Comparison of the exponential distribution with the Central Limit Theorem

Mao Soldevilla

Overview

In this project We are investigating the exponential distribution and compare it with the Central Limit Theorem. The mean of exponential distribution is 1/lambda and the standard deviation is also 1/lambda. lambda was set in 0.2 for all of the simulations. The distribution of averages of 40 exponentials with thousand simulations.

Simulations

Sample Theoretical

We can get the mean and variance from the sample theoretical exponential distribution.

```
exp <- rexp(1000, .2)
summary(exp)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.0028  1.5727  3.5135  5.1119  7.2716 35.1612
```

```
var(exp)
```

```
## [1] 24.55588
```

Theoretically the mean and the standard deviation of any exponential distribution is 1/lambda: 5. Then the mean of our sample distribution is 5.1119168 and the standard deviation is 4.9553891 that are close to 5 in one simulation.

But if we run a fourteen simulations we can check how the mean and the standard deviation are converging

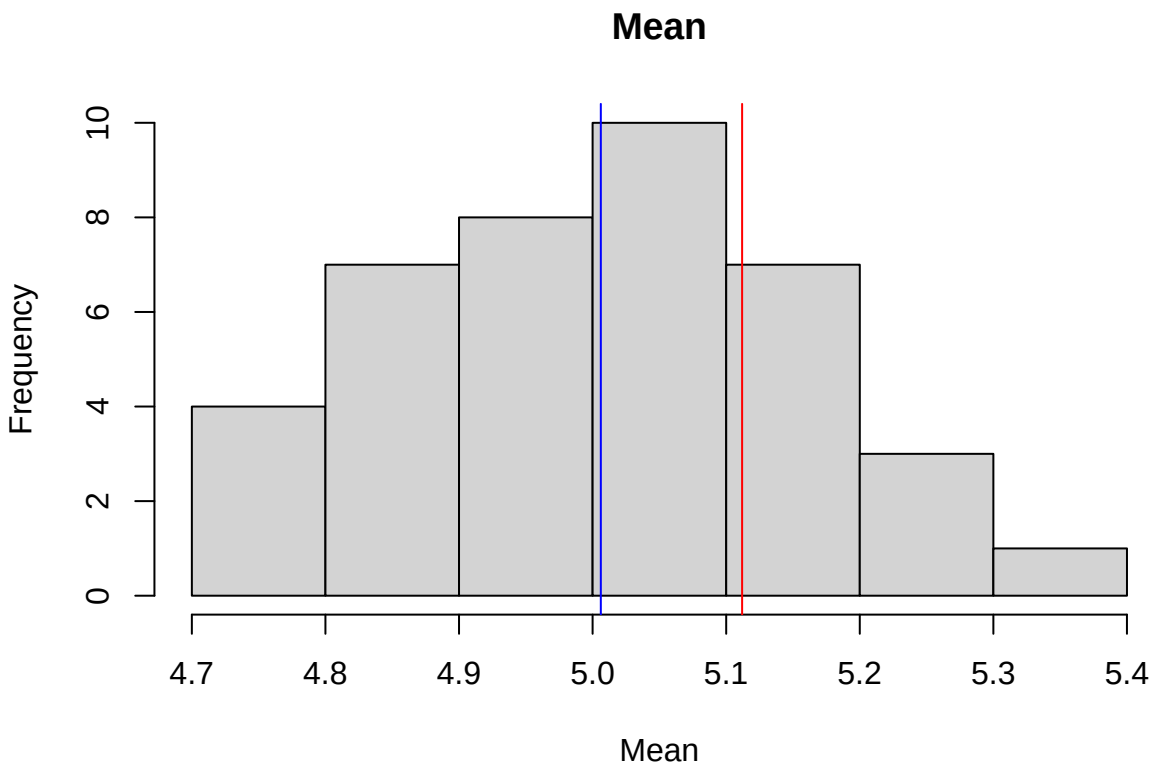
comparisons

Whit this chunk of code we can get the vectors of means and variances of 40 simulation in order to compare with the sample.

```
mns = NULL
variance = NULL
for (i in 1 : 40){
        s <- rexp(1000, .2)
        mns = c(mns, mean(s))
        variance = c(variance, var(s))
}
```

