Statistical Inference Course Project

Abhijeet

Loading Library

```
library("ggplot2")
```

Parameters

```
set.seed(1234)
#Sample size
n<-40
simulations<-1000
lambda<-0.2
```

1. Simulation

```
mns<-NULL
for (i in 1 : simulations){ mns <- c(mns, mean(rexp(n,lambda)))}
```

Comparing the sample mean with theoretical mean of the distribution.

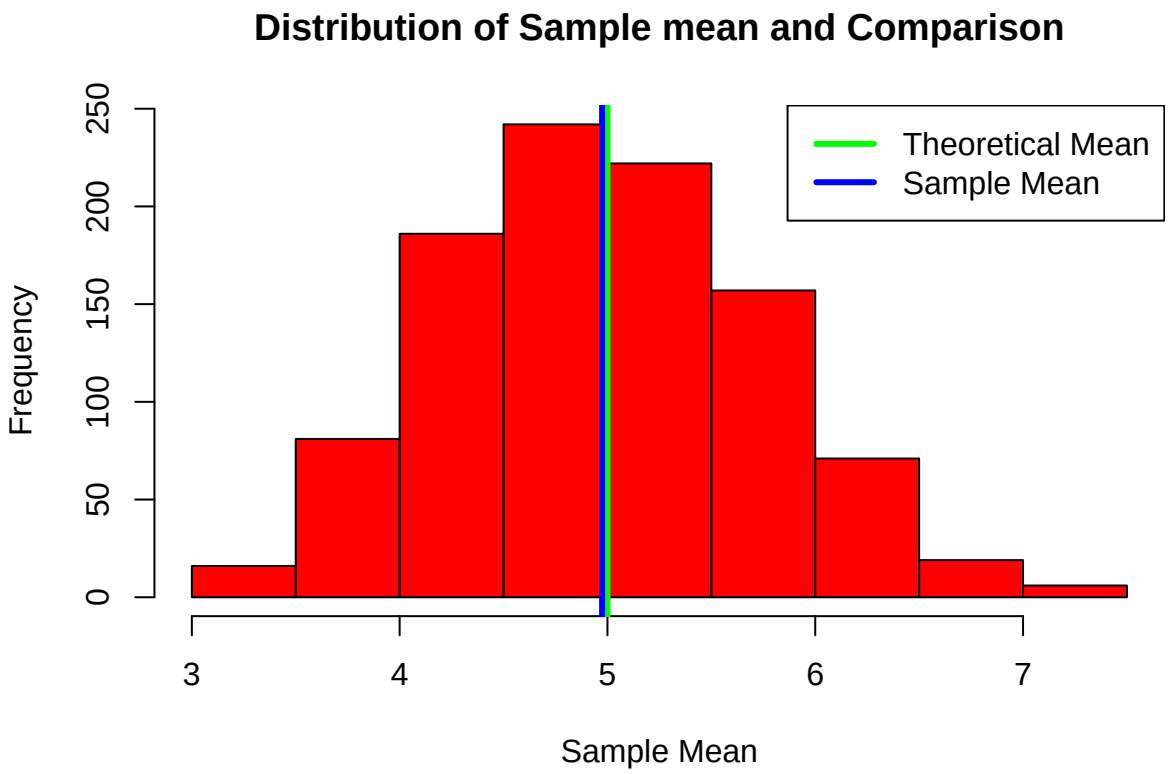
```
#Theoretical Mean
m1<-1/lambda
print(paste("Theoretical Mean: ",round(m1,2)))
```

```
## [1] "Theoretical Mean:  5"
```

```
#Sample Sample Mean
m2<-mean(mns[])
print(paste("Sample Mean: ",round(m2,2)))
```

```
## [1] "Sample Mean:  4.97"
```

```
hist(mns,xlab = "Sample Mean", main="Distribution of Sample mean and Comparison",col="red")
abline(v=m1,col="green",lwd=3)
abline(v=m2,col="blue",lwd=3)
legend("topright", legend = c("Theoretical Mean", "Sample Mean"), col = c("green", "blue"), lwd = 3)
```



The calculated sample mean is 4.97, while the theoretical mean is 5. This indicates that the center of distribution of averages from 40 exponential sample closely aligns with the expected theoretical center.

Standard Deviation

```
# Sample
Sample_sd<-sd(mns)
print(paste("Sample Standard Deviation: ",round(Sample_sd,3)))
```

```
## [1] "Sample Standard Deviation:  0.755"
```

```
# Theoretical
Theo_sd<-m1/sqrt(n)
print(paste("Theoretical Standard Deviation: ", round(Theo_sd,3)))
```

```
## [1] "Theoretical Standard Deviation:  0.791"
```

Variance

```
# Sample
Sample_var<-Sample_sd^2
print(paste("Sample Variance: ",round(Sample_var,3)))
```

