ASSIGNMENT-6

(FINAL LAB)

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REG.NO: 21BCE7727

1. Calculate the mean, median and mode marks of students from the following distribution.

Marks	20 − 30	30 − 40	40 − 50	50 − 60	60 − 70	70 − 80	80 − 90	90 − 100
No. of Studs	6	11	18	25	22	20	12	7

Mean:

Code:

```
#M Gyanada Chowdary
#21BCE7727
# mean
#class intervals
class= c('20 − 30','30 − 40',' 40 − 50',' 50 − 60','60 − 70',' 70 − 80','80 − 90','90 − 100')
#Frequency of weights
fi=c(6, 11 ,18, 25 ,22, 20 ,12, 7);
#Midvalues of class intervals
xi=c(25,35,45,55,65,75,85,95);
#Arbitrary mean
A=55;
di=(xi-A)/4;
fi.di=fi*di
meandata=data.frame(class,fi,xi,di,fi*di);
meandata
N=sum(fi)
N
sum(fi.di)
mean=A+sum(fi.di)*4/N
mean
```

Output:

```
> #M Gyanada Chowdary
> #21BCE7727
> # mean
> #class intervals
> class= c('20 – 30','30 – 40',' 40 – 50',' 50 – 60','60 – 70',' 70 – 80','80 – 90','90 – 100')
> #Frequency of weights
> fi=c(6, 11 ,18, 25 ,22, 20 ,12, 7);
> #Midvalues of class intervals
> xi=c(25,35,45,55,65,75,85,95);
> #Arbitrary mean
> A=55;
> di=(xi-A)/4;
> fi.di=fi*di
> meandata=data.frame(class,fi,xi,di,fi*di);
> meandata
     class fi xi   di fi...di
1  20 – 30  6 25 -7.5     -45
2  30 – 40 11 35 -5.0     -55
3  40 – 50 18 45 -2.5     -45
4  50 – 60 25 55  0.0       0
5  60 – 70 22 65  2.5      55
6  70 – 80 20 75  5.0     100
7  80 – 90 12 85  7.5      90
8 90 – 100  7 95 10.0      70
> N=sum(fi)
> N
[1] 121
> sum(fi.di)
[1] 170
> mean=A+sum(fi.di)*4/N
> mean
[1] 60.61983
```

MEDIAN:

Code:

#M Gyanada Chowdary

#21BCE7727

#Median

#class intervals

class= c('20 – 30','30 – 40',' 40 – 50',' 50 – 60','60 – 70',' 70 – 80','80 – 90','90 – 100')

#Frequencies

fi=c(6, 11 ,18, 25 ,22, 20 ,12, 7);

#upper limits

ul=c(30,40,50,60,70,80,90,100)

#lower limits

ll=c(20,30,40,50,60,70,80,90)

#total Frequency

N=sum(fi)

N

#cumulative sum of frequencies

cf=cumsum(fi)

#class width

```
C=10

median_class= which.max(cf>=(N/2));

median_class

#Cumulative Frequency of class just preceding median class

m = cf[median_class-1]

m

#frequency of Median class

f=fi[median_class]

f

#lower limit of Median class

l=ll[median_class]

l

median = l+((N/2-m)*C)/f

median

mediandata=data.frame(class,fi,cf)

mediandata
```

Output:

```
Console   Terminal ×   Background Jobs ×
R 4.2.2 · ~/
> #M Gyanada Chowdary
> #21BCE7727
> #Median
> #class intervals
> class= c('20 − 30','30 − 40',' 40 − 50',' 50 − 60','60 − 70',' 70 − 80','80 − 90','90 − 100')
> #Frequencies
> fi=c(6, 11 ,18, 25 ,22, 20 ,12, 7);
> #upper limits
> ul=c(30,40,50,60,70,80,90,100)
> #lower limits
> ll=c(20,30,40,50,60,70,80,90)
> #total Frequency
> N=sum(fi)
> N
[1] 121
> #cumulative sum of frequencies
> cf=cumsum(fi)
> #class width
> C=10
> median_class= which.max(cf>=(N/2));
> median_class
[1] 5
> #Cumulative Frequency of class just preceding median class
> m = cf[median_class-1]
> m
[1] 60
> #frequency of Median class
> f=fi[median_class]
> f
[1] 22
> #lower limit of Median class
> l=ll[median_class]
> l
[1] 60
> median = l+((N/2-m)*C)/f
> median
[1] 60.22727
> mediandata=data.frame(class,fi,cf)
> mediandata
     class fi  cf
1  20 − 30  6   6
2  30 − 40 11  17
3  40 − 50 18  35
4  50 − 60 25  60
5  60 − 70 22  82
6  70 − 80 20 102
7  80 − 90 12 114
8 90 − 100  7 121
```

MODE:

Code:

class intervals

class= c('20 − 30','30 − 40',' 40 − 50',' 50 − 60','60 − 70',' 70 − 80','80 − 90','90 − 100')

Frequencies

f=c(6, 11 ,18, 25 ,22, 20 ,12, 7);

lower limits of class intervals

ll=c(20,30,40,50,60,70,80,90)

c <- 10

modal_class <- which.max(f)

```r
# frequency of the modal class

f1 <- f[modal_class]

f1

# frequency preceding the modal class frequency

f0 <- f[modal_class - 1]

f0

# frequency succeeding the modal class frequency

f2 <- f[modal_class + 1]

f2

# lower limit of modal class

l <- ll[modal_class]

l

# f0, f1, f2

x <- c(f0, f1, f2)

x

y <- data.frame(class, f)

y

modal_index <- modal_class - 1

mode <- ll[modal_index] + (f1 - f0) / (2 * f1 - f0 - f2) * c

mode
```