First we can check the mean versus the sample.

```
hist(mns, main = "Mean", xlab = "Mean")
abline(v = mean(exp), col = "red")
abline(v = mean(mns), col = "blue")
```

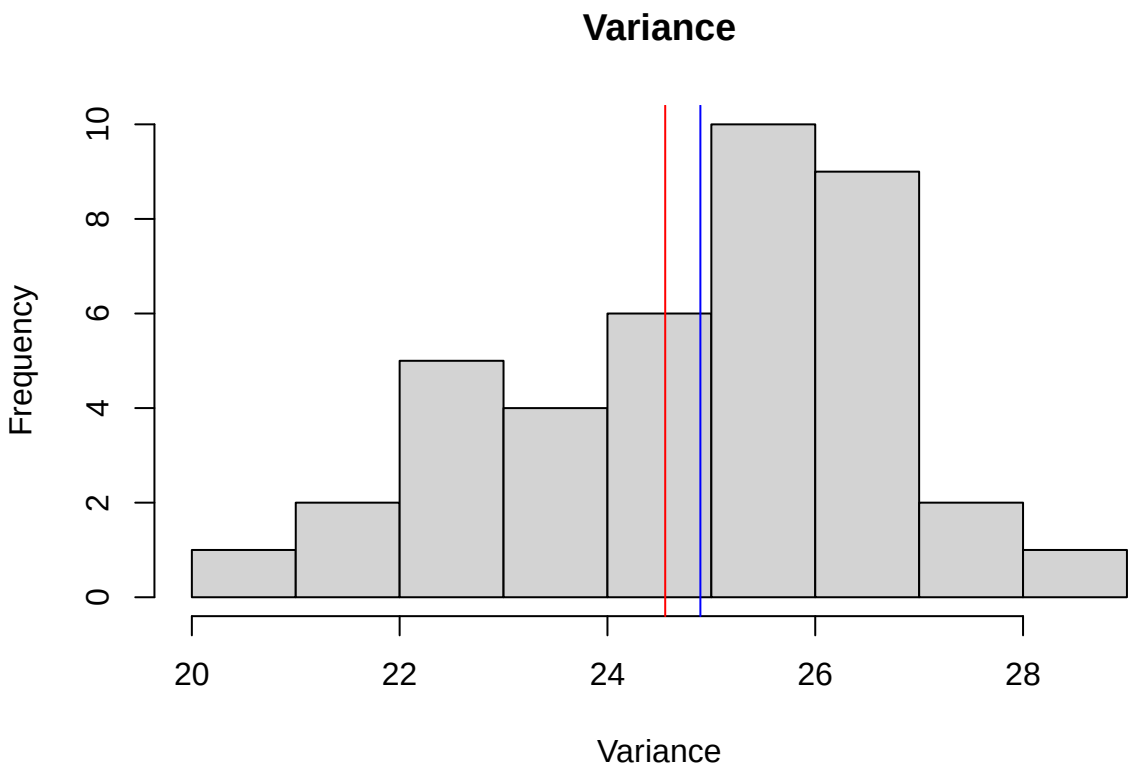


As we can see the red line is the mean of the theoretical sample and the blue one is the mean from the 40 simulations.

- According to our simulation we can conclude that the mean is converging to 5 being 5.1119168, and have approximately normal distribution.

Second we can check the variance versus the sample.

```
hist(variance, main = "Variance", xlab = "Variance")
abline(v = var(exp), col = "red")
abline(v = mean(variance), col = "blue")
```



As we can see the red line is the variance of the theoretical sample and the blue one is the mean from the 40 simulations.

- According to our simulation we can conclude that the variance is converging to 25 being the variance of all simulations 24.8944681 for then 4.9894356 the standard deviation close to theoretical, and have approximately normal distribution.