OPERATIONS RESEARCH
Lab 1 – Introduction to Linear Programming

1) **GRAPHICAL SOLUTION:** Given is the following LP problem. Use the graphical method to solve it. Mark the feasible region and find the optimal solution. Then, answer the questions.
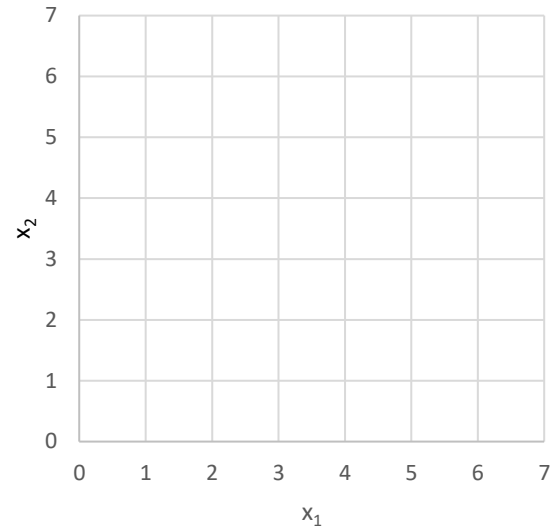
$Max \quad x_1 + x_2$

(1) $\quad x_1 + 3x_2 \geq 6$
(2) $\quad 2x_1 - x_2 \geq 0$
(3) $\quad x_1 + 2x_2 \leq 12$
(4) $\quad 2x_1 + x_2 \leq 12$

$s.t. \quad x_1 \geq 0, x_2 \geq 0$

a) How many Corner Point Feasible solutions are in this problem?
b) What is the score attained by the optimal CPF solution?
c) Which CPF solution becomes optimal when replacing the inequality with the equality in the (2) constraint?

2) **CASE STUDY #1:** ELECTRO-STAR company produces two electronic devices: A and B, using two components C1 and C2. One unit of device A requires 2 units of C1 and 1 unit of C2, while B requires 1 unit of C1 and 3 units of C2. The company has stored 400 units of C1 and 450 units of C2. The income from selling 1 unit of A is 10$, while for B, it is 30$. Formulate the LP problem and solve it using the graphical method.
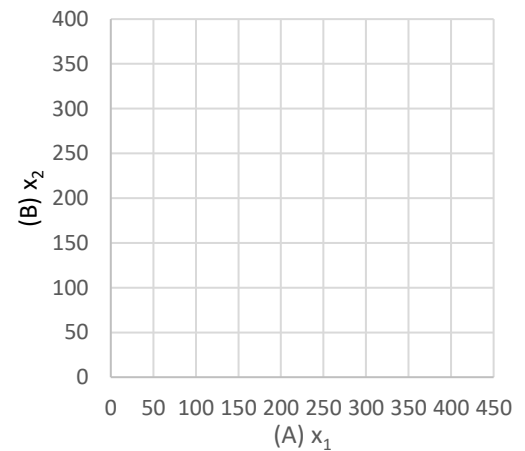
3) **CASE STUDY #2:** JOHNSON & SONS food company produces two products: milk and bread. Each sold unit of milk and bread yields a profit of, respectively, 2 and 1 dollars. The company hires ten full-time employees, i.e., working 40 hours per week. Production of one unit of milk takes 5 minutes, while one unit of bread 4 minutes. The company receives 400 gallons and 500 kgs of, respectively, unprocessed milk and flour weekly from external sources. From one gallon of raw milk, 10 units of ready-to-sell units of milk can be produced. Further, from 1 kg of flour, 5 loaves of bread can be baked. How many units of milk and bread should be produced to maximize the profit? On which product should the company be focused more? Imagine that the company wants to increase the price of another product, but it does not want to change the production level of the dominant one, i.e., it wants to hold its optimality. How much can the price increase?