END TERM ASSESSMENT REPORT

-By M. Rachel

QUESTION 1:

a) Explain why a Linear Programming (LP) model would be suitable for this case study?

Linear programming is used for maximizing the profit and minimizing the cost, here the problem statement defines the garment factory produces shirts and pants for Kmart chain were given profit per unit for the two garments. Through LP we'll used to get optimal solution which will be Maximum profit at the given time requirement.

b) Formulate a LP model to help the factory management to determine the optimal daily production schedule that maximises the profit while satisfying all constraints.

<u>Objective Function</u>: Max z =10x+8y

<u>Constraints:</u>

40x+20y <= 20*8*60

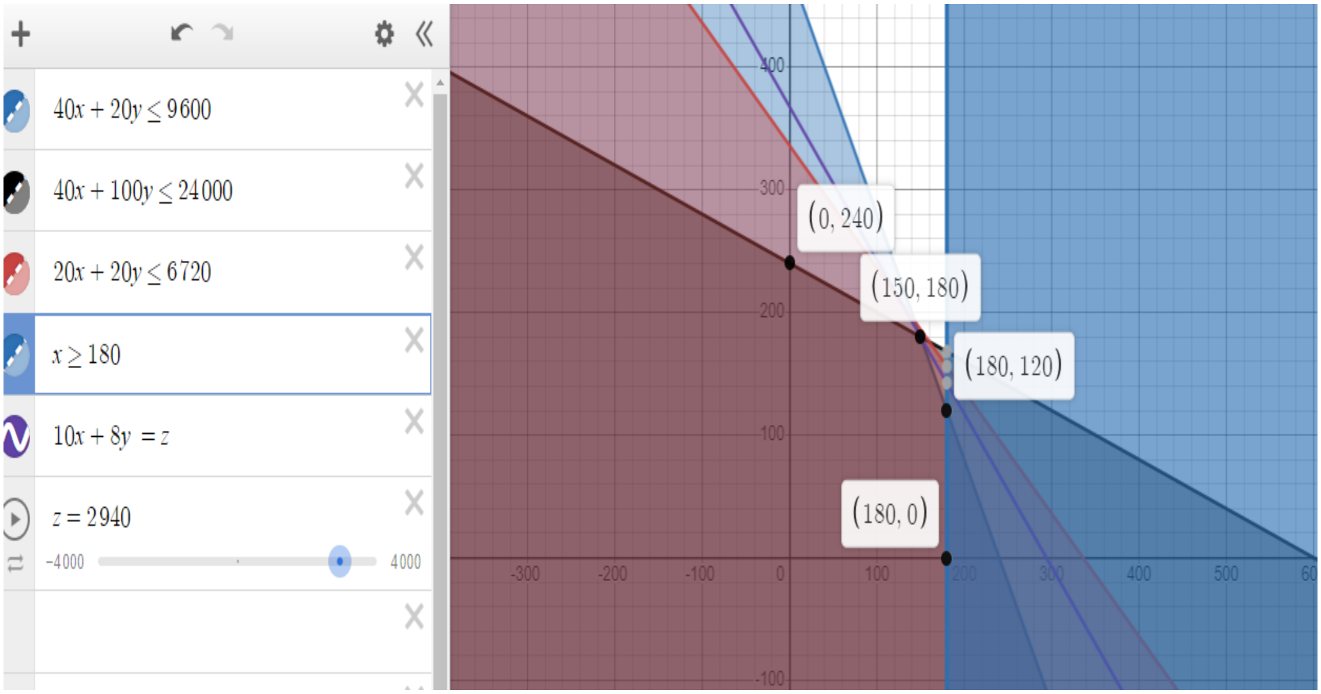
40x+100y <= 50*8*60

20x+20y <= 14*8*60

x >= 180

x,y >=0

c) Use the graphical method to find the optimal solution. Show the feasible region and the optimal solution on the graph. Annotate all lines on your graph. What is the optimal daily profit for the factory?

