NAME: GAURAV POOSARLA

REGISTER NUMBER: 19BBS0104

SUBJECT: OPERATION RESEARCH

1. Create your own (Student Record) dataset and do the summary statistics and graphs with interpretation. Use at least 25 observations with five variables.

Solution:

Code:

```
> regNo <- c("19BBS0090","19BBS0091","19BBS0092","19BBS0093","19BBS0094","19BB
+              "19BBS0090","19BBS0101","19BBS0102","19BBS0103","19BBS0104","19
+              "19BBS0111","19BBS0112","19BBS0113")
> age<-c(18,19,20,20,18,19,18,20,17,18,18,19,20,20,18,19,18,20,17,18,18,19,20,
> Gender <- c("Female","Male","Male","Male","Female","Female","Male","Male","M
+               "Male","Male","Male","Female","Female","Male","Male","Male","F
> marks <- c(9,8,7,5,4,3,8,7,9,6,10,4,5,9,8,7,5,4,3,8,7,9,6,10,4)
> year<-c(1,1,2,3,1,2,1,3,2,1,1,1,2,3,1,2,1,3,2,1,1,1,2,3,1)
> studentInfo = data.frame(regNo, age, Gender, marks, year)
```

Output:

```
> studentInfo
       regNo age Gender marks year
1  19BBS0090  18 Female     9    1
2  19BBS0091  19   Male     8    1
3  19BBS0092  20   Male     7    2
4  19BBS0093  20   Male     5    3
5  19BBS0094  18 Female     4    1
6  19BBS0095  19 Female     3    2
7  19BBS0096  18   Male     8    1
8  19BBS0097  20   Male     7    3
9  19BBS0098  17   Male     9    2
10 19BBS0099  18 Female     6    1
11 19BBS0100  18 Female    10    1
12 19BBS0090  19   Male     4    1
13 19BBS0101  20   Male     5    2
14 19BBS0102  20   Male     9    3
15 19BBS0103  18 Female     8    1
16 19BBS0104  19 Female     7    2
17 19BBS0105  18   Male     5    1
18 19BBS0106  20   Male     4    3
19 19BBS0107  17   Male     3    2
20 19BBS0108  18 Female     8    1
21 19BBS0109  18 Female     7    1
22 19BBS0110  19   Male     9    1
23 19BBS0111  20   Male     6    2
24 19BBS0112  20   Male    10    3
25 19BBS0113  18 Female     4    1
```

