Course Project for Statistical Inference Course

A Simulation Exercise

By

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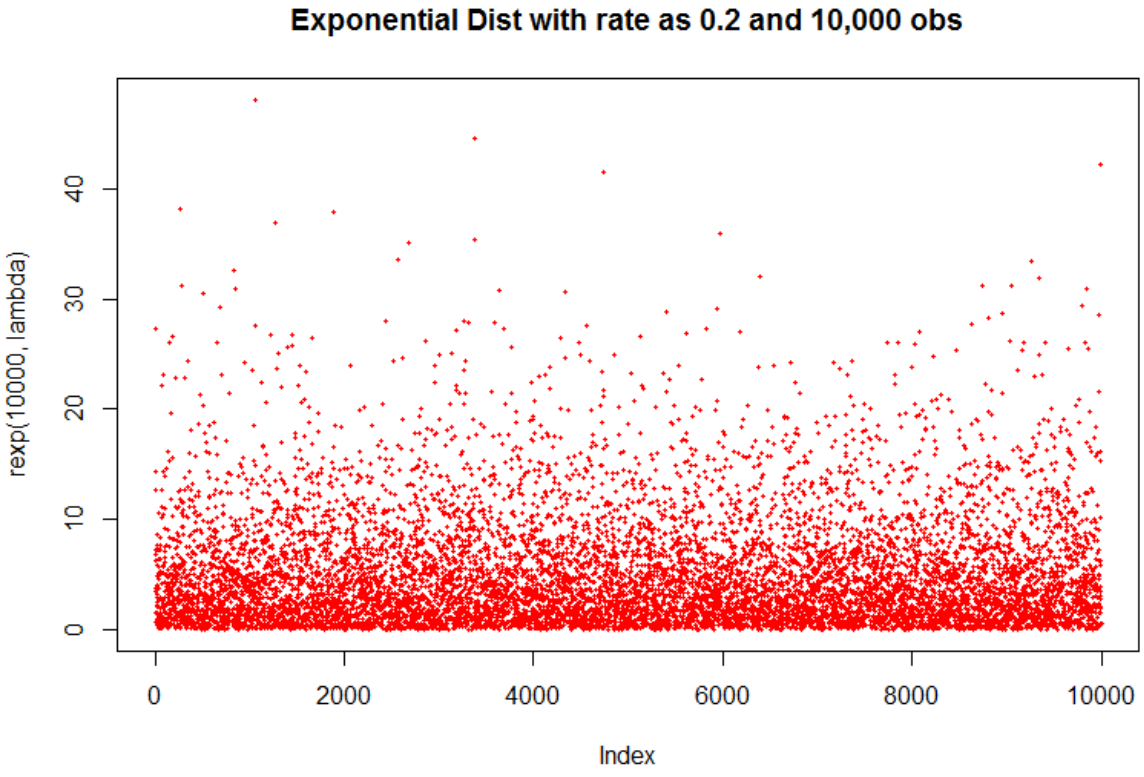
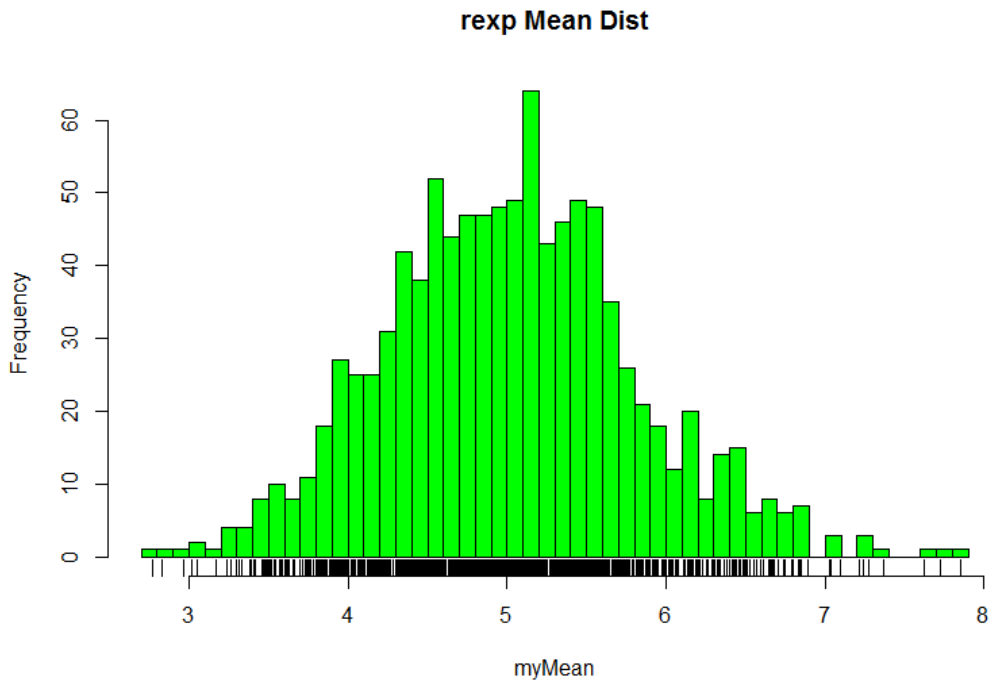
```
> set.seed(3007)
> lambda = 0.2
> n = 40
> simNum = 1000
> plot(rexp(10000,lambda ), pch = 20, cex=0.6, main = "Exponential Dist wi
th rate as 0.2 and 10,000 obs")
> plot(rexp(10000,lambda ), pch = 20, cex=0.6, main = "Exponential Dist wi
th rate as 0.2 and 10,000 obs", col= "red")
```

