Statistical Modelling and Machine Learning –

03 Introduction to Machine Learning concepts and Probabilities

Submitted by: **Jatin Talwar**

R homework reports:

7.3

Question 19:

Univariate Distribution of choice: Normal distribution.

code:

```
#### N = 1
N_1=rnorm(1,mean=0,sd=1)
Mean_values_1 <- c()
for (i in 1:5){
  M <- sample(N_1,replace=T)
  Mean_values_1[i] <- mean(M)
}

#### N = 10
N_10 <- rnorm(10,mean=0,sd=1)
Mean_values_10 <- c()
for (i in 1:7){
  M <- sample(N_10,replace=T)
  Mean_values_10[i] <- mean(M)
}

#### N = 100
N_100=rnorm(100,mean=0,sd=1)
Mean_values_100 <- c()
for (i in 1:35){
  M <- sample(N_100,replace=T)
  Mean_values_100[i] <- mean(M)
}

#### N = 1000
N_1000=rnorm(1000,mean=0,sd=1)
Mean_values_1000 <- c()
for (i in 1:350){
  M <- sample(N_1000,replace=T)
  Mean_values_1000[i] <- mean(M)
}
```
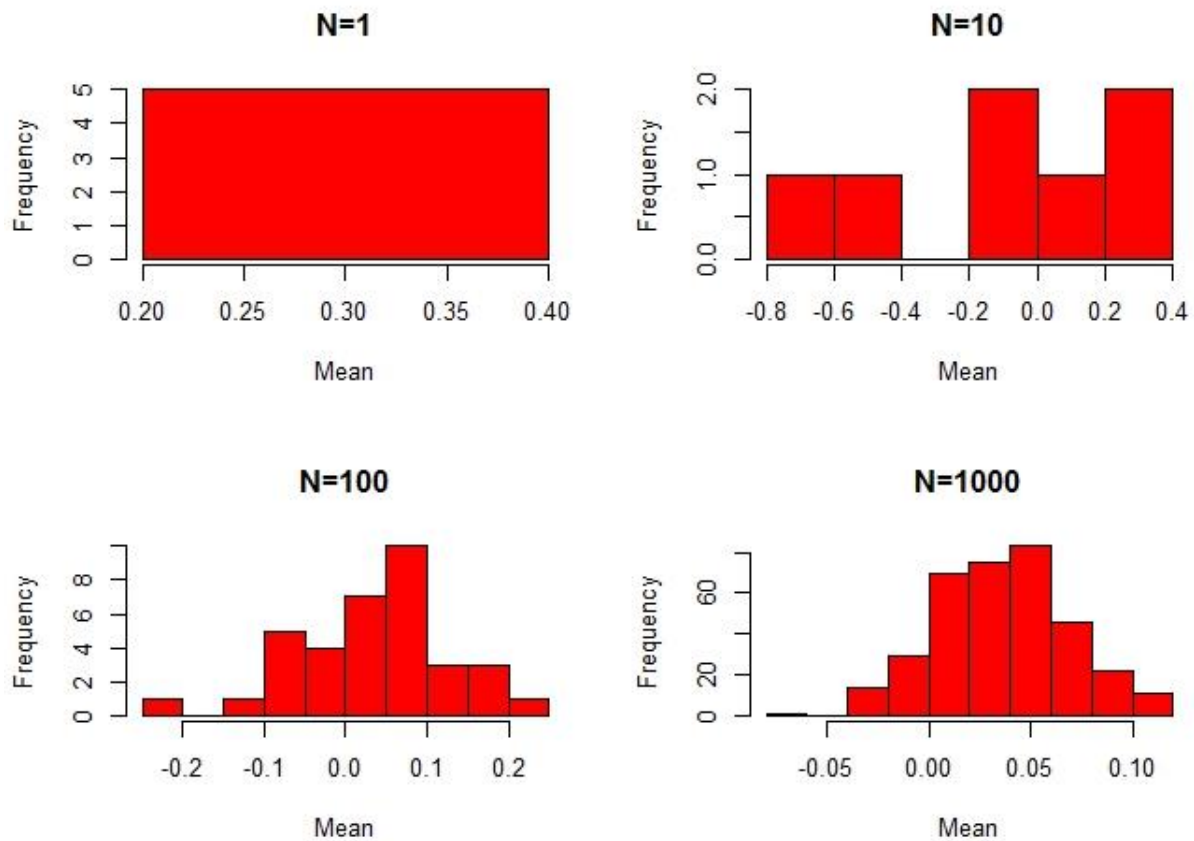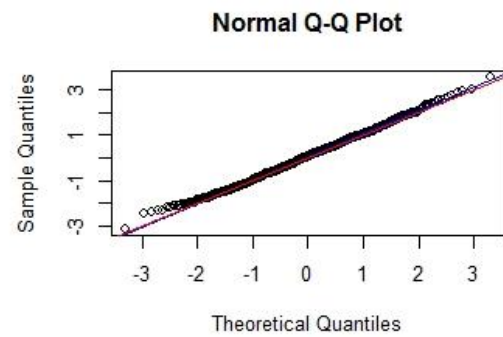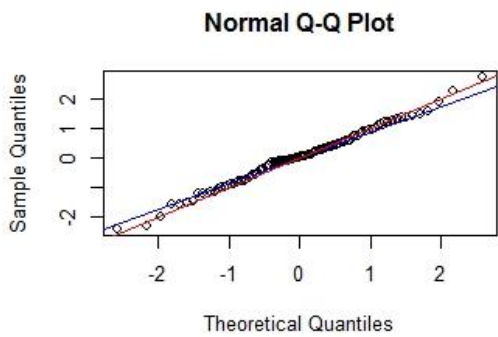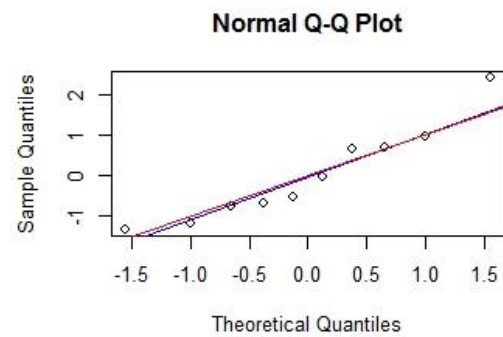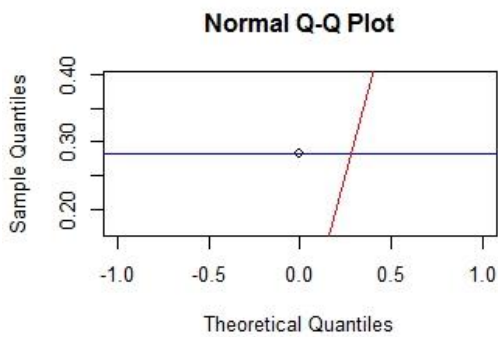
Figures:

```
par(mfrow=(c(2,2)))
hist(Mean_values_1,col='red',main='Mean of sampled values N=1')
hist(Mean_values_10,col='red',main='Mean of sampled values N=10')
hist(Mean_values_100,col='red',main='Mean of sampled values N=100')
hist(Mean_values_1000,col='red',main='Mean of sampled values N=1000')
```

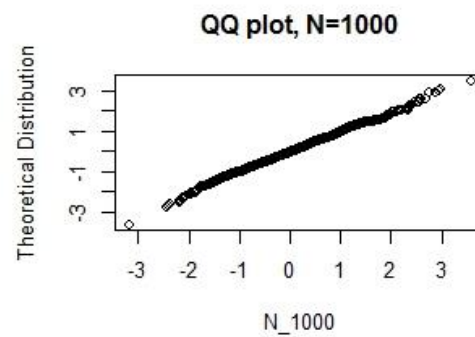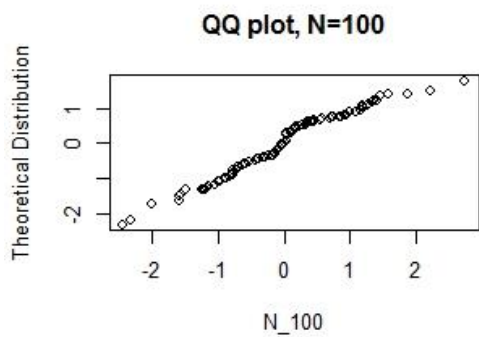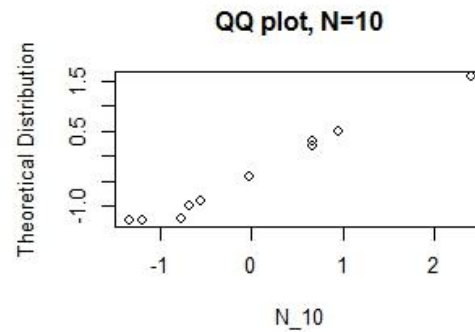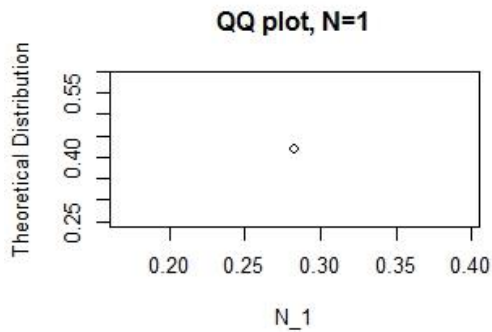## Histogram for mean of sampled values from each distribution:

qqnorm plots for each N =1,10,100,1000 resp. :

```
par(mfrow=(c(2,2)))
qqnorm(N_1)
qqline(N_1,col='blue')
abline(0,1,col='red')
qqnorm(N_10)
qqline(N_10,col='blue')
abline(0,1,col='red')
qqnorm(N_100)
qqline(N_100,col='blue')
abline(0,1,col='red')
qqnorm(N_1000)
qqline(N_1000,col='blue')
abline(0,1,col='red')
```
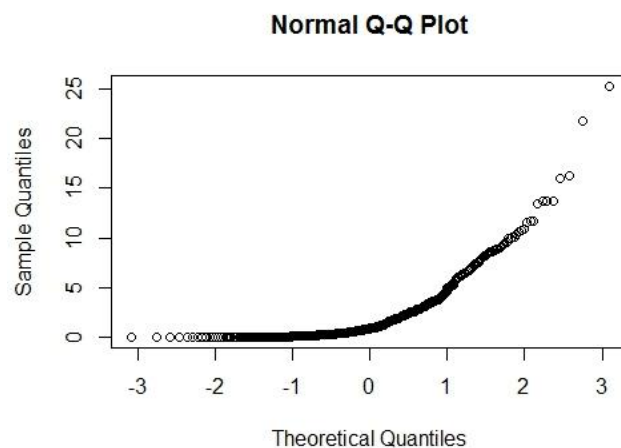
qqplot for each N :

QQ plot, N=1

Theoretical Distribution (y-axis): 0.25, 0.40, 0.55
N_1 (x-axis): 0.20, 0.25, 0.30, 0.35, 0.40

QQ plot, N=10

Theoretical Distribution (y-axis): -1.0, 0.5, 1.5
N_10 (x-axis): -1, 0, 1, 2

QQ plot, N=100

Theoretical Distribution (y-axis): -2, 0, 1
N_100 (x-axis): -2, -1, 0, 1, 2

QQ plot, N=1000

Theoretical Distribution (y-axis): -3, -1, 1, 3
N_1000 (x-axis): -3, -2, -1, 0, 1, 2, 3

Question 20:

```
x=seq(from =-2, to=3,by=0.01)
x=rnorm(x,mean=mean(x),sd=sd(x))
y=x^2
plot(y)
qqnorm(y)
```

Normal Q-Q Plot

Sample Quantiles (y-axis): 0, 5, 10, 15, 20, 25
Theoretical Quantiles (x-axis): -3, -2, -1, 0, 1, 2, 3

the graph shows it is a exponential curve
hence the PDF of y is exponential.