a) Determine a minimum-cost staffing plan for the center. In your solution, how many consultants will be paid to work full time and how many will be paid to work part time? What is the minimum cost?

**#Decision Variables:**

Xa = Number of Part time Worker in time period a.     a = 1,2,3,4

Yb=Number of Full time worker in time period b.     b = 1, 2, 3

4 Shift for part time worker in a day: 4h/day

8:00am-12:00pm = X1

12:00pm-4:00pm = X2

4:00pm-8:00pm = X3

8:00pm-12:00am = X4

3 shift for full time worker in a day: 8h/day

8:00am -4:00pm = Y1

12:00pm-8:00pm = Y2

8:00pm-12:00am = Y3

#Objective Function is to minimize the cost:

Cost for part time workers: 4 * $12 =$48/worker

Cost for full time workers:  8 * $14 =$112/worker

**#Objective Function: [$48(x1+x2+x3+x4) + $112(b1+b2+b3)]**

**#Constraints:**

X1 + Y1 ≥4

Y1+Y2+X2 ≥ 8

Y2+Y3+X3 ≥ 10

X4 + Y3 ≥ 6

$Y1 \geq X1$

$Y2 \geq X2 + X3$

$Y3 \geq X3 + X4$

$Xab \geq 0$, $a = 1, 2, 3, 4$ ; $b = 1, 2, 3$

$Yab \geq 0$, $a = 1, 2, 3, 4$ ; $b = 1, 2, 3$

b) After thinking about this problem for a while, you have decided to recognize meal breaks explicitly in the scheduling of full-time consultants**. In particular, full-time consultants are entitled to a one-hour lunch break during their eight-hour shift.** In addition, employment rules specify that the lunch break can start after three hours of work or after four hours of work, but those are the only alternatives. Part-time consultants do not receive a meal break. Under these conditions, find a minimum-cost staffing plan. What is the minimum cost?

