Exponential Distribution and Compairing with CLT

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install.packages("knitr")
install.packages("markdown")
install.packages("rmarkdown")

Overview

In this project we will investigate the exponential distribution in R and compare it with the Central Limit Theorem. The mean of exponential distribution is 1/lambda and the standard deviation is also 1/lambda. For analysis purpose, we will set lambda = 0.2 for all of the simulations and this investigation will compare with the distribution of averages of 40 exponentials over 1000 Simulations.

Simulations

Set the simulation variables and Run Simulation

```
set.seed(6817)
n<-40
lambda<-0.2
nosim<-1000
simMeans <- NULL
for(i in 1:1000) simMeans= c(simMeans, mean(rexp(n, lambda)))
```

Sample mean Versus Theoretical mean

Sample Mean

Calculating mean from Simulations

```
mean(simMeans)
```

```
## [1] 5.017058
```

Theoretical Mean

Calculating mean of Exponential distribution , whose mean is 1/ lambda

```
expMeans<-1/lambda
expMeans
```

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

Comparison between Sample Mean and Theoretical Mean

```
abs(mean(simMeans)-expMeans)
```

```
## [1] 0.01705794
```

This shows that the Center of distribution of Sample Mean 5.0170579 is closely related to Theoretical Mean 5.

Sample Variance Versus Theoretical Variance

Sample Variance

Calculating Variance and Standard deviation from Simulations

```
var(simMeans)
```

```
## [1] 0.6643289
```

```
sd(simMeans)
```

```
## [1] 0.8150637
```

Theoretical Variance

Calculating Variance of Exponential distribution and standard deviation

```
expVariance<-(1/lambda)^2/(n)
expVariance
```

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

```
expStdev<- 1/(lambda*sqrt(n))
expStdev
```

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

Comparison between Sample Variance and Theoretical Variance

```
abs(var(simMeans)-expVariance)
```

```
## [1] 0.03932887
```

This shows that the variability of distribution of Sample Variance 0.6643289 is closely related to Theoretical Variance 0.625.

Distribution

Show that distribution is approximately Normal.

The Histogram plot of the means of 1000 simulations is overlaid with the normal distribution with mean 5 and standard deviation 0.7905694.
This shows the distribution of simulation is normal.

```
g<-ggplot(data.frame(y=simMeans), aes(x=y))
g<- g+ geom_histogram(aes(y=..density..), binwidth= 0.2, fill="blue", color="red") +
  stat_function(fun=dnorm,args=list(mean=expMeans, sd=expStdev), size=2)+
  ggtitle('Simulation Plot')+ xlab('Simulation mean')+ ylab('density')
g
```