Statistical Inference Course Project

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Overview

This assignment demonstrates the Central Limit Theorem with the exponential distribution by showing that the means of many samples from an exponential distribution are normally distributed.

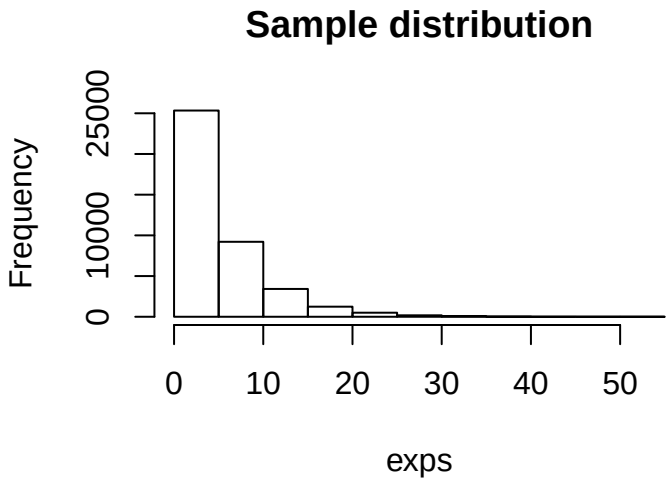
Simulations

We will demonstrate this with 1000 random samplings of 40 samples each from the expontential distribution with a rate parameter (lambda) of 0.2.

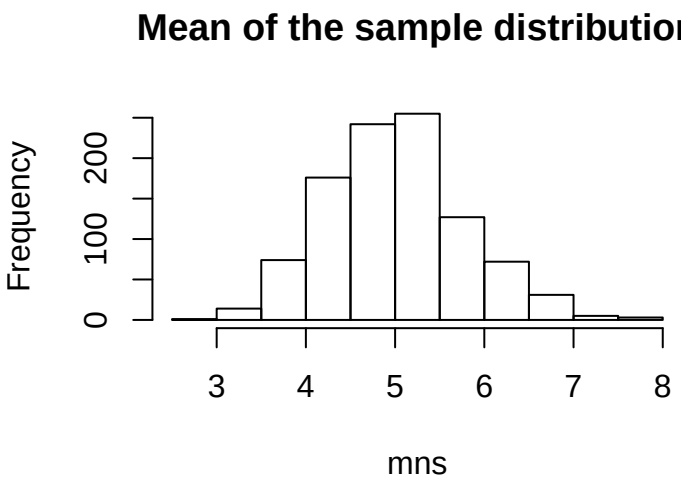
```
exps = NULL
n = 40
runs = 1000
lambda = 0.2
for (i in 1 : runs) exps = c(exps, rexp(n, lambda))
exps = matrix(exps, runs, n)
mns = apply(exps, 1, mean)
vars = apply(exps, 1, var)
```

Plots

We can see the original samples from the exponential distribution looks very exponential:



But the mean looks normally distributed:



The mean of the sample means is:

```
mean(mns)
```

```
## [1] 5.015769
```

The variance of the sample means is:

```
var(mns)
```

```
## [1] 0.6053753
```

As expected, the mean of the sample mean is very close to the theoretical mean, `1/lambda = 5`, and the variance is very close to the theoretical variance divided by n, `(1/lambda)^2/n = 0.625` since, according to the CLT, the sample means is approximately normal with a mean equal to the population mean and a variance equal to the population variance divided by the sample count.