Part 1: Simulation of Exponential Distribution

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'r format(Sys.time(),'%d %B, %Y')'

```
## loading all packages
pacman::p_load(knitr,
               dplyr,
               ggplot2,
               ggthemr)
ggthemr::ggthemr("fresh")

set.seed(1702) # for greater stability while exploring where no one (except my peers) has gone before
```

1 Introduction

This assignment will explore the exponential distribution and the Central Limit Theory (CLT). The CLT states that as N_i

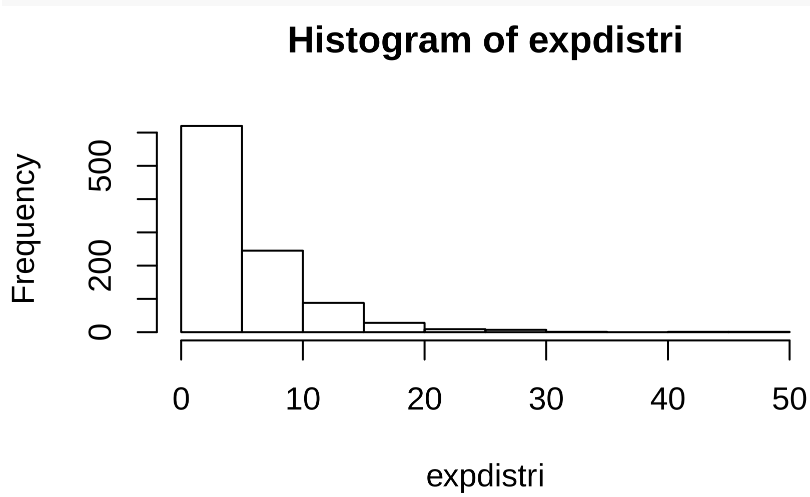
The theory is that

For this project, $\lambda = 1/5$ (0.2).

2 Exploration

1000 random exponential

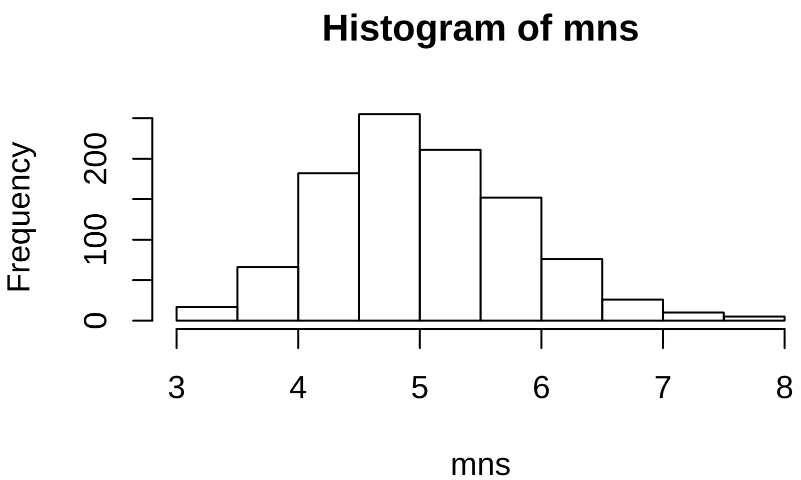
```
sample_num <- 1000
expdistri <- rexp(sample_num, rate = 0.2)
hist(expdistri)                 # to generate exp dist
```



```
means <- cumsum(expdistri)/(1:sample_num)
```

1000 Averages, 40 random exponential

```
n2  <- 40
sim_num <- 1000
mns = NULL
for (i in 1:sim_num) mns = c(mns, mean(rexp(n2, rate = 0.2)))              # to generate exp dist
hist(mns)
```



2.1 Show the sample mean and compare it to the theoretical mean of the distribution

law of large numbers:

```
## plotting to see if exp distri follows law of large numbers
means <- cumsum(expdistri)/(1:sample_num)
asymp_point <- round(mean(means), digits=1)
means %>%
    data.frame(x=1:sim_num, y = .) %>%
    ggplot(aes(x=x, y=y)) +
    geom_point() +
    xlab("range") + ylab("")
```

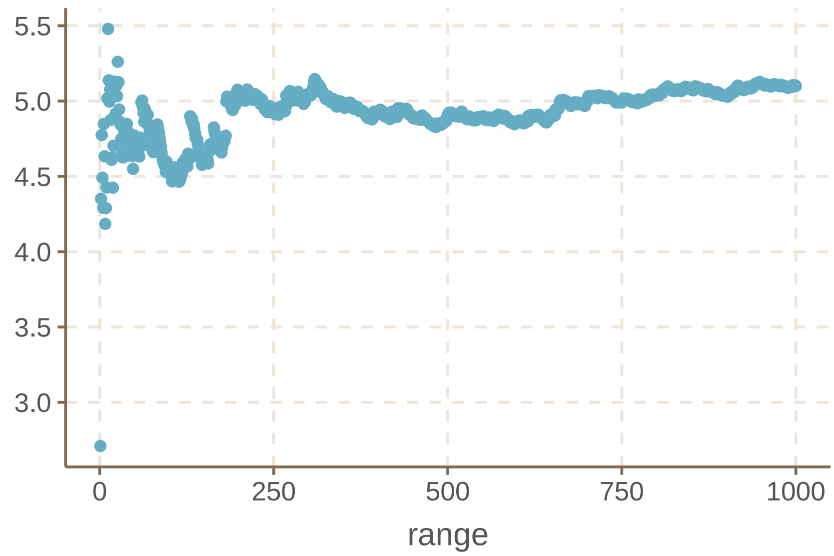


Figure 1: The simulated exponential distribution should be asymptotic at 5, as $\lambda = 1/5$

```
#    knitr::kable_styling(caption="The simulated exponential distribution should be asymptotic at 5, as
```

