# Statistical Inference Class Project

*Ron Collins*

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### Description of simulation exercise

In this project I have investigate the exponential distribution in R ( with lambda = 0.2,distribution of averages of 40 exponentials, and 1000 simulations) and compare it with the Central Limit Theorem. The exponential distribution can be simulated in R with rexp(n, lambda) where lambda is the rate parameter. The mean of exponential distribution is 1/lambda and the standard deviation is also 1/lambda.

loading required libraries and setting of constant values

```
library(ggplot2)

# assigning parameters values
lamda <- 0.2
n <- 40
simulationNumber <- 1000

set.seed(3413)
```

```
exponentialDistributions <- matrix(data=rexp(n * simulationNumber, lamda), nrow=simulationNumber)
meanExponentialDistribution <- data.frame(means=apply(exponentialDistributions, 1, mean))
```

## !. Comparison of sample mean and theortical mean

```
 The expected mean "mu' of a exponential distribution of rate lamda is mu = 1/lamda
```

```
mu  <- 1/lamda
mu
```

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

The average sample mean of a 1000 simulations of 40 randomly sampled exponential distributions.

```
averageSampleMean <- mean(meanExponentialDistribution$means)
averageSampleMean
```

```
## [1] 5.021016
```

The average sample mean is an close approximatimation of the expectimated mean.

### 2 Sample variance versus expected variance

The expected standard deviation sigma of a exponential distribution of rate lambda is sigma = (1/lama)/sqrt(n)

```
sigma <- (1/lamda)/sqrt(n)
sigma
```

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

The variance var of the standard deviation sigma is varSigma = sigma^2

```
varSigma <- sigma^2
varSigma
```

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

The variance of the average sample mean of 1000 simulations of 60 randomly sampled exponential distributions is varX, The standard deviation is sigmaX.

```
sigmaX <- sd(meanExponentialDistribution$means)
sigmaX
```

```
## [1] 0.7963641
```

```
varX <-  var(meanExponentialDistribution$means)
varX
```

```
## [1] 0.6341958
```

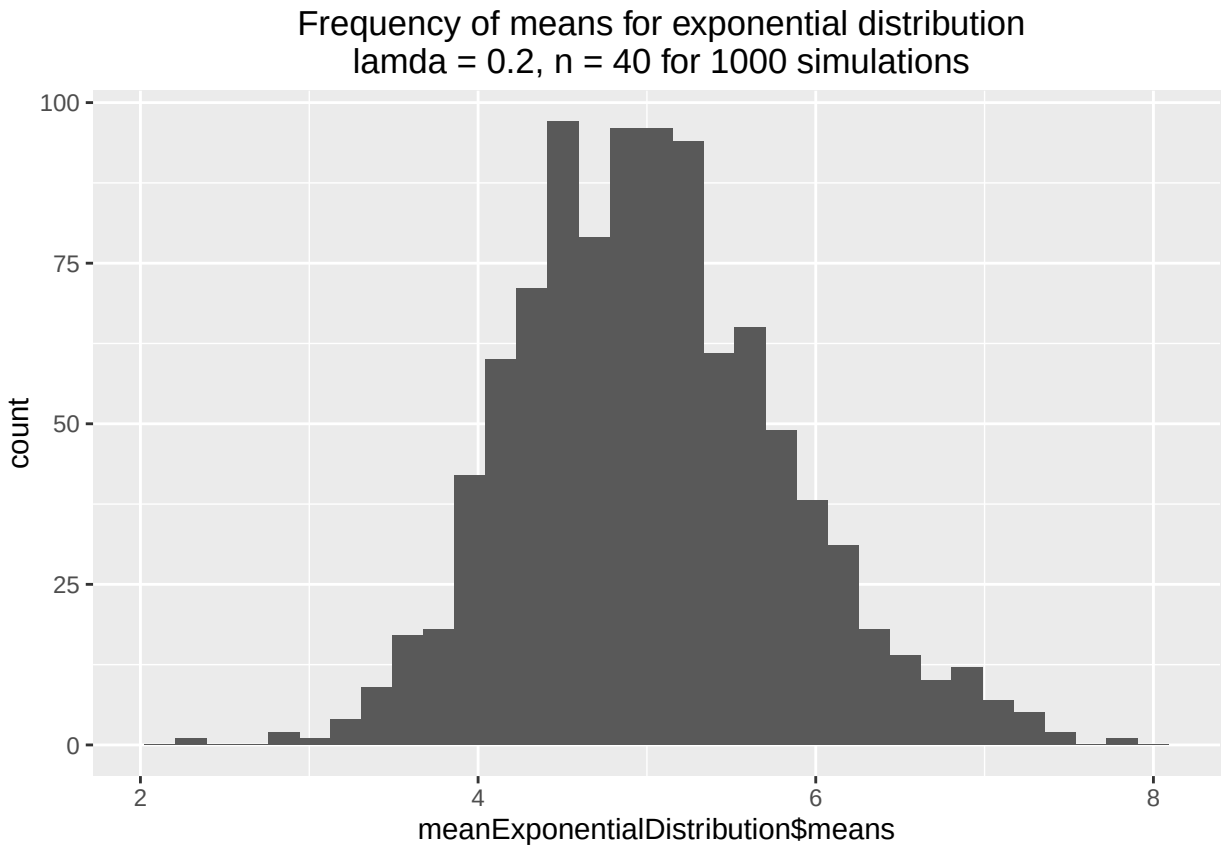
```
 The sample variance is a close approximation of the expected variance.
```

## 3. The distribution is approximately normal.

The following graph of the exponential distribution with lamda= 0.2, n=40 and 1000 simulations is approximately.

```
gg <-qplot(meanExponentialDistribution$means, geom="histogram")
gg + ggtitle(" Frequency of means for exponential distribution\n lamda = 0.2, n = 40 for 1000 simulatio
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```


Frequency of means for exponential distribution
lamda = 0.2, n = 40 for 1000 simulations
count
100
75
50
25
0
2
4
6
8
meanExponentialDistribution$means