Output:

```
> #M Gyanada Chowdary
> #21BCE7727
> #Mode
> # class intervals
> class= c('20 - 30','30 - 40',' 40 - 50',' 50 - 60','60 - 70',' 70 - 80','80 - 90','90 - 100')
> # Frequencies
> f=c(6, 11 ,18, 25 ,22, 20 ,12, 7);
> # lower limits of class intervals
> ll=c(20,30,40,50,60,70,80,90)
> c <- 10
> modal_class <- which.max(f)
> # frequency of the modal class
> f1 <- f[modal_class]
> f1
[1] 25
> # frequency preceding the modal class frequency
> f0 <- f[modal_class - 1]
> f0
[1] 18
> # frequency succeeding the modal class frequency
> f2 <- f[modal_class + 1]
> f2
[1] 22
> # lower limit of modal class
> l <- ll[modal_class]
> l
[1] 50
> # f0, f1, f2
> x <- c(f0, f1, f2)
> x
[1] 18 25 22
> y <- data.frame(class, f)
> y
     class  f
1  20 - 30  6
2  30 - 40 11
3  40 - 50 18
4  50 - 60 25
5  60 - 70 22
6  70 - 80 20
7  80 - 90 12
8 90 - 100  7
> modal_index <- modal_class - 1
> mode <- ll[modal_index] + (f1 - f0) / (2 * f1 - f0 - f2) * c
> mode
[1] 47
```

2. If 15% of the tools produced in a certain manufacturing process turns out to be defective. Find the probability that a sample of 20 tools chosen at random, (i) exactly three will be defective, (ii) at least 4 will be defective and (iii) at most 6 will be defective by using

(a) Binomial distribution

(b) Poisson Distribution.

Code:

a) Binomial distribution:

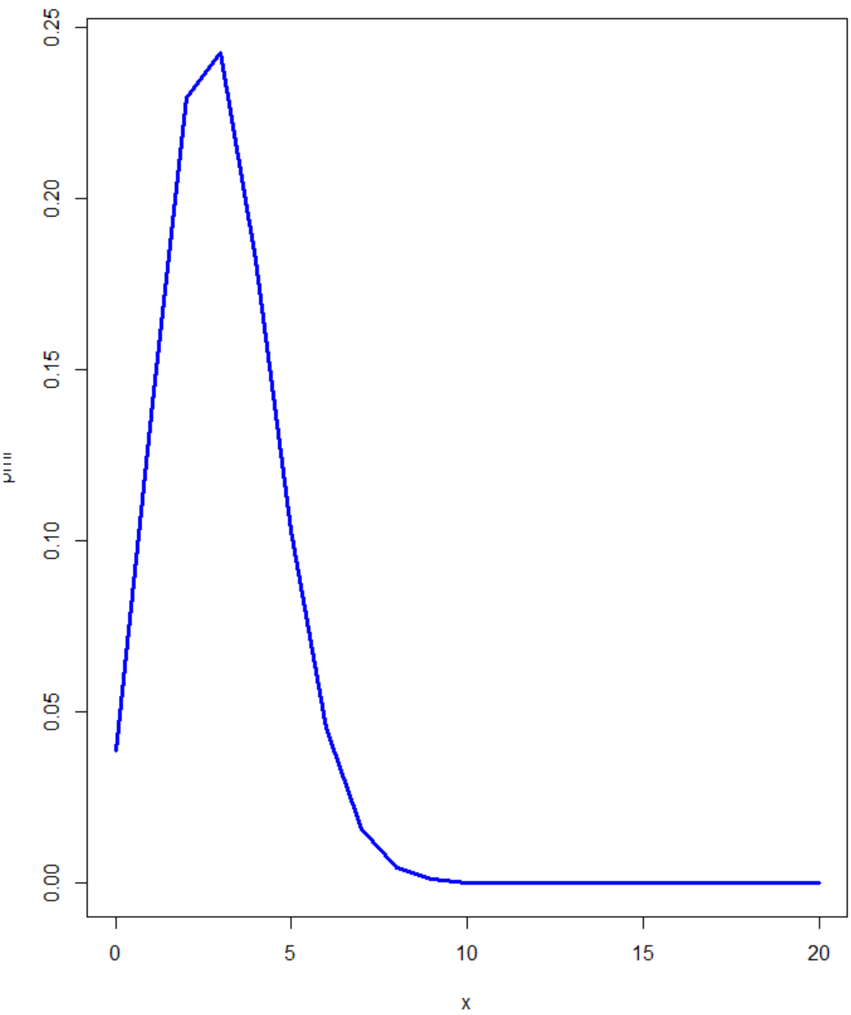
Code:

```
#21BCE7727
#M gyanada chowdary
n <- 20  # Sample size
p <- 0.15  # Probability of defect

# (i) Probability that exactly three tools will be defective (Binomial distribution)
k1 <- 3  # Number of defective tools
prob1 <- dbinom(k1, size = n, prob = p)
prob1
# (ii) Probability that at least four tools will be defective (Binomial distribution)
k2 <- 4  # Minimum number of defective tools
prob2 <- pbinom(k2 - 1, size = n, prob = p, lower.tail = FALSE)
prob2

# (iii) Probability that at most six tools will be defective (Binomial distribution)
k3 <- 6  # Maximum number of defective tools
prob3 <- pbinom(k3, size = n, prob = p)
prob3

# Plotting probability mass function (PMF) for the Binomial distribution
x <- 0:n  # Possible number of defective tools
pmf <- dbinom(x, size = n, prob = p)

plot(x, pmf, type = "l", lwd = 3, col ="blue")
```