**2.**

**Maximize $Z = 32X1 + 24X2$**

**S.T.:**

**$3X1 + 2X$** $\leq 5000$ ft^2

$45X1 + 40x2 \leq 84000$

$X1 \leq 1000$, $X1 \geq 0$,

$X2 \leq 1200$, $X2 \geq 0$

**(1000,1200)**

**$45X1 + 40X2 = 84000$**

**$X1 = 0$, $X2 = 2100$**

**(0 ,2100)**

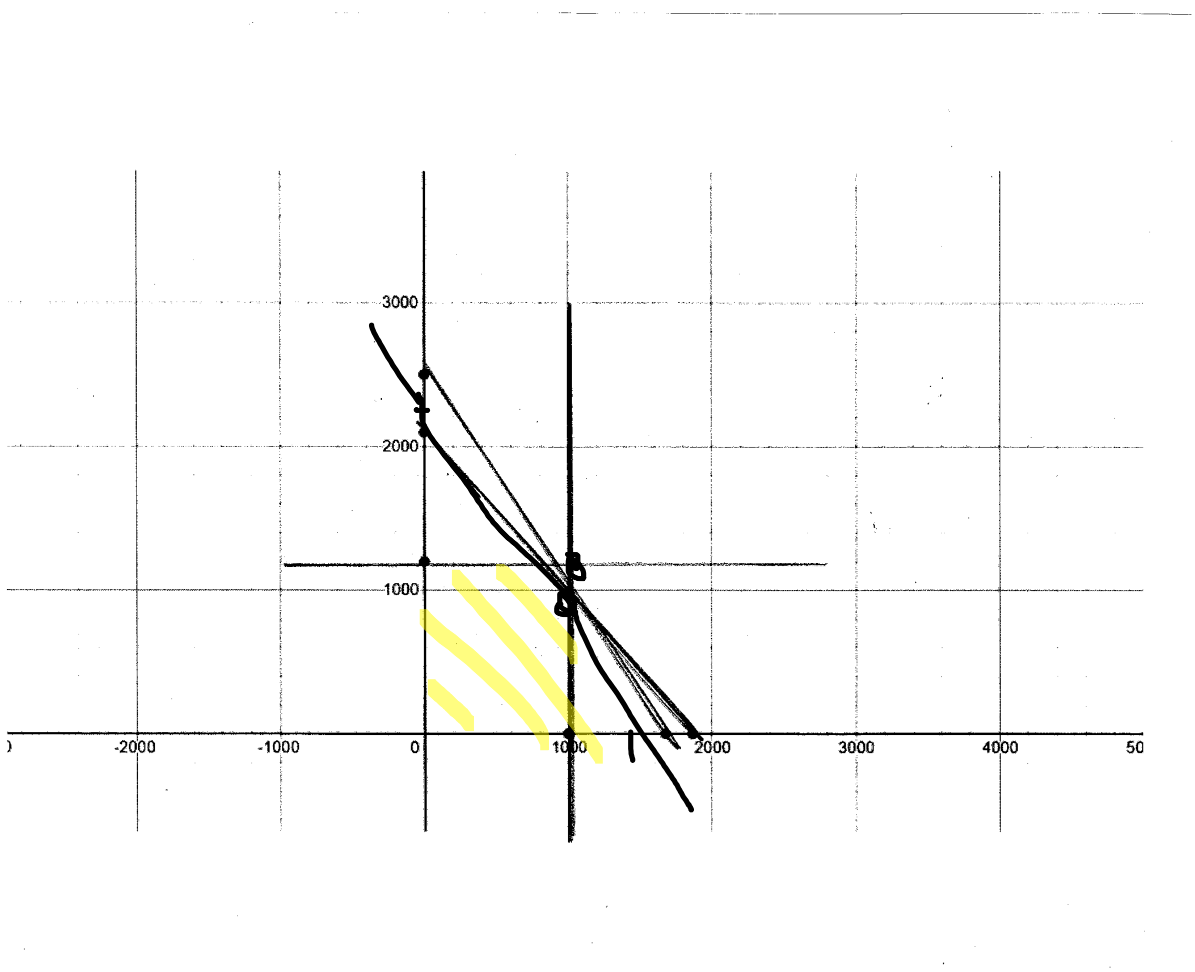
**$X2 = 0$ , $X1= 1866.66$**

**(1867,0)**

**3X1 + 2X2= 5000**

**X1=0, X2= 2500. (0,2500)**

**X2=0, X1= 1667. (1667,0)**




**3.**

a. Define the decision variables, b Formulate a linear programming model

Xp1s= number of small units will be produced per day at Plant 1

Xp1m= number of medium units will be produced per day at Plant 1

Xp1l= number of large units will be produced per day at Plant 1

Xp2s= number of small units will be produced per day at Plant 2

Xp2m= number of medium units will be produced per day at Plant 2

Xp2l= number of large units will be produced per day at Plant 2

Xp3s= number of small units will be produced per day at Plant 3

Xp3m= number of medium units will be produced per day at Plant 3

Xp3l= number of large units will be produced per day at Plant 3

b. Formulate a linear programming model for this problem.
c. Solve the problem using *lpsolve*, or any other equivalent library in R.

**Objective Function:**

**To maximize profit:**

**$420(Xp1l+Xp2l+Xp3l) + $360(Xp1m+Xp2m+Xp3m) + $300(Xp1s + Xp2s + Xp3s)**

**#Constraints:**

Capacity:

Xp1s + Xp1m + Xp1l ≤ 750

Xp2s + Xp2m + Xp2l ≤ 900

Xp3s + Xp3m + Xp3l ≤ 300

Storage Space limitation:

12Xp1s + 15Xp1m + 20Xp1l ≤ 13000

12Xp2s + 15Xp2m + 20Xp2l ≤ 12000

12Xp3s + 15Xp3m + 20Xp3l ≤ 5000

Sales forecasts

Xp1s + Xp2s + Xp3s ≤ 750

Xp1m + Xp2m + Xp3m ≤ 1200

Xp1l + Xp2l + Xp3l ≤ 900

Xp1s ≥ 0, Xp1m ≥ 0, Xp1l ≥ 0

Xp2s ≥ 0, Xp2m ≥ 0, Xp2l ≥ 0

Xp3s ≥ 0, Xp3m ≥ 0, Xp3l ≥ 0