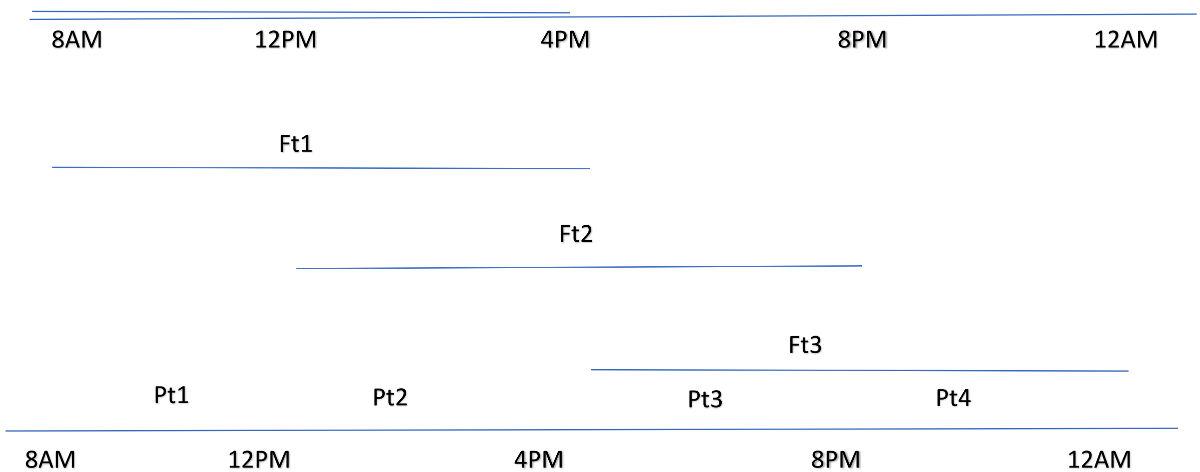
Assignment-2

A) **Computer Center Staffing:**



a)

Let Ft1= number of full time consultants for the morning shift (8 A.M to 4 P.M)

Ft2 = number of full time consultants for the afternoon shift (Noon to 8 P.M)

Ft3 = number of full time consultants for the Evening shift (4 P.M to Midnight)

Pt1 = number of part time consultants for the first shift (8 A.M to noon)

Pt2 = number of part time consultants for the second shift (Noon to 4 P.M)

Pt3 = number of part time consultants for the third shift (4 P.M to 8 P.M)

Pt4= number of part time consultants for the fourth shift (8 P.M to Midnight)

Min Cost = (8*14)*(Ft1+Ft2+Ft3) + (4*12)*(Pt1+Pt2+Pt3+Pt4)

= 112 Ft1 + 112 Ft2+ 112 Ft3 + 48Pt1 + 48Pt2 +48Pt3 + 48Pt4

S.T

(8AM-Noon) : $Pt1 + Ft1 >= 4$

(Noon -4 PM) : $Pt2+Ft1+Ft2 >=8$

(4 PM - 8 PM) : $Pt3+Ft2+Ft3 >=10$

(8 PM-MidNight): $Ft3+Pt4 >=6$

It is given that during every time period, at least one full-time consultant must be on duty for every part-time consultant on duty.

$Ft1>=Pt1$

$Ft1+Ft2>=Pt2$

$Ft2+Ft3>=Pt3$

$Ft4>=Pt4$

$Ft1,Ft2,Ft3,Pt1,Pt2,Pt3,Pt4 >=0$

b)

(8AM-Noon) : $Pt1 + Ft1 >= 4$ (No Break)

(Noon -4 PM) : $Pt2+Ft1+Ft2 +b1 >=8$ (b1= break taken by ft1 (12PM to 1PM)

(4 PM - 8 PM) : $Pt3+Ft2+Ft3 +b2+b3 >=10$

(b2= break taken by Ft2(4PM to 5PM),

b3=Break by Ft3(7 to 8PM))

