Exponential distribution Simulation

This is the first part of the project for the Statistical inference course. The exponential distribution was simulated with the function rexp(n,lambda), using lambda = 0.2

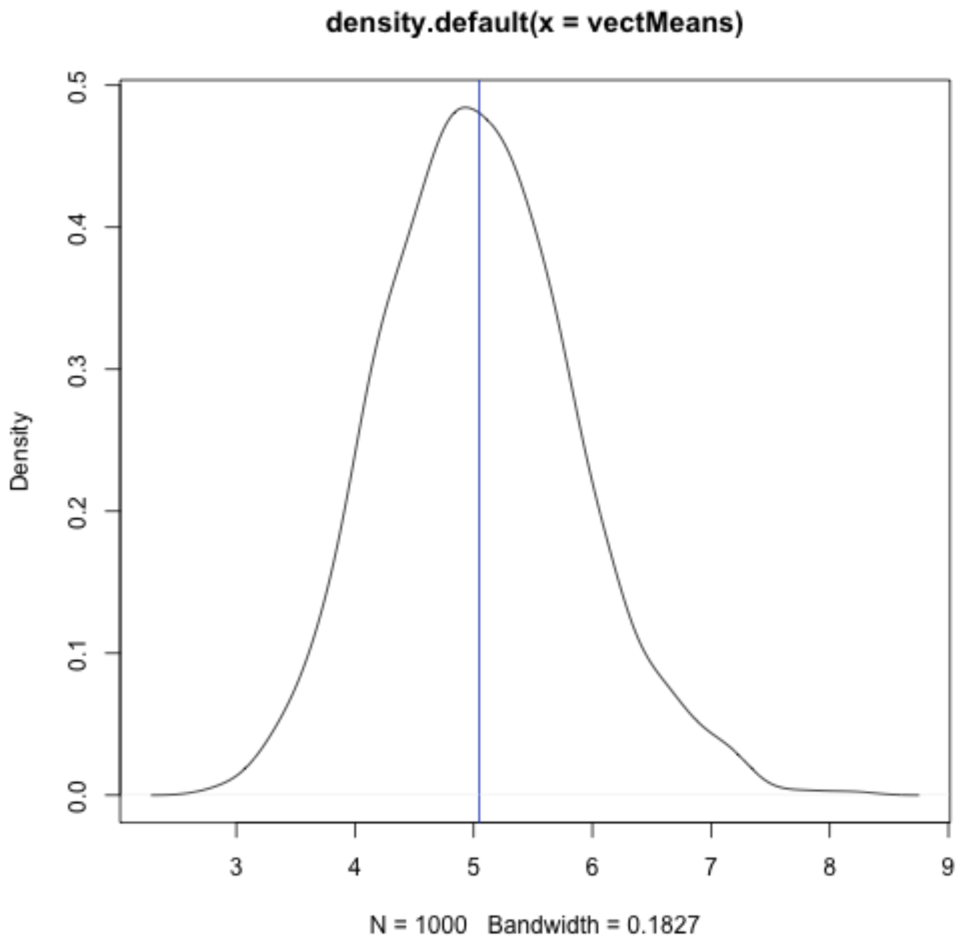
0. The simulation

First run thousand times the simulated data for n=40, lambda=0.2 and stored the mean of each sample in a vector

```
lambda = 0.2
n= 40
times = 1000

 vectMeans<- NULL
 vectVar<-NULL
 vectStDev<-NULL

samples <- replicate(times,rexp(n,lambda))

for (i in 1:times)
  {
     vectMeans <- c(vectMeans,mean(samples[,i]))
     vectVar <- c(vectVar,var(samples[,i]))
     vectStDev<-c(vectStDev, sd(samples[,i]))
  }
```

1. Where the distribution is centered at and compare it to the theoretical center of the distribution

```
theMean<-mean(vectMeans)
theDensity <- density(vectMeans)
plot(theDensity)
abline(v=theMean,col='blue')
```



The mean of the simulated data was 5.0489 , which is very close to the theoretical center of the distribution: 1/0.2=5

2. How variable it is and compare it to the theoretical variance of the distribution

The theoretical variance for the exponential distribution is 1/(lambda*lambda), in this case: 1/(0.2 * 0.2)=25

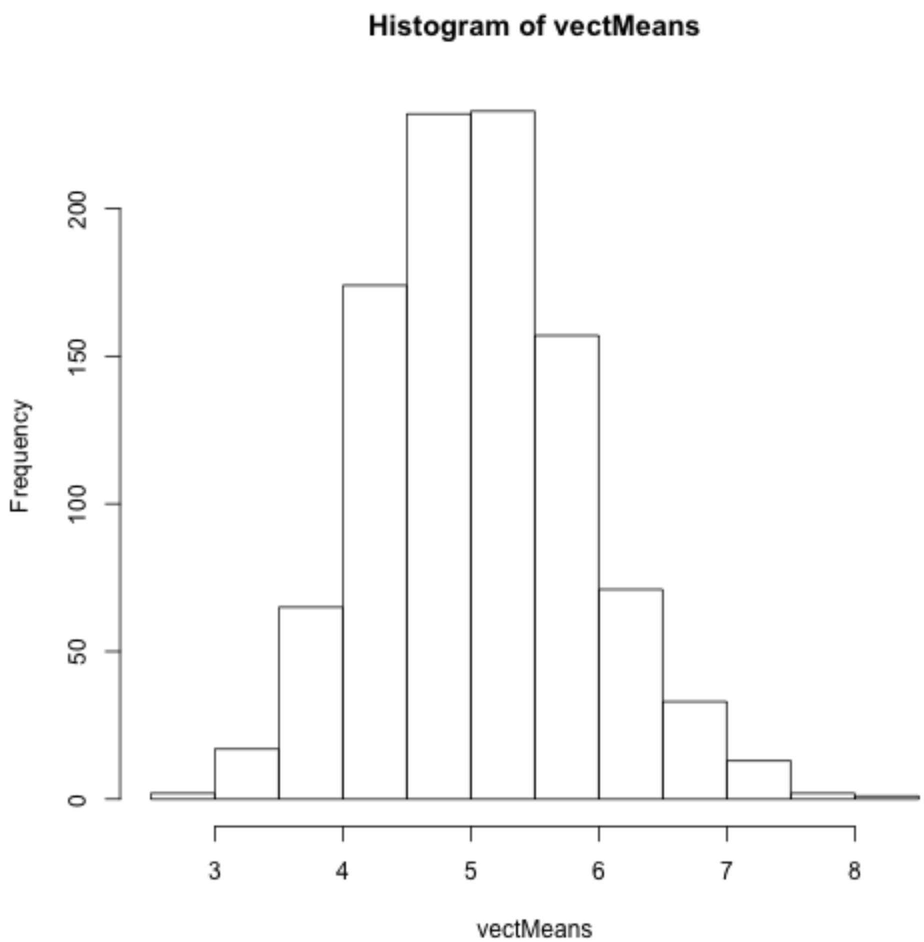
```
variance<- mean(vectVar)
```

The variance for the simulated data is 25.7314, again very close to the theoretical value.

3. Show that the distribution is approximaterly normal

The next graph is a qqplot that evaluates the fit of the sample data with a normal distribution. It uses the theoretical quantiles of the distribution

```
hist(vectMeans)
```



As seen in the histogram above, the data seems to follow a normal distribution.

4. Evaluate the coverage of the confidence interval

Calculates the confidence interval for each sample, then count how many times the population mean it is not in the intervals

```
   lower <- array(0,times)
   upper <- array(0,times)


   for (k in 1:times)
   {

        lower[k] <- vectMeans[k] - (1.96 *
vectStDev[k]/sqrt(n))
        upper[k] <- vectMeans[k] + (1.96 *
vectStDev[k]/sqrt(n))

     }

   noLower <- length(which(theMean < lower))
   noUpper <- length(which(upper < theMean))
   badCases <- (noLower+noUpper)/times
```

The coverage of the confidence interval is close to 95%, the population mean it is not in the interval in near 0.076 , that is near 5%