Statistical Inference Course Project - Part 1

Luis Fernando Agottani

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The first part of this project has the intention to study how the Central Limit Theorem works with means from simulations with exponential distribution.

Part 1 - A simulation exercise.

The goal of the first step is input the mean of each 1000 simulations with 40 exponentials, where lambda=0.2, rexp(n,lambda) and compare with de mean of the exponencial distribution, which is 1/lambda.

```
n=40
simulations=1000
lambda=0.2

mns = NULL
for (i in 1 : 1000) mns = c(mns,
                            mean(rexp(n,lambda)))
```

1. Show the sample mean and compare it to the theoretical mean of the distribution.

```
Theoricalmean<- 1/lambda

Theoricalmean
```

```
## [1] 5
```

```
Samplemean<- mean(mns)

Samplemean
```

```
## [1] 4.983745
```

2. Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution.

```
Theoricalvariance<- (1/lambda/sqrt(40))^2

Theoricalvariance
```

```
## [1] 0.625
```

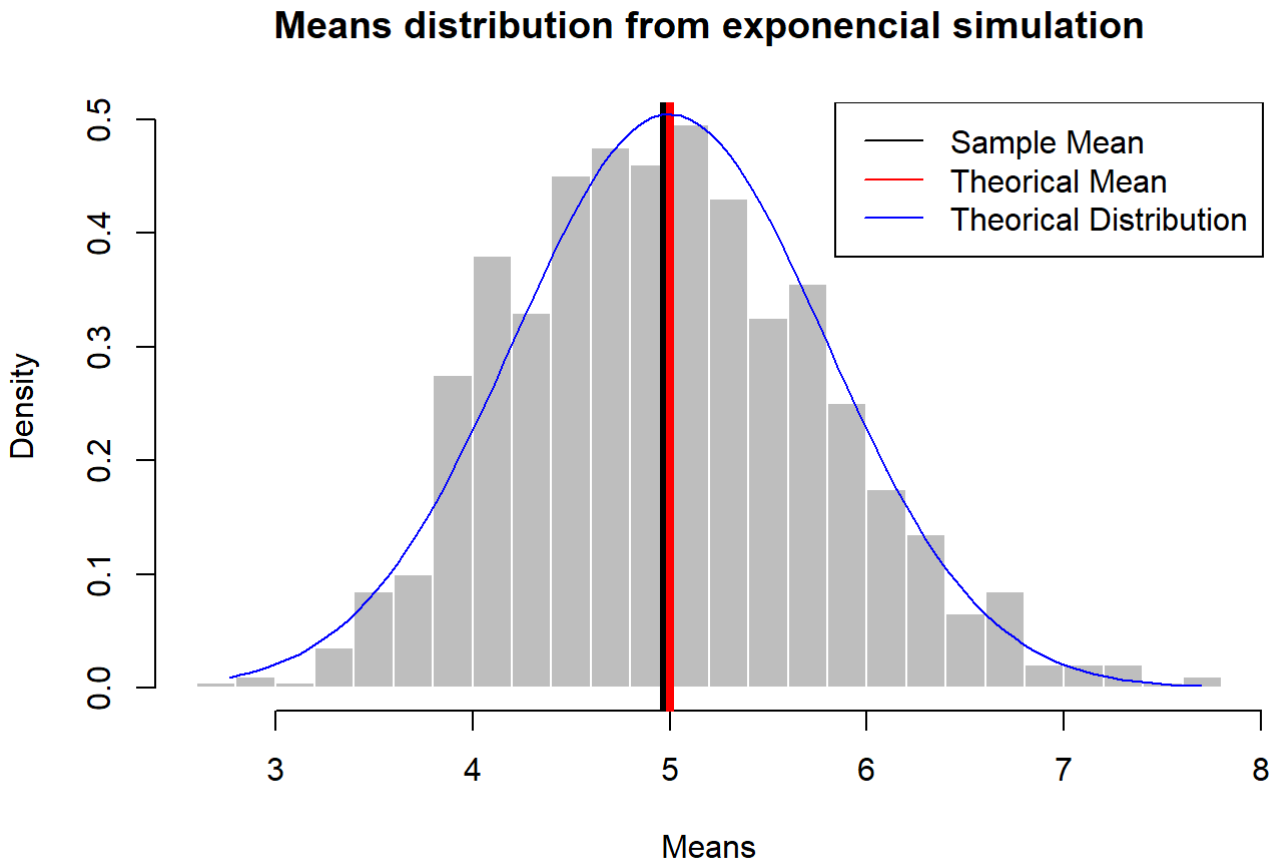
```
Samplevariance<- var(mns)

Samplevariance
```

```
## [1] 0.6416964
```

As we can see, the sample mean and variance are very similar to the therorical.

3. Show that the distribution is approximately normal.

```
hist(mns,
     breaks= 25,
     prob = TRUE,
     col="grey",
     border="white",
     xlab="Means",
     main="Means distribution from exponencial simulation")

abline(v=mean(mns),
       col="black",
       lwd=6)

abline(v=5,
       col="red",
       lwd=4)

legend(x="topright",
      c("Sample Mean","Theorical Mean", "Theorical Distribution"),
      col=c("black","red", "blue"),
      lty=c(1,1))

x <- seq(min(mns), max(mns), length = 100)

lines(x, dnorm(x, mean = 1/lambda, sd = (1/lambda/sqrt(n))), pch = 25, col = "blue")
```



So, the blue line represents the theorical distribuition, which is similar to the sample mean.