Output:

```
> #21BCE7727
> #M gyanada chowdary
> n <- 20  # Sample size
> p <- 0.15  # Probability of defect
>
> # (i) Probability that exactly three tools will be defective (Binomial distribution)
> k1 <- 3  # Number of defective tools
> prob1 <- dbinom(k1, size = n, prob = p)
> prob1
[1] 0.2428289
> # (ii) Probability that at least four tools will be defective (Binomial distribution)
> k2 <- 4  # Minimum number of defective tools
> prob2 <- pbinom(k2 - 1, size = n, prob = p, lower.tail = FALSE)
> prob2
[1] 0.3522748
>
> # (iii) Probability that at most six tools will be defective (Binomial distribution)
> k3 <- 6  # Maximum number of defective tools
> prob3 <- pbinom(k3, size = n, prob = p)
> prob3
[1] 0.9780649
>
> # Plotting probability mass function (PMF) for the Binomial distribution
> x <- 0:n  # Possible number of defective tools
> pmf <- dbinom(x, size = n, prob = p)
>
> plot(x, pmf, type = "l", lwd = 3, col ="blue")
```

Graph:



b) Poisson distribution:

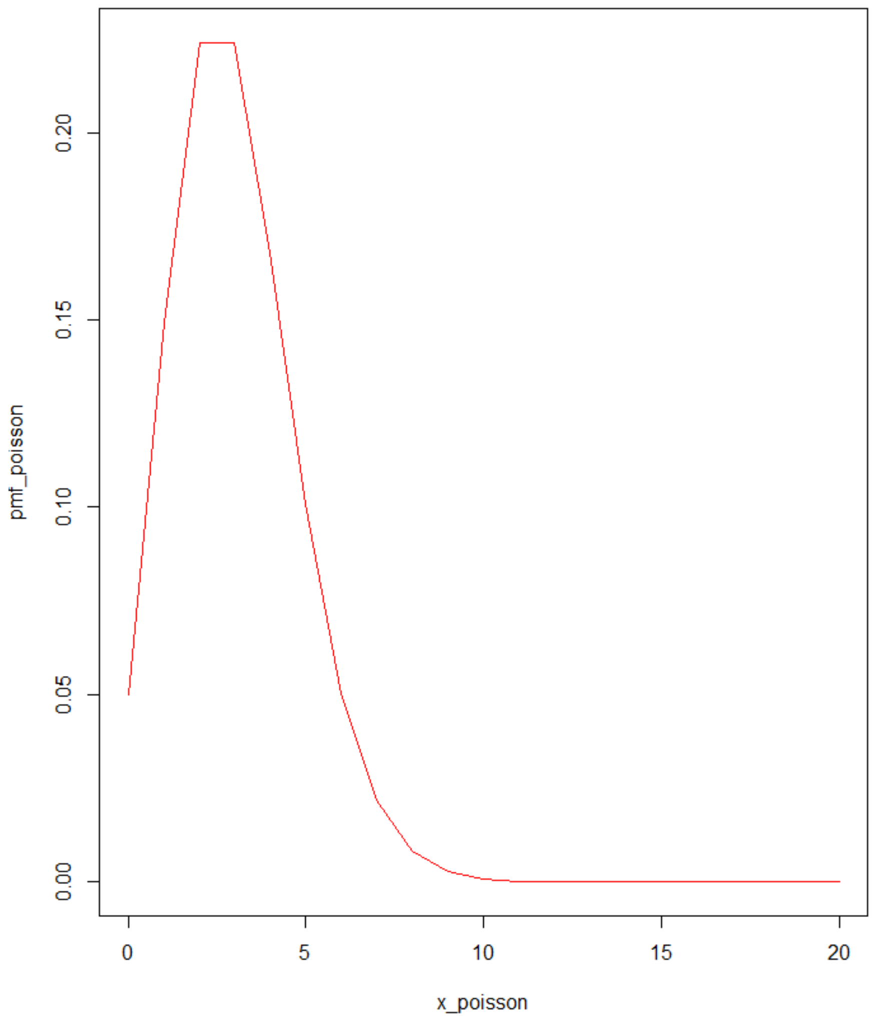
Code:

```
#21BCE7727

#M Gyanada Chowdary

# (iv) Probability that exactly three tools will be defective (Poisson distribution)

lambda <- n * p  # Poisson parameter

k4 <- 3  # Number of defective tools

prob4 <- dpois(k4, lambda)

prob4

# (v) Probability that at least four tools will be defective (Poisson distribution)

k5 <- 4  # Minimum number of defective tools

prob5 <- ppois(k5 - 1, lambda, lower.tail = FALSE)

prob5


# (vi) Probability that at most six tools will be defective (Poisson distribution)

k6 <- 6  # Maximum number of defective tools

prob6 <- ppois(k6, lambda)

prob6


# Plotting probability mass function (PMF) for the Poisson distribution

x_poisson <- 0:n  # Possible number of defective tools

pmf_poisson <- dpois(x_poisson, lambda)


plot(x_poisson, pmf_poisson, type = "l", lwd = e,col='red')
```

