# OR Assignment #1

Date:

S. M. Hassan Ali
K20-1052.
BSE-4B

Q.1

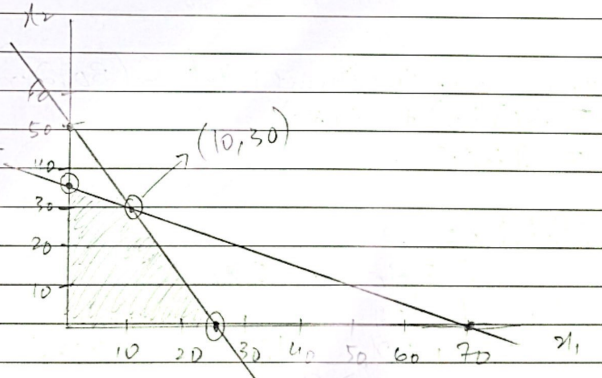
Maximize:

$$Z = 8x_1 + 10x_2$$

subject to:

$$2x_1 + x_2 \leq 50$$
$$x_1 + 2x_2 \leq 70$$

| | |
|---|---|
| $x_2 = 0$ | $x_2 = 0$ |
| $x_1 = 50/2 = 25$ | $x_1 = 70$ |
| $(25, 0)$ | $(70, 0)$ |
| $x_1 = 0$ | $x_1 = 0$ |
| $x_2 = 50$ | $x_2 = 35$ $(0, 35)$ |
| $(0, 50)$ | |




At $(10, 30)$ we have $Z = 8(10) + 10(30)$

$= 380.$

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Q.2. Minimize:

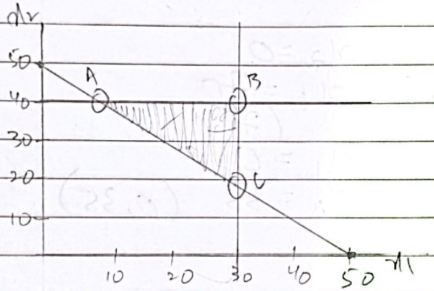
$Z = 20x_1 + 30x_2$. $\quad x_1, x_2 \geq 0$

subject to

$x_1 + x_2 \geq 50$

$x_1 \leq 30 \quad x_2 \leq 40$

(0, 50) (50, 0) (30, 0) (0, 40).




Minimum value at extreme point C(30, 20)

$= 20(30) + 30(20)$

$= 1200.$

Q.3

Minimize:

$Z = 30x_1 + 40x_2$

Subject to:

$2x_1 + x_2 \geq 12. \quad x_1, x_2 \geq 0$

$x_1 + x_2 \geq 9$

$x_1 + 3x_2 \geq 15$

| | | |
|---|---|---|
| $x_1 = 0$ | $x_1 = 0$ | $x_1 = 0$ |
| $x_2 = 12$ | $x_2 = 9$ | $x_2 = 5$ |
| $x_2 = 0$ | $x_2 = 0$ | $x_2 = 0$ |
| $x_1 = 6$ | $x_1 = 9$ | $x_1 = 15$ |
| (0, 12) (6, 0) | (0, 9) (9, 0) | (0, 5) (15, 0) |

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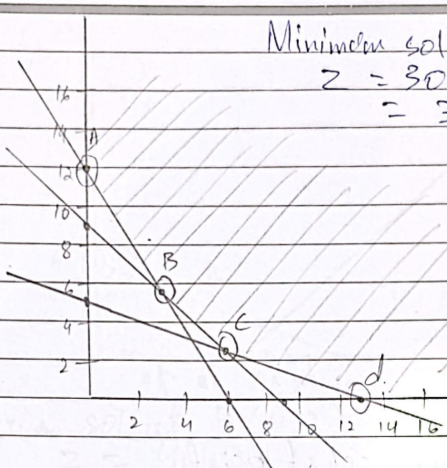


Minimum sol at C(6,3)
$Z = 30(6) + 40(3)$
$= 300.$

Shaded area is open-ended hence maximization is not possible. (Only minimization is).

Q.4

Maximize

$Z = 40{,}000(x_1) + 45{,}000(x_2)$

subject to.

$x_1 \geq 2 \quad x_1 \leq 4 \quad | \quad x_1, x_2 \geq 0$

$x_2 \geq 24$

$x_1 + x_2 \leq 30$

$(2,0) \; (4,0) \; (0,24)$

$(0,30) \; (30,0).$

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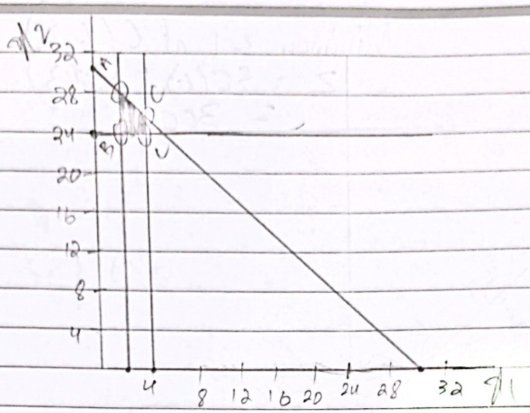


Maximum optimum sol at point

Q.05

Maximize:

$$Z = 4x_1 + 6x_2$$

Subject to

$$x_1, x_2 \geq 0$$

$$x_1 + 2x_2 \leq 10$$
$$x_1 + x_2 \leq 7$$

(10, 0) (0, 5)

(7, 0) (0, 7)

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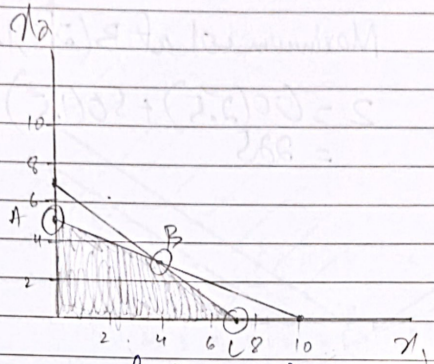


Maxim sol at B(4,3)

$Z = 4(4) + 6(3) = 34$

Q.6

Maximize:

$Z = 60x_1 + 50x_2$

subject to $\quad x_1, x_2 \geq 0$

$3x_1 + 5x_2 \leq 15$

$4x_1 + 4x_2 \leq 16$

(5,0) (0,3)

(4,0) (0,4)

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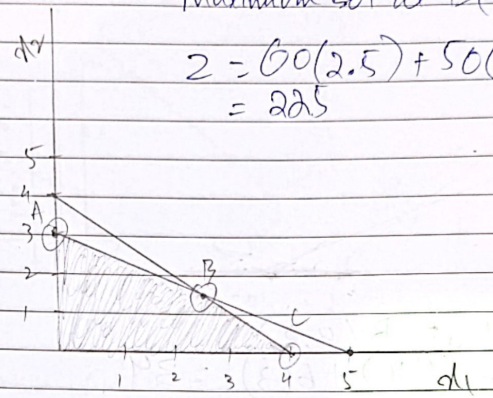
Maximum sol at B(2.5, 1.5)

$Z = 60(2.5) + 50(1.5)$

$= 225$




Q.7

Minimize

$Z = 20{,}000A + 25{,}000B$

subject to

$40x_1 + 60x_2 \geq 300$

$20x_1 + 3x_2 \leq 12.$

(7.5, 0) (0, 5)

(6.4, 0) (0, 4)

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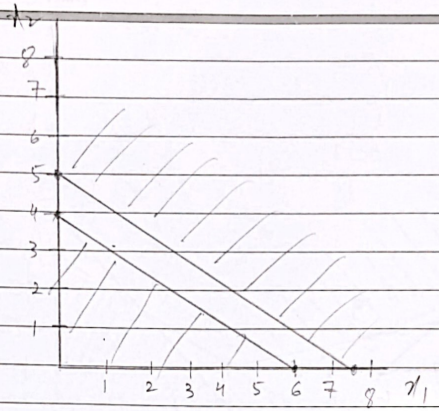


No feasible region, hence no minimum.

Q.8

Minimize

$$Z = 10x_1 + 12x_2$$

subject to

$$2x_1 + 3x_2 \geq 18$$
$$x_1 + 3x_2 \geq 12$$
$$80x_1 + 60x_2 \geq 480$$

(9,0) (12,0) (6,0)

(0,6) (0,4) (0,8)

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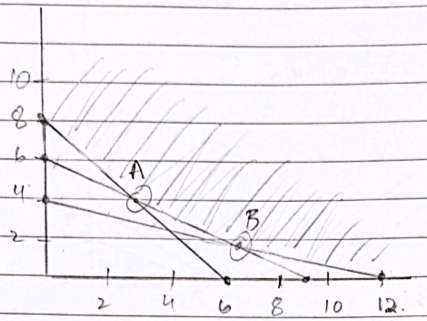


Minimum value at point A(3,4)

$Z = 10(3) + 12(4)$

$= 78.$

Q.9

Min Maximize:

$Z = 120x_1 + 100x_2.$

subject to:

$2x_1 + 2x_2 \leq 8$

$5x_1 + 3x_2 \leq 15$

(4,0) (3,0)

(0,4) (0,5)

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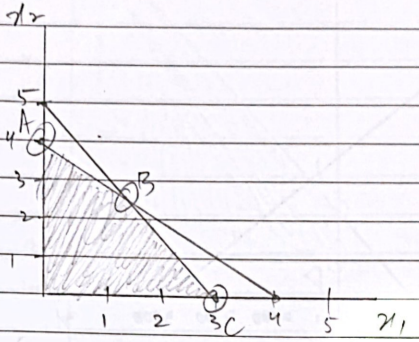



