Statistical inference project

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Introduction

In this project , we will use simulation to explore inference and do some simple inferential data analysis. In the first part of the project we will use simuation to estimate some theoritcal values.

Part One : Estimations

Here are the definition of the globals variables of the simulations

```
## The rate of exponential distribution for all the document
lambda = .2
## The numbers of simulation
nSim = 1000 # Numbers of sample to be generated
ls = 40 # Length of sample
```

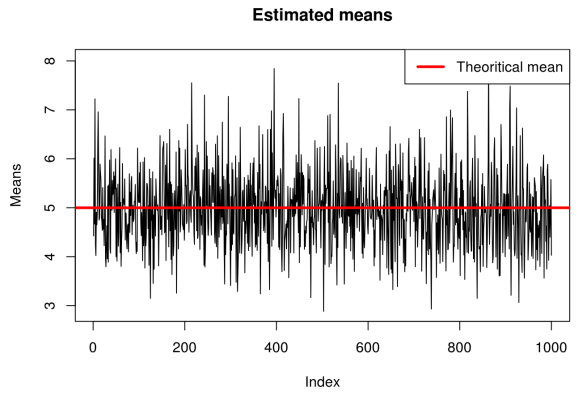
1 - Estimation of the mean

To show that the estimation of the mean fit to theoritical mean, let generate 40 thousands of exponentials and split it thousand group of 40 sample of exponentials and then we measure the mean of each sample.

```
## Fix the generated values for this simulation
set.seed(9767)
## Generationof exponentials
exps = rexp(nSim * ls, lambda)
## Split it into 40-samples
dim(exps) <- c(ls, nSim)
## Calculation of the mean of each sample
mhats = colMeans(exps)
```

The estimated means generate a trail follwong the theoritical mean as showed is following figure.

```
plot(mhats, type = "l", ylab = 'Means', main = 'Estimated means')
abline(h = 1/lambda, col = 'red', lwd = 3)
legend('topright', c('Theoritical mean'), lty = c(1), lwd =c(3), col = c('red')
)
```

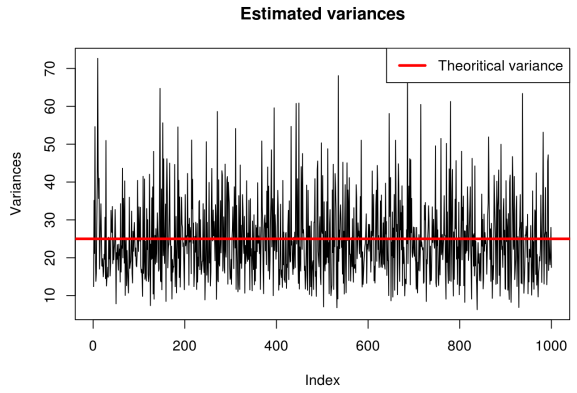


The ratio of errors by estimated values is 2.39 percents.

2 - Estimation of the variance

As we did for the mean, we will do the same operations for the variance. The only difference is that this time we calculate the variance instead of the mean. And then we plot directly the result.

```
# Estimated variances of each sample
vhats <- apply(exps, 2, sd) ^ 2
plot(vhats, type = "l", ylab = 'Variances', main = 'Estimated variances')
abline(h = 1/lambda^2, col = 'red', lwd = 3)
legend('topright', c('Theoritical variance'), lty = c(1), lwd =c(3), col = c('r
ed'))
```

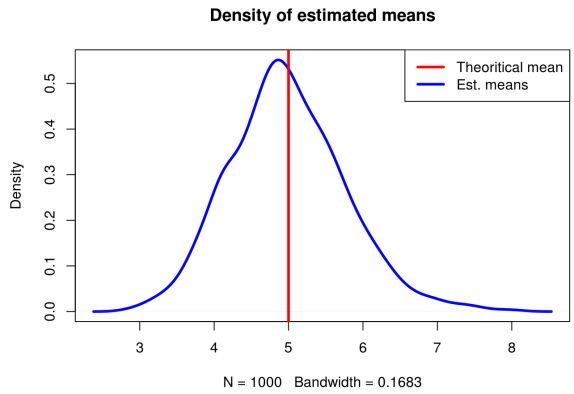


The ratio of errors by estimated values is 15.44 percents.

3 - How far are thes distributions normal ?

Let’s draw the density of estimated means and the vertical bar of theoritical mean. * Means

```
plot(density(mhats), type = "l", lwd ="3", col = "blue", main = 'Density of est
imated means')
abline(v = 1/lambda, col = 'red', lwd = 3)
legend('topright', c('Theoritical mean', 'Est. means'), lty = c(1,1), lwd =c(3,
3), col = c('red', 'blue'))
```



This figure show how close is the distribution of estimated to a normal distribution with the mean 5.