Part 1

Ayush Kumar

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##Loading Libraries

```
library(data.table)
library(ggplot2)
library(knitr)
opts_chunk$set(echo = TRUE, results = 'hold')
```

##Assigning Values

```
set.seed(120)
expnum <- 40
lambda <- 0.2
simnum <- 1000
expsimu <- replicate(simnum, rexp(expnum, lambda))
expmean <- apply(expsimu, 2, mean)
```

##Q1 Show the sample mean and compare it to the theoretical mean of the distribution.

```
analytic_mean<-mean(expmean)
analytic_mean
```

```
## [1] 5.03946
```

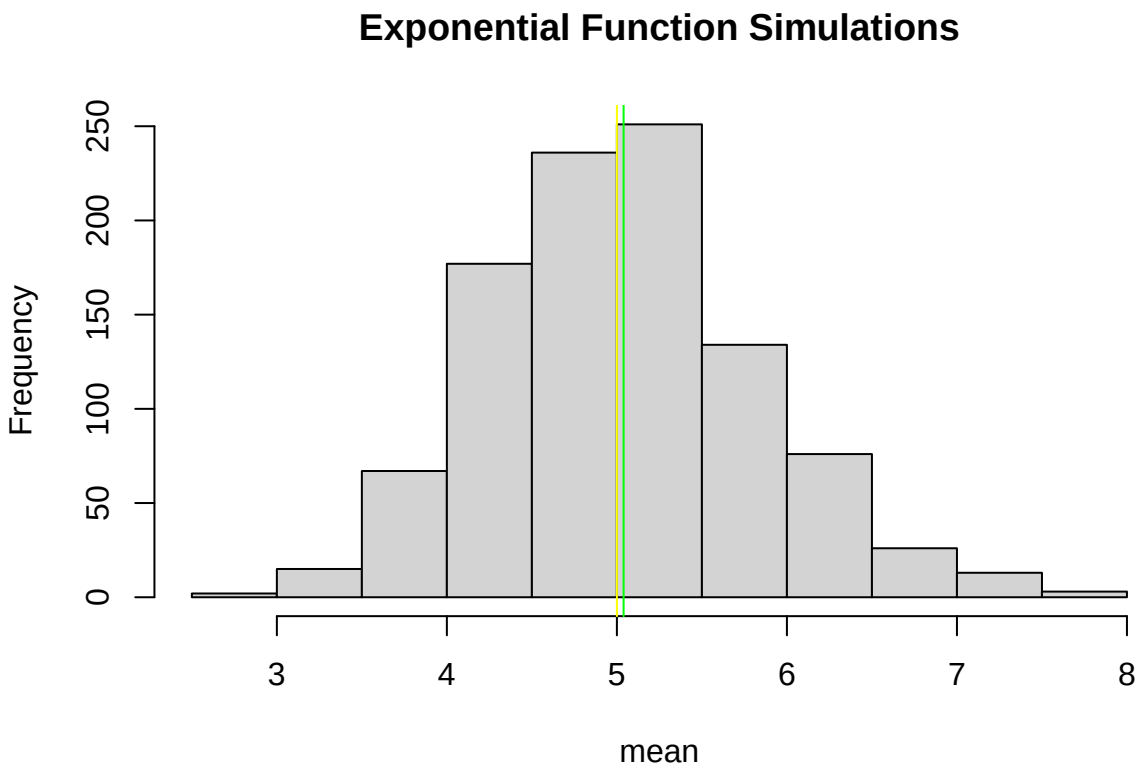
```
theoretical_mean<-1/lambda
theoretical_mean
```

```
## [1] 5
```

```
analytic_mean-theoretical_mean
```

```
## [1] 0.03945984
```

```
hist(expmean, xlab = "mean", main = "Exponential Function Simulations")
abline(v = analytic_mean, col = "green")
abline(v = theoretical_mean, col = "yellow")
```



The analytics mean is 4.993867 wheras the theoretical mean is 5 showing that average centre of distribution is very close to theoretical centre of distribution.

##Q2 Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution.

```
theoreticl_variance<-(theoretical_mean)^2/expnum
theoreticl_variance
```

```
## [1] 0.625
```

```
sqrt_expnum<-sqrt(expnum)
theoretical_sd<-theoretical_mean/sqrt_expnum
theoretical_sd
```

```
## [1] 0.7905694
```

```
sampleVariance<- var(analytic_mean)
sampleVariance
```

```
## [1] NA
```

```
standard_deviation<-sd(expmean)
standard_deviation
```

```
## [1] 0.7865754
```

```
variance_distribution<-standard_deviation^2
variance_distribution
```

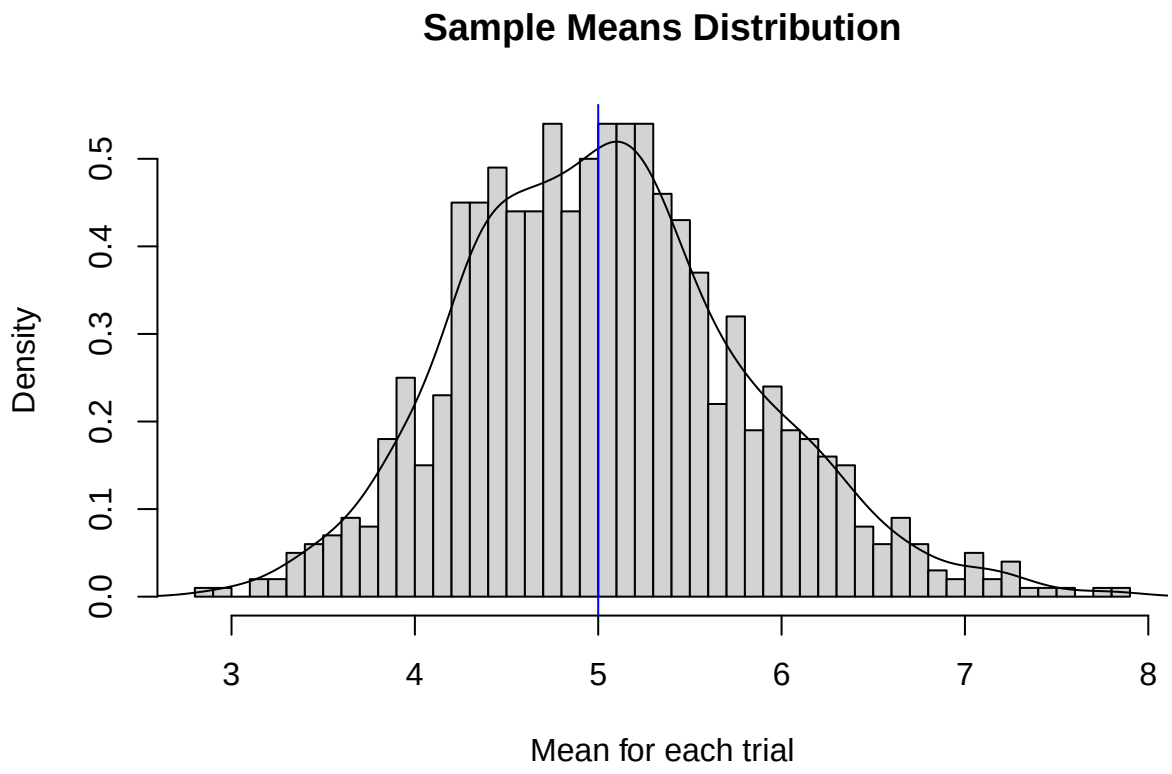
```
## [1] 0.6187008
```

We could see that variance_distribution is same as sample_variance.

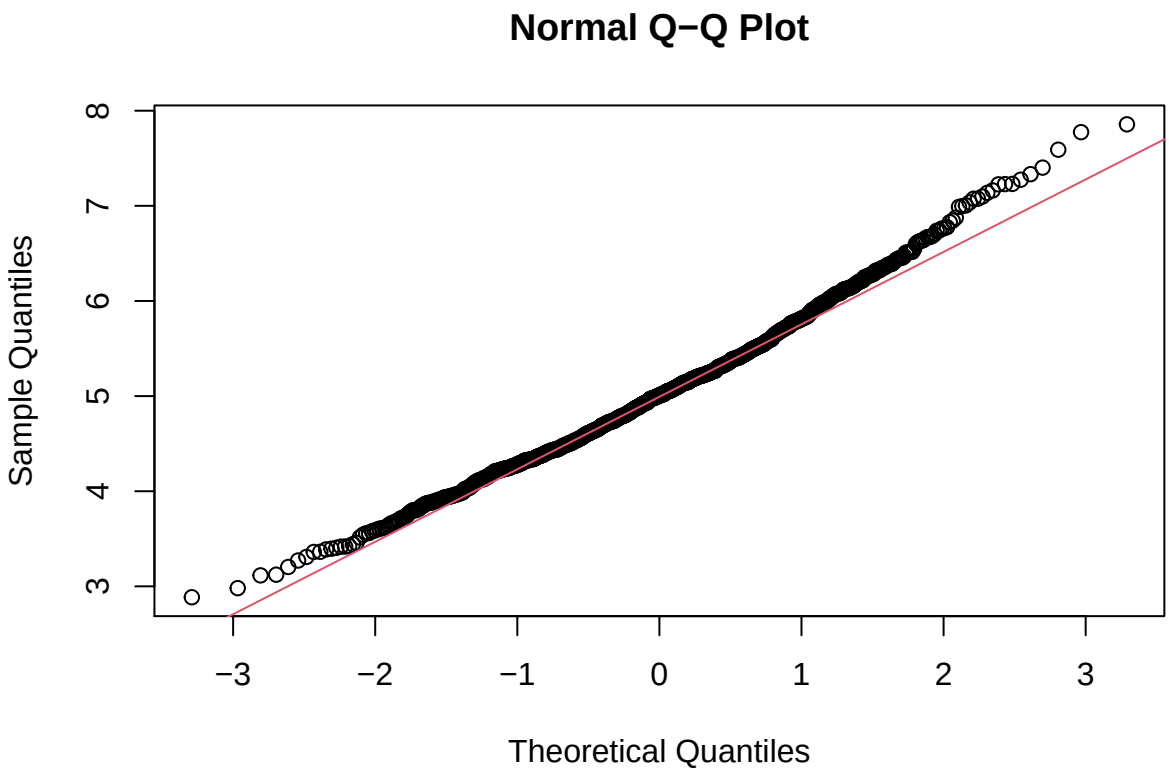
Theoretical Standard Deviation is 0.7905694. Standard Deviation is 0.7865754.

##Q3 Show that the distribution is approximately normal.

```
hist(expmean,  xlab="Mean for each trial", ylab = "Density", main="Sample Means Distribution", breaks=ex
lines(density(expmean))
abline(v = 1/lambda, col = "blue")
```




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



The above graph show a curve like structure(bell curve) and hence we could say that the distribution of 40 averages exponential is close to normal distribution.