



Roll No: \_\_\_\_\_

26-3-18

**DOON UNIVERSITY, DEHRADUN**  
Department of Mathematics, School of Physical Sciences  
Mid Semester Examination, Even Semester 2017-18

Class : M.Sc. Mathematics  
Course: Linear Programming Problem  
Time Allowed : 2 Hours

Semester : II  
Course Code: MAC-455  
Max Marks : 30

**Note:** Attempt all **Three** questions in Section A. Each question carries **2** marks.  
Attempt any **Three** questions in Section B. Each question carries **4** marks.  
Attempt any **Two** questions in Section C. Each question carries **6** marks.

**Section: A**

(Very Short Answer Type Questions)

Attempt all Three questions

[3×2 = 6 Marks]

1. Use Graphical method for solving the following LPP:

$$\text{Maximize } Z = -x_1 + 2x_2$$

$$\text{Subject to: } -x_1 + 3x_2 \leq 10; \quad x_1 + x_2 \leq 6; \quad x_1 - x_2 \leq 2; \quad x_1, x_2 \geq 0.$$

2. Write the dual of the linear programming problem(LPP):

$$\text{Maximize } Z = x_1 + x_2 + x_3$$

$$\text{Subject to: } x_1 - 3x_2 + 4x_3 = 5; \quad x_1 - 2x_2 \leq 3; \quad 2x_2 - x_3 \geq 4, \quad x_1, x_2 \geq 0, x_3 \text{ is unrestricted.}$$

3. Solve the following game using dominance property:

	Player B		
	1	-1	0
Player A	-6	3	-2
	8	-5	2

**Section B**

(Short Answer Type Questions)

Attempt any Three questions

[3×4 = 12 Marks]

4. Use Simplex method to solving the following LPP:

$$\text{Maximize } Z = 5x_1 + 3x_2$$

$$\text{Subject to: } x_1 + x_2 \leq 2; \quad 5x_1 + 2x_2 \leq 10; \quad 3x_1 + 8x_2 \leq 12; \quad x_1, x_2 \geq 0.$$

5. Solve the following LPP using Two-Phase method:

$$\text{Maximize } Z = 6x_1 + 4x_2$$

$$\text{Subject to: } 2x_1 + 3x_2 \leq 30; \quad 3x_1 + 2x_2 \leq 24; \quad x_1 + x_2 \geq 3; \quad x_1, x_2 \geq 0.$$

6. Solve the following LPP using Dual-Simplex method:

$$\text{Minimize } Z = -x_1 - 4x_2 + 3x_3$$

$$\text{Subject to: } 2x_1 + x_2 - 6x_3 = 20; \quad 6x_1 + 5x_2 + 10x_3 \leq 76; \quad 8x_1 - 3x_2 + 6x_3 \leq 50; \quad x_1, x_2, x_3 \geq 0.$$

7. Solve the following assignment problems:

	a	b	c	d
A	8	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

**Section C**  
(Long Answer Type Questions)

Attempt any Two questions

[2×6 = 12 Marks]

8. Solve the following LPP using Big-M method:

Minimize  $Z = 2x_1 + x_2$

Subject to:  $3x_1 + x_2 = 3$ ;  $4x_1 + 3x_2 \geq 6$ ;  $x_1 + 2x_2 \leq 3$ ;  $x_1, x_2 \geq 0$ .

Also, discuss the effect on the optimal solution when the vector  $b$  is changed from  $(3, 6, 3)^T$  to  $(5, 5, 3)^T$ .

9. Solve the following maximization transportation problem:

Market	Plant			Requirement at Market
	P1	P2	P3	
M1	2	7	4	5
M2	3	3	1	8
M3	5	4	7	7
M4	1	6	2	14
Available	7	9	18	

10. Examine the convexity of the sets

(a)  $S = \{(x_1, x_2) : x_1^2 + x_2^2 \leq 1, x_1 + x_2 \geq 1\}$

(b)  $S = \{(x_1, x_2) : 4x_1 + 3x_2 \leq 6, x_1 + x_2 \geq 1\}$ .