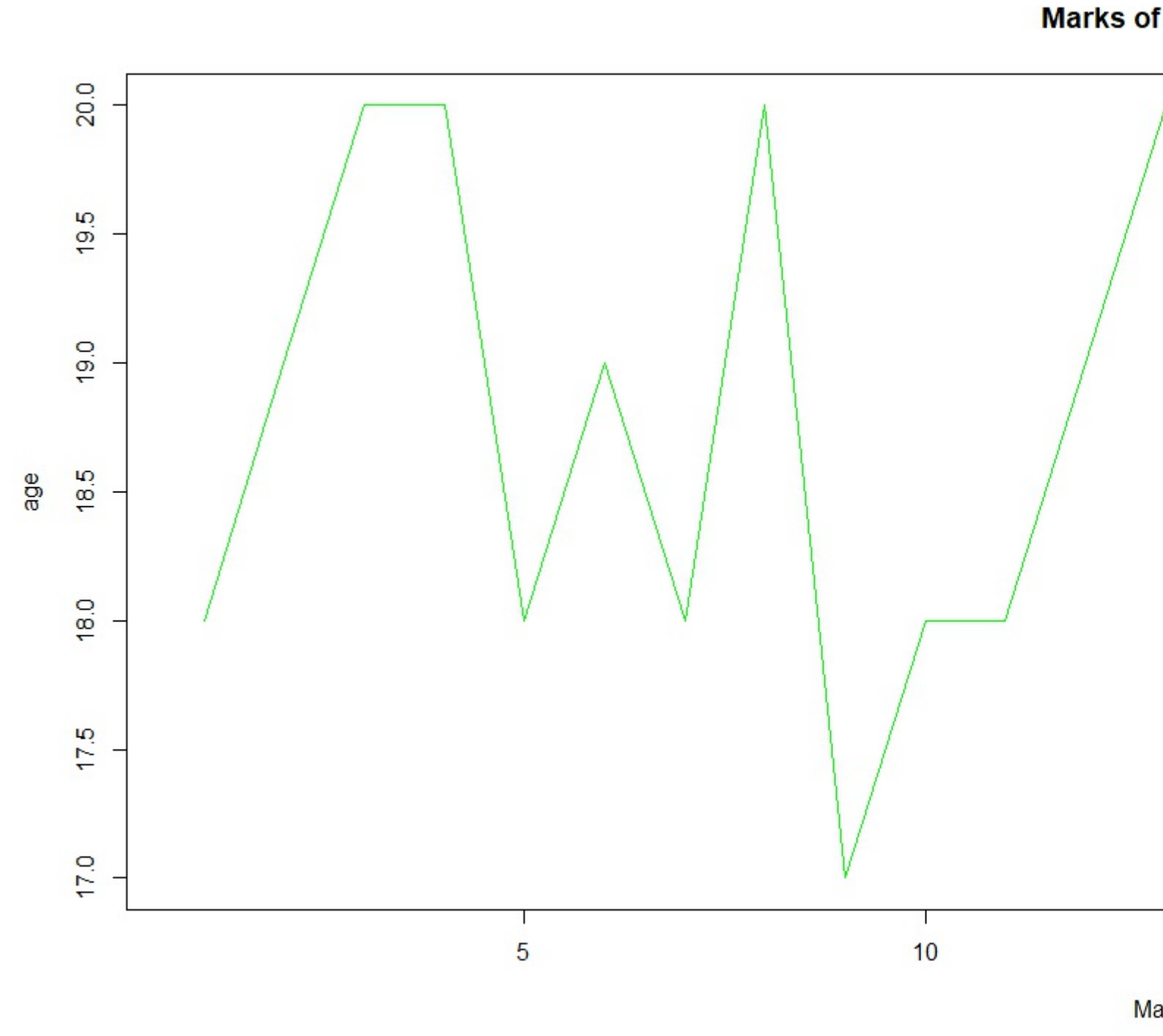
```
> summary(studentInfo)
      regNo          age            Gender      marks           year
 19BBS0090: 2   Min.   :17.00   Female:10   Min.   : 3.0   Min.   :1.00
 19BBS0091: 1   1st Qu.:18.00   Male  :15   1st Qu.: 5.0   1st Qu.:1.00
 19BBS0092: 1   Median :19.00               Median : 7.0   Median :1.00
 19BBS0093: 1   Mean   :18.76               Mean   : 6.6   Mean   :1.68
 19BBS0094: 1   3rd Qu.:20.00               3rd Qu.: 8.0   3rd Qu.:2.00
 19BBS0095: 1   Max.   :20.00               Max.   :10.0   Max.   :3.00
 (Other)  :18
```

Graphs:

Codes:

```
> plot(studentInfo$age,type="l",main="Marks of Students",xlab="Marks",ylab="ag
```

Output:

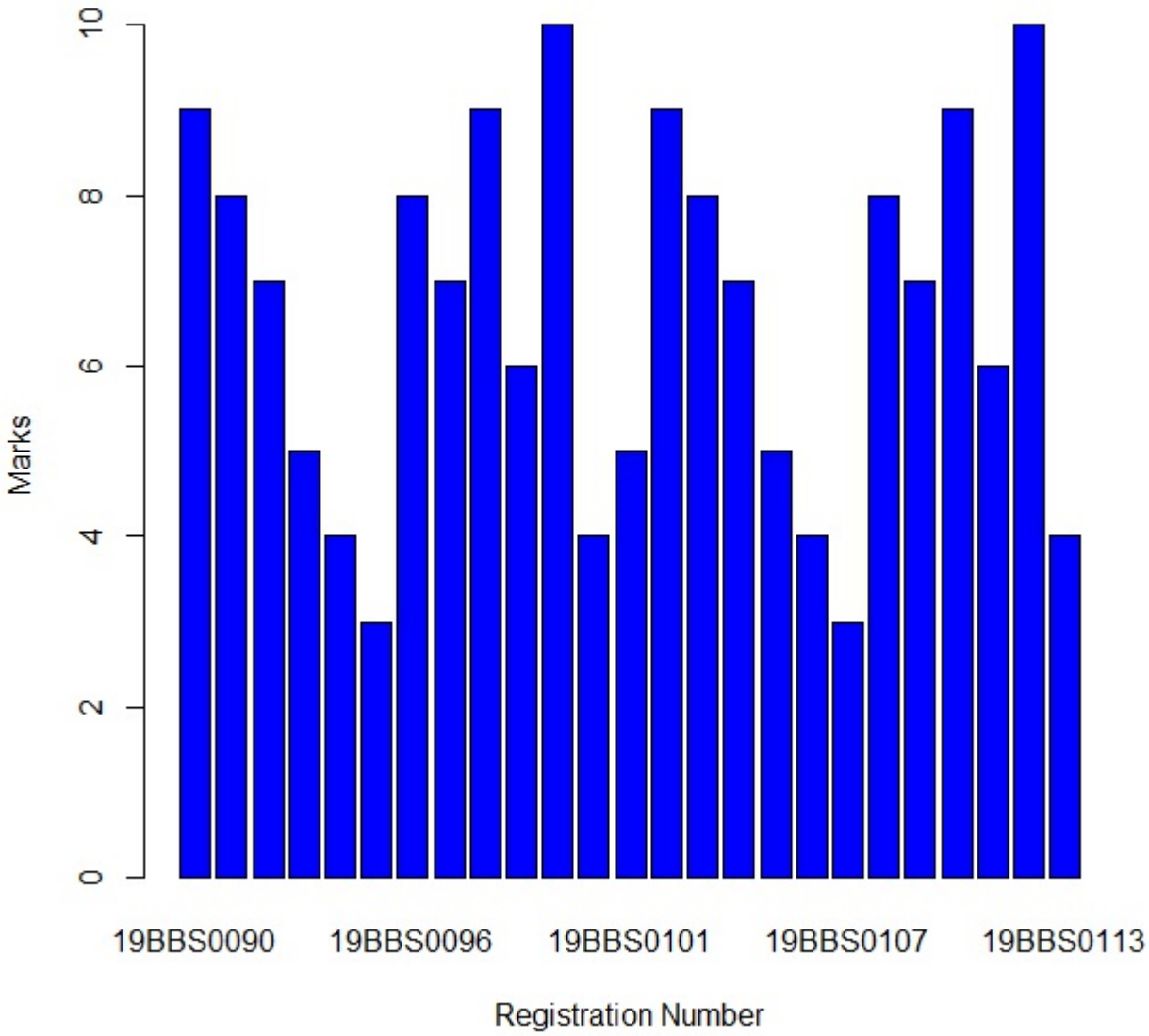


Barplot:

Code:

```
> barplot(marks,names.arg=regNo,xlab="Registration Number",ylab="Marks",col="b
```

Output:

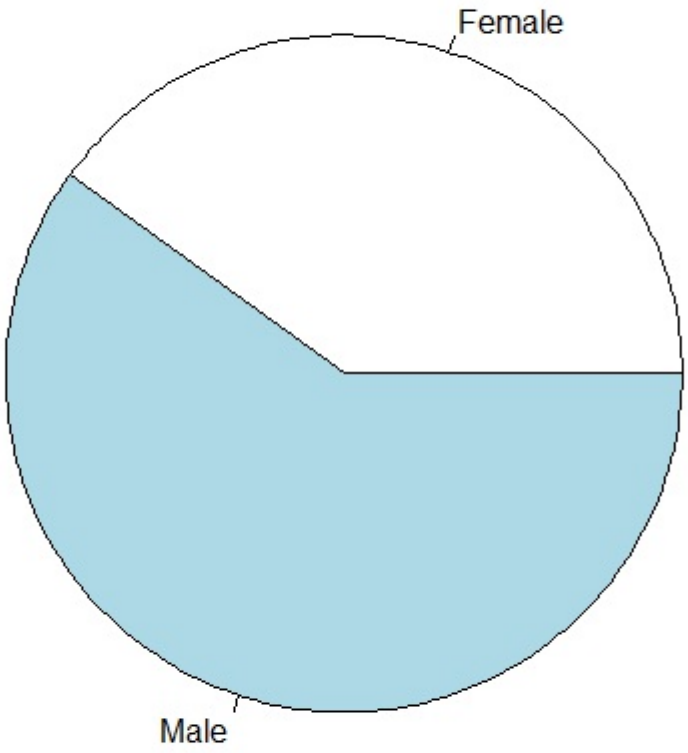


Pie Chart:

Code:

```
> table1<-table(studentInfo$Gender)
> pie(table1)
```

Output:



2. Write the R programming code to draw the graph for the following LPP's:

i. An aviation fuel manufacturer sells two types of fuel A and B. Type A fuel is 25 % grad 1gasoline, 25 % of grade 2 gasoline and 50 % of grade 3 gasoline. Type B fuel is 50 % o grade 2 gasoline and 50 % of grade 3 gasoline. Available for production are 500 liters pe hour grade 1 and 200 liters per hour of grade 2 and grade 3 each. Costs are 60 paise pe liter for grade 1, 120 paise for grade 2 and100 paise for grade 3. Type A can be sold at Rs 7.50 per liter and B can be sold at Rs. 9.00 per liter. How much of each fuel should be mad and sold to maximise the profit.