(8 PM-MidNight): $Ft3+Pt4 >=6$ (No break)

<u>**Question 2- Backsavers**</u>

<u>**Decision Variables:**</u>

Let X = Number of Collegiate Model Backpacks   Y = Number of Mini model Backpacks

<u>**Objective Function:**</u> Maximize Profit(P) = 32X+24Y

<u>**Constraints:**</u>

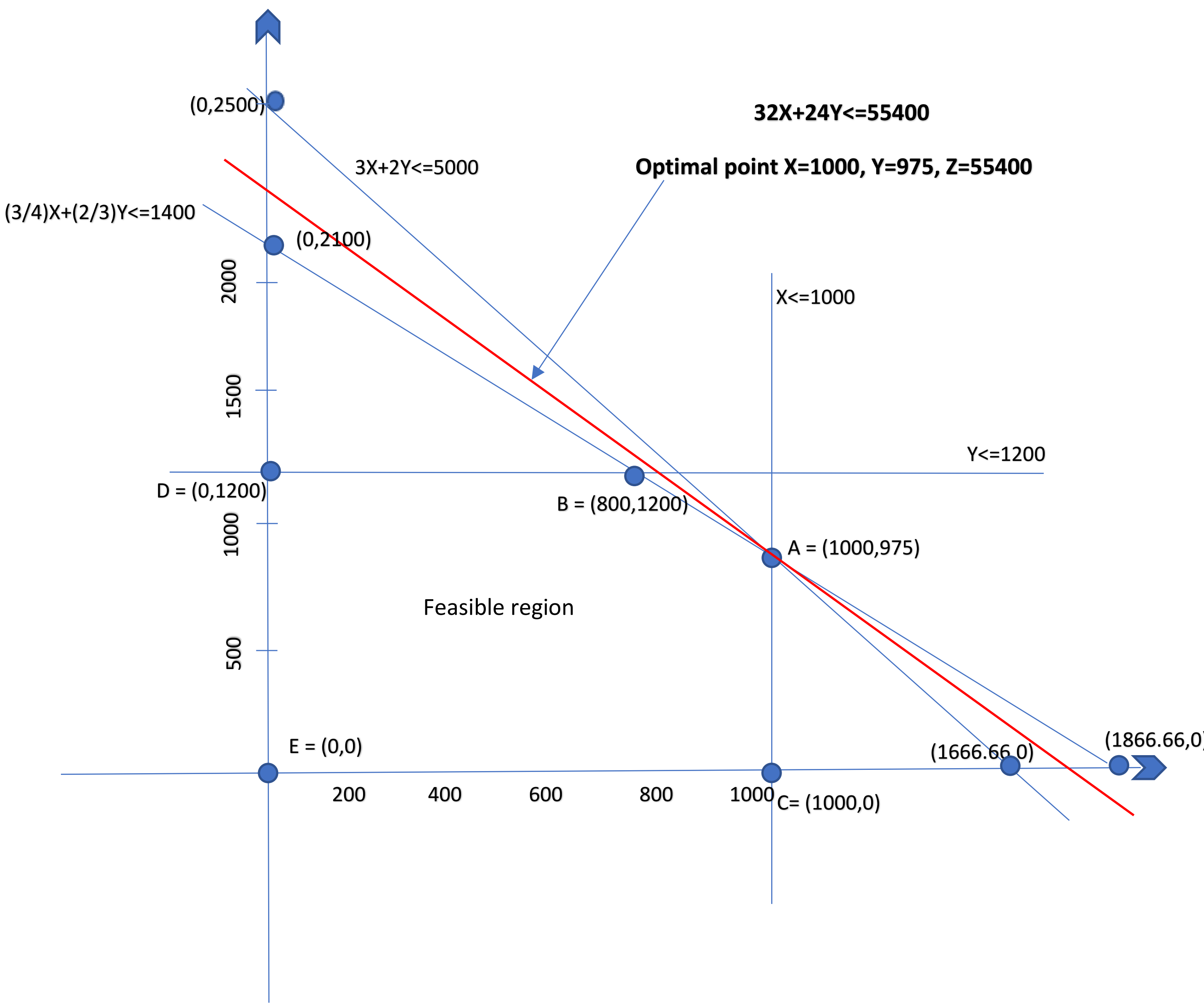
s.t Nylon (Sq.ft): $3X+2Y \leq 5000$

Labor (Hrs): $(3/4)X+(2/3)Y \leq 1400$

Sales Forecast: $X \leq 1000$; $Y \leq 1200$

And $X \geq 0$, $Y \geq 0$

Graphical Solution:



Algebraic solution:

$3X+2Y \leq 5000$: (X=0; Y=2500) ;(X=1666.67, Y=0) (1)

$(3/4)X+(2/3)Y \leq 1400$: (X=0 ;Y= 2100);(X=1866.67, Y= 0) (2)

$X \leq 1000$: (X=1000;Y=0) (3)

$Y \leq 1200$: (X=0; Y=1200) (4)

Solving (3) and (2): **A(1000,975)**

3/4X+2/3Y=1400

Sub X=1000 ; ¾(1000)+2/3Y=1400

(2/3)Y = 1400 – 750

Y= 975

Solving(1) and (4): **B(800,1200)**

CPF: A(1000,975), B(800,1200), C(1000,0), D(0,1200), E(0,0)

Optimal Point: A (1000,975), Z= 55400

Question-3(Weigelt Corporation)

Decision Variables:

XP1L= Number of Large size units produced in the plant 1

XP1M= Number of Medium size units produced in the plant 1

XP1S= Number of small size units produced in the plant 1

XP2L= Number of Large size units produced in the plant 2

XP2M= Number of Medium size units produced in the plant 2

XP2S= Number of small size units produced in the plant 2

