Statistical Inference Course Project Part 1: Simulation

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Investigation of the exponential distribution in R and comparation with the Central Limit Theorem.

Instruction:
1) 1000 Simulation
2) 40 exponentials
3) Lambda = 0.2

```
# Basic settings
knitr::opts_chunk$set(echo = TRUE,tidy.opts=list(width.cutoff=60),tidy=TRUE)
set.seed(1983)
# Main variables
Lambda = 0.2
Simulation <- NULL
for (i in 1 : 1000) Simulation = c(Simulation, mean(rexp(40,Lambda)))
```

QUESTION 1: Show the sample mean and compare it to the theoretical mean of the distribution.

Theoretical mean is 1/Lambda, sample mean is the mean of the simulation values.

```
TheoreticalMean <- 1/Lambda
SampleMean <- mean(Simulation)
paste("Theoretical mean is", round(TheoreticalMean, 3), "sample mean is",
    round(SampleMean, 3))
```

```
## [1] "Theoretical mean is 5 sample mean is 5.028"
```

The sample mean is very close to the theoretical mean.

QUESTION 2: Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution.

I can calculate theoretical variance by dividing 1/Lambda for the square root of the number of exponenentials and squaring all.

```
TheoreticalVariance <- ((1/Lambda)/sqrt(40))^2
SampleVariance <- var(Simulation)
paste("Theoretical variance is", TheoreticalVariance, "sample variance is",
    round(SampleVariance, 3))
```

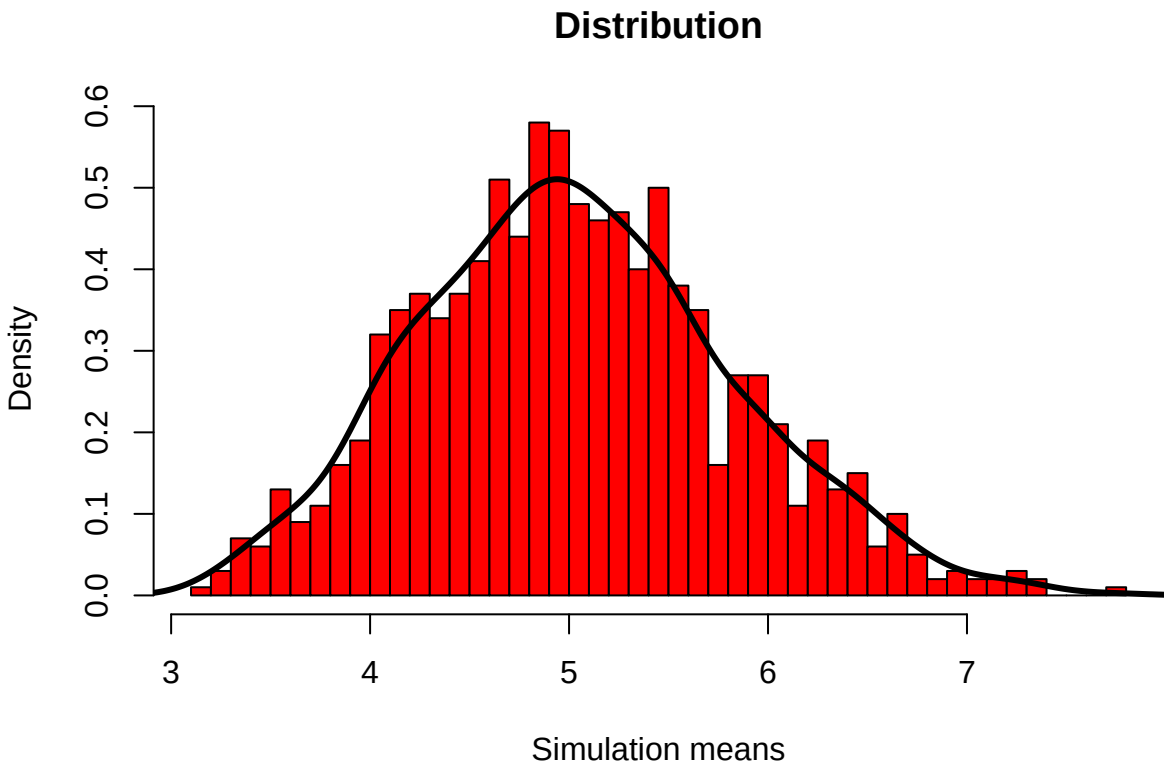
```
## [1] "Theoretical variance is 0.625 sample variance is 0.617"
```

The sample variance is very close to the theoretical variance.

QUESTION 3: Show that the distribution is approximately normal.

Using an histogram I can easily see if the distribution is approximately normal.

```
hist(Simulation, probability = TRUE, breaks = 40, col = "red",
    main = "Distribution", xlab = "Simulation means")
lines(density(Simulation), lwd = 3, col = "black")
```



The distribution of averages of random sampled exponentials is like a normal distribution.