Seems to be asymptotic at roughly 4.9

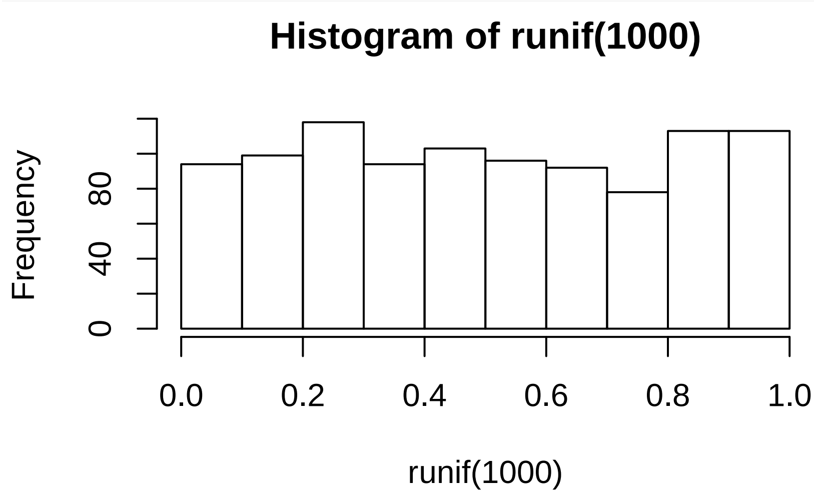
2.2 Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution

2.3 Show that the distribution is approximately normal

3 example prof gave as motiviation

1000 random uniforms

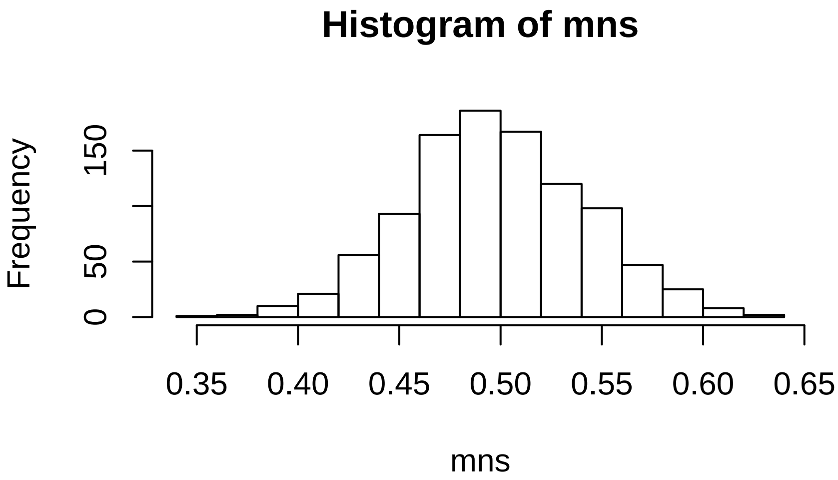
```
hist(runif(1000))
```



1000 averages, 40 random uniforms

```
mns = NULL
for (i in 1 : 1000) mns = c(mns, mean(runif(40)))
```

```r
hist(mns)
```


Histogram of mns
Frequency
0
50
150
0.35
0.40
0.45
0.50
0.55
0.60
0.65
mns

4 Appendix

```
knitr::purl("./peer-graded-assignment.Rmd")
source("./peer-graded-assignment.R")
## loading all packages
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               dplyr,
               ggplot2,
               ggthemr)
ggthemr::ggthemr("fresh")

set.seed(1702) # for greater stability while exploring where no one (except my peers) has gone before
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means <- cumsum(expdistri)/(1:sample_num)
n2  <- 40
sim_num <- 1000
mns = NULL
for (i in 1:sim_num) mns = c(mns, mean(rexp(n2, rate = 0.2)))                # to generate exp dist
hist(mns)
## plotting to see if exp distri follows law of large numbers
means <- cumsum(expdistri)/(1:sample_num)
asymp_point <- round(mean(means), digits=1)
means %>%
    data.frame(x=1:sim_num, y = .) %>%
    ggplot(aes(x=x, y=y)) +
    geom_point() +
    xlab("range") + ylab("")
#    knitr::kable_styling(caption="The simulated exponential distribution should be asymptotic at 5, as
hist(runif(1000))
mns = NULL
for (i in 1 : 1000) mns = c(mns, mean(runif(40)))
hist(mns)
```