Coursera Johns Hopkins -- Statistical Inference Project Report

Part 1 : investigate the exponential distribution

The goal of this section is to explore the **exponential distribution** and see how it applies to the **Central Limit Theorem**.

In R, the exponential distribution can be simulated in R with rexp(n, lambda) where lambda is the rate parameter. The mean and the standard of a such distribution have the same value : 1/lambda. `?rexp` for full details.

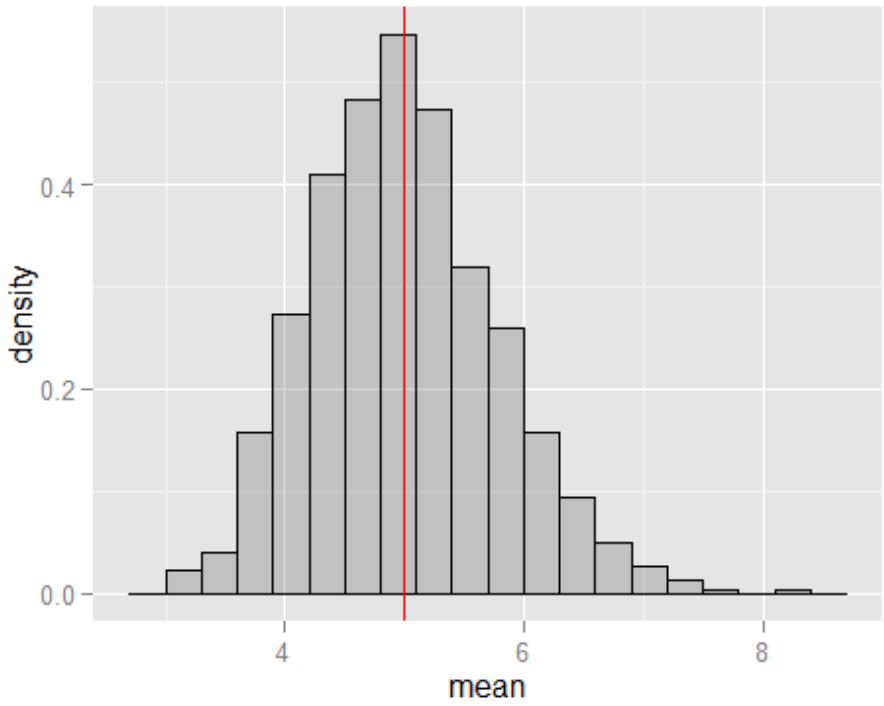
Simulation

To complete the simulation, we'll set : n = 40, lambda = 0.2, nsim : 1000.

The resulting distribution consists of 1000 observations, each of which is the mean of 40 random exponentials `rexp(40,0.2)`

```
lambda = 0.2
n = 40
nsims = 1:1000
set.seed(234)
obs <- data.frame(mean = sapply(nsims, function(x) {mean(rexp(n, lambda))}))
```

Below the plot of the distribution' density. The x-intercept of the red vertical line is the distribution mean.



Sample mean vs Theoretical mean

The distribution of averages of 40 exponentials has a mean almost equal to the **theorical mean 1/lamda=5**

```
round(mean(obs$mean),3)
```

```
## [1] 5.002
```

Sample variance vs Theoretical variance

The two variance are very close as highlighted below

Variance of the sample distribution is

```
round(var(obs$mean),3)
```

```
## [1] 0.606
```

Theoretical variance of averages of 40 exponentials is

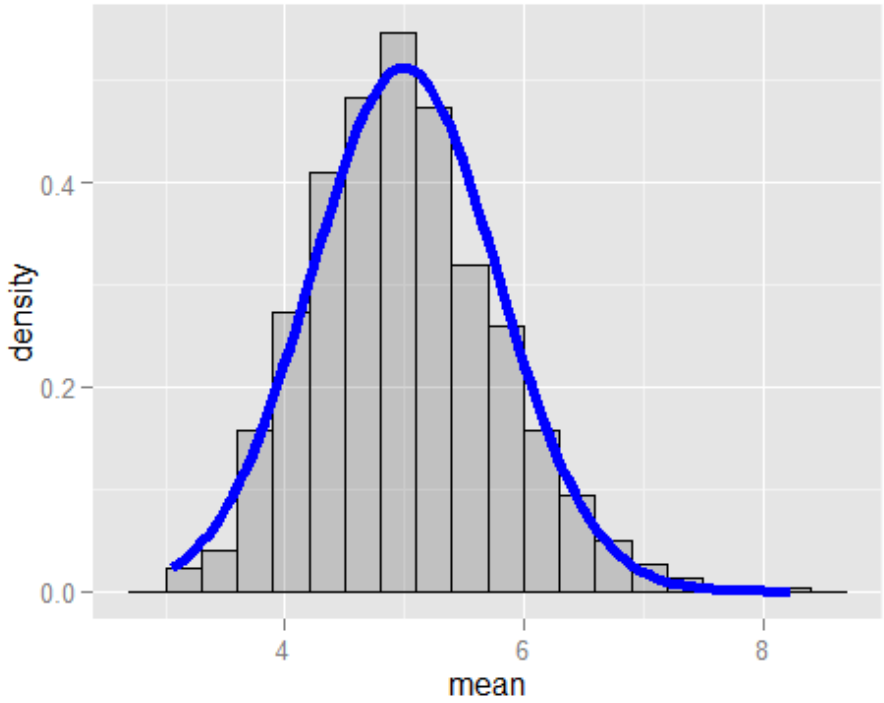
```
(1/lambda)^2 / n
```

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

Comparaison to a normal distribution

Here we'll compare the exponentials' means distribution to a normal distribution with same stats

```
suppressWarnings(library(ggplot2))
g <- ggplot(obs, aes(x = mean))
g <- g + geom_histogram(alpha = .20, binwidth=.3, colour = "black", aes(y = .
.density..))
g <- g + stat_function(fun = dnorm,
                       arg = list(mean = round(mean(obs$mean)), sd = sd(obs$m
ean)),
                       colour="blue",
                       size=2
                      )
g
```



Yes, the exponentials' means distribution appears normal according to the plot above