Exponential Distribution in R

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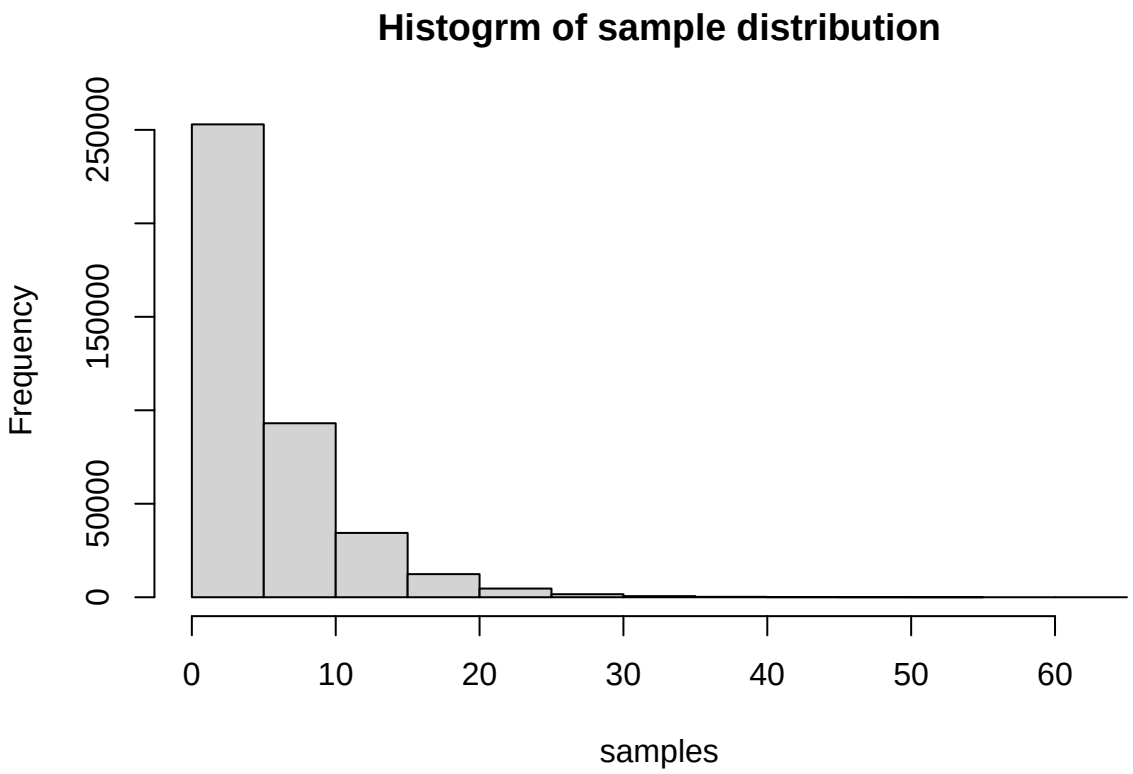
Overview

In this report we 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*.

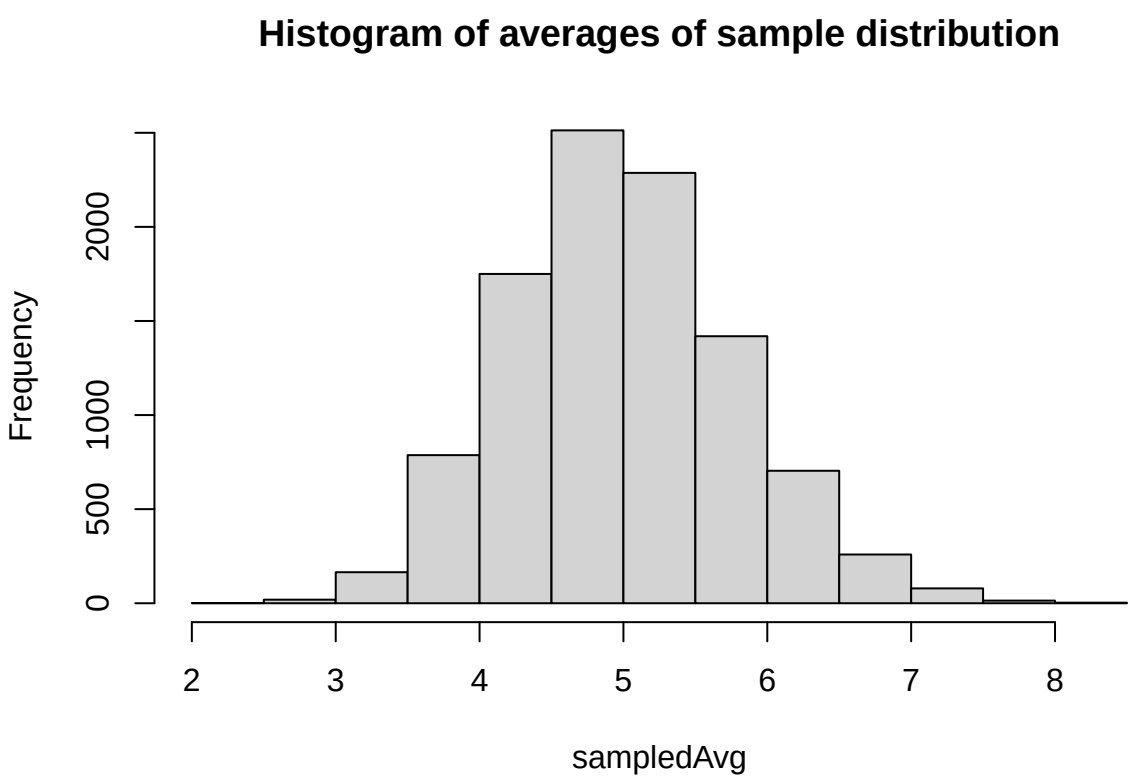
Simulation

```
set.seed(3339)

lambda <- 0.2
n <- 40
B <- 10000

samples <- matrix(rexp(B*n, lambda),B, n)

hist(samples, main = 'Histogrm of sample distribution')
```



