

# Model Question

B.Sc. Sem - VI

Paper - DSE 3 (Linear

|                |
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| Prime Merit    |
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Programming)

## Group - A. (Very short answer type questions).

1. Define a Hyperplane
2. Define convex combination.
3. Define a convex set.
4. Define a General linear programming problem.
5. Define a basic solution.
6. Define a feasible solution.
7. Define an optimal solution.
8. Define a basic feasible solution.
9. Define an optimal basic feasible solution.
10. Define slack and surplus variables.
11. Write the condition of optimality for an LPP.
12. Write the conditions for an unbounded solution for a maximization LPP.
13. Write the formula for finding incoming vector.  
$$s_1 + t_1 x_2 = \dots$$
14. Write the formula for finding outgoing vector.  
$$s = s_1 + t_1 x_2$$
15. Define an artificial variable.
16. Write the standard form of the primal.
17. State Fundamental Duality theorem.
18. Write the condition for a L.P.P. having no feasible solution.
19. What is degeneracy problem?
20. Define Assignment problem

Group-B (Short answer type questions)

1. Prove that a hyperplane is a convex set.
2. Prove that the set of all convex combinations of a finite number of points  $x_1, x_2, \dots, x_n$  is a convex set.
3. Prove that the set of all feasible solutions (if not empty) of a L.P.P. is a convex set.
4. Examine the convexity of the set  $\{(x_1, x_2) \in \mathbb{R}^2 : 4x_1 + 3x_2 \leq 6, x_1 + x_2 \geq 1\}$ .
5. Examine the convexity of the set  $S = \{(x_1, x_2) : x_1^2 + x_2^2 \leq 1, x_1 + x_2 \geq 1\}$ .
6. Show that the set  $S = \{(x_1, x_2) : 3x_1^2 + 2x_2^2 \leq 6\}$  is convex.
7. Find all the basic solutions of the following system
 
$$x_1 + 2x_2 + x_3 = 4$$

$$2x_1 + x_2 + 5x_3 = 5.$$
8. Write the difference between primal & dual.
9. Prove that dual of the dual of a given primal
10. Write the dual of the following problem.
10. Write the dual of the problem
 
$$\min Z = 2x_2 + 5x_3$$
 s.t.
 
$$x_1 + x_2 \geq 2$$

$$2x_1 + x_2 + 6x_3 \leq 6$$

$$x_1 - x_2 + 3x_3 = 4$$
 and  $x_1, x_2, x_3 \geq 0$ .

12. Solve the following assignment problem

|   | 1  | 2  | 3  | 4  |
|---|----|----|----|----|
| A | 10 | 12 | 19 | 11 |
| B | 5  | 10 | 7  | 8  |
| C | 12 | 14 | 13 | 11 |
| D | 8  | 15 | 11 | 9  |

12. Write the Hungarian method for solving an assignment problem.

Group - c (Long answer type questions).

1. Solve graphically the following LPP.  
max.  $Z = 3x_1 + 2x_2$   
s.t.  
 $-2x_1 + x_2 \leq 1$   
 $x_1 \leq 2$   
 $x_1 + x_2 \leq 3$   
and  $x_1, x_2 \geq 0$ .
  
2. Solve graphically the following LPP.  
min  $Z = 4x_1 + 2x_2$   
s.t.  
 $x_1 + 2x_2 \geq 2$   
 $3x_1 + x_2 \geq 3$   
 $4x_1 + 3x_2 \leq 6$   
and  $x_1, x_2 \geq 0$ .
  
3. Write the Computational procedure of the simplex method for the solution of the a maximization LPP.
  
4. Solve the following LPP by Simplex Method.  
max.  $Z = 2x_1 + 4x_2 + x_3$   
s.t.  
 $x_1 + 2x_2 \leq 4$   
 $2x_1 + x_2 \leq 3$   
 $x_2 + 4x_3 \leq 3$   
and  $x_1, x_2, x_3 \geq 0$ .
  
5. Solve by Simplex method.  
max.  $Z = 3x_1 + 5x_2 + 4x_3$   
s.t.  
 $2x_1 + 3x_2 \leq 8$   
 $2x_2 + 5x_3 \leq 10$   
 $3x_1 + 2x_2 + 4x_3 \leq 15$   
and  $x_1, x_2, x_3 \geq 0$ .

6. Solve by Simplex method.

max.  $Z = 2x_1 + 4x_2$   
 s.t.

$2x_1 + 3x_2 \leq 48$   
 $x_1 + 3x_2 \leq 42$   
 $x_1 + x_2 \leq 21$

and  $x_1, x_2 \geq 0$ .

min  $Z = x_1 - 3x_2 + 2x_3$   
 s.t.

or  $3x_1 - x_2 + 2x_3 \leq 7$   
 $-2x_1 + 4x_2 \leq 12$   
 $-4x_1 + 3x_2 + 8x_3 \leq 10$

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

7. Solve by Simplex method (Big-M method).

max.  $Z = 3x_1 - x_2$   
 s.t.

$2x_1 + x_2 \geq 2$   
 $x_1 + 3x_2 \leq 3$   
 $x_2 \leq 4$

and  $x_1, x_2 \geq 0$

8. Solve by Simplex method (Big-M method).

min  $Z = 2x_1 + x_2$   
 s.t.

$3x_1 + x_2 = 3$   
 $4x_1 + 3x_2 \geq 6$   
 $x_1 + 2x_2 \leq 3$

and  $x_1, x_2 \geq 0$ .

9. Find the dual of the problem

max.  $Z = 2x_1 - x_2$   
 s.t.

$x_1 + x_2 \leq 10$   
 $-2x_1 + x_2 \leq 2$   
 $4x_1 + 3x_2 \geq 12$

and  $x_1, x_2 \geq 0$ .

Solve the primal problem by simplex method and deduce from it the solution to the dual problem.

10. Solve the assignment problem represented by the following matrix

|   | I  | II | III | IV | V  | VI |
|---|----|----|-----|----|----|----|
| A | 9  | 22 | 58  | 11 | 19 | 27 |
| B | 43 | 78 | 72  | 50 | 63 | 48 |
| C | 41 | 28 | 91  | 37 | 45 | 33 |
| D | 74 | 42 | 27  | 49 | 39 | 32 |
| E | 36 | 11 | 57  | 22 | 25 | 18 |
| F | 3  | 56 | 53  | 31 | 17 | 28 |