Unit - 02

Graphical Method

Problem 1:

Solve the following LPP by Graphical method Max $Z = 3x_1 + 2x_2$ subject to $-2x_1 + x_2 \leq 1$

$$x_1 \leq 2$$

$$x_1 + x_2 \leq 3$$

$$x_1, x_2 \geq 0.$$

Soln:

$-2x_1 + x_2 = 1.$

x_1	0	$-1/2$
x_2	1	0

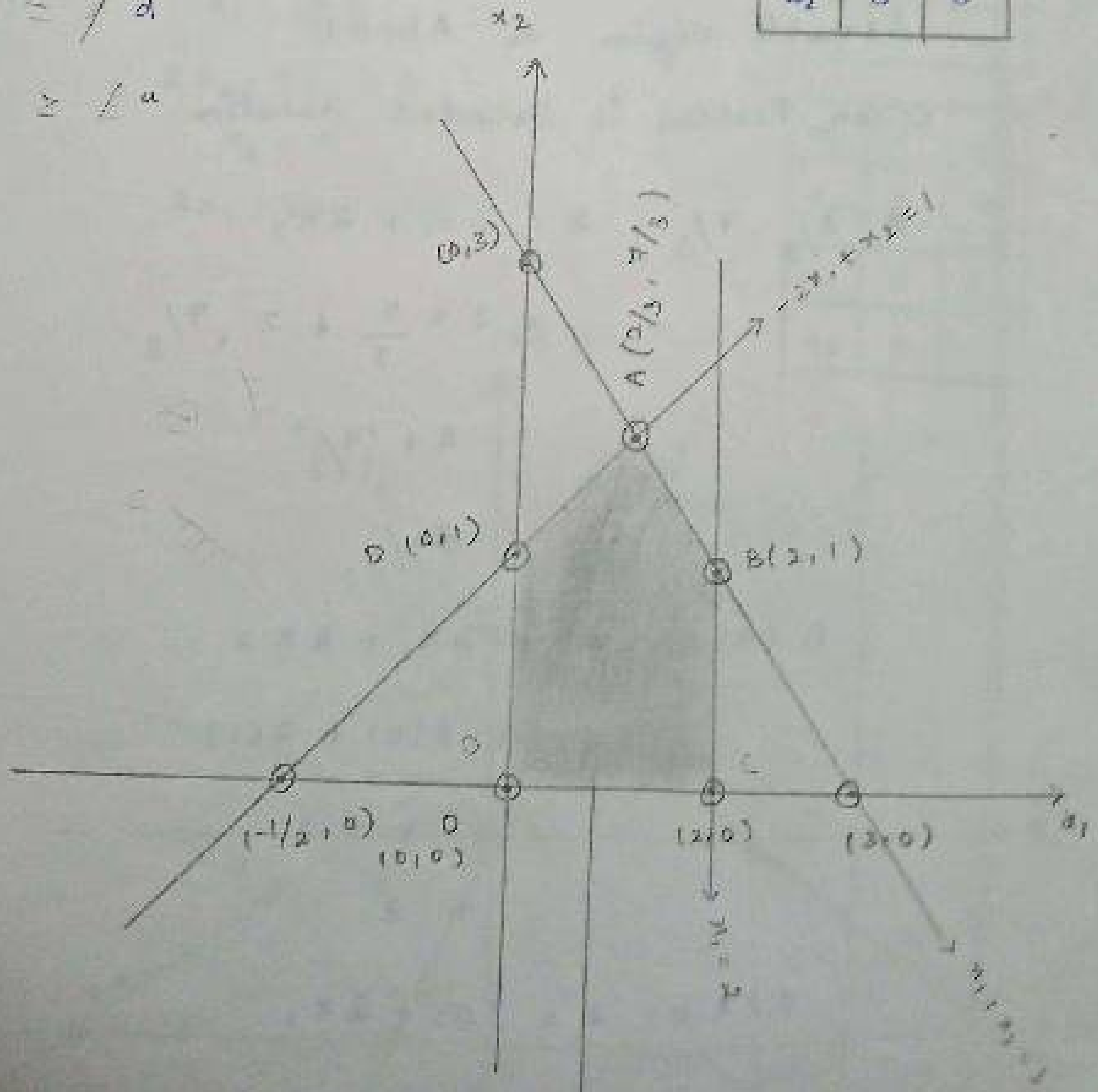
$x_1 = 2$

$x_1 + x_2 = 3.$

x_1	0	3
x_2	3	0

$\leq$ / d

$\geq$ / u



$-2x_1 + x_2 = 1 \rightarrow (1)$

$x_1 + x_2 = 3 \rightarrow (2)$

$\underline{(-) \quad (-) \quad (-)}$

$-3x_1 = 2$

$x_1 = 2/3$ in (1)