Output:

```
> #21BCE7727
> #M Gyanada Chowdary
> # (iv) Probability that exactly three tools will be defective (Poisson distribution)
> lambda <- n * p  # Poisson parameter
> k4 <- 3  # Number of defective tools
> prob4 <- dpois(k4, lambda)
> prob4
[1] 0.2240418
> # (v) Probability that at least four tools will be defective (Poisson distribution)
> k5 <- 4  # Minimum number of defective tools
> prob5 <- ppois(k5 - 1, lambda, lower.tail = FALSE)
> prob5
[1] 0.3527681
>
> # (vi) Probability that at most six tools will be defective (Poisson distribution)
> k6 <- 6  # Maximum number of defective tools
> prob6 <- ppois(k6, lambda)
> prob6
[1] 0.9664915
>
> # Plotting probability mass function (PMF) for the Poisson distribution
> x_poisson <- 0:n  # Possible number of defective tools
> pmf_poisson <- dpois(x_poisson, lambda)
>
> plot(x_poisson, pmf_poisson, type = "l", lwd = e,col='red')
```

Graph:



3. The thicknesses of glass sheets produced by a certain process are normally distributed with a mean of 3.00 mm and a standard deviation of 0.12 mm. Plot the Normal Distribution diagram for each.
   (a) What is the probability that a glass sheet is thicker than 2.7 mm and thinner than 3.3 mm?
   (b) What is the thickness of glass sheet which has a probability 0.75?

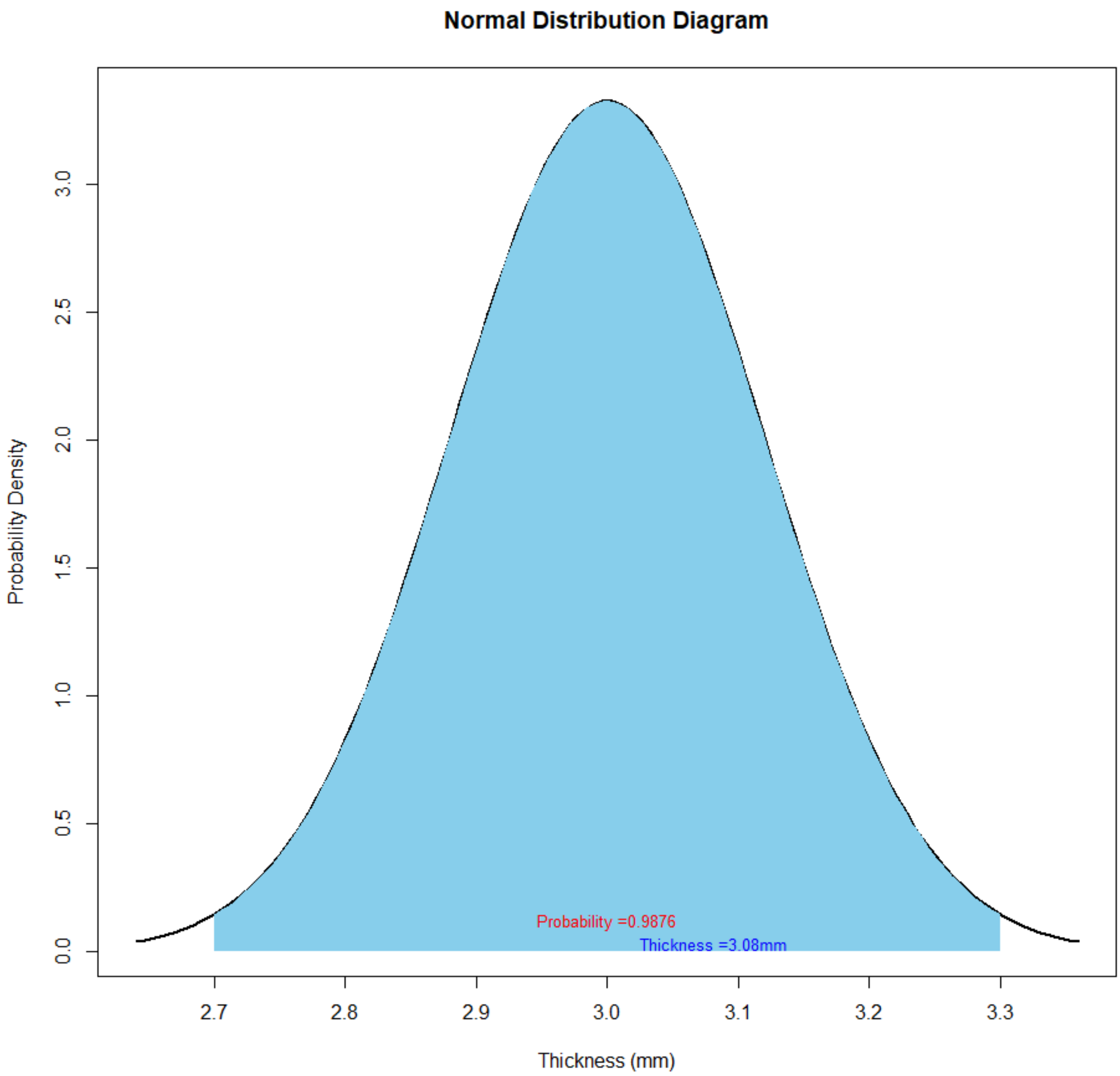
Code:

```
#21BCE7727
#M Gyanada Chowdary
mean <- 3.00  # Mean thickness (in mm)
sd <- 0.12  # Standard deviation (in mm)

# (a) Probability that a glass sheet is thicker than 2.7 mm and thinner than 3.3 mm
lower <- 2.7  # Lower thickness limit (in mm)
upper <- 3.3  # Upper thickness limit (in mm)
prob <- pnorm(upper, mean, sd) - pnorm(lower, mean, sd)
prob
# (b) Thickness of glass sheet with probability 0.75
target_prob <- 0.75  # Target probability
thickness <- qnorm(target_prob, mean, sd)
thickness

# Plotting normal distribution diagram
x <- seq(mean - 3 * sd, mean + 3 * sd, length.out = 100)
y <- dnorm(x, mean, sd)

plot(x, y, type = "l", lwd = 2, xlab = "Thickness (mm)", ylab = "Probability Density",
    main = "Normal Distribution Diagram")
```

