

ASSIGNMENT 1**(Marks=10*10= 100)****(Graphical, Simplex, Two phase and Big M method)**

Q1) Solve the following LP graphically. Also identify the binding and redundant constraint(s).

Maximize $z = 7x_1 + 10x_2$

$$x_1 \leq 36$$
$$x_2 \leq 12$$
$$x_1 + 4x_2 \leq 60$$
$$2x_1 + x_2 \geq 30$$
$$x_1 - x_2 \geq 0$$

and $x_1 \geq 0, x_2$ unrestricted.

Q2) Consider the following LP:

Maximize $z = x_1 + 3x_2$

Subject to:

$$x_1 + x_2 \leq 4$$
$$x_1 - x_2 \leq 2$$
$$x_1 \geq 0, x_2 = \text{unrestricted}$$

- (i) Determine all the basic solutions of the problem, and classify them as feasible and infeasible.
- (ii) Solve the problem using graphical approach.

Q3) Consider the LP:

(A) Maximize	$3x_1 + 4x_2$	(B) Maximize	$x_1 + 2x_2$
Subject to	$3x_1 + 2x_2 \leq 30$		
	$x_1 + 2x_2 \leq 22$		
	$x_1, x_2 \geq 0$		

Solve A and B using the tabular simplex method. Which problem has multiple optimal solutions?

Q4) Use tabular Simplex method to solve the following LP Problem:

$$\text{Maximize} \quad 3x_1 + 4x_2 + x_3$$

Subject to constraints:

$$x_1 + 2x_2 + 3x_3 \leq 90$$

$$2x_1 + x_2 + x_3 \leq 60$$

$$3x_1 + x_2 + 2x_3 \leq 80$$

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

Q5) Solve the following LP problem using Big M method:

$$\text{Minimize} \quad 3x_1 + 2.5x_2$$

Subject to constraints:

$$x_1 + 2x_2 \geq 20$$

$$5x_1 + 2x_2 \geq 50$$

$$x_1, x_2 \geq 0$$

Q6) Use Big M Simplex Method to solve the following LP Problem:

$$\text{Maximize} \quad 30x_1 + 20x_2$$

Subject to constraints:

$$-x_1 - x_2 \geq -8$$

$$-6x_1 - 4x_2 \leq -12$$

$$5x_1 + 8x_2 = 20$$

$$x_1, x_2 \geq 0$$

Q7) Consider the following LP:

$$\text{Minimize} \quad 0.4x_1 + 0.5x_2$$

$$\text{Subject to} \quad 0.3x_1 + 0.1x_2 \leq 1.8$$

$$x_1 + x_2 = 12$$

$$0.6x_1 + 0.4x_2 \geq 6$$

$$x_1, x_2 \leq 0$$

Use the two phase variant of simplex method to find an initial basic feasible solution.

Q8) Solve the following LP problem using the two phase simplex method:

$$\begin{array}{ll}\text{Maximize} & 2x_1 + 3x_2 + x_3 \\ \text{Subject to} & x_1 + x_2 + x_3 \leq 40 \\ & 2x_1 + x_2 - x_3 \geq 10 \\ & -x_2 + x_3 \geq 10 \\ & x_1, x_2, x_3 \geq 0\end{array}$$

Q9) Solve the following LP problem using the simplex method. Please indicate if you have found a degenerate solution.

$$\begin{array}{ll}\text{Maximize} & 3x_1 + x_2 \\ \text{Subject to} & x_1 + 2x_2 \leq 5 \\ & x_1 + x_2 - x_3 \leq 2 \\ & 7x_1 + 3x_2 - 5x_3 \leq 20 \\ & x_1, x_2, x_3 \geq 0\end{array}$$

Q10) Solve the following LP problem using the simplex method. If you change the objective to maximization type, what would be the optimal solution?

$$\begin{array}{ll}\text{Minimize} & -x_1 + x_2 \\ \text{Subject to} & x_1 - 4x_2 \geq 5 \\ & x_1 - 3x_2 \leq 1 \\ & 2x_1 - 5x_2 \geq 1 \\ & x_1, x_2 \geq 0\end{array}$$