Statistical Inference Project 1

Madan Lamichhane

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Project Description

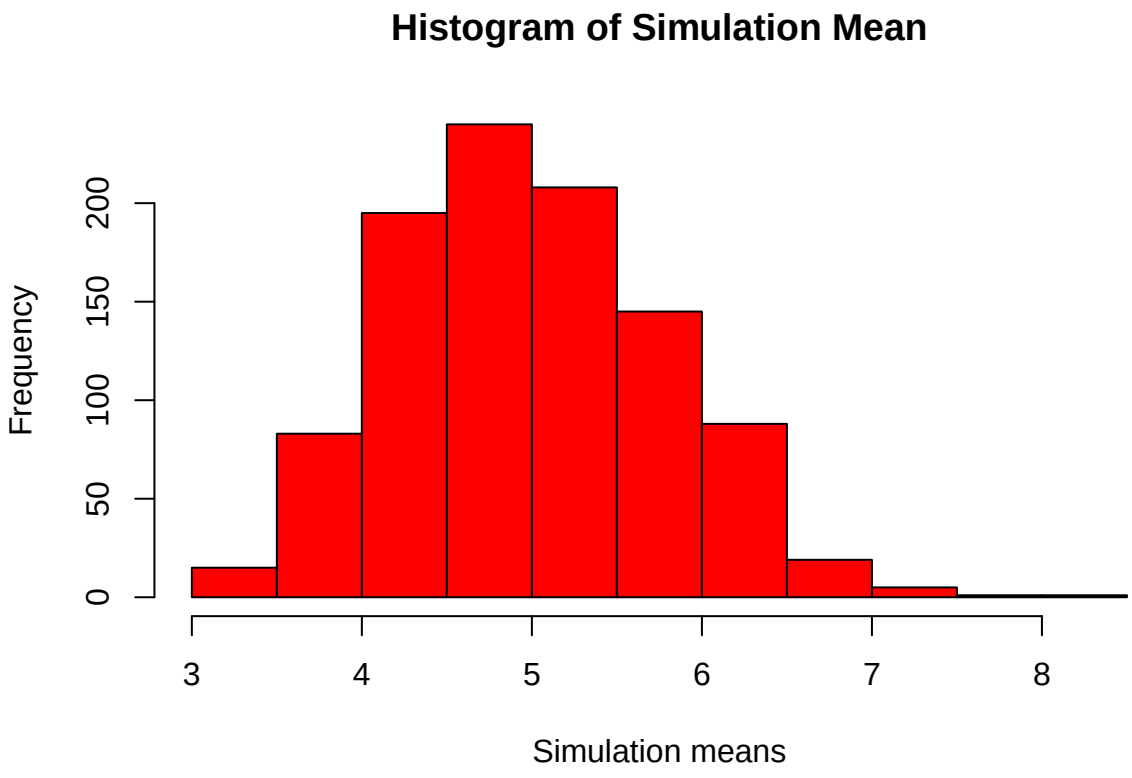
This project investigate the exponential distribution in R and compare with the central Limit Theorem. The exponential distribution has been simulated using rexp(n, lambda) where lambda is a rate paramenter which has been set to 0.2. This investigation has been performed over 40 exponentials.

Simulation

We can perform simulation over the 40 exponential suing fowllowing r codes.

```
set.seed(1)
lambda = 0.2
numSim = 1000
sampleSize = 40
sim = matrix(rexp(numSim * sampleSize, rate=lambda), numSim, sampleSize)
simMean = rowMeans(sim)
```

The simulation data can be plotted as



Comparision of mean

The sample and theoretical mean can be evaluated using following r-codes.

```
meanData = mean(simMean)
theoMean = 1/lambda
```

```
meanData
```

```
## [1] 4.990025
```

```
theoMean
```

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

The mean from simulation is 4.990025 whereas the theoretical mean is 5.0.

Comparision of varaince

Similarly the variance from the simulation can be compared from the theoretical variance using following codes

```
simVar = var(simMean)
theoVar = (1/lambda)^2/sampleSize
```

```
simVar
```

```
## [1] 0.6177072
```

```
theoVar
```