Output:

```
> #21BCE7727
> #M Gyanada Chowdary
> mean <- 3.00  # Mean thickness (in mm)
> sd <- 0.12  # Standard deviation (in mm)
>
> # (a) Probability that a glass sheet is thicker than 2.7 mm and thinner than 3.3 mm
> lower <- 2.7  # Lower thickness limit (in mm)
> upper <- 3.3  # Upper thickness limit (in mm)
> prob <- pnorm(upper, mean, sd) - pnorm(lower, mean, sd)
> prob
[1] 0.9875807
> # (b) Thickness of glass sheet with probability 0.75
> target_prob <- 0.75  # Target probability
> thickness <- qnorm(target_prob, mean, sd)
> thickness
[1] 3.080939
>
> # Plotting normal distribution diagram
> x <- seq(mean - 3 * sd, mean + 3 * sd, length.out = 100)
> y <- dnorm(x, mean, sd)
>
> plot(x, y, type = "l", lwd = 2, xlab = "Thickness (mm)", ylab = "Probability Density",
+      main = "Normal Distribution Diagram")
```

Graph:



4. Compute and interpret the rank correlation coefficient for the following marks of 8 students selected at random as follows:

Marks in Mathematics	65	54	94	65	83	74	65	38
Marks in English	53	44	39	61	61	36	85	61

Code:

```
#21BCE7727

#M Gyanada Chowdary

# Marks in Mathematics

x <- c(65, 54, 94, 65, 83, 74, 65, 38)

meanx <- mean(x)


# Marks in English

y <- c(53, 44, 39, 61, 61, 36, 85, 61)

meany <- mean(y)


# Compute df

xy <- x * y

meanxy <- mean(xy)

df <- data.frame(c(x, meanx), c(y, meany), c(xy, meanxy))


# Compute df2

rankx <- rank(x)

ranky <- rank(y)

d <- rankx - ranky

df2 <- data.frame(x, y, rankx, ranky, d)


n <- length(math_marks)

d <- rank(math_marks) - rank(english_marks)

s <- (6 * sum(d^2)) / (n * (n^2 - 1))

r_spearman <- 1 - s

r_spearman

covxy <- cov(math_marks, english_marks)

sdx <- sd(math_marks)

sdy <- sd(english_marks)

r_pearson <- covxy / (sdx * sdy)
```

r_pearson

Plot graph

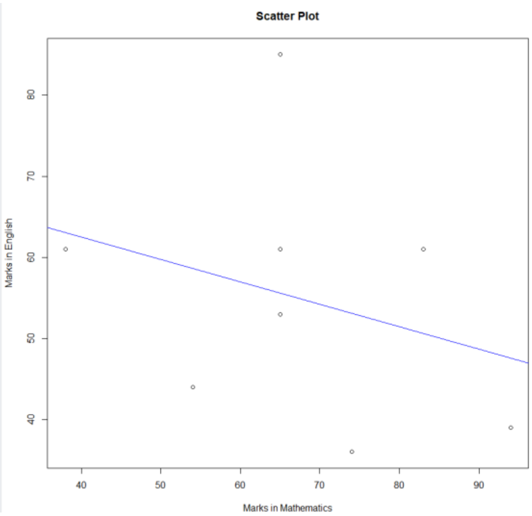
plot(x, y, xlab = "Marks in Mathematics", ylab = "Marks in English", main = "Scatter Plot")

abline(lm(y ~ x, data = df2), col = "blue")

Output:

```
> #21BCE7727
> #M Gyanada chowdary
> #Marks in Mathematics
> x <- c(65, 54, 94, 65, 83, 74, 65, 38)
> meanx <- mean(x)
>
> # Marks in English
> y <- c(53, 44, 39, 61, 61, 36, 85, 61)
> meany <- mean(y)
>
> # Compute df
> xy <- x * y
> meanxy <- mean(xy)
> df <- data.frame(c(x, meanx), c(y, meany), c(xy, meanxy))
>
> # Compute df2
> rankx <- rank(x)
> ranky <- rank(y)
> d <- rankx - ranky
> df2 <- data.frame(x, y, rankx, ranky, d)
>
> n <- length(math_marks)
> d <- rank(math_marks) - rank(english_marks)
> s <- (6 * sum(d^2)) / (n * (n^2 - 1))
> r_spearman <- 1 - s
> r_spearman
[1] -0.2857143
> covxy <- cov(math_marks, english_marks)
> sdx <- sd(math_marks)
> sdy <- sd(english_marks)
> r_pearson <- covxy / (sdx * sdy)
> r_pearson
[1] -0.2994819
>
> # Plot graph
> plot(x, y, xlab = "Marks in Mathematics", ylab = "Marks in English", main = "Scatter Plot")
> abline(lm(y ~ x, data = df2), col = "blue")
```

