Statistical Inference Assesment Part 1

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The goal of the analysis is to demonstrate the Central Limit Theorem using the exponential distribution. The distribution can be simulated in R with rexp(n, lambda). In our case, lambda = 0.2 and n=40. To better illustrate the concept we'll run 1000 simulations to generate datasets. While simulating, let's calculate the mean and variance.

```
set.seed(1)
lambda<-0.2
n=40
n.simulations <- 1000
exp.data = NULL
exp.means <- NULL
for(i in 1:n.simulations) {
    tmp <- rexp(n,lambda)
    exp.means <- c(exp.means, mean(tmp))
    exp.data <- cbind(exp.data, rexp(n,lambda))
}
```

While the theoretical value of the the mean equals 1/lambda, the mean of our simulated example stands pretty close

```
#Mean
matrix(nrow = 2, data=c("Theoretical",1/lambda,"Simulated",round(mean(exp.means),3)))
```

```
##      [,1]          [,2]
## [1,] "Theoretical" "Simulated"
## [2,] "5"           "4.997"
```

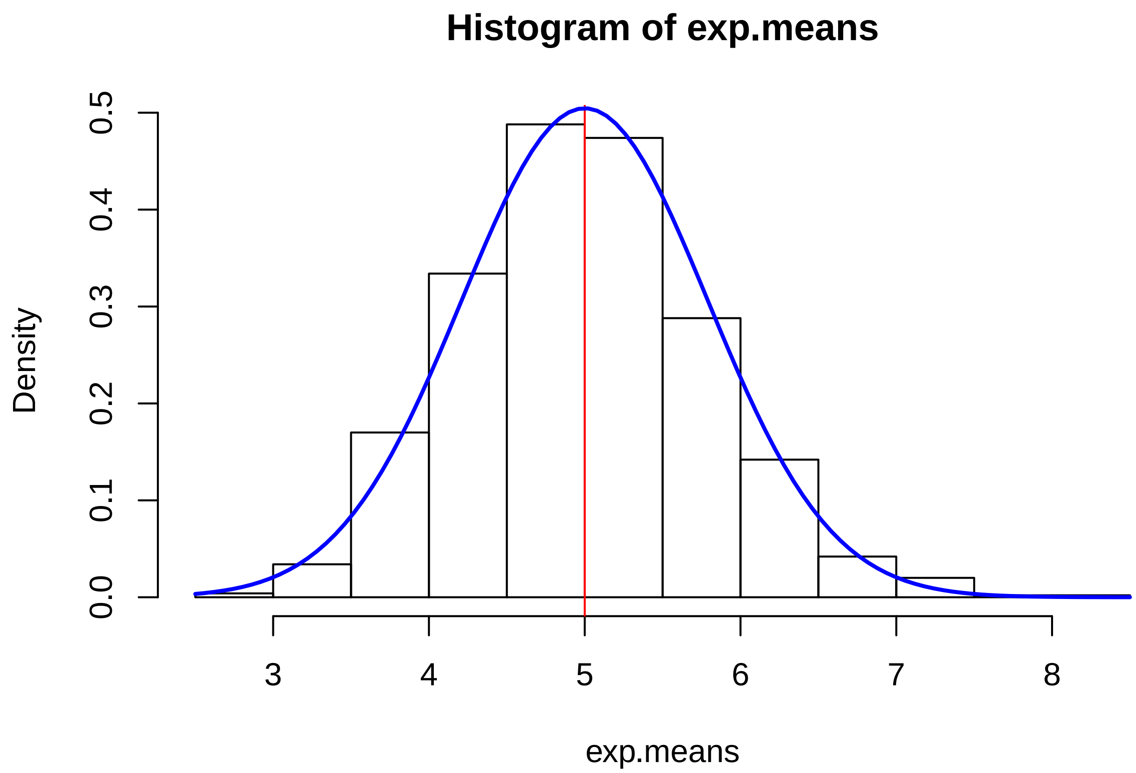
The theoretical value of the standard deviation of the exponential distribution is also 1/lambda. The variance of the sample mean equals (1/lambda)^2/n.

```
#Variance
matrix(nrow = 2, data=c("Theoretical",round((1/lambda)^2/n,3),"Simulated",round(var(exp.means),3)))
```

```
##      [,1]          [,2]
## [1,] "Theoretical" "Simulated"
## [2,] "0.625"       "0.622"
```

From the histogramm we can see that distribution of the means is approximately normal.

```
hist(exp.means,freq=FALSE)
abline(v=1/lambda, col="red")
curve(dnorm(x, mean=1/lambda, sd=1/lambda/sqrt(n)), add=TRUE, col="blue", lwd=2)
```



Based on the above analysis we can conclude that the mean value of the exponential distribution is subject to normal distribution, which confirms the Central Limit Theorem.