Series TD 4 Linear Programming Optimization

Exercise N° 1

Consider the Linear Programming Optimization problem defined as follows:

$$\max f = 3x_1 + 2x_2$$
$$s.t.$$
$$2x_1 + x_2 \leq 4$$
$$-2x_1 + x_2 \leq 2$$
$$x_1 - x_2 \leq 1$$
$$x_1, x_2 \geq 0$$

- Solve the above optimization problem using Simplex Algorithm by specifying the value of the optimal solution and the corresponding optimal value of the objective function.

Exercise N° 2

Use the Simplex algorithm and find the optimal solution of the following linear programming optimization problems:

1.

$$\min f = x_1 - 2x_2$$
$$s.t.$$
$$2x_1 + 3x_3 = 1$$
$$3x_1 + 2x_2 - x_3 = 5$$
$$x_1 - x_2 \leq 1$$
$$x_1, x_2, x_3 \geq 0$$

2.

$$\min f = 3x_1 + 5x_2 - x_3$$
$$s.t.$$
$$-3x_1 - x_2 + x_3 \leq 3$$
$$2x_1 - 3x_2 - 2x_3 \geq 4$$
$$x_1 - x_3 = 2$$
$$x_1, x_2, x_3 \geq 0$$

Exercise N° 3

We consider the following optimization problem :

$$\max f = 2x_1 + x_2$$
$$s.t.$$
$$x_1 + 2x_2 \leq 14$$
$$2x_1 - x_2 \leq 10$$
$$x_1 - x_2 \leq 3$$
$$x_1, x_2 \geq 0$$

1. Verify that $\bar{x} = \left(\frac{20}{3}, \frac{11}{3}\right)$ is a feasible solution for the problem.

2. Check whether $\bar{x}$ is an optimal solution of the optimization problem.

Exercise N° 4

We define the linear programming optimization problem as follows:

$$\min f = 240x_1 + 104x_2 + 60x_3 + 19x_4$$

$$s.t.$$

$$20x_1 + 9x_2 + 6x_3 + x_4 \leq 20$$

$$10x_1 + 4x_2 + 2x_3 + x_4 \leq 10$$

$$x_i \geq 0, i = 1,2,3,4$$

1- Investigate all the basic feasible solutions of the given problem.

2- Among the obtained solutions, identify the optimal one.

Exercise N° 5

Considering the optimization problem defined as :

$$\max f = 6x + 7y$$

$$s.t.$$

$$6x + 7y \leq 42$$

$$5x + 9y \leq 45$$

$$x - y \leq 4$$

$$x, y \geq 0$$

- Solve the above problem using the Simplex algorithm.