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

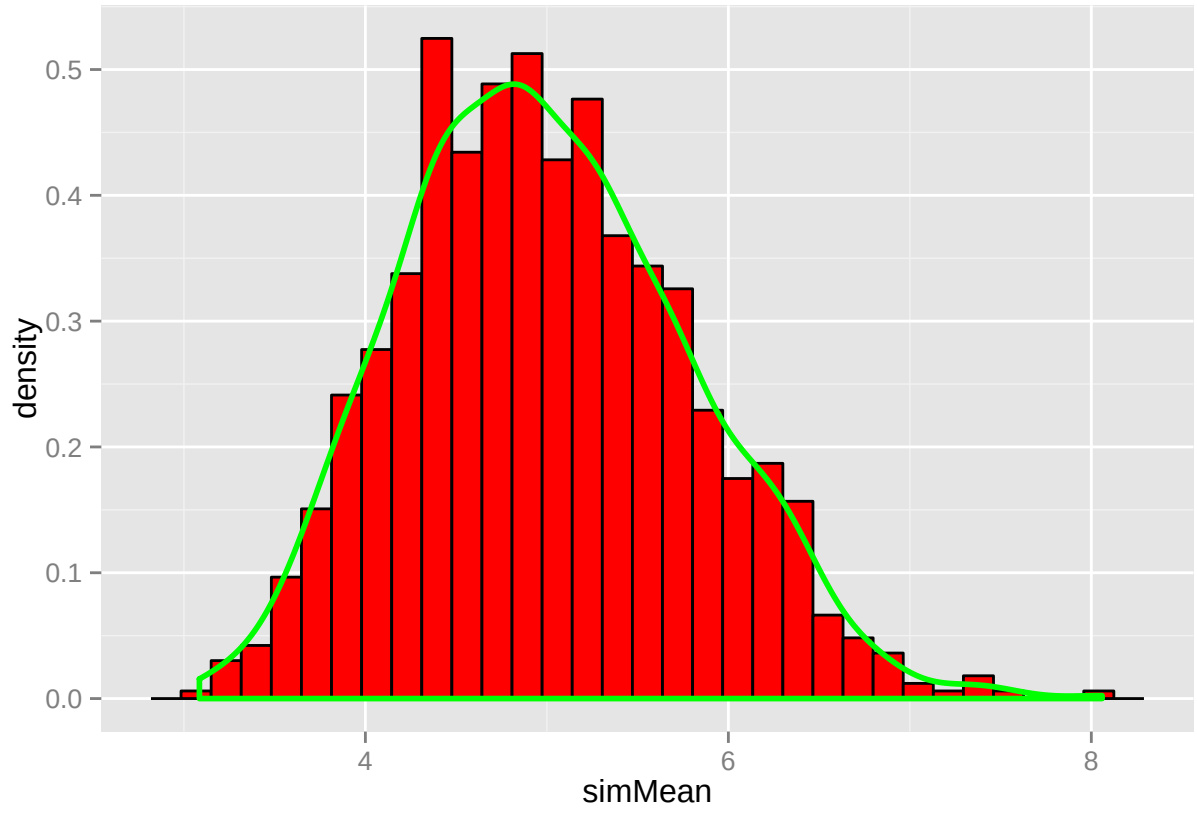
The varainace obtained from the simulation is 0.6177072 nearly equal to theoretical varaince 0.625.

Approximating with normal distribuation

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.2.2
```

```
pData <- data.frame(simMean);
a <- ggplot(pData, aes(x =simMean))
a <- a + geom_histogram(aes(y=..density..), colour="black",
fill = "red")
a + geom_density(colour="green", size=1);
```



Matching confidence interval

```
simConInterval = round(mean(simMean) + c(-1,1)*1.96*sd(simMean)/sqrt(sampleSize), 3)
theoConInterval = theoMean + c(-1, 1) * 1.96 * sqrt(theoVar)/sqrt(sampleSize);
```

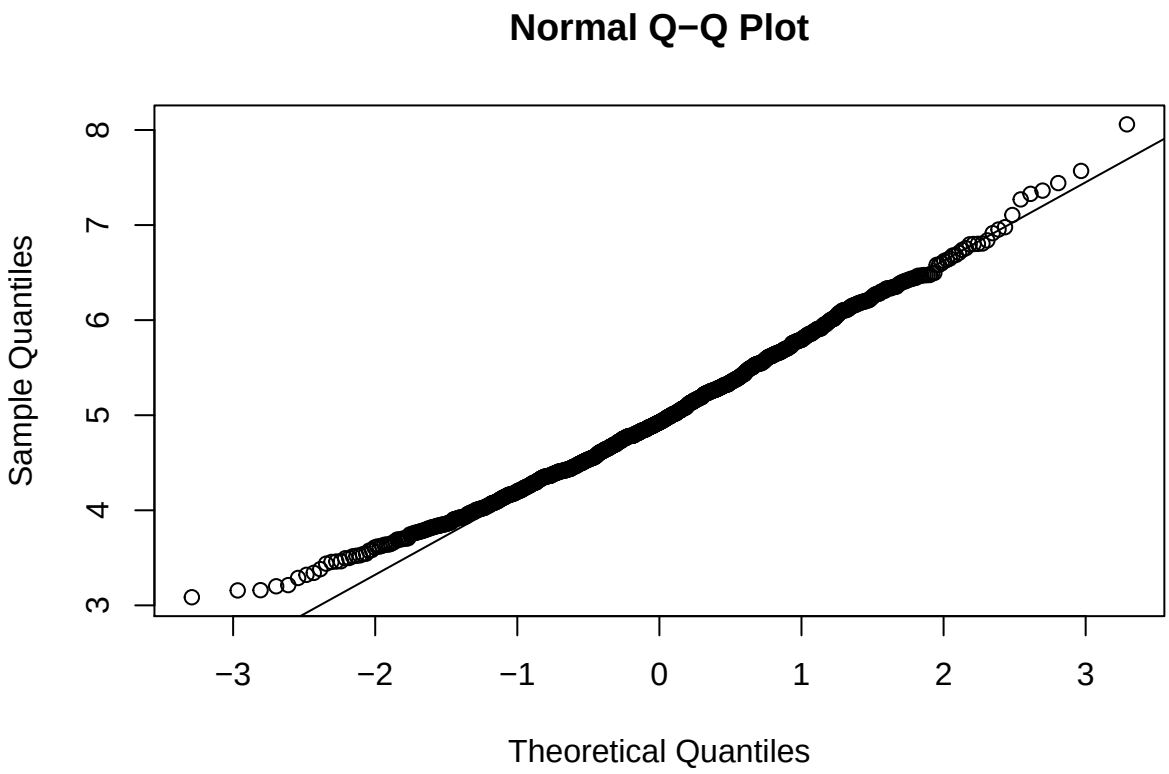
```
simConInterval
```

```
## [1] 4.746 5.234
```

```
theoConInterval
```

```
## [1] 4.755 5.245
```

```
qqnorm(simMean);
qqline(simMean)
```


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