

Statistical Inference Project Part I

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Part I Assignment Instructions

In this project you 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 $1/\lambda$. Set $\lambda = 0.2$ for all of the simulations. You will investigate the distribution of averages of 40 exponentials. Note that you will need to do a thousand simulations.

Illustrate via simulation and associated explanatory text the properties of the distribution of the mean of 40 exponentials. You should:

- (1) Show the sample mean and compare it to the theoretical mean of the distribution.
- (2) Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution.
- (3) Show that the distribution is approximately normal.

Part I Overview

The code performs calculations, plots and compares confidence intervals to prove the distribution is a normal distribution.

step 1

Set the seed and required variable values per the assignment instructions written above.

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.6.3
```

```
set.seed(100)
lambda <- 0.2
NumberExp <- 40
NumberSimulations <- 1000
```

Step 2 for Part I (1)

Run the simulation 1000 times and get the sample mean and compare it to the theoretical mean of the distribution.

```
MySimulatedSample <- replicate(NumberSimulations, rexp(NumberExp, lambda))
MySimSampleMean <- apply(MySimulatedSample, 2, mean)
SampleMean <- mean(MySimSampleMean)
TheoreticalMean <- 1 / lambda
```

Comparison summary. The sample and theoretical mean are very close with a different of -0.0002980731

```
SampleMean
```

```
## [1] 4.999702
```

```
TheoreticalMean
```

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

```
SampleMean - TheoreticalMean
```

```
## [1] -0.0002980731
```