Simulation Exercise

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Construction of simulation

Simulation was perform by sampling mean of a thousand of exponantial distribution

```
library(ggplot2)

n <- 40
lambda <- 0.2

pvals <- seq(0.1, 0.9, by = 0.05)

exp_r_sim <- NULL

for (i in 1 : 1000) exp_r_sim = c(exp_r_sim, mean(rexp(n,lambda)))
```

Mean Comparision Sample Mean vs Theoretical Mean of the Distribution

```
# Sample Mean
sampleMean <- mean(exp_r_sim) # Mean of sample means
print (paste("Sample Mean is : ", sampleMean))
```

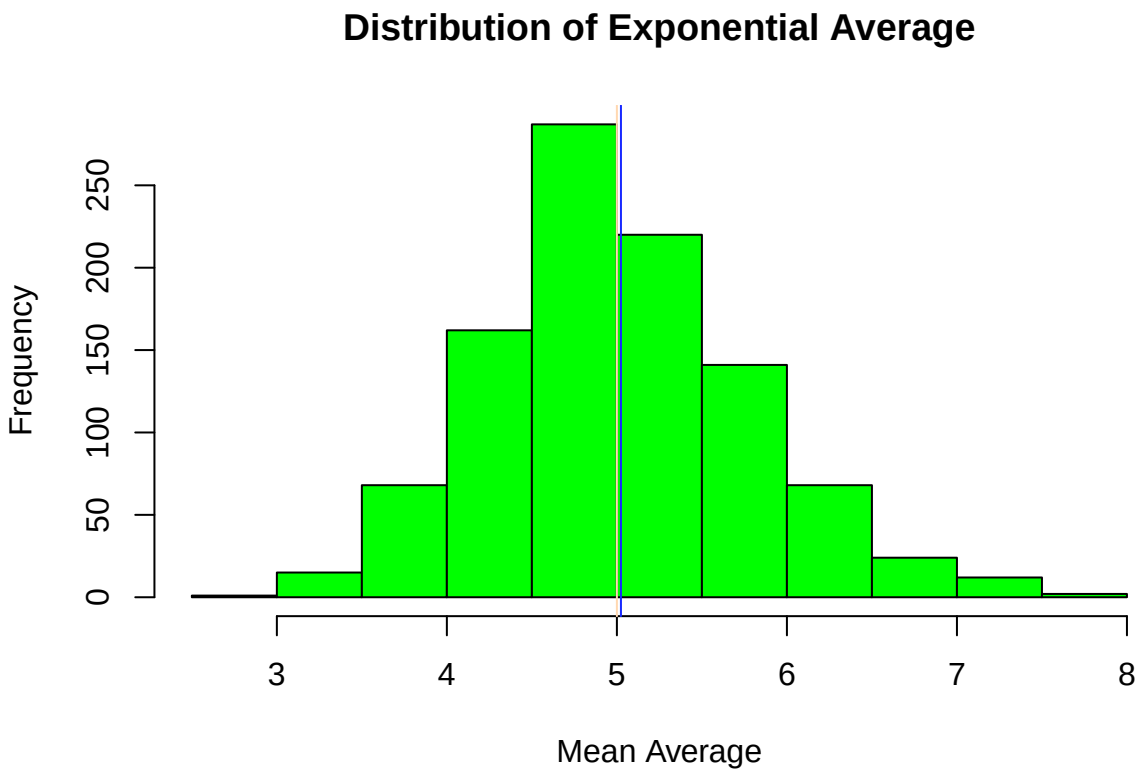
```
## [1] "Sample Mean is :  5.02375406879649"
```

```
# Theoretical Mean
# the expected mean of the exponential distribution of rate = 1/lambda
theoretical_mean <- (1/lambda)
print (paste("Theoretical Mean is : ", theoretical_mean))
```

