title: Investigate exponential distribution in R and compare it with the Central Limit Theorem author: "Thimmaraju Rudrappa" date: "July 13, 2019" output: html_document: default

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Overview

The objective is to investigate the exponential distribution and compare it to the Central Limit Theorem.

Simulations

Set variables lambda, exponentials, and seed. ```{r} ECHO=TRUE set.seed(1337) lambda = 0.2 exponentials = 40

```
Run Simulations
```{r}
sMeans = NULL
for (i in 1 : 1000) sMeans = c(sMeans, mean(rexp(exponentials, lambda)))
```

Sample Mean Vs Theoretical Mean

Sample Mean

Calculate mean from the simulations with give the sample mean. ```{r} mean(sMeans)

```
#### Theoretical Mean
Theoretical mean of an exponential distribution is lambda^-1.
```{r}
lambda^-1
```

Comparison

As we can see there is only a slight difference between the sample mean and the theoretical mean. ```{r} abs(mean(sMeans)-lambda^-1)

```
## Sample Variance Vs Theoretical Variance
#### Sample Variance
Calculate the variance from the simulation means with give the sample
variance.
```{r}
var(sMeans)
```

Theoretical Variance

The theoretical variance of an exponential distribution is (lambda * sqrt(n))^-2. ```{r} (lambda * sqrt(exponentials))^-2

```
#### Comparison
As we can see there is only a slight difference between the sample variance and theoreti
```{r}
abs(var(sMeans)-(lambda * sqrt(exponentials))^-2)
```

Distribution

Density histogram of the 1000 simulations. There is an overlay with a normal distribution that has a mean of lambda^-1 and standard deviation of (lambda*sqrt(n))^-1, the theoretical normal distribution for the simulations. `{r} library(ggplot2) ggplot(data.frame(y=sMeans), aes(x=y)) + geom_histogram(aes(y=..density..), binwidth=0.2, fill="#0072B2", color="black") + stat_function(fun=dnorm, arg=list(mean=lambda^-1, sd=(lambda*sqrt(exponentials))^-1), size=2) + labs(title="Plot of the Simulations", x="Simulation Mean")`