PA1_StatisticalInference

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Purpose: 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.

Load in Global Knitr Parameters

```
library(knitr)
opts_chunk$set(echo = TRUE, results = 'hold')
```

1. Show the sample mean and compare it to the theoretical (expected) mean of the distribution.

Create Simulation with 40 samples and 1000 num of simulations

```
#Set the constants
set.seed(50) # Make simulation reproducible
lambda <- 0.2  # set for rex, the rate parameter
samples <- 40 #number of exponetials being distributed
sim <- 1000 # number of tests
sample_mean <- NULL #initalize sample_mean
for (i in 1:sim) sample_mean <- c(sample_mean, mean(rexp(samples, lambda)))
```

Compare Sample Mean vs Theoritical Mean

Report the Sample Mean

```
mean_of_means<- round(mean(sample_mean))
mean_of_means
```

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

Report the Theoretical Mean - expected mean mu of expoential distribution rate lambda given = .20

```
mu <- 1/lambda
mu
```

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

results: Shows that the sample mean and expected mean are closely related.

2. Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution.

Compare Sample Variance vs Theoretical Variance

Report the Sample Variance

```
#var() function to get sample variance
variance_sample<-var(sample_mean)
variance_sample
```

```
## [1] 0.6399667
```

Calculate the Expected Standard Deviation of a exponential distribution of rate parameter lambda

As variance = sd ˆ 2. Find the sd through 1/(lambda/sqrt(#ofsamples))

```
sd <- 1/lambda/sqrt(samples)
sd
```

```
## [1] 0.7905694
```

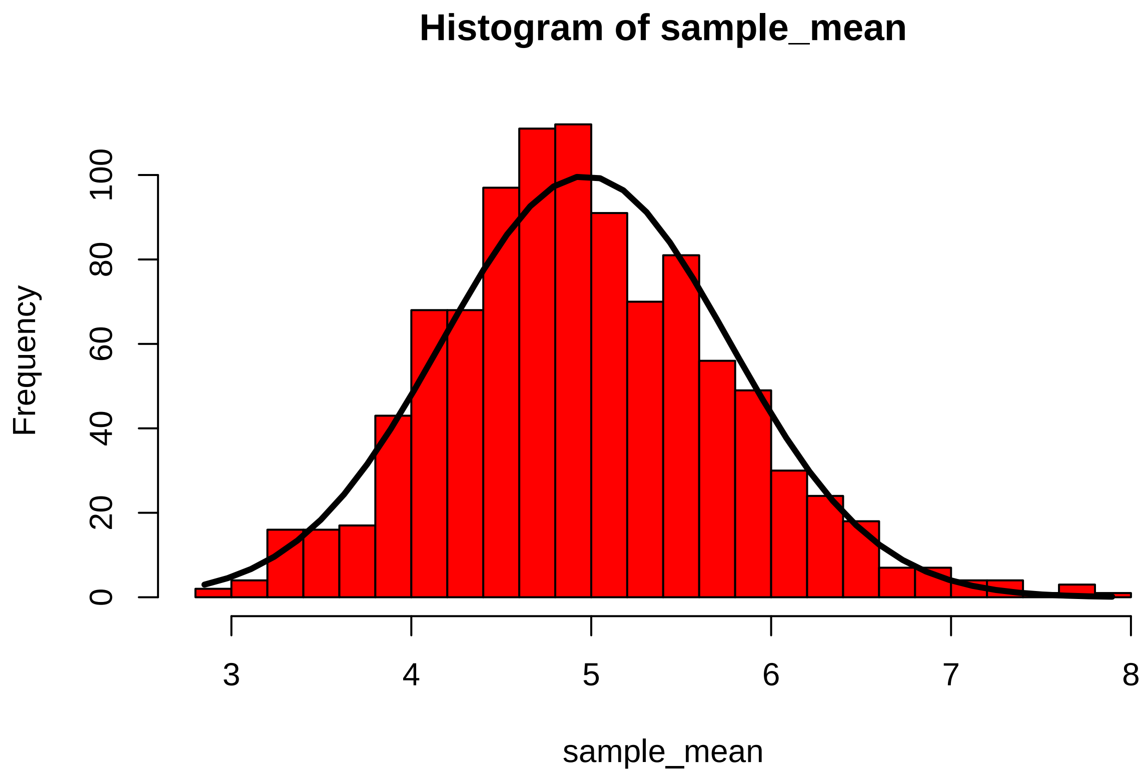
Report the Theoretical Variance of Distribution

```
variance_theoretical<- sd^2
variance_theoretical
```

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

3. Show that the distribution is approximately normal.

We use a normal distribution of expected values to compare the population means and standard deviation. The normal fitted curve shows the normal distribution


Histogram of sample_mean
Frequency
0
20
40
60
80
100
3
4
5
6
7
8
sample_mean