

ASSIGNMENT #01

Ayсалан Ahmed Khatyan
SP19-BSSE-0018

Operations Research

Q No 1

Decisions Variables:

$$x_1, x_2$$

Objective Function:

$$Z = 3x_1 + 2x_2$$

Constraints:

$$x_1 + 2x_2 \leq 6$$

$$2x_1 + x_2 \leq 8$$

$$-x_1 + x_2 \leq 1$$

$$x_1 + x_2 \geq 1$$

$$x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

$$\therefore x_1 + 2x_2 = 6$$

$$\text{let, } x_1 = 0 \Rightarrow (0, 3)$$

$$\text{let, } x_2 = 0 \Rightarrow (6, 0)$$

$$\therefore 2x_1 + x_2 = 8$$

$$\text{let, } x_1 = 0 \Rightarrow (0, 8)$$

$$\text{let, } x_2 = 0 \Rightarrow (4, 0)$$

$$\therefore -x_1 + x_2 = 1$$

$$\text{let, } x_1 = 0 \Rightarrow (0, 1)$$

$$\text{let, } x_2 = 0 \Rightarrow (-1, 0)$$

$$\therefore x_1 + x_2 = 1$$

$$\text{let, } x_1 = 0 \Rightarrow (0, 1)$$

$$\text{let, } x_2 = 0 \Rightarrow (1, 0)$$

$$\therefore Z = 3x_1 + 2x_2 \quad \text{--- A}$$

$$\text{let, } Z = -6$$

$$\therefore x_1 = 0 \Rightarrow (0, -3)$$

$$\therefore x_2 = 0 \Rightarrow (-2, 0)$$

$$\text{let, } Z = -12$$

$$\therefore x_1 = 0 \Rightarrow (0, -6)$$

$$\therefore x_2 = 0 \Rightarrow (-4, 0)$$

then,

$$-x_1 + x_2 = 1 \quad \text{--- ①}$$

$$x_1 + x_2 = 1 \quad \text{--- ②}$$

$$\underline{2x_2 = 2}$$

$$\boxed{x_2 = 1}$$

by ① \Rightarrow

$$-x_1 + 1 = 1$$

$$-x_1 = 1 - 1$$

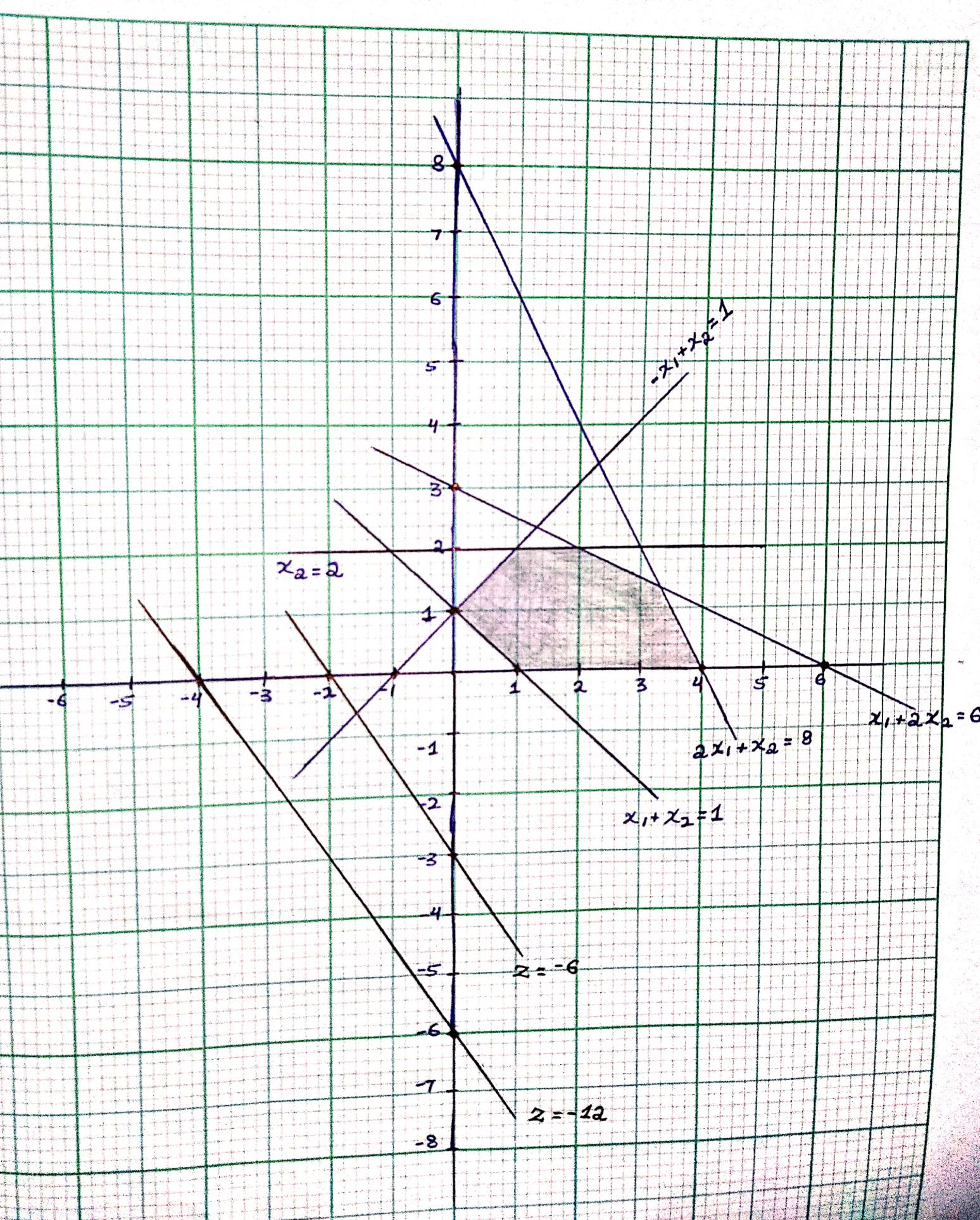
$$\boxed{x_1 = 0}$$

$$\text{by A} \Rightarrow x_1 + x_2 = (0, 1)$$

$$Z = 3x_1 + 2x_2$$

$$= 3(0) + 2(1)$$

$$\boxed{Z = 2}$$



Q NO 2

Decision Variables:

x_1 = No. of batches of product 1 produced per week
 x_2 = No. of batches of Product 2 produced per week

Objective Function:

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

Constraints:

$$x_1 \leq 4$$

$$2x_2 \leq 12$$

$$3x_1 + 2x_2 \leq 18$$

$$x_1, x_2 \geq 0$$

$$\therefore 3x_1 + 2x_2 = 18$$

$$\text{let, } x_1 = 0 \Rightarrow (0, 9)$$

$$\text{let, } x_2 = 0 \Rightarrow (6, 0)$$

$$\therefore 2x_2 = 12$$

$$\text{let, } x_2 = 0 \Rightarrow (0, 6)$$

$$\text{let, } x_2 = 0 \Rightarrow (0, 0)$$

$$\therefore Z = 3x_1 + 5x_2$$

$$\text{let, } Z = 6$$

$$\therefore x_1 = 0 \Rightarrow (0, 1.2)$$

$$\therefore x_2 = 0 \Rightarrow (2, 0)$$

$$\text{let, } Z = 12$$

$$\therefore x_1 = 0 \Rightarrow (0, 2.4)$$

$$\therefore x_2 = 0 \Rightarrow (4, 0)$$

$$\text{let, } Z = 18$$

$$\therefore x_1 = 0 \Rightarrow (0, 3.6)$$

$$\therefore x_2 = 0 \Rightarrow (6, 0)$$

From Graph, Subtracting eq ① & ②

$$\begin{array}{r} 3x_1 + 2x_2 = 18 \quad \text{--- ①} \\ - 2x_2 = 12 \quad \text{--- ②} \\ \hline 3x_1 = 6 \\ |x_1 = 2 \end{array}$$

Putting value of $x_1=2$ in eq ① \Rightarrow

$$\begin{aligned} 3(2) + 2x_2 &= 18 \\ 2x_2 &= 18 - 6 \\ x_2 &= 12/2 \\ |x_2 &= 6 \end{aligned}$$

eq ④ \Rightarrow

$$\begin{aligned} Z &= 3x_1 + 5x_2 \\ &= 3(2) + 5(6) \\ &= 6 + 30 \end{aligned}$$

$| \text{Max } Z = 36 \text{ (In Thousands Dollar)}$

The Company will earn \$36,000 when production of Product 1 is 2 hours per week and production of product 2 is 6 hours per week.

