Simulation Exercise

Ismail HASSAN DJILAL

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Peer-graded Assignment: Statistical Inference Course Project

Part 1: Simulation Exercise Instructions

In this project you will investigate the exponential distribution in R and compare it with the Central Limit Theorem. 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 with a thousand simulations.

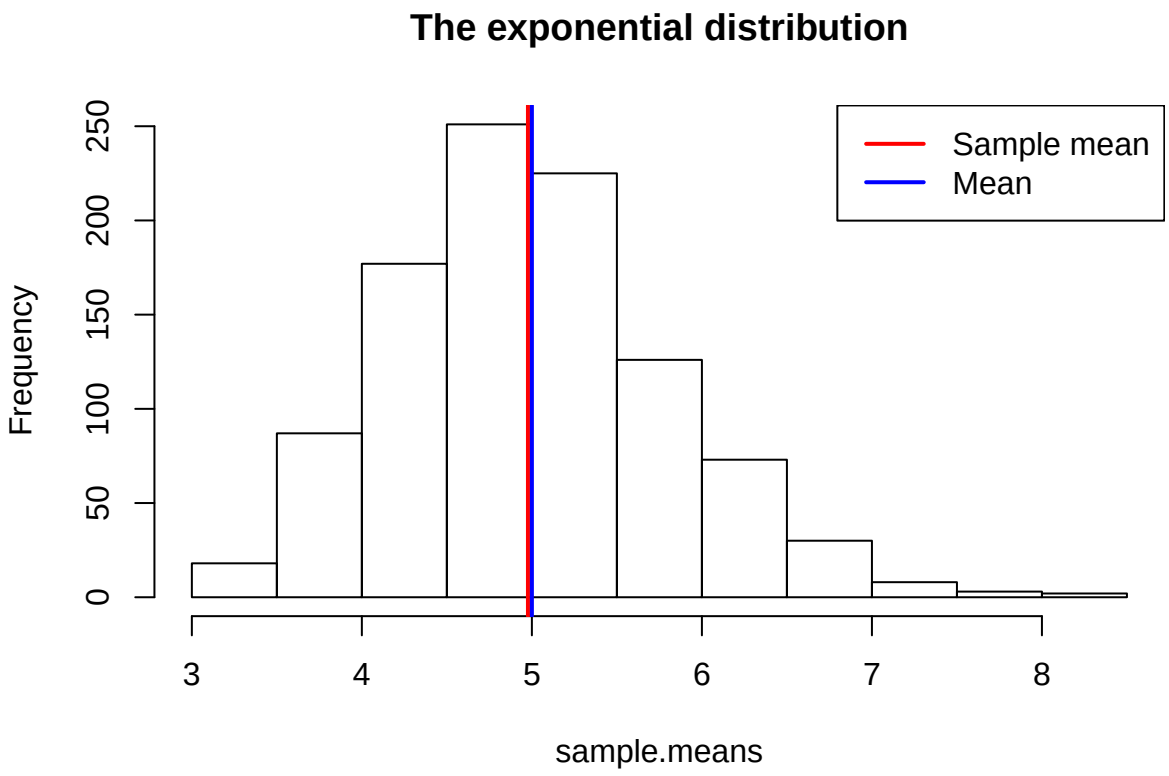
Illustrate via simulation and associated explanatory text the properties of the distribution of the mean of 40 exponentials. You should

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

Show that the distribution is approximately normal. In point 3, focus on the difference between the distribution of a large collection of random exponentials and the distribution of a large collection of averages of 40 exponentials.

```
set.seed(47)
lambda=0.2
n<-40
simulations<-1000

sim<-rexp(n*simulations, lambda)
m<-matrix(sim,simulations)
sample.means<-rowMeans(m)
sm.avg<-mean(sample.means)
mean<-1/lambda
sm.var<-var(sample.means)
sm.var.clt<-1/(lambda^2*n)
hist(sample.means,main="The exponential distribution")
abline(v = sm.avg, col="red", lwd=2)
abline(v= mean, col="blue",lwd=2)
legend(x = "topright",c("Sample mean", "Mean"),
col = c("red", "blue", "red"),lwd = c(2, 2, 2))
```



1.

```
## [1] "the sample mean : 4.97693807483859"
```

```
## [1] "the theoretical mean of the distribution :5"
```

We can see that two means are equivalent

2.

```
## [1] "the variance of sample distribution :0.659157023362141"
```

```
## [1] "the theoretical variance of the distribution : 0.625"
```

We note that the two variances are roughly equivalent.

3.

The distribution is normal for two reasons

1.The histogram is centered at the population mean (1/lamda=sample.mean=mean) 2.The 95th of exponential distribution is mu+1.65*sigma (5+5*1.65) is 13.225 and qnorm(.95,mean=5, sd=5) =13.22427 are equivalent.