Statistical Inference Course Project Part 1

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Overview

In this project we will investigate the exponential distribution in R and compare it with the Central Limit Theorem.

Simulations

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 1/lambda. Set lambda = 0.2 for all of the simulations. We will investigate the distribution of averages of 40 exponentials. We will perform simulation for 1000 times.

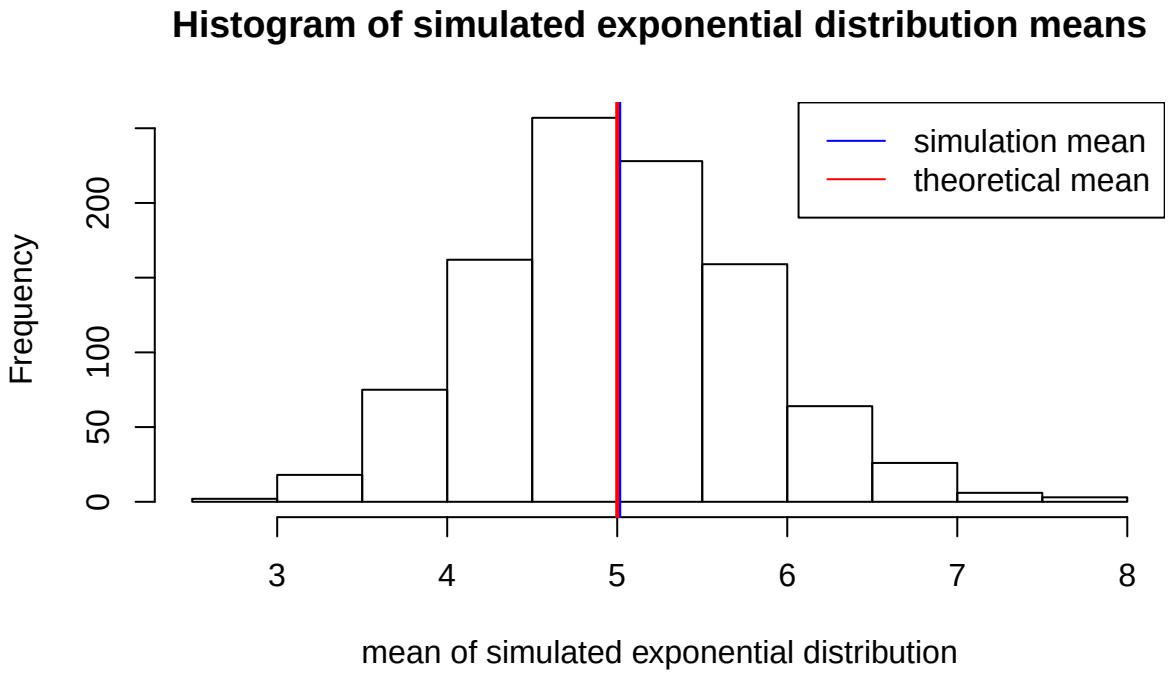
```
set.seed(123)
n_exp = 40 # set the number of random number of exponential distribution
n_sim = 1000 # set the number of simulation
lambda = 0.2 # set the lambda in exponential distribution

sim_means = NULL
for (i in 1: n_sim) {
        sim_means = c(sim_means, mean(rexp(n_exp, lambda)))
}
```

Sample Mean versus Theoretical Mean

According to Central Limit Theorem, the expectation of the mean of simulated exponential distribution is 1/lambda.

```
sample_mean = mean(sim_means)
theoretical_mean = 1/lambda
means_comp = c(sample_mean, theoretical_mean)
names(means_comp) = c("sample mean", "theoretical mean")
print (means_comp)
```

```
##      sample mean theoretical mean
##         5.011911         5.000000
```



From the above figure, we can see that the sample mean is pretty similar with the theoretical mean.

Sample Variance versus Theoretical Variance

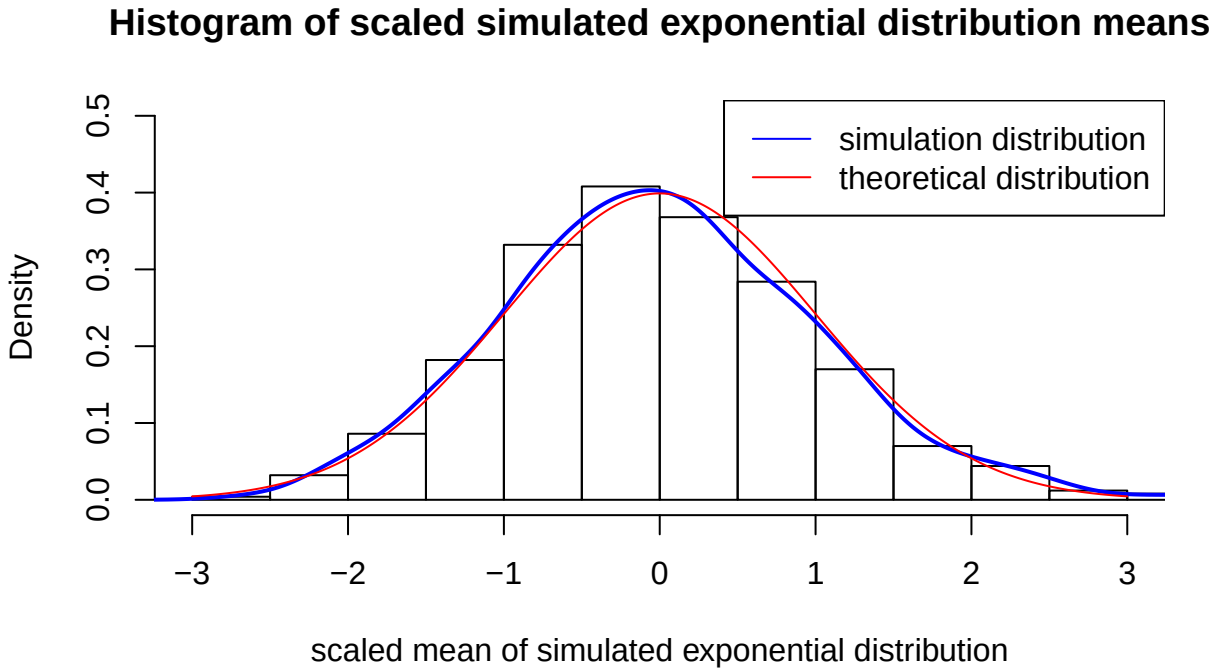
According to Central Limit Theorem, the variation of the mean of simulated exponential distribution is (1/lambda ^2)/n

```
sample_var = var(sim_means)
theoretical_var = (1/lambda ^ 2) / n_exp
var_comp = c(sample_var, theoretical_var)
names(var_comp) = c("sample variance", "theoretical variance")
print (var_comp)
```

```
##      sample variance theoretical variance
##            0.6004928            0.6250000
```

Distribution

According to Cental Limit Theorem, if we scale the simulated means, the distribution would approximate a standard normal distribution.



From the above figure, we can see that the scaled simulation distribution is pretty similar to the theoretical distribution.