XP3L= Number of Large size units produced in the plant 3

XP3M= Number of Medium size units produced in the plant 3

XP3S= Number of Small size units produced in the plant 3

Maximize the profit:

Z= 420(XP1L+ XP2L+XP3L) + 360(XP1M+XP2M+XP3M)+300(XP1S+XP2S+XP3S)

= 420XP1L + 360XP1M + 300XP1S + 420XP2L + 360XP2M + 300XP2S+ 420XP3L+ 360XP3M+ 300XP3S

S.T)

Storage:

Storage_Plant1: 20 XP1L +15 XP1M +12 XP1S <= 13000;

Storage_Plant2: 20 XP2L +15 XP2M +12 XP2S <= 12000;

Storage_Plant3: 20 XP3L +15 XP3M +12 XP3S <= 5000;

Excess Capacity:

Excess_Cap_Plant1: XP1L +XP1M +XP1S <= 750;

Excess_Cap_Plant2: XP2L +XP2M +XP2S <= 900;

Excess_Cap_Plant3: XP3L +XP3M +XP3S <= 450;

Sales Forecast:

Sales_Large: XP1L +XP2L +XP3L <= 900;

Sales_Medium: XP1M +XP2M +XP3M <= 1200;

Sales_Small: XP1S +XP2S +XP3S <= 750;

Plants should use the same percentage of their excess capacity to produce the new product.

Percent_P1_P2 : 1/750(XP1L+XP1M+XP1S) – 1/900(XP2L+XP2M+XP2S) = 0 (1)

Percent_P1_P3: 1/750(XP1L+XP1M+XP1S) – 1/450(XP3L+XP3M+XP3S) = 0 (2)

Percent_P2_P3: 1/900(XP2L+XP2M+XP2S) – 1/450(XP3L+XP3M+XP3S) = 0 (3) – redundant

While any of the 3 constraints is redundant, We can use any 2 constraints among (1),(2),(3).

I used (1) and (2) to solve the LP Model as (3) is redundant.

XP1L, XP1M, XP1S, XP2L, XP2M, XP2S, XP3L, XP3M, XP3S >= 0