Q.1)

Decision Variables :

X_{ij} = amount of land allocated by kibbutz j for crop i

i : 1 (Sugar beets), 2 (Cotton), 3 (Sorghum)

j : 1, 2, 3

Model

$$\text{Max } 1000(X_{11}+X_{12}+X_{13})+750(X_{21}+X_{22}+X_{23})+250(X_{31}+X_{32}+X_{33})$$

S.t

$$\left.\begin{aligned} X_{11}+X_{12}+X_{13} &\leq 600 \\ X_{21}+X_{22}+X_{23} &\leq 500 \\ X_{31}+X_{32}+X_{33} &\leq 325 \end{aligned}\right\} \text{ for max quota}$$

$$\left.\begin{aligned} 3X_{11}+2X_{21}+X_{31} &\leq 600 \\ 3X_{12}+2X_{22}+X_{32} &\leq 800 \\ 3X_{13}+2X_{23}+X_{33} &\leq 375 \end{aligned}\right\} \text{ for water Const.}$$

$$\left.\begin{aligned} X_{11}+X_{21}+X_{31} &\leq 400 \\ X_{12}+X_{22}+X_{32} &\leq 600 \\ X_{13}+X_{23}+X_{33} &\leq 300 \end{aligned}\right\} \text{ for usable land}$$

$$\left(\frac{X_{11}+X_{21}+X_{31}}{400}=\frac{X_{12}+X_{22}+X_{32}}{600}=\frac{X_{13}+X_{23}+X_{33}}{300}\right)$$

linearize the equation

$$(X_{12}+X_{22}+X_{32})-2(X_{13}+X_{23}+X_{33})=0$$

$$3(X_{11}+X_{21}+X_{31})-2(X_{12}+X_{22}+X_{32})=0$$

$$3(X_{11}+X_{21}+X_{31})-4(X_{13}+X_{23}+X_{33})=0$$

$X_{ij} \geq 0$ $\quad i=1,2,3$ $\quad j=1,2,3$

Dec. Var

C_i = Cash on hand at the end of month i, $i = 1, \dots, 4$

X_i = amount of tons purchased at the begining of month i, $i = 1, \dots, 4$

y_i = amount of tons sold at the end of month i, $i = 1, \dots, 4$

I_i = amount of tons on hand at month i, $i = 1, \dots, 4$ (after purchase, befor selling)

Parameters

P_i = price of buying at month i, $i = 1, \dots, 4$

S_i = price of selling at month i, $i = 1, \dots, 4$

Model

$$\max \quad C_4$$

s.t

$$I_i = I_{i-1} + X_i - y_{i-1} \qquad i = 1, \dots, 4 \quad \text{(Inventory balance)}$$

$$C_i = C_{i-1} - P_i X_i + S_i y_i \qquad i = 1, \dots, 4 \quad \text{(Cash balance)}$$

$$I_i \leq 100 \qquad i = 1, \dots, 4 \quad \text{(Capacity Constraint)}$$

$$y_i \leq I_i \qquad i = 1, \dots, 4 \quad \text{(Can't sell more Corn than you have)}$$

$$P_i X_i \leq C_{i-1} \qquad i = 1, \dots, 4 \quad \text{(Can't spend more money than you have)}$$

$$I_0 = 50$$

$$C_0 = 1000$$

$$y_0 = 0$$

$$C_i, X_i, y_i, I_i \geq 0 \qquad i = 1, \dots, 4$$

Dec. Var. : X_i : number of hours process i runs, $i = 1, 2, 3$

a) max $9(2X_1 + 2X_3) + 10(X_1 + 3X_2 - 3X_3) + 24X_3 - (5X_1 + 4X_2 + X_3)$
rev of web rev of BC rev of GST running costs of processes

$- 2(2X_1 + X_2) - 3(3X_1 + 3X_2 + 2X_3)$
Cost of A Cost of B

s.t
$2X_1 + X_2 \leq 200$ (Sugar type A) (i)
$3X_1 + 3X_2 + 2X_3 \leq 300$ (Sugar type B) (ii)
$X_1 + X_2 + X_3 \leq 100$ (hour limitation) (iii)
$X_1 + 3X_2 \geq 3X_3$ (max BC that can be used in process 3) (iv)
$X_1, X_2, X_3 \geq 0$ (v)

b) Instead of (i) and (ii), add the following one:

$(2X_1 + X_2) + (3X_1 + 3X_2 + 2X_3) \leq 500 \rightarrow 5X_1 + 4X_2 + 2X_3 \leq 500$

c) Add dec. var y : # of Wonka Box

$y = \min\left\{2X_1 + 2X_3, \frac{X_1 + 3X_2 - 3X_3}{2}, X_3\right\}$ → 0 Not linear, you MUST linearize in your model