Graph:



5. The height (in cm) of the husband and wife for 7 families in an apartment are selected at random as follows:

Height of husband	161	158	169	175	172	178	180
Height of wife	157	160	154	161	166	165	176

(a) Estimate the linear regression line.
(b) Estimate the quadratic regression curve.
(c) Estimate the height of the wife whose husband height is 170 cm.
(d) Draw the scattered plot with line and curve.

Code:

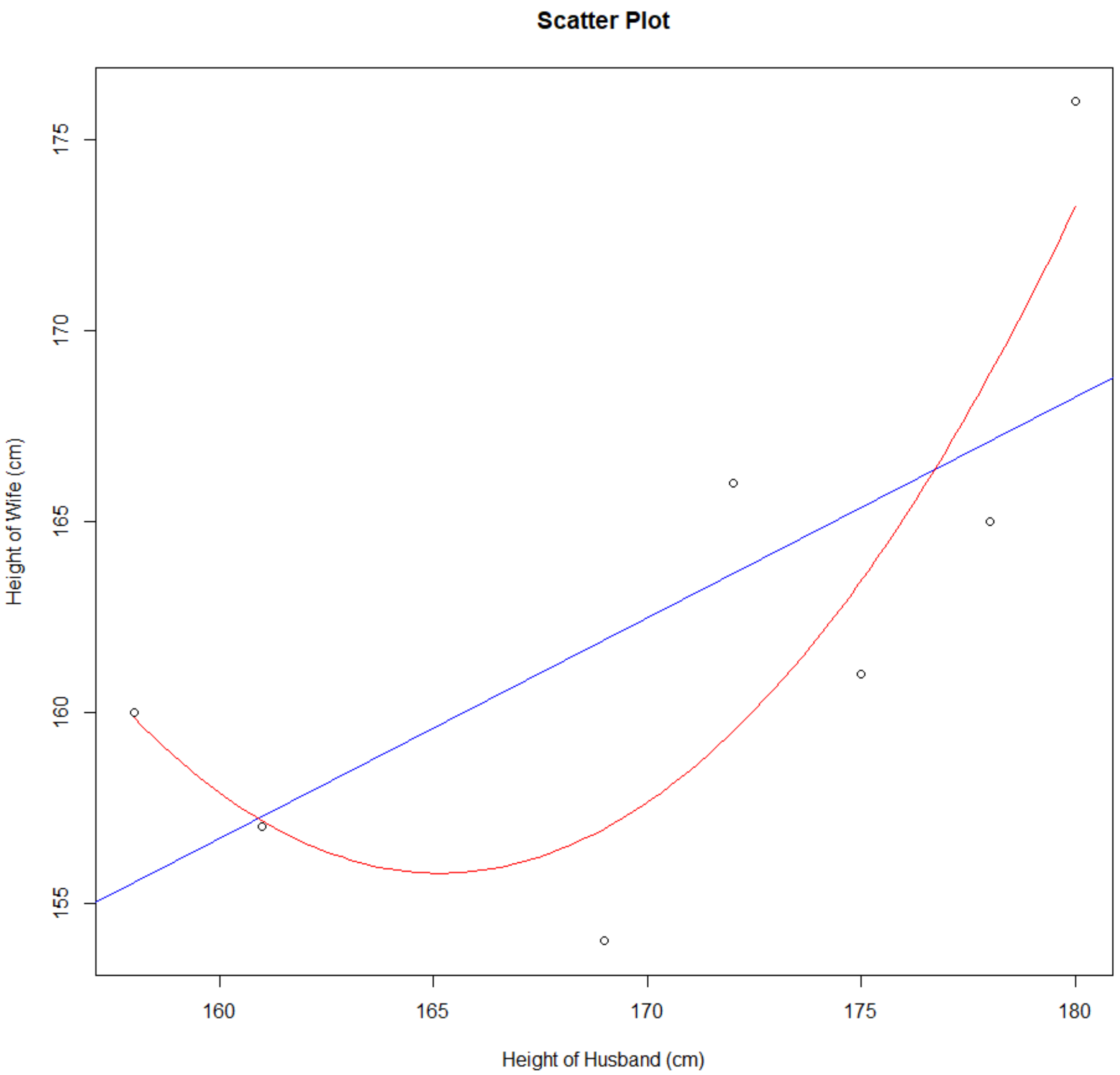
```
#21BCE7727
#M Gyanada Chowdary

# Height of husband

x <- c(161, 158, 169, 175, 172, 178, 180)


# Height of wife

y <- c(157, 160, 154, 161, 166, 165, 176)


# Estimate the linear regression line

n <- length(x)

slope <- (n * sum(x * y) - sum(x) * sum(y)) / (n * sum(x^2) - sum(x)^2)

intercept <- mean(y) - slope * mean(x)

cat("Linear Regression Equation: y =", round(intercept, 3), "+", round(slope, 3), "* x\n")


# Estimate the quadratic regression curve

x2 <- x^2

x3 <- x^3

x4 <- x^4

sx <- sum(x)

sx2 <- sum(x2)

sx3 <- sum(x3)

sx4 <- sum(x4)

sy <- sum(y)

sxy <- sum(x * y)

sx2y <- sum(x2 * y)

a <- matrix(c(n, sx, sx2, sx, sx2, sx3, sx2, sx3, sx4), ncol = 3)
```

```
b <- c(sy, sxy, sx2y)

coefficients <- solve(a, b)

cat("Quadratic Regression Equation: y =", round(coefficients[3], 3), "* x^2 +",
  round(coefficients[2], 3), "* x +", round(coefficients[1], 3), "\n")


# Estimate the height of the wife whose husband height is 170 cm

husband_height <- 170

wife_height <- coefficients[3] * husband_height^2 + coefficients[2] * husband_height + coefficients[1]

cat("Estimated height of wife when husband height is 170 cm:", round(wife_height, 3), "cm\n")


# Scatter plot with line and curve

plot(x, y, xlab = "Height of Husband (cm)", ylab = "Height of Wife (cm)", main = "Scatter Plot")

abline(a = intercept, b = slope, col = "blue")

curve(coefficients[3] * x^2 + coefficients[2] * x + coefficients[1], add = TRUE, col = "red")
```

