	6	10	12	15	

8. Solve following assignment problem :

	I	II	III	IV
A	8	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

9. Find all the Basic feasible solution for equation :

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

10. Solve the following L.P.P. by Gomory technique :

Max. $Z = 3x_2$

Subject to constraints

$$3x_1 + 2x_2 \leq 7$$
$$x_1 - x_2 \geq -2$$
$$x_1, x_2 \geq 0 \text{ and are integers.}$$

Section—C

B.Sc. : $10 \times 3 = 30$

B.A. : $5 \times 3 = 15$

1. Solve by graphical method the following L.P.P. :

Minimize $Z = 20x_1 + 10x_2$

Subject to constraints

$$x_1 + 2x_2 \leq 40$$
$$3x_1 + x_2 \geq 30 \text{ where } x_1, x_2 \geq 0$$
$$4x_1 + 3x_2 \geq 60$$

2. Solve by Simplex Method the following L.P.P. :

Maximize $Z = 3x_1 + 5x_2 + 4x_3$

Subject to
$$2x_1 + 3x_2 \leq 8$$
$$2x_2 + 5x_3 \leq 10$$
$$3x_1 + 2x_2 + 4x_3 \leq 15, \; x_1, x_2, x_3 \geq 0$$

3. Solve the following L.P.P. by Revised Simplex Method :

Max. $Z = x_1 + 2x_2$

Subject to
$$x_1 + x_2 \leq 3$$
$$x_1 + 2x_2 \leq 5$$
$$3x_1 + x_2 \geq 6, \; x_1, x_2 \geq 0$$

4. Use duality to solve the following L.P.P. :

Max. $Z = 2x_1 + x_2$

Subject to
$$x_1 + 2x_2 \leq 10$$
$$x_1 + x_2 \leq 6, x_1 - x_2 \leq 2$$
$$x_1 - 2x_2 \leq 1 \text{ and } x_1, x_2 \geq 0$$

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	34
$b_j \rightarrow$	16	18	31	25	