[This question paper contains 8 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 898** **G**

Unique Paper Code : 2362571101

Name of the Paper : Introduction to Operational Research and Linear Programming

Name of the Course : **B.A. (Program)**

Semester : I

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 any **five** questions.
3. **All** questions carry equal marks.

P.T.O.

1. (a) Briefly explain the applications of Operations Research. (7)

(b) Alumco manufactures aluminum sheets and aluminum bars. The maximum production capacity is estimated at either 800 sheets or 600 bars per day. The maximum demand is 550 sheets and 580 bars. The profit is \$40 per sheet and \$35 per bar. Formulate the linear programming problem and determine the optimal daily Production by graphical method. (11)

2. (a) Define the convex set. (9)

Examine whether the set $S = \{(x_1,x_2) : x_1^2 + x_2^2 \leq 1, x_1 + x_2 \geq 1\}$ is convex or not.

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

$$2x_1 + 3x_2 + 2x_3 + 4x_4 = 3$$

$$6x_1 + 4x_2 + 4x_3 + 6x_4 = 2 \qquad (9)$$

3. (a) Define the following terms :

(i) Linear programming problem

(ii) Basic feasible solution

(iii) Artificial variable

(iv) Unrestricted variable (8)

(b) Use simplex method to solve the lpp :

Maximize $Z = 4x_1 + 3x_2 + 4x_3 + 6x_4$

Subject to $x_1 + 2x_2 + 2x_3 + 4x_4 \leq 80$

$2x_1 + 2x_3 + x_4 \leq 60$

$3x_1 + 3x_2 + x_3 + x_4 \leq 80$

$x_1, x_2, x_3, x_4 \geq 0$ (10)

4. (a) Write algorithm of two – phase simplex method. (7)

(b) Use penalty method to solve the given lpp :

Maximize $Z = 12x_1 + 15x_2 + 9x_3$

Subject to $8x_1 + 16x_2 + 12x_3 \leq 250$

$4x_1 + 8x_2 + 10x_3 \geq 80$

$7x_1 + 9x_2 + 8x_3 = 105$

$x_1, x_2, x_3 \geq 0$ (11)

5. (a) Solve the given lpp :

Maximize $Z = 6x_1 + 4x_2$

Subject to the constraints

$2x_1 + 3x_2 \leq 30$

$3x_1 + 2x_3 \leq 24$

$x_1 + x_2 \geq 3$

$x_1, x_2 \geq 0$

Is the solution unique? If not, Give two different solutions. (9)

(b) Use two phase simplex method to solve lpp :

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

Subject to the constraints

$$2x_1 + x_2 - 6x_3 = 20$$

$$6x_1 + 5x_2 + 10x_3 \leq 76$$

$$8x_1 - 3x_2 + 6x_3 \leq 50$$

$$x_1, x_2, x_3 \geq 0$$ (9)

6. (a) Explain the concept of 'degeneracy' in linear programming problem.

Explain the perturbation technique to handle degeneracy in linear programming problem.

(9)

(b) Solve the given linear programming problem :

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

Subject to $x_1 + 2x_2 = 0$

$x_2 + x_3 = 1$

$x_1, x_2, x_3 \geq 0$ (9)

7. (a) What is difference between simplex method and revised simplex method? (7)

(b) Use revised simplex method to solve the linear programming problem :

P.T.O.

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Maximize $Z = x_1 + 2x_2$

Subject to $x_1 + x_2 \leq 3$

$x_1 + 2x_2 \leq 5$

$3x_1 + x_2 \leq 6$

$x_1, x_2 \geq 0$ (11)