Statistical Inference Course Project

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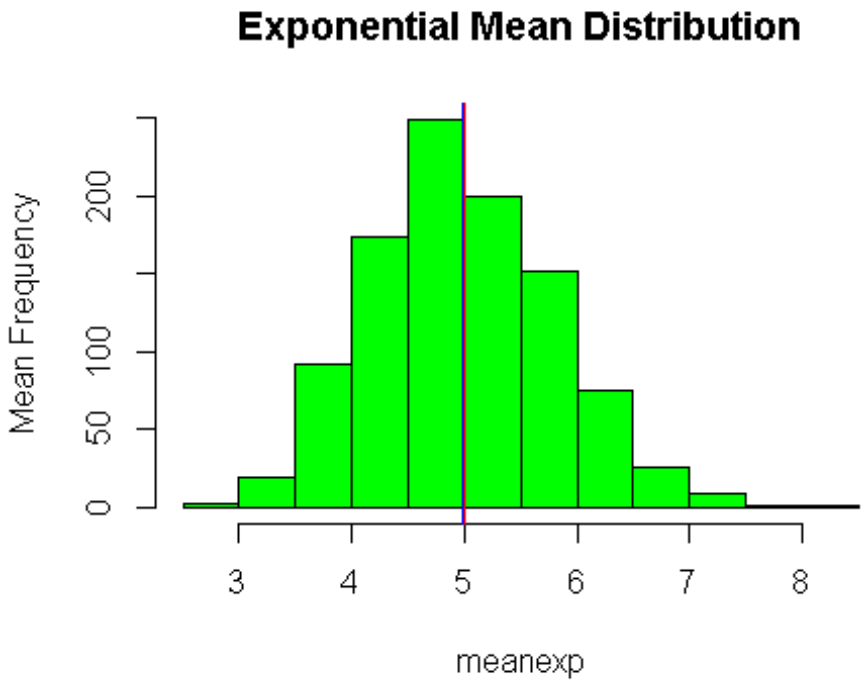
Part 1: Simulation Exercise Instructions

1. Show the sample mean and compare it to the theoretical mean of the distribution.
2. Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution.
3. Show that the distribution is approximately normal.

Question 1

```
#Set seed so we can reproduce
set.seed(1000)
#From question
lambda <- 0.2
n <- 40
sim <- 1000

#Simulate some numbers
simexp <- replicate(sim, rexp(n, lambda))

#apply to get the mean
meanexp <- apply(simexp, 2, mean)
mean1 <- mean(meanexp)
theoreticalmean <- 1/lambda

#create a histogram and add in the mean1 and theoreticalmean
hist(meanexp, ylab = "Mean Frequency", col="green", main="Exponential Mean
Distribution")
abline(v = mean1, col = "blue")
abline(v = theoreticalmean, col = "red")
```



Answer

The mean and the theoretical mean are within a few decimals of each other so they are about the same.

```
theoreticalmean

## [1] 5

mean1

## [1] 4.986963
```

Question 2

```
sdmeanexp <- round(sd(meanexp), 4)
sdmeanexp

## [1] 0.8089

sdtmean <- round((theoreticalmean)/sqrt(n), 4)
sdtmean

## [1] 0.7906

actualvariance <- round(var(meanexp) ,4)
actualvariance

## [1] 0.6543
```

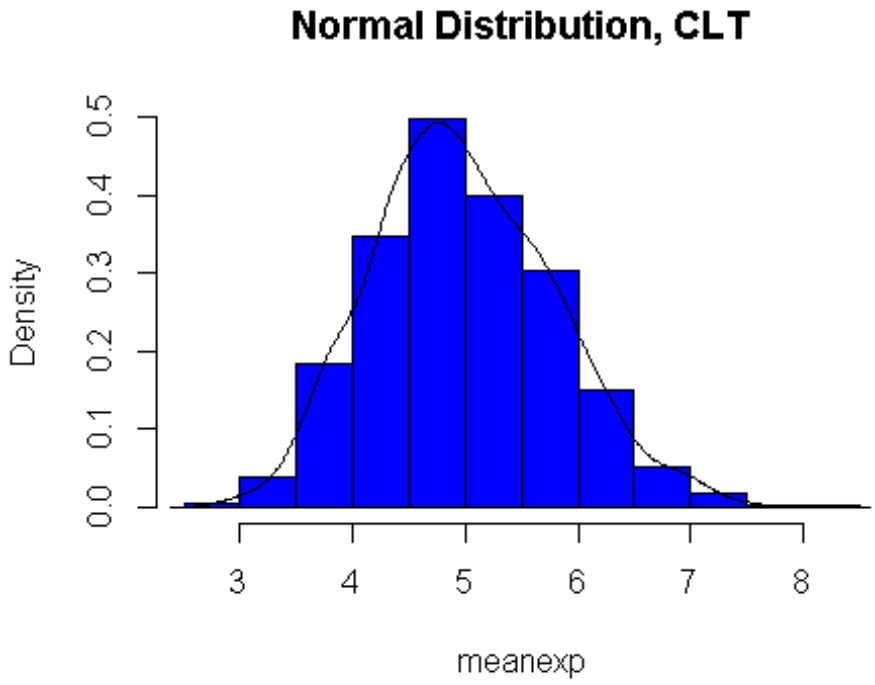
```
theoreticalvariance <- (theoreticalmean)^2/n
theoreticalvariance

## [1] 0.625
```

Answer

So the SD is around .81 and the theoretical SD is around .8 and the actual variance is .625 and the theoretical variance is .65.

Question 3

```
#Histogram of the meanexp
hist(meanexp, col = "blue", prob = TRUE, main = "Normal Distribution, CLT")
#density line showing normal distribution
lines(density(meanexp), col="black")
```



Answer

Because this is a large sample size with a finite level of variance, we can conclue that the mean of the simulations are approximately the mean due to the Central Limit Theorem