Project 1/1 - Statistic Inference

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1 Simulation exercises

In this part of Project the Exponential Distribution is simulated. The exponential distribution mean is $1/\lambda$ and the standard deviation is also $1/\lambda$. The simultation make use of rexp(n, lambda) function that generates a random exponential distribution with rate lambda (i.e, mean = 1/lambda). Instructions for this project specifies $\lambda = 0.2$ parameter to simulation. The simulation do a 1000 simultated averages of 40 exponential(0.2)s.

```
n <- 40
nosim <- 1000
lambda <- 0.2
meansExp <- rowSums(matrix(rexp(n*nosim, rate=lambda), nosim)) / n
meanDist <- mean(meansExp)
meanDist
```

```
## [1] 5.038
```

1 - This distribution is centered at: 5.0382. Theoretical center of this distribution is around the population mean, $\mathrm{E}[\bar{X}] = \mu = 1/\lambda = \frac{1}{0.2} = 5$,

2 - The standard deviation (σ) of exponential distribution is $\frac{1}{\lambda}$. Where $\lambda = 0.2$.

```
sigma = 1 / 0.2
sigma
```

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

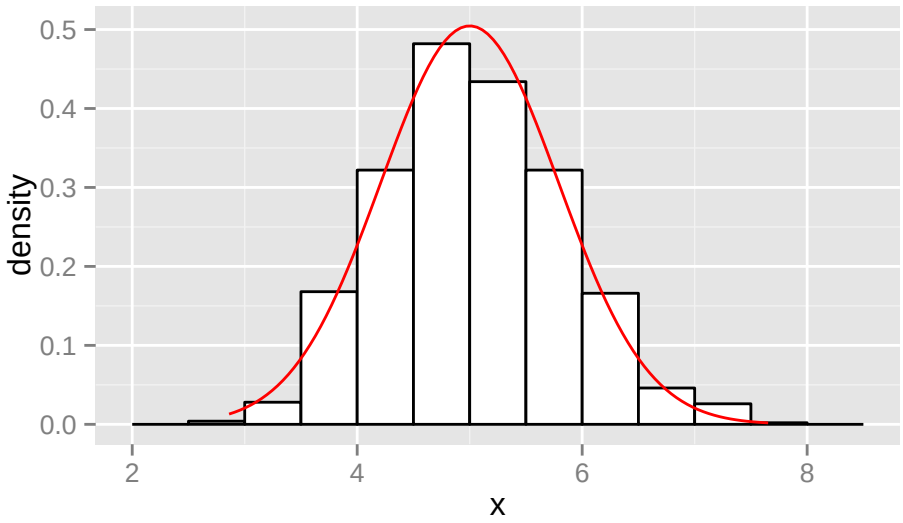
So we can conclude that the variation is $\sigma^2 = 25$. The theoritical value of variation of distribution means is $\frac{\sigma^2}{n}$. The logical estimation is $\frac{S^2}{n} = \frac{25}{40} = 0.625$. By simulation we can confirm this value is very close to variance.

```
var(meansExp)
```

```
## [1] 0.6401
```

3 - The normal curve drawn below shows that the distribution is approximately normal.

```
library(ggplot2)
df <- data.frame(meansExp)
ggplot(df, aes(x=df$meansExp)) +
     geom_histogram(aes(y=..density..),
                    binwidth=.5,
                    colour="black", fill="white") +
        stat_function(fun = dnorm, colour = "red",
                      arg = list(mean=5, sd=sigma/sqrt(n))) +
        labs(x= "x")
```



4 - The interval confidence $\bar{X} \pm 1.96 \frac{S}{\sqrt{(n)}}$ is called 95% interval for μ and the interval is [4.7903, 5.2861]. This represents that about 95% of intervals obtained would contain μ.