Exponential Distribution Vs Central Limit Theorem

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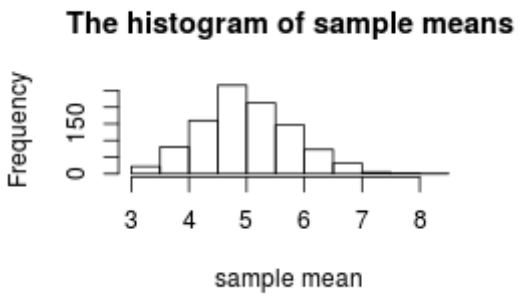
OVERVIEW

The objectif of the report is to study and to prove via simulations the central limit theorem applied on the exponential distribution. The central distribution theorem states that the mean of a sufficiently large number of iterates of independent random variables , will be approximately normally distributed, regardless of the underlying distribution.

The distribution of sample means

Firstly , we will generate 1000 simulation of samples. Each sample contains 40 values generated via the exponential distribution with Lambda = 0,2. Then will we compute the mean of each sample and plot the result in a histogram.




```
>for (i in 1 : 1000) mns = c(mns, mean(rexp(n, lambda)))
>averageOfMeans<-mean(mns)
>png("DataExported/project/file2.png",height = 180,width = 260)
>hist(mns,xlab="sample mean",main= "The histogram of sample means")
>dev.off()
```

Sample Mean Vs Distribution Mean

Using R, the sample Mean is :

```
> averageOfMeans<-mean(mns)
> print(averageOfMeans)
> 4.999702
```

The theorical mean of exponential distribution is : 1/ lambda → 5

We can conclude that sample mean ~ Mean of the underlying exponential distribution as it's stated by the central limit theorem.

The variance of the Sample mean distribution

The variance of the sample means distribution can be computed using the R Command :

```
>print("standard deviations")
> sdMns<-sd(mns)
> print(sdMns)
>0.8020251
```

if we compute the quantity stated as variance by the central limit theorem :

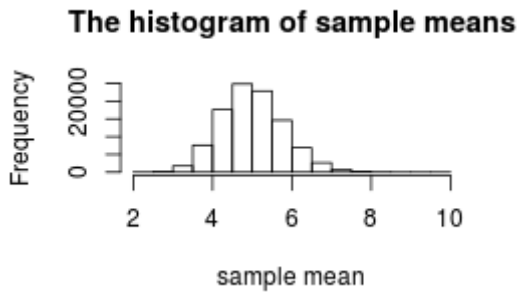
```
> print((1/lambda)/sqrt(n))
> 0.7905694
```

Again , the results confirm the central limit theorem stated by the central limit theorem.

Distribution

the figure of our histogram shows that the sample distribution follows nearly a normal distribution.

Let's see what happens if we compute 100 ,000 samples.



Clearly, the histogram tends to confirmsthe convergence to a normal distribution as states the central limit theorem.

Annex

All results above can be generated using : set.seed(100).