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

Calculating the theoretical and sample variance

```
# Histogram shows differences
hist(exp_r_sim, col="#00ff00", xlab = "Mean Average", main="Distribution of Exponential Average")
abline(v = theoretical_mean, col="#FFD8B1")
abline(v = sampleMean, col="#1829ff")
```




```
# sample deviation & variance
sample_dev <- sd(exp_r_sim)
print (paste("The sample standard deviation is : ", sample_dev))
```

```
## [1] "The sample standard deviation is :  0.786358273982754"
```

```
sample_variance <- sample_dev^2
print (paste("The sample variance is : ",sample_variance))
```

```
## [1] "The sample variance is :  0.618359335061136"
```

```
# theoretical deviation & variance
theoretical_dev <- (1/lambda)/sqrt(n)
print (paste("The theoeriatical standard deviation is : ",theoretical_dev))
```

```
## [1] "The theoeriatical standard deviation is :  0.790569415042095"
```

```
theoretical_variance <- ((1/lambda)*(1/sqrt(n)))^2
print (paste("The theoretical variance is : ",theoretical_variance))
```

```
## [1] "The theoretical variance is :  0.625"
```

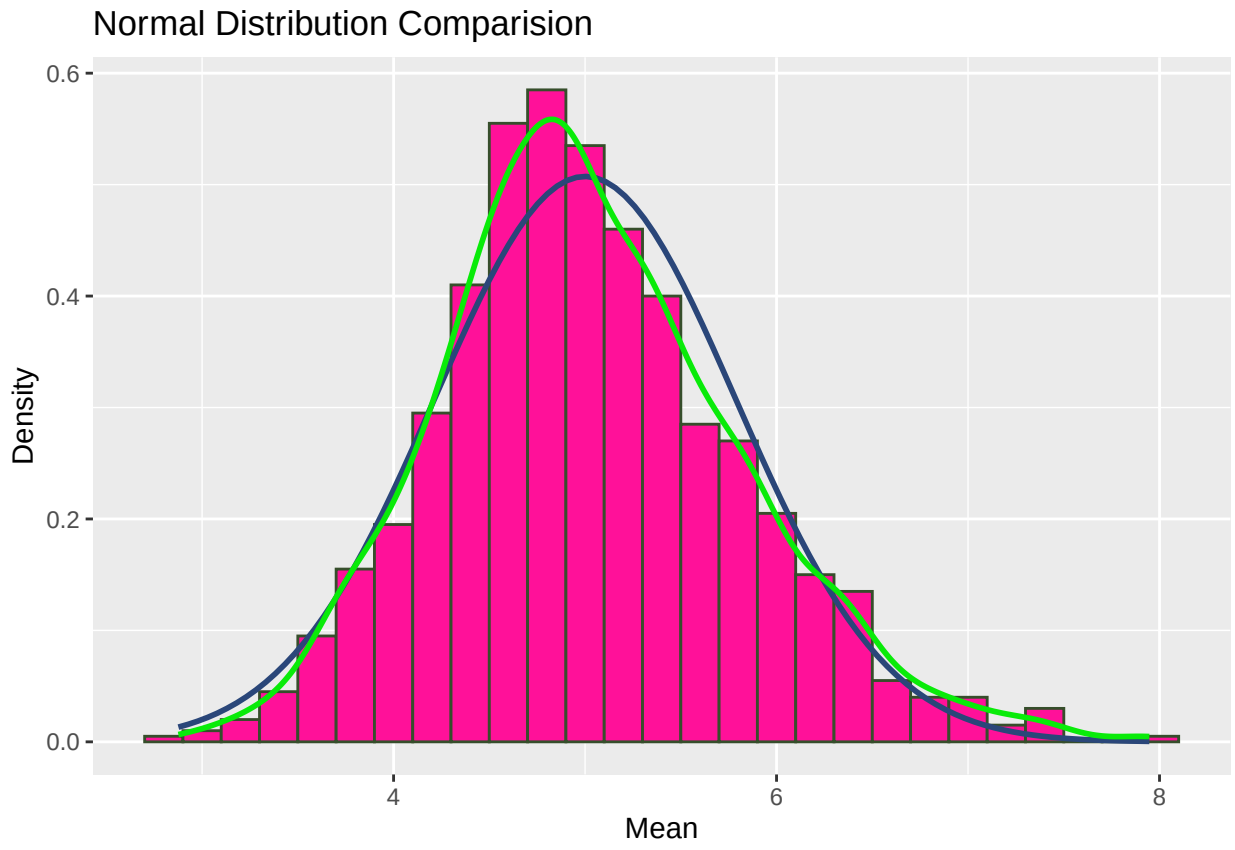
```
2
```

```
## [1] 2
```

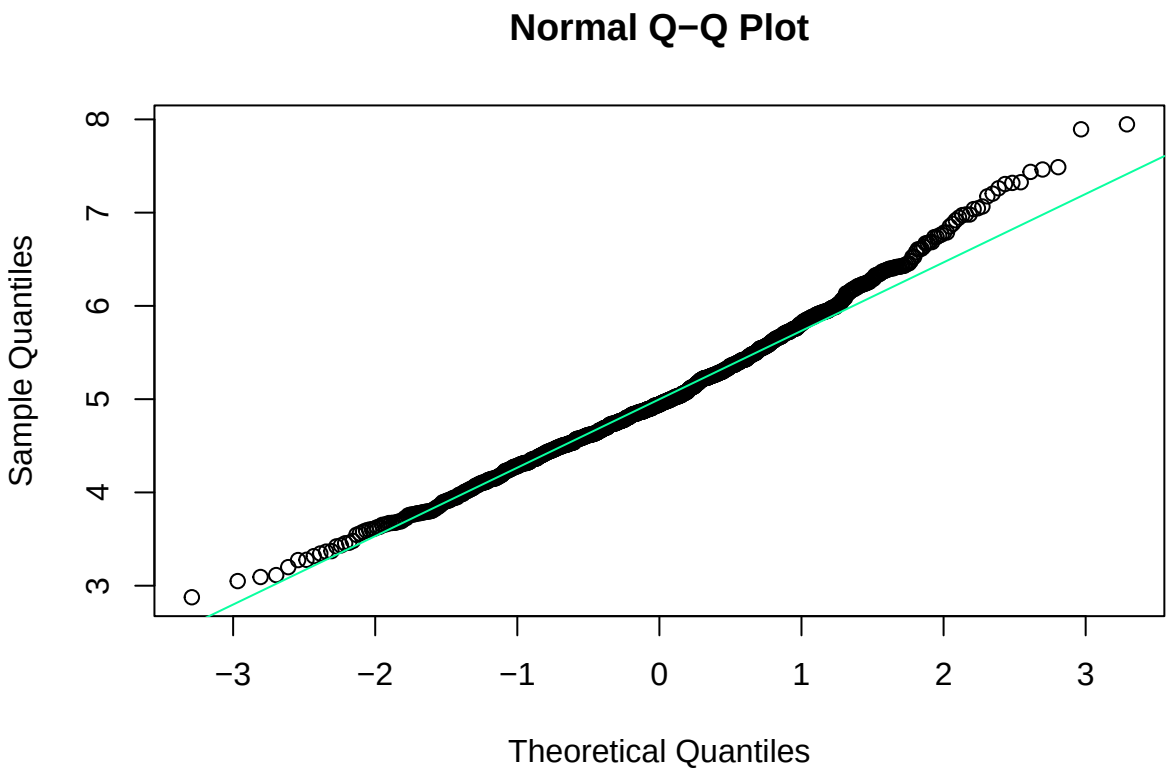
Show that the distribution is approximately normal Histogram with Density and sample means:

```
d <- data.frame(exp_r_sim)
t <- data.frame(theoretical_mean)
g <- ggplot(d, aes(x = exp_r_sim)) +
geom_histogram(binwidth = .2, color="#364e2b", fill="#ff1199" , aes(y=..density..))+
stat_function(fun=dnorm, args=list(mean=theoretical_mean, sd=sd(exp_r_sim)),
color="#2a4679", size =1) +
stat_density(geom = "line", color = "#09eb09", size =1) +
labs(x="Mean", y= "Density",
title="Normal Distribution Comparision")

g
```




```
qqnorm(exp_r_sim)
qqline(exp_r_sim, col = "#0affa0")
```


Normal Q−Q Plot
Sample Quantiles
Theoretical Quantiles
3
4
5
6
7
8
−3
−2
−1
0
1
2
3