Simulation exercises

Requirements

1. Simulate the mean of 40 exponential(0.2)s.

2. Investigate the distribution of averages of 40 exponential(0.2)s.

3. Need to do a thousand or so simulated averages of 40 exponentials.

```
#go through the 1000 trials with 40 samples pooled in each trial.
#The mean of each 40 samples is saved in a data frame sample_mean.
#Here we got 1000 means.
n <- 40
nosim <- 1000
lambda <- .2
set.seed(1234)
sample_mean <- replicate(nosim, mean(rexp(n, rate = lambda)))
```

Questions

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

```
#got a mean of the sample mean.
sample_mean_mu <- mean(sample_mean)
#theoretical mean of the distribution
theo_mean = 1/lambda
```

the distribution is centered at 4.9742, the theoretical center of the distribution is 5

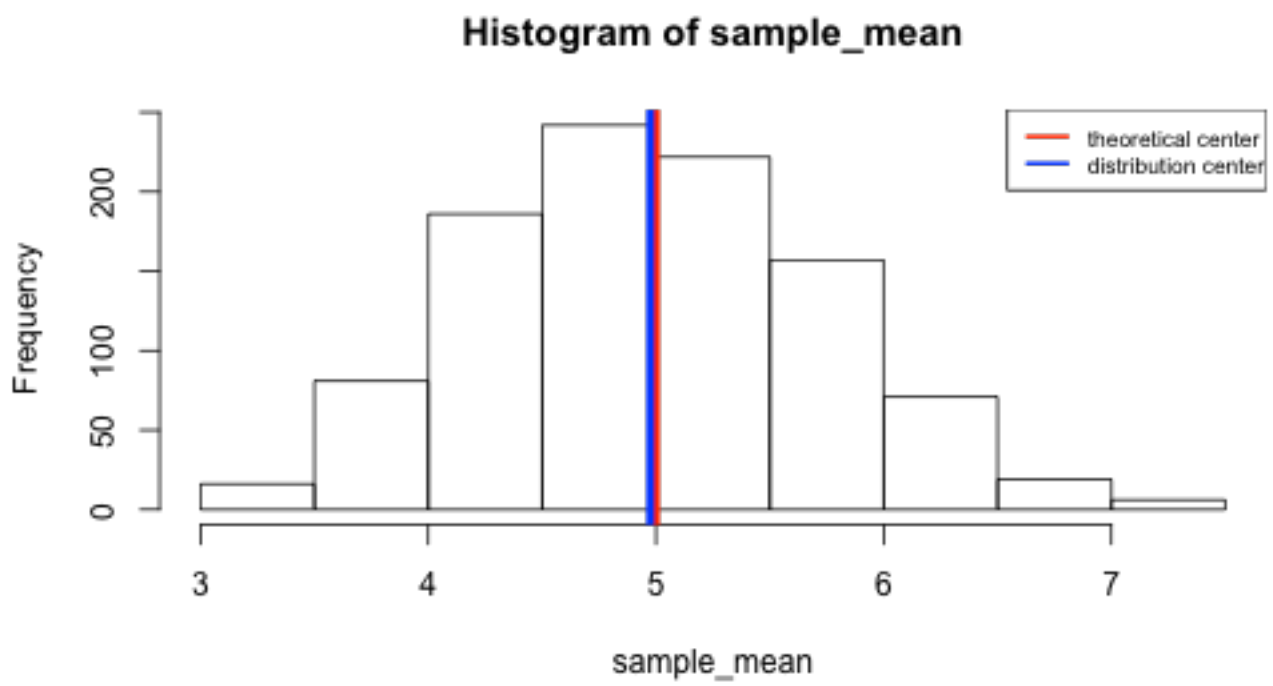
2.Show how variable it is and compare it to the theoretical variance of the distribution.

```
#got the standard deviation of the sample mean.
sample_sd <- sd(sample_mean)
sample_var <- (sample_sd)^2
#theoretical variance of the distribution
theo_mean = 1/lambda
theo_var<- (1/lambda)^2/n
```

the variance of the distribution is 0.5707, the theoretical variance of the distribution is 0.625

3. Show that the distribution is approximately normal.

```
#make a histogram of the frequency of sample_mean, which can show
the shape of the distribution
hist(sample_mean)
#add line to the histogram to show where the distribution is
centered at
#and compare it to the theoretical center of the distribution
abline(v=theo_mean, col = "red", lwd = 4)
abline(v=sample_mean_mu, col = "blue", lwd = 4)
legend("topright", lty = 1, lwd = 2, col = c("red", "blue"), legend
= c("theoretical center", "distribution center"), cex = .7)
```



we can see that the distribution is approximately normal from the histogram.

4.Evaluate the coverage of the confidence interval for 1/lambda

```
CI <- sample_mean_mu + c(-1,1) + 1.96*sample_var/sqrt(n)
```

the confidence interval for 1/lambda is 4.1511 to 6.1511