SOLUTION:

GIVEN PROBLEM IN R: AFTER DOING CALCULATIONS INSERTING THE FINAL EQUATIONS.

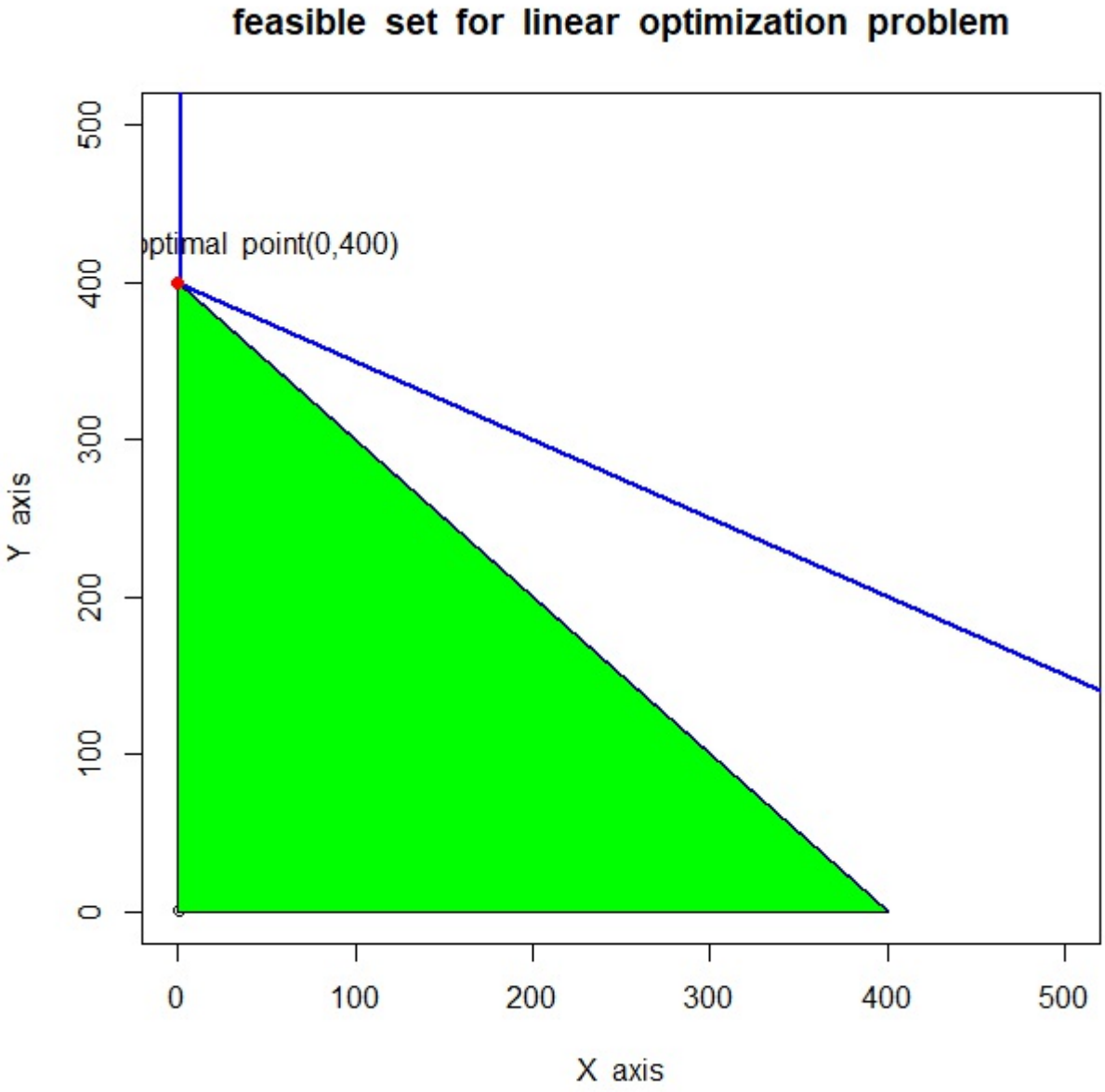
```
> # Max Z = 6.55x1+7.9x2
> # ie: Min Z = -6.55x1-7.9x2
> # S.T.C
> # 0.25x1<=500
> # 0.25x1+0.5x2<=200
> # 0.5x1+0.5x2<=200
```

