Exponential Distribution Simulation and the Central Limit Theorem Project.

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Introduction

In this project, the goal is to compare the the exponential distribution with the Central Limit Theorem with **mean** and **variance**. The exponential distribution is simulated where lambda value is 0.2, sample size is 40 and 1,000 times simulations.

Load Packages

```
library(dplyr)
library(ggplot2)
knitr::opts_chunk$set(comment = NA, message = F,cache=TRUE)
```

Simulation and calculation of Mean.

Simulation

```
set.seed(123)
forty_number <- replicate(1000,rexp(40, 0.2))
```

Sample Mean

```
exponential_mean <- apply(forty_number, 2, mean)
mean(exponential_mean)
```

```
[1] 5.011911
```

Theoretical mean :1/lambda

```
1/0.2
[1] 5
```

- The sample mean is close to the theoretical mean, 5.01 and 5 respectivly.

Calculation of Variance.

Sample variance

```
(sd(exponential_mean))^2
[1] 0.6004928
```

Theoretical variance : (1/(lamnda)^2)/40

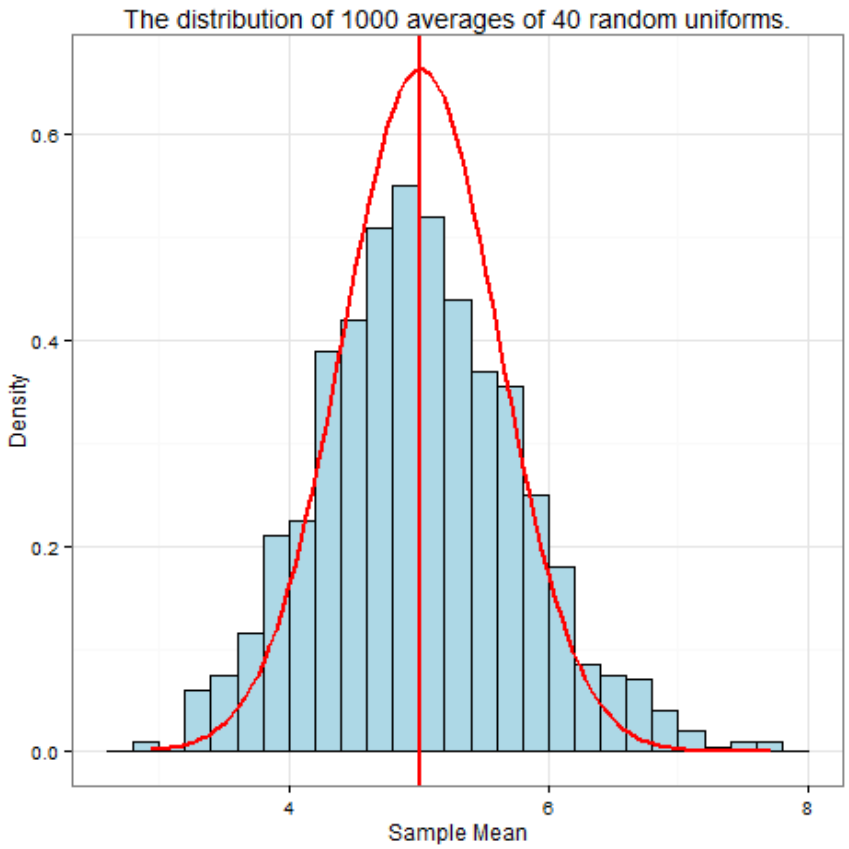
```
(1/(0.2)^2)/40
[1] 0.625
```

- The sample variance is close to the theoretical variance, 0.6 and 0.625 respectivly.

The distribution is approximately normal.

```
plot <- as.data.frame(exponential_mean)

ggplot(plot, aes(x = exponential_mean)) +
  geom_histogram(binwidth = 0.2, color = 'black', fill = "lightblue", aes(y =
..density..)) +
  theme_bw() +
  stat_function(fun = dnorm, color = "red", size = 1,
                args = list(mean = mean(exponential_mean), sd =
(sd(exponential_mean))^2)) +
  geom_vline(xintercept = mean(exponential_mean), size = 1, color="red") +
  xlab("Sample Mean") +
  ylab("Density") +
  ggtitle("The distribution of 1000 averages of 40 random uniforms.")
```



- The distribution of simulation is close normal. The vertical red line is the sample mean at 5.01. The bell curve means that it is a normal dsitribution.