Output:

```
> # Height of husband
> x <- c(161, 158, 169, 175, 172, 178, 180)
>
> # Height of wife
> y <- c(157, 160, 154, 161, 166, 165, 176)
>
> # Estimate the linear regression line
> n <- length(x)
> slope <- (n * sum(x * y) - sum(x) * sum(y)) / (n * sum(x^2) - sum(x)^2)
> intercept <- mean(y) - slope * mean(x)
> cat("Linear Regression Equation: y =", round(intercept, 3), "+", round(slope, 3), "* x\n")
Linear Regression Equation: y = 64.036 + 0.579 * x
>
> # Estimate the quadratic regression curve
> x2 <- x^2
> x3 <- x^3
> x4 <- x^4
> sx <- sum(x)
> sx2 <- sum(x2)
> sx3 <- sum(x3)
> sx4 <- sum(x4)
> sy <- sum(y)
> sxy <- sum(x * y)
> sx2y <- sum(x2 * y)
> a <- matrix(c(n, sx, sx2, sx, sx2, sx3, sx2, sx3, sx4), ncol = 3)
> b <- c(sy, sxy, sx2y)
> coefficients <- solve(a, b)
> cat("Quadratic Regression Equation: y =", round(coefficients[3], 3), "* x^2 +",
+     round(coefficients[2], 3), "* x +", round(coefficients[1], 3), "\n")
Quadratic Regression Equation: y = 0.079 * x^2 + -26.193 * x + 2318.803
>
> # Estimate the height of the wife whose husband height is 170 cm
> husband_height <- 170
> wife_height <- coefficients[3] * husband_height^2 + coefficients[2] * husband_height + coefficients[1]
> cat("Estimated height of wife when husband height is 170 cm:", round(wife_height, 3), "cm\n")
Estimated height of wife when husband height is 170 cm: 157.639 cm
>
> # Scatter plot with line and curve
> plot(x, y, xlab = "Height of Husband (cm)", ylab = "Height of Wife (cm)", main = "Scatter Plot")
> abline(a = intercept, b = slope, col = "blue")
> curve(coefficients[3] * x^2 + coefficients[2] * x + coefficients[1], add = TRUE, col = "red")
```

Graph:



6. In a study to estimate the proportion of residents in a certain city and its suburbs who favor the construction of a neutrino power plant, it is found that 126 of 200 urban residents favor the construction while only 68 of 250 suburban residents are in favor. Test whether urban residents are more favor the construction of the neutrino plant than suburban residents, at the 5% and 1% level of significance separately?.

Code:

```
#21BCE7727

#M Gyanada chowdary

# Number of urban residents and number favoring the construction

n_urban <- 200
```

```r
urban_favor <- 126

# Number of suburban residents and number favoring the construction
n_suburban <- 250
suburban_favor <- 68

# Calculate the proportions
prop_urban <- urban_favor / n_urban
prop_suburban <- suburban_favor / n_suburban

# Calculate the standard error
se_urban <- sqrt(prop_urban * (1 - prop_urban) / n_urban)
se_suburban <- sqrt(prop_suburban * (1 - prop_suburban) / n_suburban)

# Calculate the test statistic (Z-score)
z <- (prop_urban - prop_suburban) / sqrt(se_urban^2 + se_suburban^2)

# Test at the 5% level of significance
alpha_5 <- 0.05
z_critical_5 <- qnorm(1 - alpha_5/2)  # Two-tailed test
z_critical_5
p_value_5 <- 2 * (1 - pnorm(abs(z)))
p_value_5
if (z > z_critical_5) {
  cat("At the 5% level of significance, there is evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.\n")
} else {
  cat("At the 5% level of significance, there is no significant evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.\n")
}

# Test at the 1% level of significance
alpha_1 <- 0.01
z_critical_1 <- qnorm(1 - alpha_1/2)  # Two-tailed test
z_critical_1
p_value_1 <- 2 * (1 - pnorm(abs(z)))
p_value_1
if (z > z_critical_1) {
```

```
  cat("At the 1% level of significance, there is evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.\n")

} else {

  cat("At the 1% level of significance, there is no significant evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.\n")

}
```