CODE:

```
> obj.fun=function(x)  -6.55*x[1]  +  -7.9*x[2]
> plot(1,xlim=c(0,500),ylim=c(0,500),xlab="X  axis",ylab="Y  axis",lty=2, lwd=
> lines(c(2000,0),lwd=2,col="blue")
> lines(c(800,0),c(0,400),lwd=2,col="blue")
> lines(c(400,0),c(0,400),lwd=2,col="blue")
> x.vert=c(0,400,0)
> y.vert=c(0,0,400)
> polygon(x.vert,y.vert,col="green")
> text(50,425,"optimal  point(0,400)")
> points(0,400,pch=19,col="red")
> grad=function(x1,x2)  c(-6.55,-7.9)
> minim=constrOptim(theta=c(0.1,0.1),f=obj.fun,grad=grad,ui=matrix(c(- 0.25,0,
+ 200)))
```

OUTPUT:

```
> minim$par
[1] 2.285244e-03 3.999977e+02
> #  0  litres  of  fuel  A  and  400  litres  of  fuel  B  should  be  made
> minim$val
[1] -3159.997
> #  The  maximum  profit  is  ₹  3160.
```



ii. A company manufactures two products *X*1 and *X*2 on three machines *A*, *B*, and *C*. *X*1 require 1 hour on machine *A* and 1 hour on machine *B* and yields a revenue of Rs.3/- Product *X*2 requires 2 hours on machine *A* and 1 hour on machine *B* and 1 hour on machine *C* and yields revenue of Rs. 5/-. In the coming planning period the available time of three machines *A*, *B*, and *C* are 2000 hours, 1500 hours and 600 hours respectively. Find the optimal product mix.

SOLUTION: GIVEN PROBLEM IN R

```
> # Max Z = 3x1+5x2
> # ie: Min Z = -3x1-5x2
> # S.T.C
> # x1+2x2<=2000
> # x1+x2<=1500
> # x2<=600
```