$2 \times 2/3 + x_2 = 1$

$-4/3 + x_2 = 1$

$x_2 = 1 + 4/3$

$x_2 = 7/3$

$x_1 = 2$

$2 \Rightarrow 2 + x_2 = 3$

$x_2 = 3 - 2$

$x_2 = 1$

Feasible region is ABCOD

Given Problem is bounded solution.

$A(2/3, 7/3)$ $z = 3x_1 + 2x_2$

$= 3 \times \frac{2}{3} + 2 \times 7/3$

$= 2 + 14/3$

$= 20/3.$

$B(2,1)$ $z = 3x_1 + 2x_2$

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

$= 6 + 2$

$= 8.$

$C(2,0)$ $z = 3x_1 + 2x_2$

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

$= 6$

$D(0,0)\quad z = 2x_1 + 2x_2$

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

$= 0$

$D(0,1)\quad z = 3(0) + 2(1)$

$= 2$

max z is 8 at $B(2,1)$.

Problem 2 :

Solve the LPP by Graphical method $\min z = 3x_1 + 5x_2$

subject to $-3x_1 + 4x_2 \le 12$

$x_1 \le 4$

$2x_1 - x_2 \ge -2$

$x_2 \ge 2$

$2x_1 + 3x_2 \ge 12.$

soln :