Here we have created exponential distribution of 4×10^5 values arranged in a matrix of dimensions 10000, 40

```
sampledAvg <- apply(samples, 1, mean)
hist(sampledAvg, main = 'Histogram of averages of sample distribution')
```



Sample Mean vs Theoretical Mean

```
mu <- mean(sampledAvg)  # our sample data mean
mu0 <- 1/lambda  # theoretical mean
```

Mean of our sample data = 4.9932855
Theoretical mean = 5
Hence it can be seen that our sample data mean and theoretical mean are very close.

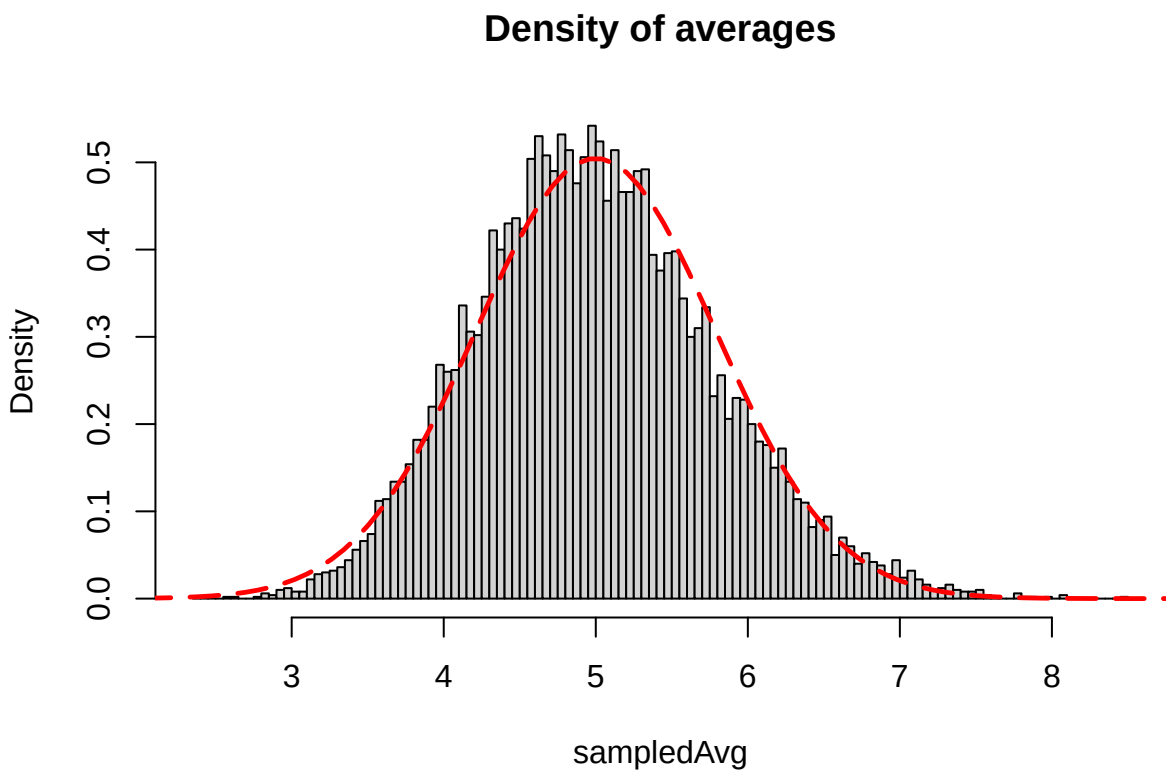
Sample Variance vs Theoretical Variance

```
sigma <- var(sampledAvg)  # our sample data variance
sigma0 <- (1/lambda^2)/n  # theoretical variance
```

Variance of our sample data = 0.6137652
Theoretical variance = 0.625
Hence it can be seen that our sample data variance is pretty close to theoretical variance.

Distribution

```
hist(sampledAvg,breaks = 100, freq = FALSE, main = 'Density of averages')
x <- seq(from=1,to=9,length.out = 100)
y <- dnorm(x, mean = 1/lambda, sd = (1/lambda)/sqrt(n))
lines(x,y,type='l',lty=5,lwd=2.4,col='red')
```



Here the histogram of averages of sample distribution is plotted against its density and the red dotted line shows normal distribution with same mean and standard deviation.
Hence it can be seen that the distribution is approximately normal.