Model max $54y - (5X_1 + 4X_2 + X_3) - 2(2X_1 + X_2) - 3(3X_1 + 3X_2 + 2X_3)$

s.t (i) - (v)
$y \leq 2X_1 + 2X_3$
$y \leq \frac{X_1 + 3X_2 - 3X_3}{2}$
$y \leq X_3$
$y \geq 0$

Decision Variables

x_1 = number of netbook produced

x_2 = number of desktop

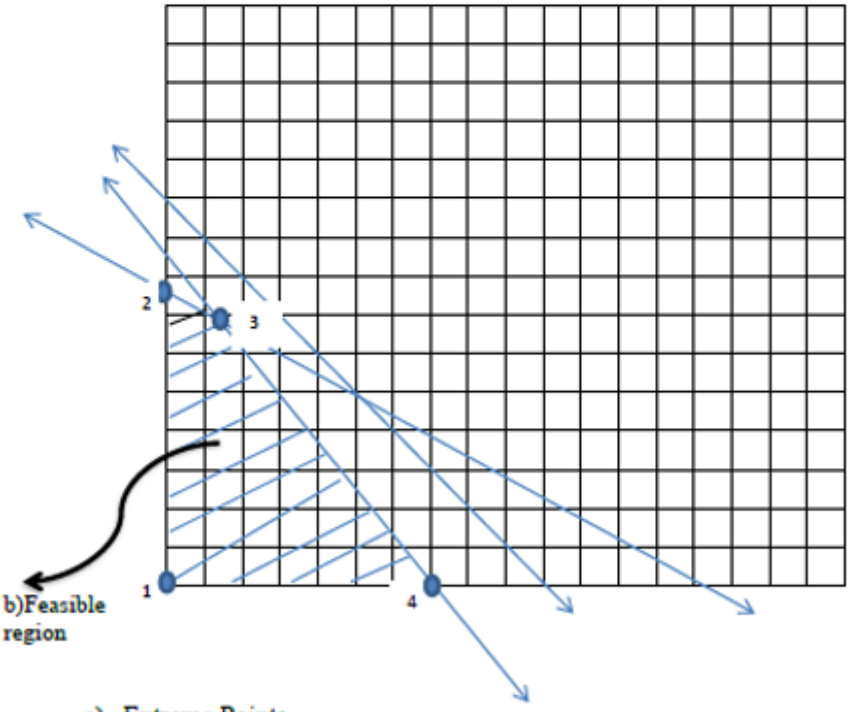
maximize $750x_1 + 1000x_2$

$x_1 + x_2 <= 10$ (memory) (1)

$x_1 + 2x_2 <= 15$ (chip) (2)

$4x_1 + 3x_2 <= 25$ (assembly time) (3)

all variables >= 0



b)Feasible region

c) Extreme Points

1-(0,0)

2- (0, 7.5)

3- (1.7)

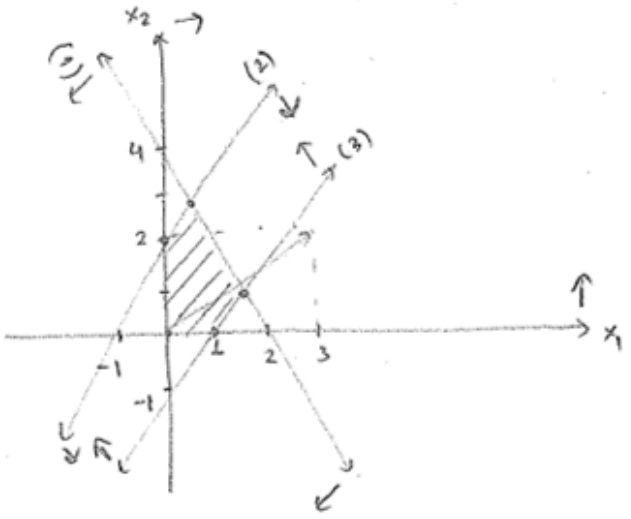
4- (6.25, 0)

5)

$\max \; z = 3x_1 + 2x_2$

s.t.

			(x_1, x_2)
$2x_1 + x_2 \leq 4$ (1)	$\longrightarrow$	$2x_1 + x_2 = 4$	$(2, 4)$
$-2x_1 + x_2 \leq 2$ (2)	$\longrightarrow$	$-2x_1 + x_2 = 2$	$(-1, 2)$
$x_1 - x_2 \leq 1$ (3)	$\longrightarrow$	$x_1 - x_2 = 1$	$(1, -1)$
$x_1, x_2 \geq 0$			



Extreme points	Object. value
$(0,0)$	0
$(0,2)$	4
$(1,0)$	3
$(5/3, 2/3)$	$19/3$
* $(1/2, 3)$	$15/2$

$z^* = 15/2$

$x^* = (1/2, 3)$