Exponential Distribution and Compairing with CLT

Vasudha Singh

December 6, 2018

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

