Analysis of the Exponential Distribution in R

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Introduction

This is an analysis testing the Central Limit Theorem. I will be doing this by running a comparison of the base exponential distribution in r to the Central Limit Theorem.

Exponential Distribution

Data Processing

We must first generate the data that we will use throughout the analysis

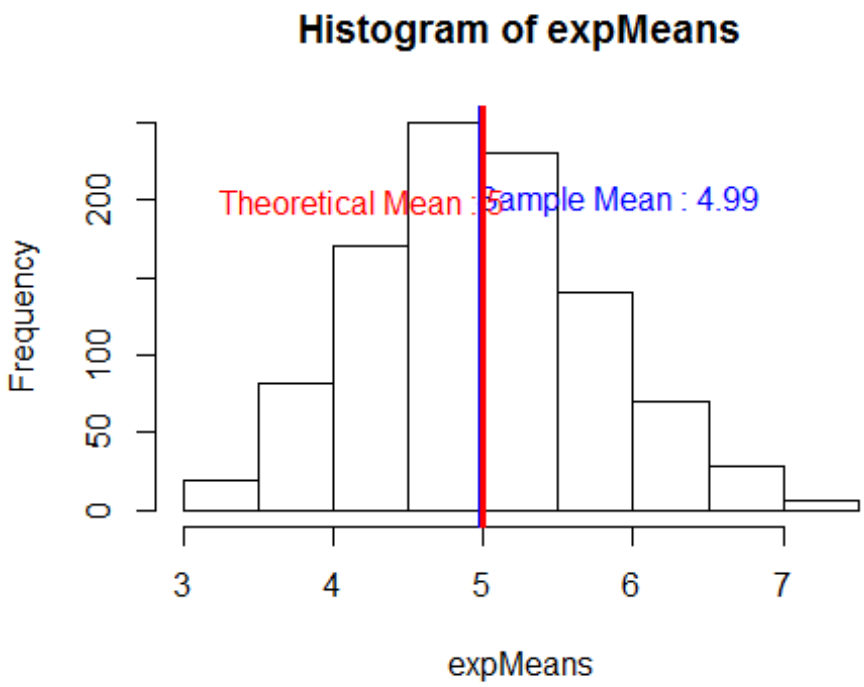
Analysis

The first section of code generates numbers to be used in the analysis. Lambda is set due to assignment instructions

```
set.seed(1)
lambda = .2
n = 40
expMeans = replicate(1000,mean(rexp(n,lambda)))
```

Next we create a plot to show the sample and theoretical mean and how they compare. Examination of this shows that the means are close to the same values and that the calculated means at first look seem normally distributed.

```
hist(expMeans)
abline(v=mean(expMeans), col = "blue", lwd = 3)
text(x=5.9,y = 200, labels = paste("Sample Mean :
",round(mean(expMeans),digits = 4),sep = ""), col = "blue")
abline(v=1/lambda, col = "red", lwd = 3)
text(x=4.2,y = 200, labels = "Theoretical Mean : 5", col = "red")
```



The theoretical varaiance is calculated as:

```
theoreticalMean = 1/lambda
theoreticalVar = (1/lambda)^2/n
theoreticalVar

## [1] 0.625
```

The sample variance is calculated as:

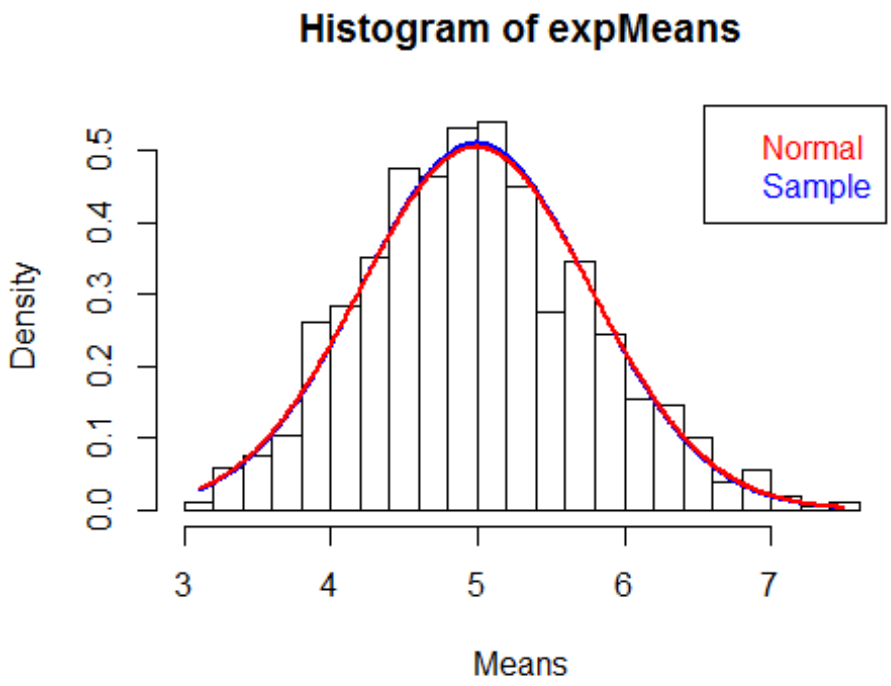
```
sampleVar = var(expMeans)
sampleVar

## [1] 0.6111165
```

Next we are going to compare the sample to the normal distribution witht the theoretical variance, and mean.

```
xfit = seq(min(expMeans),max(expMeans),length.out = 500)
yfit = dnorm(xfit,mean=mean(expMeans),sd = sqrt(theoreticalVar))
yfitsample = dnorm(xfit, mean=mean(expMeans), sd = sqrt(sampleVar))
hist(expMeans,breaks = 20,xlab = "Means",prob=TRUE)
#best fit line for sample data
lines(xfit,yfitsample,col="blue",lwd=2)
#normal distribution line
lines(xfit,yfit,col="red",lwd=2)
#plotting legend
legend("topright",
```

```
       c("Normal","Sample"),
       text.col=c("red", "blue"))
```



Results

The comparison here shows that as we explore the measures that sampling the exponential distribution, is approximating a normal distribution well.