

# Statistical Inference Course Project

#Part 1: Simulation Exercise

It is good practice to set a defined seed on an experiment to improve reproducibility.

```
set.seed(240598)
```

We then assign the data given to us for this experiment

```
lambda <- 0.2  
n <- 40  
nsim <- 1000
```

Then the experiment is made through the replicate function and the mean of the exponentials is calculated

```
sim <- replicate(nsim, rexp(n, lambda))  
eMean <- apply(sim, 2, mean)
```

## Comparison of the Means

The first question of the first part is to compare the sample mean and the theoretical mean. We start by calculating both:

```
sMean <- mean(eMean)  
sMean
```

```
## [1] 5.016071
```

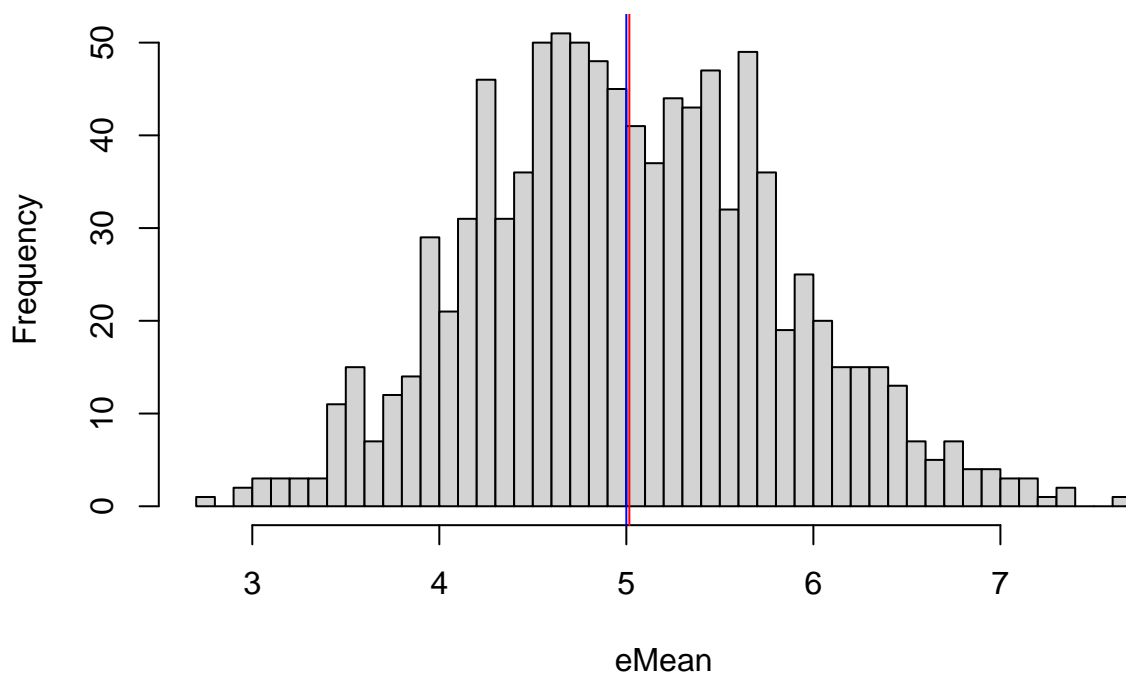
```
tMean <- 1/lambda  
tMean
```

```
## [1] 5
```

The histogram is then plotted. Both means are also plotted as lines to do the comparison

```
hist(eMean, breaks = 50, main = "Histogram of the simulated data")  
abline(v = sMean, col = "red")  
abline(v = tMean, col = "blue")
```

## Histogram of the simulated data



We can clearly see that both means almost overlap each other, since both are very close to 5.

## Comparison of the Variances

As we did before, we calculate both variances:

```
sSd <- sd(eMean)
sVar <- sSd^2
sVar
```

```
## [1] 0.6599058
```

```
tSd <- (1/lambda)/sqrt(n)
tVar <- tSd^2
tVar
```

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

We therefore proved that both variances are very close to each other

## Distribution