Maximum solution at B (1.5, 2.5)

$Z =$

Q.10

Maximize:

$Z = 30x_1 + 60x_2$

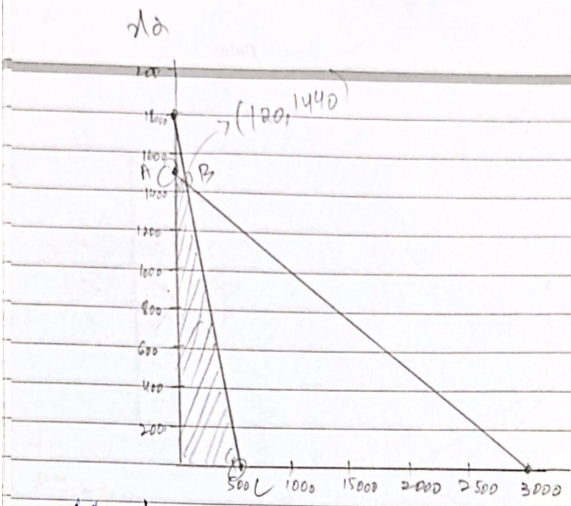
subject to:

$6x_1 + 12x_1 \leq 18000$

$3x_1 + x_2 \leq 1800$

(3000, 0) ; (600, 0)

(0, 1500) ; (0, 1800)




Maximum sol at point B (120, 1440)

$Z = 30(120) + 60(1440)$

$= 86,760$

Q.11

Maximize:

$Z = 10x_2 + 8x_1$

Subject to

$x_1 \leq 4000$

$x_2 \geq 1500$

$x_1 + x_2 \leq 6000$

$x_1, x_2 \geq 0$

$x_1 = 4000$

$x_2 = 1500$

$(4000, 0)$

$(1500, 0)$

$x_1 = 0$

$x_2 = 6000$

$x_2 = 0$

$x_1 = 6000$

$(0, 6000)$

$(6000, 0)$

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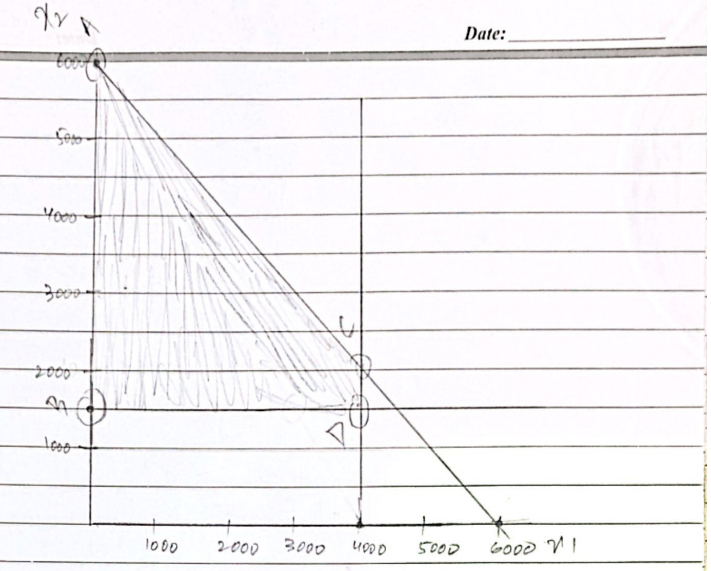
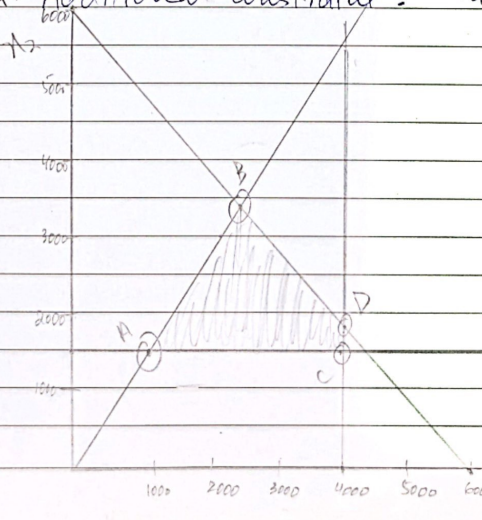



From graph we see A(0,6000) produces max optimum solution as

$$Z = 8(0) + 10(6000)$$
$$= 60000.$$

8.12. Additional constraint: $x_2 \leq \frac{3}{2}x_1$




$$\frac{3}{2}x_1 - x_2 \geq 0$$
$$x_1 = \frac{2}{3}x_2$$
$$y = mx + c$$

B(2400, 3600) extreme point that gives

$$Z = 2400(8) + 10(3600)$$
$$= 55200.$$