Comparison of the Exponential and CLT Distributions

Carl Turner

December 24, 2015

This project investigates the exponential distribution in R and compares it with the distribution based on the Central Limit Theorem.

1. Via simulation, we take the mean of 40 samples of the exponential distribution (lambda = 0.2). We run the simulation 1000 times.

```
means = NULL
n<-40
nosim<-1000
lambda<-0.2
for (i in 1 : nosim) means = c(means, mean(rexp(n, lambda)))
expMean <-round(mean(means), 3)
expSD <-round(sd(means), 3)
cbind(expMean, expSD)
```
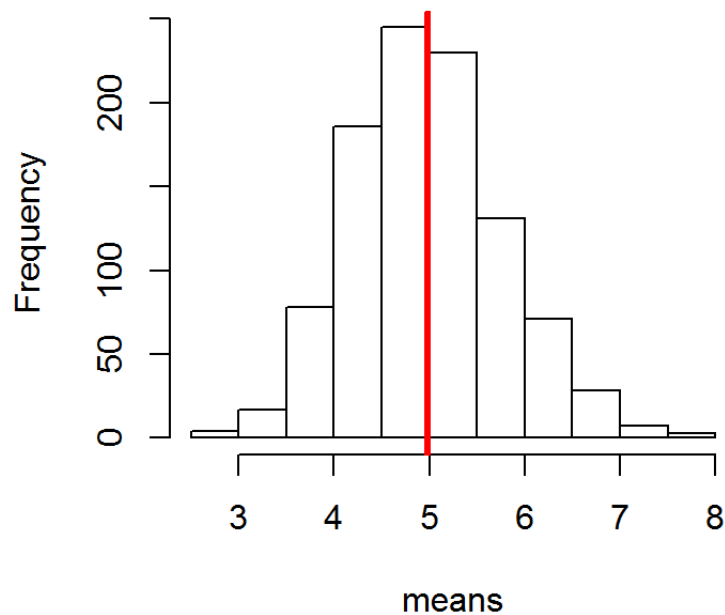
```
##      expMean expSD
## [1,]   4.982 0.796
```

The mean of the simulation is 4.982 with a standard deviation of 0.796, approximating the theoretical mean of 5 and standard deviation of 0.8.

2. A histogram of the 1000 simulations approximates a normal curve around the mean of 4.982.

```
hist(means)
abline(v=mean(means), lwd="3", col="red")
```

Histogram of means

3. In the next example, we'll take 1000 samples directly from the exponential distribution (lambda = 0.2), rather than taking the mean of 40 samples 1000 times as shown above.

```
expDist = NULL
expDist <-rexp(1000, lambda)
expMean <-round(mean(expDist), 3)
expSD <-round(sd(expDist), 3)
cbind(expMean, expSD)
```

```
##       expMean expSD
## [1,]   4.998 5.006
```

The mean is 4.998, close to the theoretical mean of 5, but the standard deviation is 5.006. The simulation produces an exponential distribution instead of the previous normal distribution, as shown in the histogram below.

```
hist(expDist)
abline(v=mean(expDist), lwd="3", col="red")
```

Histogram of expDist