Simulation Exercise for the Exponential Distribution

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Overview: I am going to report on a simulation exercise and inferential data analysis. The first part will examine how the exponential distribution behaves under simulation. The second part will analyze the ToothGrowth data in the R dataset package.

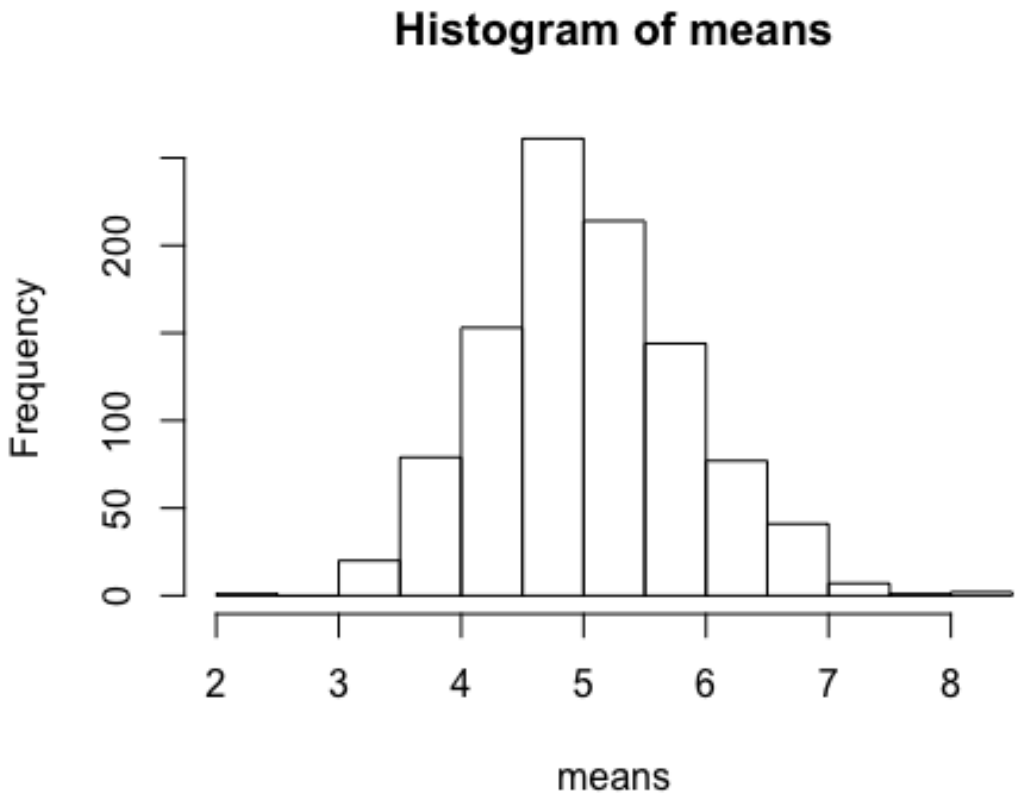
Part 1: Exponential distribution simulation

The following code will do 1000 simulations of random exponential distribution with lambda = 0.2 and 40 observations. It will then get the means and variances of those 1000 simulations.

```
set.seed(100)
sim <- 1000
means = NULL
vars = NULL
for (i in 1: sim){
        means <- c(means, mean(rexp(40,0.2)))
        vars <- c(vars, var(rexp(40,0.2)))
        }
```

The histogram of the simulation result is below:

```
hist(means)
```



Question 1: The mean of the simulated values:

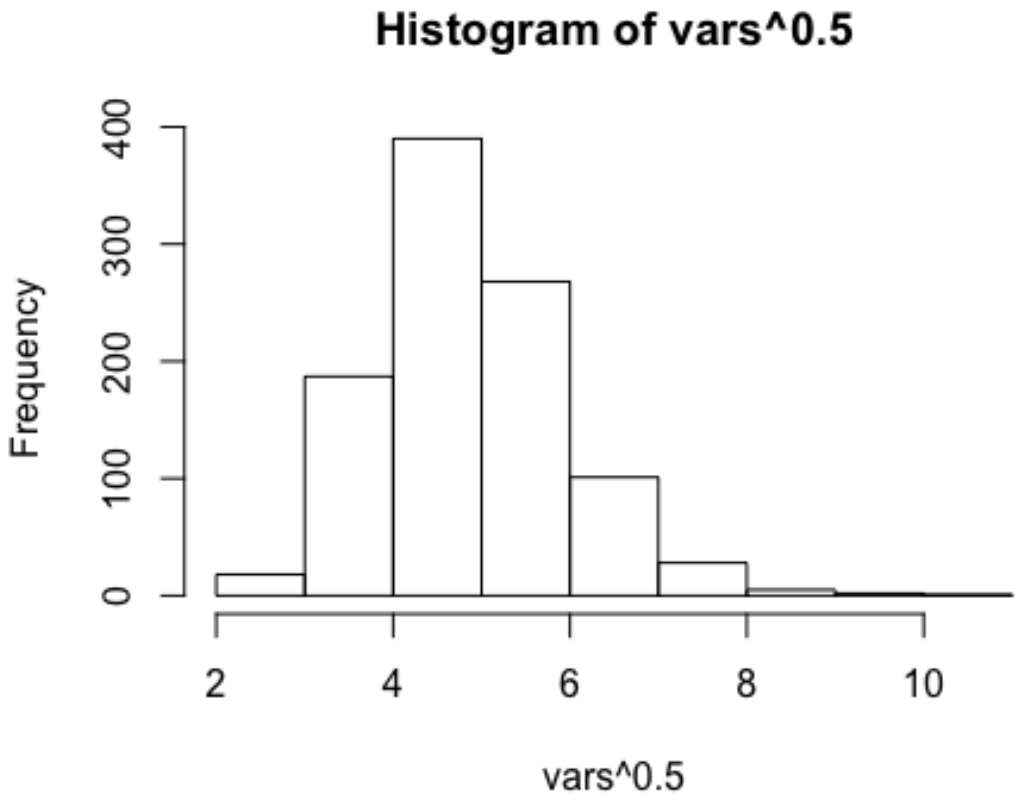
```
mean(means)
```

```
## [1] 5.03498
```

which compares quite well to the theoretical value of $1/0.2 = 5$.

Question 2: The standard deviation of the distribution:

```
hist(vars^0.5)
```




```
mean(vars^0.5)
```

```
## [1] 4.869785
```

Hence the variance of the simulation is about (1/0.2)^2 ~ 25; and the standard deviation ~5, which compares quite well to the theoretical value of 1/0.2 = 5.

Question 3: Normal distribution?

```
quantile(means)
```

```
##       0%      25%      50%      75%     100%
## 2.465068 4.489275 4.955715 5.558254 8.107675
```

```
quantile(rnorm(1000,mean=mean(means), sd=sd(means)))
```

```
##       0%      25%      50%      75%     100%
## 2.695655 4.520082 5.023524 5.610620 7.410693
```

It seems like the quantiles of the two distributions are quite comparable...