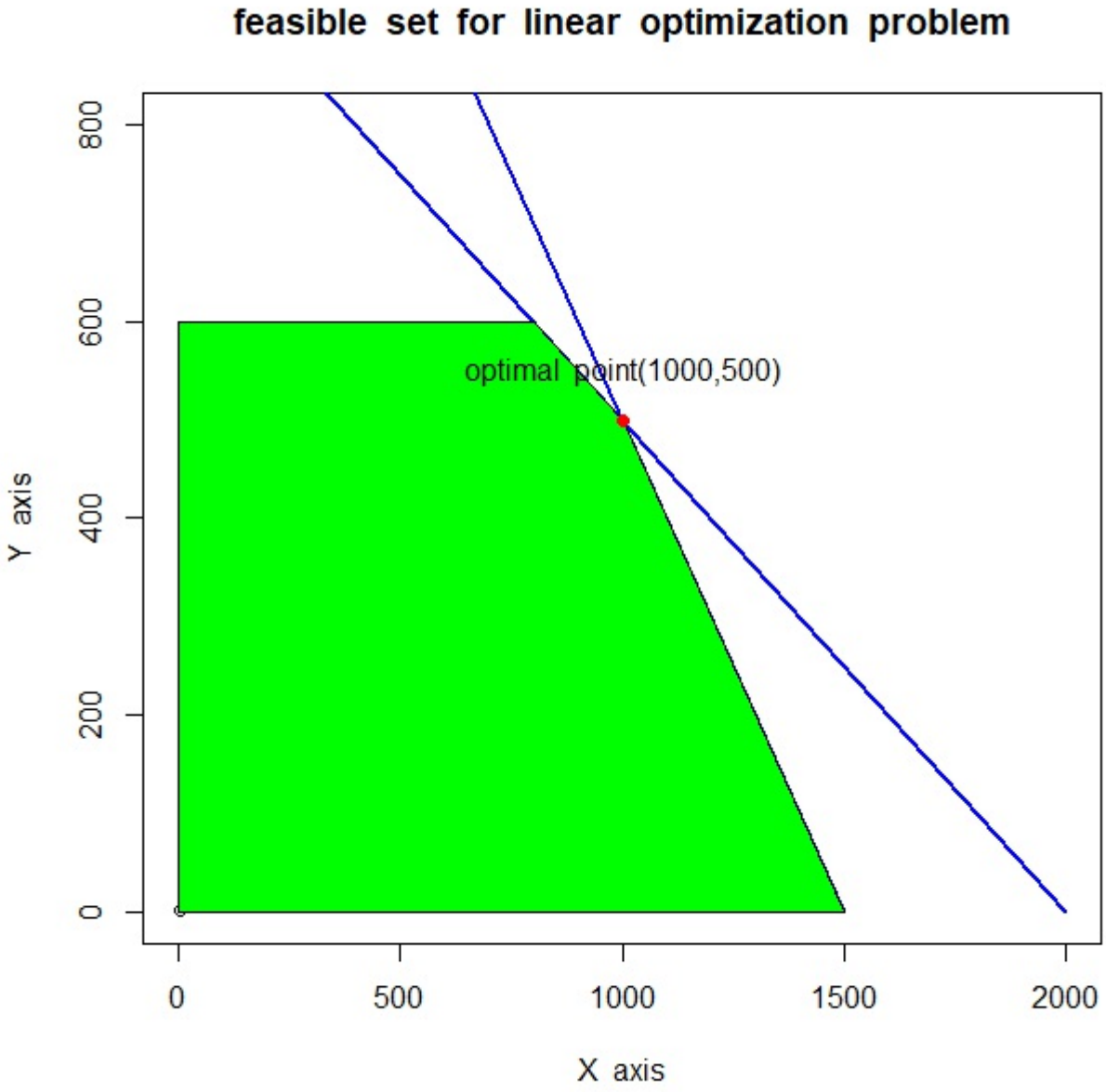
CODE:

```
> obj.fun=function(x)  -3*x[1]  +  -5*x[2]
> plot(1,xlim=c(0,2000),ylim=c(0,800),xlab="X  axis",ylab="Y  axis",lty=2
+ ,lwd=1.5,main="feasible  set  for  linear  optimization  problem")
> lines(c(2000,0),c(0,1000),lwd=2,col="blue")
> lines(c(1500,0),c(0,1500),lwd=2,col="blue")
> lines(c(0,600),lwd=2,col="blue")
> x.vert=c(0,1500,1000,800,0)
> y.vert=c(0,0,500,600,600)
> polygon(x.vert,y.vert,col="green")
> text(1000,550,"optimal  point(1000,500)")
> points(1000,500,pch=19,col="red")
> grad=function(x1,x2)  c(-3,-5)
> minim=constrOptim(theta=c(0.1,0.1),f=obj.fun,grad=grad,ui=matrix(c(- 1,-2,-1
```

OUTPUT:

```
> minim$par
[1] 999.8393 500.0804
> minim$val
[1] -5499.92
> #  Maximum  revenue  is  ₹  5500.
> #  To  maximize  revenue,  the  company  should  manufacture  1000  products
```

GRAPH:



iii. Minimize $Z = 1.5\,x + 2.5\,y$

S.T.C. $1\,x + 3\,y \geq 3$

$1\,x + 6\,y \geq 2$ and both x and $y \geq 0$.

SOLUTION:

GIVEN PROBLEM IN R:

```
> # Min Z = 1.5x+2.5y
> # S.T.C
> # x+3y>=3
> # x+6y>=2
> # x>=0
> # y>=0
```

CODE:

```
> obj.fun=function(x)  1.5*x[1]  +  2.5*x[2]
>  plot(1,xlim=c(0,4),ylim=c(0,1.25),xlab="X  axis",ylab="Y  axis",lty=2,lwd=1
>  lines(c(3,0),c(0,1),lwd=2,col="blue")
>  lines(c(2,0),c(0,1/3),lwd=2,col="blue")
>  x.vert=c(0,3,4,4,0)
>  y.vert=c(1,0,0,1.25,1.25)
> obj.fun=function(x)  1.5*x[1]  +  2.5*x[2]
> polygon(x.vert,y.vert,col="green")
>  text(0.5,1.03,"optimal  point(0,1)")
>  points(0,1,pch=19,col="red")
>  grad=function(x1,x2)  c(1.5,2.5)
>  minim=constrOptim(theta=c(0.1,1.1),f=obj.fun,grad=grad,ui=matrix(c(1,  3,1,6
```

OUTPUT:

```
> minim$par
[1] 5.191583e-09 1.000000e+00
> #  Minimum  value  of  Z  occurs  at  (0,1)
> minim$val
[1] 2.5
> #  Minimum  value  of  Z  is  2.5
```

GRAPH: