Exponential Distribution

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Synopsis

The exponential distribution can be simulated in R with rexp(n, lambda) where lambda is the rate parameter. The mean of exponential distribution is 1/lambda and the standard deviation is also also 1/lambda. Set lambda = 0.2 for all of the simulations. In this simulation, you will investigate the distribution of averages of 40 exponential(0.2)s. Note that you will need to do a thousand or so simulated averages of 40 exponentials.

Data Processing

```
## run rexp to get n values when rate is = lambda AND take the mean. Do that rep=1000 times and
 store the results in the vector means. reps = 1000, n = 40, lambda = .2
set.seed(4321)
means<-replicate(n=reps,mean(rexp(n=n, rate=lambda)))
```

Results

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

```
## [1] "The theoretical mean is 50 while the simulated mean is 50.05 This is a difference of -0
.1 percent"
```

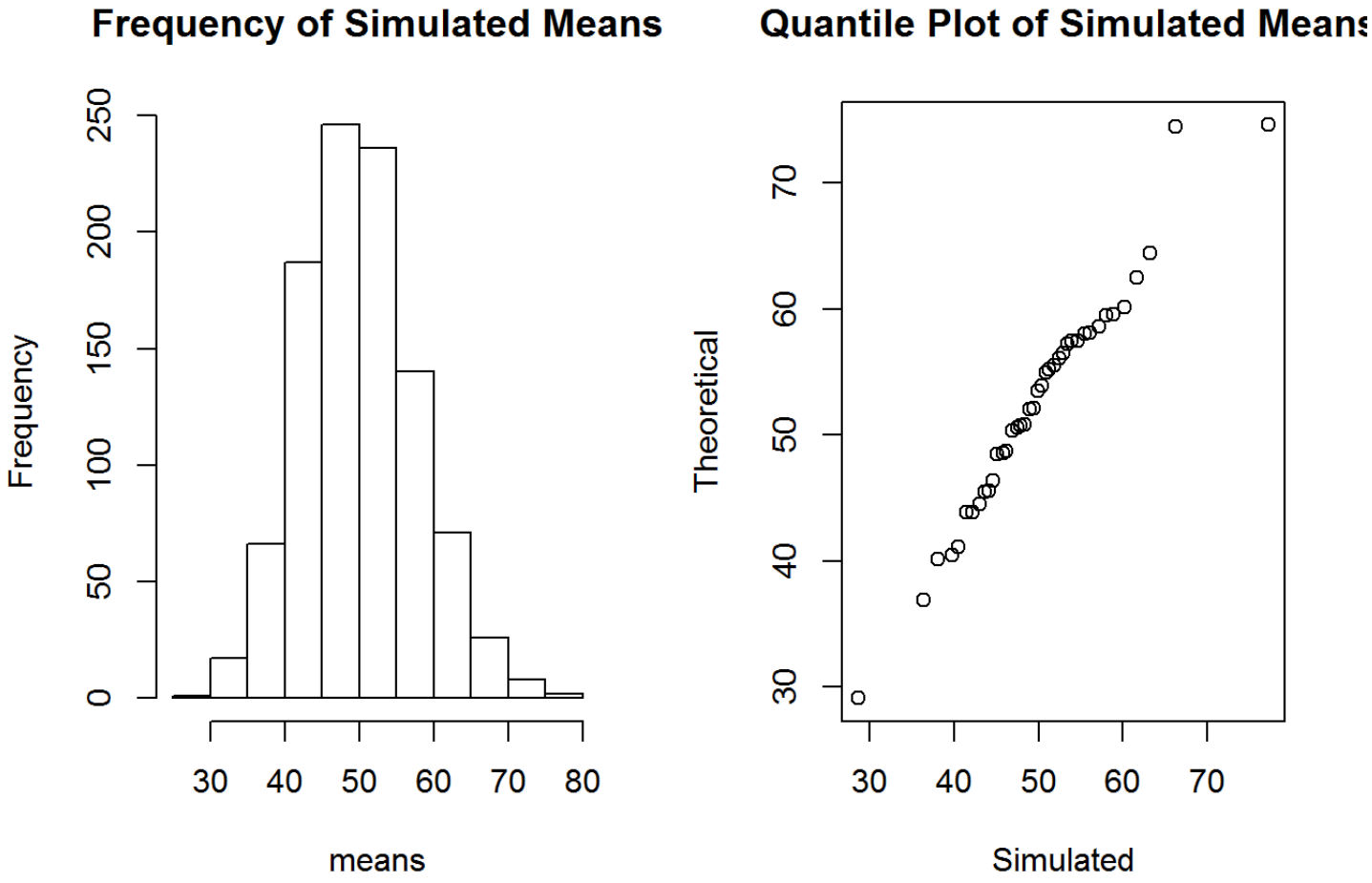
Show how variable it is and compare it to the theoretical variance of the distribution.

```
## [1] "The theoretical standard deviation is 7.91 while the simulated standard deviation is 7.
76 This is a difference of 1.9 percent"
```

Show that the distribution is approximately normal.

A visual examination of the histogram shows the distribution to be approximately normal. It is unimodal and centered around the mean. The qqplot renforces that the distribution is approximately normal, while showing it is not exactly normal. A better plot would be had by increasing sample size.

```
## Get the standard deviation of means
par(mfrow=c(1,2))
hist(means, main ="Frequency of Simulated Means")
qqplot(means, rnorm(n=n,mean=theoreticalMean, sd=theoreticalSD), main=" Quantile Plot of Simula
ted Means", ylab="Theoretical", xlab = "Simulated")
```



Evaluate the coverage of the confidence interval for 1/lambda: $\bar{X} \pm 1.96 Snv$.

```
## get the theoretical range of the 95% confidence interval
theoreticalRange<-theoreticalMean +c(-1,1)*1.96*theoreticalSD
##subset to get those in range and calculate percentage
CImeans<-subset(means, means[]>=theoreticalRange[1] & means[]<=theoreticalRange[2])
pctCI<-round(length(CImeans)/length(means),2)
paste("The simulated coverage was", pctCI, "percent", sep = " ")
```

```
## [1] "The simulated coverage was 0.95 percent"
```