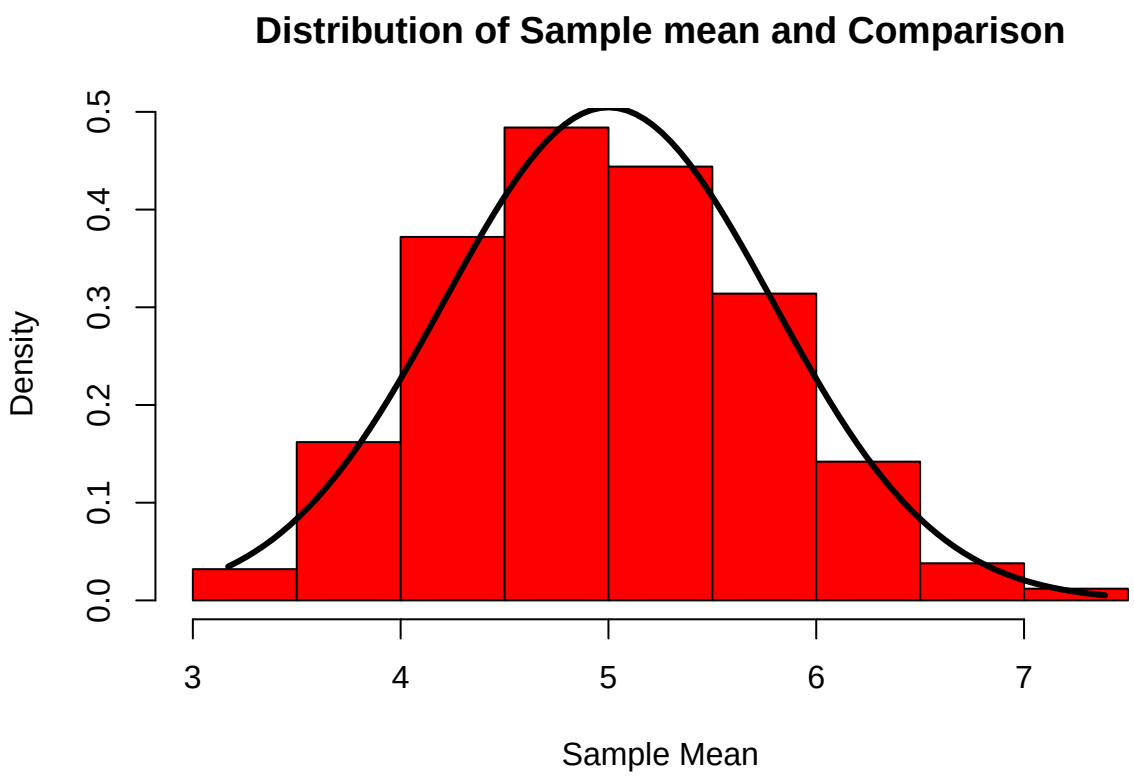
```
## [1] "Sample Variance:  0.571"
```

```
# Theoretical
Theo_var<-Theo_sd^2
print(paste("Theoretical Variance: ",round(Theo_var,3)))
```

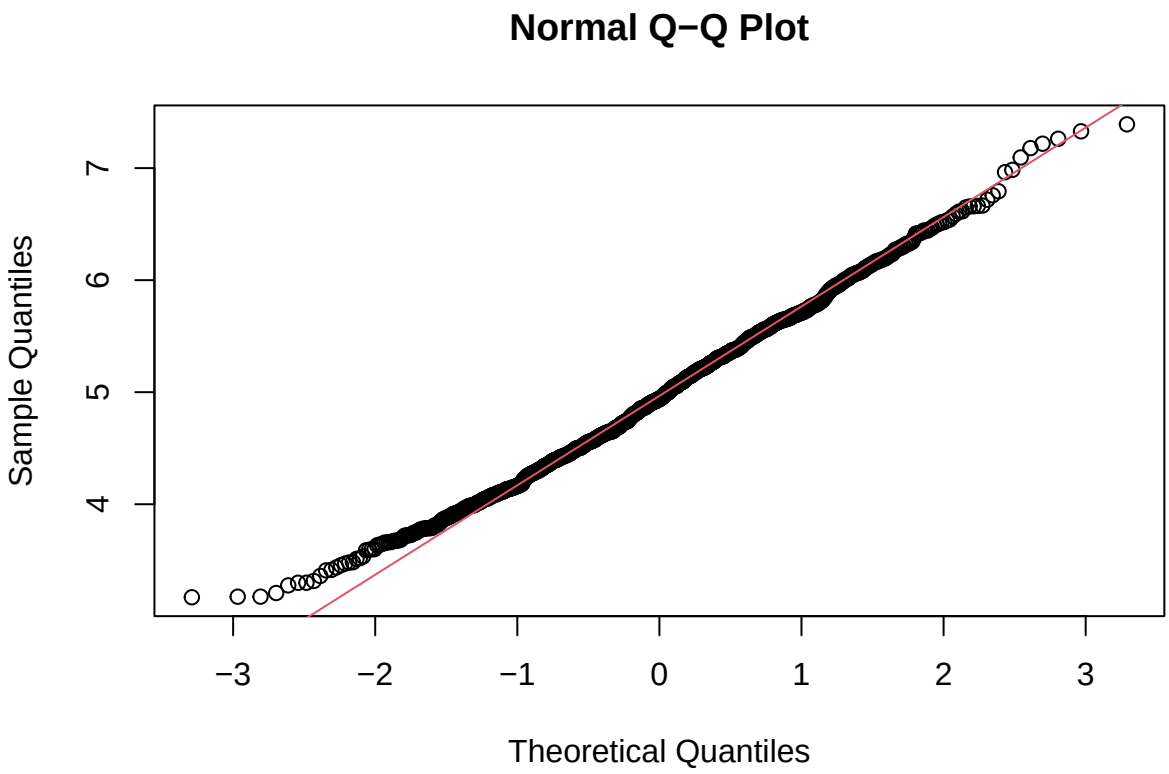
```
## [1] "Theoretical Variance:  0.625"
```

- The Standard deviation of the experimental sample is 0.755 which is close theoretical standard deviation of 0.791.
- The variance of the sample is 0.571 while it's actual theoretical value is 0.625 ## 2. Proof of normal Distribution

```
hist(mns,prob=T,xlab = "Sample Mean", main="Distribution of Sample mean and Comparison",col="red")
xfit=seq(min(mns),max(mns),length=100)
yfit=dnorm(xfit,mean=m1,sd=Theo_sd)
lines(xfit, yfit,lwd=3,col="black")
```




```
qqnorm(mns)
qqline(mns, col = 2)
```



The above plots proves that the experimental distribution is normally distributed.