$-3x_1 + 4x_2 = 12$

x_1	0	-4
x_2	3	0

$x_1 = 4$

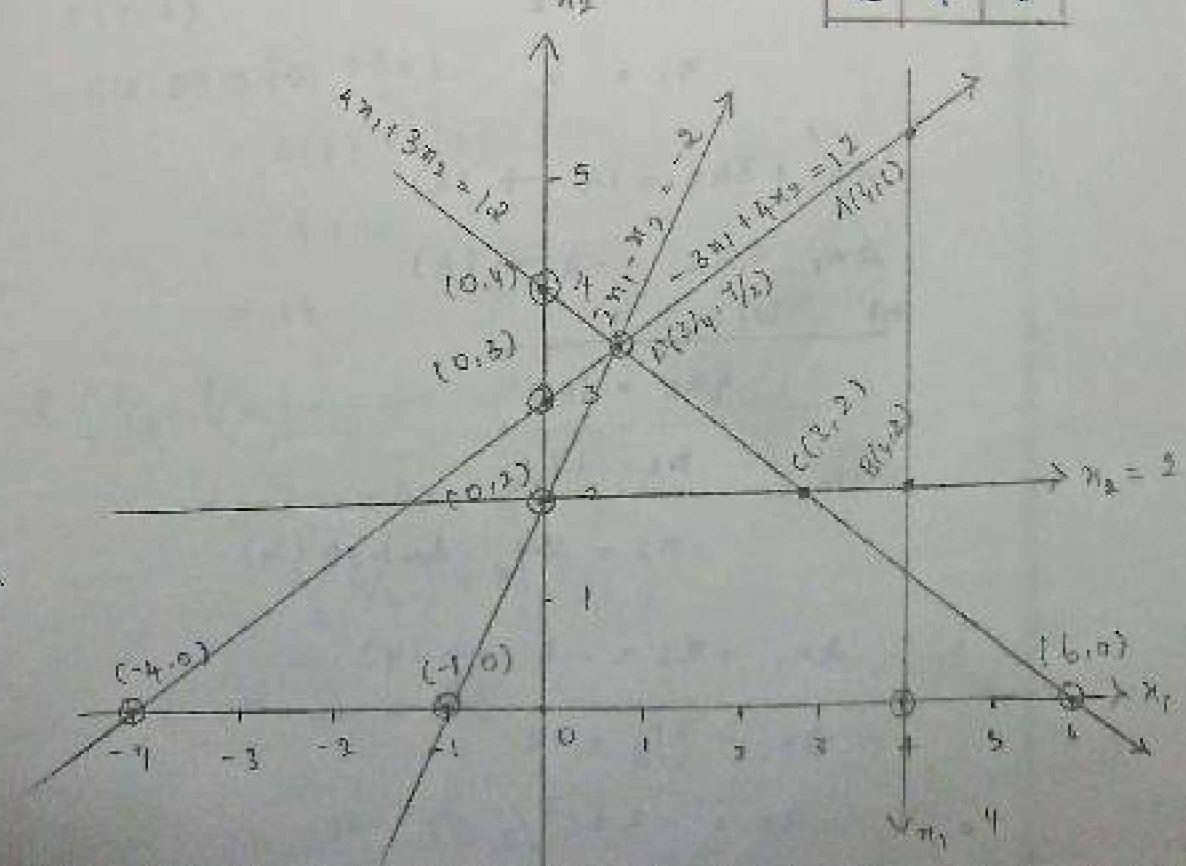
$2x_1 - x_2 = -2$

x_1	0	-1
x_2	2	0

$x_2 = 2$

$2x_1 + 3x_2 = 12$

x_1	0	6
x_2	4	0



$x_1 = 4$ sub in (1)

$-3x + 4x\, x_2 = 12 \rightarrow (1)$

$-3(4) + 4x_2 = 12$

$-12 + 4x_2 = 12$

$4x_2 = 12 + 12$

$4x_2 = 24$

$x_2 = \cancel{24}^{6}/\cancel{4}_{1}$

$x_2 = 6$ $\therefore A(4, 6)$

$x_1 = 4$

$x_2 = 2$ $\therefore B(4, 2)$

$x_2 = 2$ sub in (2)

$2x_1 + 3x_2 = 12 \rightarrow (2)$

$2x_1 + 3(2) = 12$

$2x_1 + 6 = 12$

$2x_1 = 12 - 6$

$2x_1 = 6$

$x_1 = 6/2$

$x_1 = 3$ $\therefore C(3, 2)$

$\cancel{2x_1} + 3x_2 = 12 \rightarrow (3)$

$\cancel{2x_1} - x_2 = -2 \rightarrow (4)$

$(-) \quad (+) \quad (+)$

$4x_2 = 14$

$x_2 = 14/4$

$x_2 = 7/2$ sub in (4)

$2x_1 - x_2 = -2 \rightarrow (4)$

$2x_1 - 7/2 = -2$

$2x = -2 + 7/2$

$$2x_1 = \frac{-4+7}{2} \quad \text{Divide both side 2}$$

$$2x_1 = \frac{3}{2} \quad (\text{or}) \quad \frac{\cancel{2}x_1}{\cancel{2}} = \frac{3/2}{2}$$

$$x_1 = \frac{3}{2} - 2 \qquad x_1 = \frac{3}{2} \times \frac{1}{2}$$

$$x_1 = -1/2 \qquad x_1 = 3/4$$

$$\therefore D\left(3/4, 7/2\right)$$

Feasible region is ABCD

Given Problem is bounded solution

A (4, 6)

$$z = 3x_1 + 5x_2$$
$$= 3(4) + 5(6)$$
$$= 12 + 30$$
$$= 42$$

B(4, 2)

$$z = 3x_1 + 5x_2$$
$$= 3(4) + 5(2)$$
$$= 12 + 10$$
$$= 22$$

C (3, 2)

$$z = 3x_1 + 5x_2$$
$$= 3(3) + 5(2)$$
$$= 9 + 10$$
$$= 19$$

D $\left(3/4, 7/2\right)$

$$z = 3x_1 + 5x_2$$
$$= 3\left(3/4\right) + 5\left(7/2\right)$$
$$= \frac{9}{4} + \frac{35}{2}$$
$$= \frac{18 + 140}{8}$$

$= 158/8$

$= 79/4$

$= 19.75.$

$\therefore$ Min Z is 19 at C(3, 2).