Statistical Inference Project Part 2

Contents

0.1 Synopsis

This is the project for the statistical inference class. In it, you will use simulation to explore inference. This is the first part of the project which is a simulation exercise.

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, I will investigate the distribution of averages of 40 exponential(0.2)s. Note that I will do a thousand simulated averages of 40 exponentials to illustrate via simulation and associated explanatory text the properties of the distribution of the mean of 40 exponential(0.2)s.

0.2 Simulation

```
# setting lamda the rate
lambda = 0.2

# number of samples
nSamples = 40

# number of simulations
nSimulations = 2000

# simulating
expoMeans = NULL
for( i in 1:nSimulations) expoMeans = c(expoMeans, mean(rexp(40, rate = lambda)))
```

0.3 Questions

0.3.1 Q1-Comparing the simulation distribution center to the theoretical center of the distribution.

```
expoDistributionMean = mean(expoMeans)
```

The simulation distribution mean is **5.0054589** which is pretty close to the theoritical distribution mean which is **5**

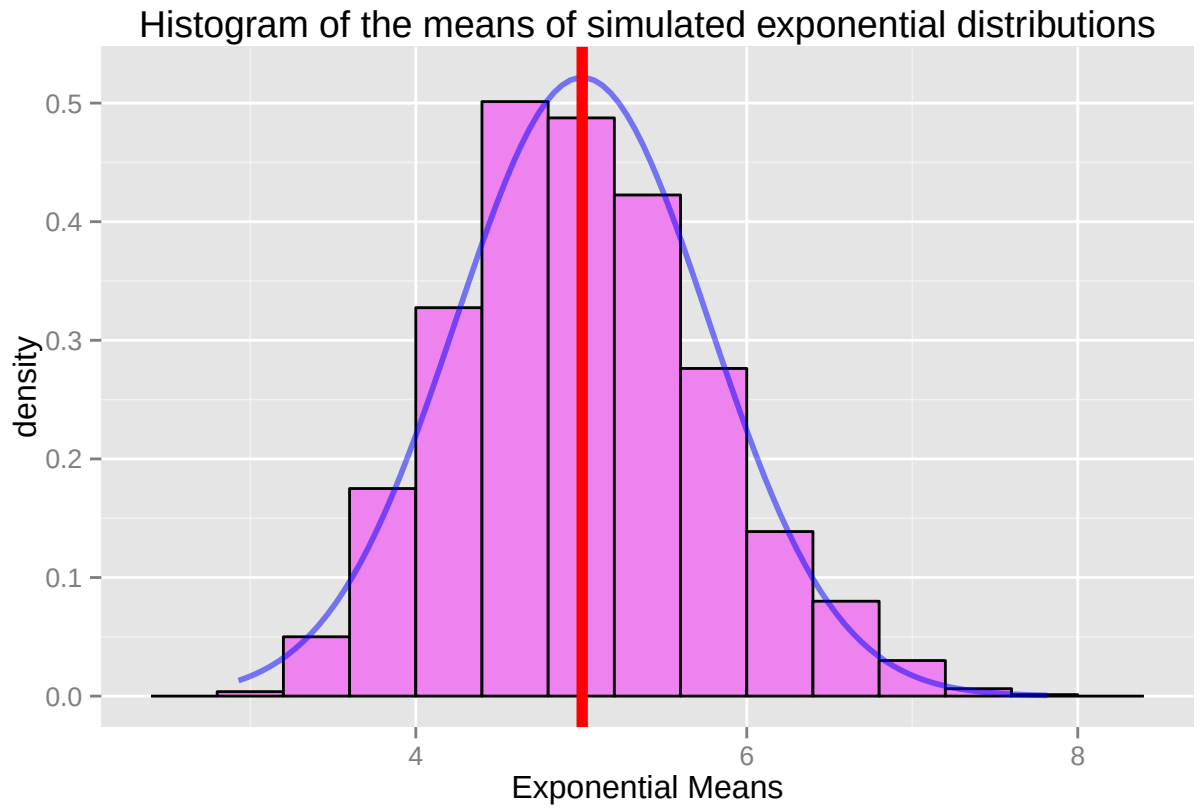
0.3.2 Q2-Comparing the simulation distribution variance to the theoretical variance of the distribution.

```
expoDistributionSD = sd(expoMeans)
```

The simulation distribution standard deviation is **0.7648535** which is pretty close to the theoritical distribution standard deviation which is **0.7905694**

0.3.3 Q3-Showing that the simulation distribution is approximately normal.

```
library(ggplot2)
expoMeansDataframe = data.frame(expoMeans)
ggplot(expoMeansDataframe, aes(x= expoMeansDataframe$expoMeans)) +
geom_histogram(aes(y=..density..), colour="black", fill="violet",  binwidth = 2 * lambda) +
stat_function(fun = dnorm, colour = "blue", alpha =0.5, size = 1,  fill = "yellow",
      args = list(mean = expoDistributionMean, sd = expoDistributionSD)) +
geom_vline(xintercept = expoDistributionMean,colour="red",size=2) +
xlab("Exponential Means") +
ggtitle("Histogram of the means of simulated exponential distributions")
```



It is obvious that the simulated distribution of exponentials (pink bins) can be approximiated as a normal distribution (blue curve).