Output:

```
> #21BCE7727
> #M gyanada chowdary
> # Number of urban residents and number favoring the construction
> n_urban <- 200
> urban_favor <- 126
>
> # Number of suburban residents and number favoring the construction
> n_suburban <- 250
> suburban_favor <- 68
>
> # Calculate the proportions
> prop_urban <- urban_favor / n_urban
> prop_suburban <- suburban_favor / n_suburban
>
> # Calculate the standard error
> se_urban <- sqrt(prop_urban * (1 - prop_urban) / n_urban)
> se_suburban <- sqrt(prop_suburban * (1 - prop_suburban) / n_suburban)
>
> # Calculate the test statistic (Z-score)
> z <- (prop_urban - prop_suburban) / sqrt(se_urban^2 + se_suburban^2)
>
> # Test at the 5% level of significance
> alpha_5 <- 0.05
> z_critical_5 <- qnorm(1 - alpha_5/2)  # Two-tailed test
> z_critical_5
[1] 1.959964
> p_value_5 <- 2 * (1 - pnorm(abs(z)))
> p_value_5
[1] 6.661338e-16
> if (z > z_critical_5) {
+   cat("At the 5% level of significance, there is evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.\n")
+ } else {
+   cat("At the 5% level of significance, there is no significant evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.\n")
+ }
At the 5% level of significance, there is evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.
>
> # Test at the 1% level of significance
> alpha_1 <- 0.01
> z_critical_1 <- qnorm(1 - alpha_1/2)  # Two-tailed test
> z_critical_1
[1] 2.575829
> p_value_1 <- 2 * (1 - pnorm(abs(z)))
> p_value_1
[1] 6.661338e-16
> if (z > z_critical_1) {
+   cat("At the 1% level of significance, there is evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.\n")
+ } else {
+   cat("At the 1% level of significance, there is no significant evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.\n")
+ }
At the 1% level of significance, there is evidence to suggest that urban residents favor the construction of the neutrino power plant more than suburban residents.
```

7. In an air-pollution experiment, researchers wish to determine whether the two types of instruments yield the measurements of polluting percentage of sulfur monoxide in the atmosphere. The readings in the following table were recorded for the two instruments Is there any significant difference between the average measurements of two instruments.
Instrument A: 0.175, 0.168, 0.168, 0.190, 0.156, 0.181, 0.182, 0.175, 0.174, 0.179
Instrument B: 0.185, 0.169, 0.173, 0.173, 0.188, 0.186, 0.175, 0.174, 0.179, 0.180.

Code:

```
# Measurements for Instrument A

A <- c(0.175, 0.168, 0.168, 0.190, 0.156, 0.181, 0.182, 0.175, 0.174, 0.179)


# Measurements for Instrument B
```

```
B <- c(0.185, 0.169, 0.173, 0.173, 0.188, 0.186, 0.175, 0.174, 0.179, 0.180)


# Perform the t-test
result <- t.test(A, B)


# Extract the test statistic and p-value
test_statistic <- result$statistic
p_value <- result$p.value


# Set the significance levels
alpha_5 <- 0.05
alpha_1 <- 0.01


# Test at the 5% level of significance
if (p_value < alpha_5) {
  cat("At the 5% level of significance, there is a significant difference between the average measurements of the two instruments.\n")
} else {
  cat("At the 5% level of significance, there is no significant difference between the average measurements of the two instruments.\n")
}


# Test at the 1% level of significance
if (p_value < alpha_1) {
  cat("At the 1% level of significance, there is a significant difference between the average measurements of the two instruments.\n")
} else {
  cat("At the 1% level of significance, there is no significant difference between the average measurements of the two instruments.\n")
}
```

Output:

```
> #21BCE7727
> #M gyanada chowdary
> # Measurements for Instrument A
> A <- c(0.175, 0.168, 0.168, 0.190, 0.156, 0.181, 0.182, 0.175, 0.174, 0.179)
>
> # Measurements for Instrument B
> B <- c(0.185, 0.169, 0.173, 0.173, 0.188, 0.186, 0.175, 0.174, 0.179, 0.180)
>
> # Perform the t-test
> result <- t.test(A, B)
>
> # Extract the test statistic and p-value
> test_statistic <- result$statistic
> p_value <- result$p.value
> p_value
[1] 0.3575549
>
> # Set the significance levels
> alpha_5 <- 0.05
> alpha_1 <- 0.01
>
> # Test at the 5% level of significance
> if (p_value < alpha_5) {
+   cat("At the 5% level of significance, there is a significant difference between the average measurements of the two instruments.\n")
+ } else {
+   cat("At the 5% level of significance, there is no significant difference between the average measurements of the two instruments.\n")
+ }
At the 5% level of significance, there is no significant difference between the average measurements of the two instruments.
>
> # Test at the 1% level of significance
> if (p_value < alpha_1) {
+   cat("At the 1% level of significance, there is a significant difference between the average measurements of the two instruments.\n")
+ } else {
+   cat("At the 1% level of significance, there is no significant difference between the average measurements of the two instruments.\n")
+ }
At the 1% level of significance, there is no significant difference between the average measurements of the two instruments.
>
```