# Part 1-Simulation Exercise

Harikrishna Vemula

10/13/2020

```
library(knitr)
library(ggplot2)
```

## Overview

This is part 1 assignment on Simulation Exercise using R. This Simulation Exercise intension is, investigating the exponential distribution and compare it with the Central Limit Theorem.

## Simulations

initializing variables lambda, seed, n and n's simulation.

```
ECHO=TRUE
set.seed(1337)
lambda = 0.2
n = 40
nsm = 1000
```

Calculating mean for 1000 samples of 40 exponentials

```
ex <- replicate(nsm, rexp(n, lambda))
exp_means <- apply(ex, 2, mean)
```

## 1.Sample Mean versus Theoretical Mean

**Sample Mean** Calculating the mean .

```
mean(exp_means)
```

```
## [1] 5.055995
```

**Theoretical Mean** Calculating theoretical mean.

```
lambda^-1
```

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

**Difference** sample mean Vs exponential distribution theoretical mean.

```
abs(mean(exp_means)-lambda^-1)
```

```
## [1] 0.05599526
```

## 2.Sample Variance versus Theoretical Variance

**Sample Variance** Calculating sample variance variance.

```
var(exp_means)
```

```
## [1] 0.6543703
```

**Theoretical Variance** Calculating theoretical variance

```
(lambda * sqrt(n))^-2
```

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

**Difference** Sample Variance Vs Theoretical Variance

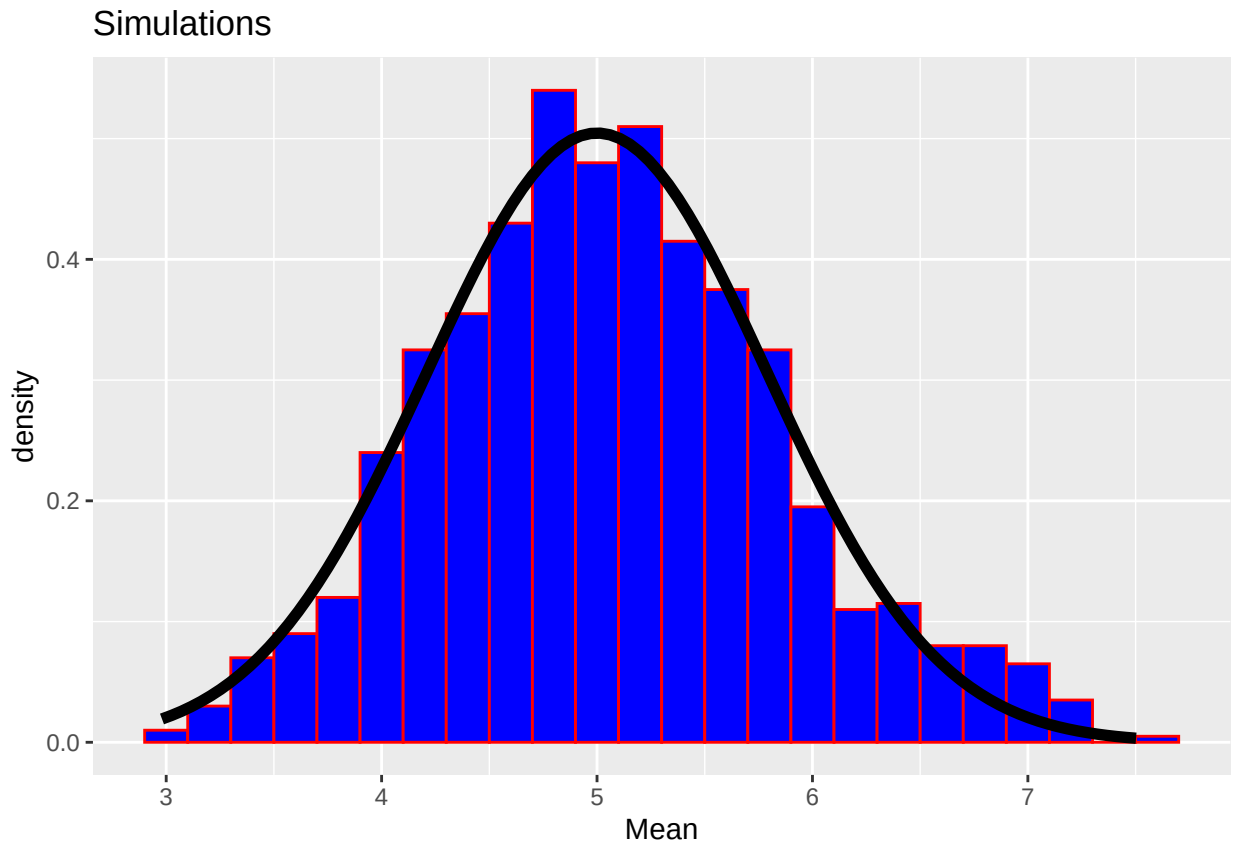
```
abs(var(exp_means)-(lambda * sqrt(n))^-2)
```

```
## [1] 0.0293703
```

## Distribution

The following graph illustrates histogram for 1000 simulations.

```
library(ggplot2)
ggplot(data.frame(y=exp_means), aes(x=y)) +
  geom_histogram(aes(y=..density..), binwidth=0.2, fill="blue",color="red") +
  stat_function(fun=dnorm, args=list(mean=lambda^-1,sd=(lambda*sqrt(n))^-1),
                size=2) +
  labs(title="Simulations", x="Mean")
```


Simulations
density
0.4
0.2
0.0
3
4
5
6
7
Mean