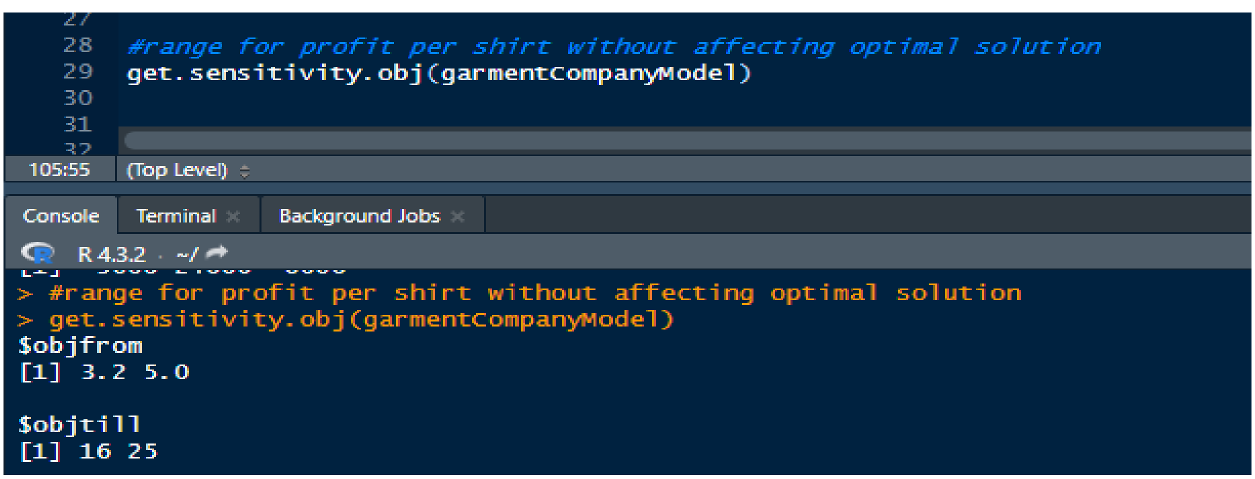


Feasible region points: (0,240), (150,180), (180,120), (180,0)

Optimal Solution: (150,180) - 150 shirts and 180 pants is the optimal solution daily profit for the factory.

d) Find the range for the profit ($) per shirt (if any) that can be obtained without affecting the optimal point of part (c)

Maximum profit can be obtained for 2940$ with the optimum value of 150,180



Range of profit per shirt without affecting Optimal Solution

- For Shirt it ranges from 3.2$ to 16$
- For pant it ranges from 5$ to 25$

Question 2:

a) Formulate an LP model for the factory that maximises the profit, while satisfying the demand and the cotton and wool proportion constraints.

Bloom with cotton X11 = 60 – 5- 40 = 15

Amber with cotton X12 = 55-4-40 = 11

Leaf with cotton X13 = 60-5-30 = 15

Bloom with wool X21 = 60-5-45 = 10

Amber with wool X22 = 55-4-45 = 6

Leaf with wool X23 =60 – 5- 45=10

Bloom with nylon X31 = 60-5-30 = 25

Amber with nylon X32 = 55-4-30 = 21

Leaf with nylon X33 =60 – 5- 30=25

<u>Objective Function :</u>

Max z= 15X11+11X12+15X13+10X21+6X22+10X23+25X31+21X32+25X33

<u>Demand:</u>

X11+X12+X13<=4200

X21+X22+X23<=3200

X31+X32+X33<=3500

<u>Cotton Proportion:</u>

0.5x11-0.5x21-0.5x31>=0

0.4x12-0.6x22-0.6x32>=0

0.5x13-0.5x23-0.5x33>=0

Wool Proportion:

0.6x21-0.4x11-0.4x31>= 0

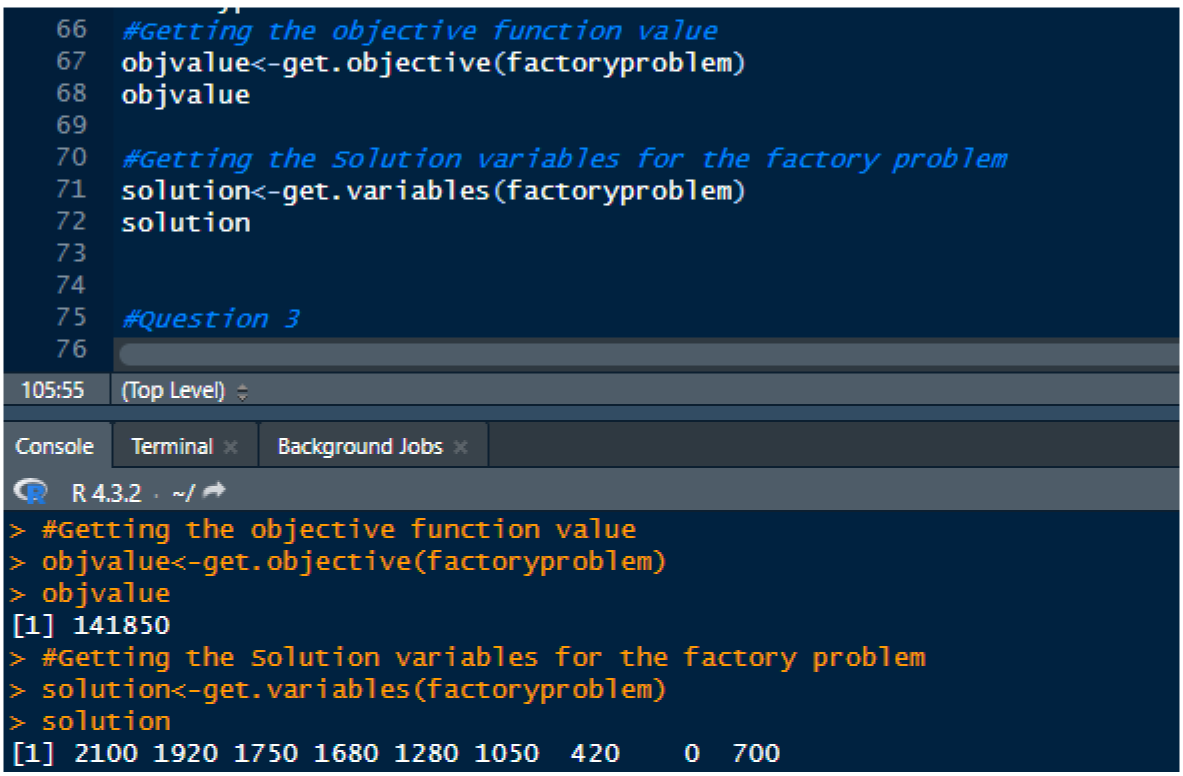
0.6x22-0.4x12-0.4x32>= 0

0.7x23-0.3x13-0.3x33>=0

Non- Negative Constraints:

x11,x12,x13,x21,x22,x23,x31,x32,x33>= 0

b) Solve the model using R/R Studio. Find the optimal profit and optimal values of the decision variables.



```
#Getting the objective function value
objvalue<-get.objective(factoryproblem)
objvalue

#Getting the Solution variables for the factory problem
solution<-get.variables(factoryproblem)
solution


#Question 3
```



```
> #Getting the objective function value
> objvalue<-get.objective(factoryproblem)
> objvalue
[1] 141850
> #Getting the Solution variables for the factory problem
> solution<-get.variables(factoryproblem)
> solution
[1] 2100 1920 1750 1680 1280 1050  420    0  700
```

The Optimal Profit: 141850

The Optimum Values: 2100, 1920, 1750, 1680, 1280, 1050, 420, 0, 700

Question 3:

(a) State reasons why/how this game can be described as a two-players-zero-sum game

The problem statement is given by there are 2 companies named Giant and sky right to bid in the field. The Giant and sky act as a 2 players is referred to two players zero sum game who are competitive against each other, player 1 by maximizing the profit against player 2. While player 2 minimizing the maximum profit of player 1

(b) Considering all possible combinations of bids, formulate the payoff matrix for the game.

Giant(P1)/sky(P2)	10	20	30	35	40
10	1	-1	-1	-1	-1
20	1	1	-1	-1	-1
30	1	1	1	-1	-1
35	1	1	1	1	-1
40	-1	-1	-1	-1	1

C) Explain what is a saddle point. Verify: does the game have a saddle point?

Saddle point is known as the outcome of minimum in its row and maximum in its column.

When two cases strategies are equal which means it has reached the saddle point.

(d) Construct a linear programming model for Company Sky in this game.

```
#Question 3
BiddingProblem <- make.lp(6, 6) #creating the linear program with 6 variables and 6 constraints

lp.control(BiddingProblem, sense= "minimize") #the lp controls as "minimize" objective

#setting the objective Function with y1,y2,y3,y4,y5,v
set.objfn(BiddingProblem, c(0,0,0,0,0,1))

# Payoff matrix
#Giant is chosen as Player1 and sky chosen as Player 2
set.row(BiddingProblem, 1, c(1,-1,-1,-1,-1,1), indices = c(1,2,3,4,5,6)) #when Player 1 choose Strateg
set.row(BiddingProblem, 2, c(1,1,-1,-1,-1,1), indices = c(1,2,3,4,5,6))  #when Player 1 choose Strateg
set.row(BiddingProblem, 3, c(1,1,1,-1,-1,1), indices = c(1,2,3,4,5,6))   #when Player 1 choose Strateg
set.row(BiddingProblem, 4, c(1,1,1,1,-1,1), indices =c(1,2,3,4,5,6))     #when Player 1 choose Strateg
set.row(BiddingProblem, 5, c(-1,-1,-1,-1,1,1), indices =c(1,2,3,4,5,6))  #when Player 1 choose Strateg

set.row(BiddingProblem, 6, c(1,1,1,1,1,0), indices =c(1,2,3,4,5,6))      #Sum of total probability
BiddingProblem

set.rhs(BiddingProblem, c(0,0,0,0,0,1)) #Setting the Right hand side Values

set.constr.type(BiddingProblem, c(">=",">=",">=",">=",">=","=")) #Setting the constraint types
BiddingProblem
```

(e) Produce an appropriate code to solve the linear programming model in part (d).
(f) Solve the game for Sky using the linear programming model and the code you constructed in parts (d) and (e). Interpret your solution.

```
solve(BiddingProblem)#Solving Bidding problem

#Getting the objective value of Bidding Problem
objvalue1<-get.objective(BiddingProblem)
objvalue1

#Getting the Solution variables for  player 1 bidding
solution1<-get.variables(BiddingProblem)
solution1
```

```
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ower         0      0      0      0      0      0
 solve(BiddingProblem)#Solving Bidding problem
1] 0
 #Getting the objective value of Bidding Problem
 objvalue1<-get.objective(BiddingProblem)
 objvalue1
1] 0
 #Getting the Solution variables for  player 1 bidding
 solution1<-get.variables(BiddingProblem)
 solution1
1] 0.5 0.0 0.0 0.0 0.5 0.0
```

Player 1’s strategy 1 and strategy 5 winning the bid