The plot is shown below:



1.Then, we will generate the collection of means for 1000 simulations of the exp dist.

```
> myMean = NULL
> for(k in 1:simNum) myMean = c(myMean, mean(rexp(n, lambda)))
> hist(myMean, col="green", main= "rexp Mean Dist", breaks = 50)
> rug(myMean)
```



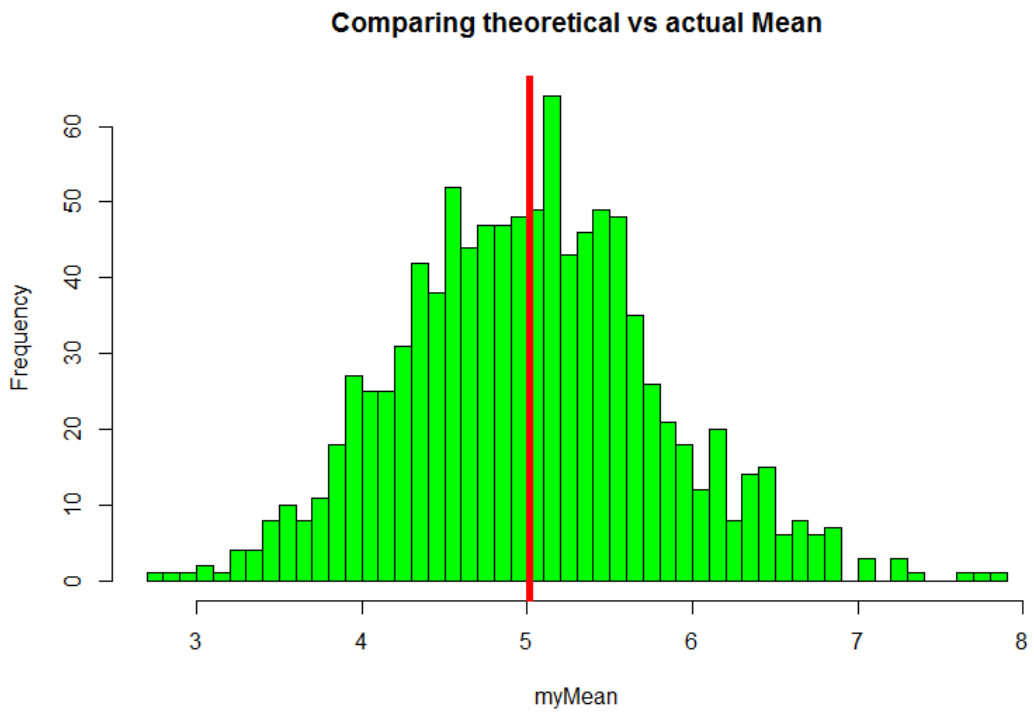
2. Now, we can compare sample mean vs theoretical mean.

In theory, since lambda is 0.2, the mean should be 1/0.2 = 5 . And in practice, let's see what the mean turns out to be.

```
> round(mean(myMean), 3)
[1] 5.017
```

Plotting it for visualization:

```
> hist(myMean, col="green", main="Comparing theoretical vs actual Mean", b
reaks = 50)
> abline(v = mean(myMean), lwd ="5", col="red")
```



It can be seen that theoretical Mean = 5
Actual Mean = 5.017

3. Running a similar check for Standard Deviation (SD)

Theoretical SD

```
> round( (1/lambda)/sqrt(n) ,4)
[1] 0.7906
```

Actual SD

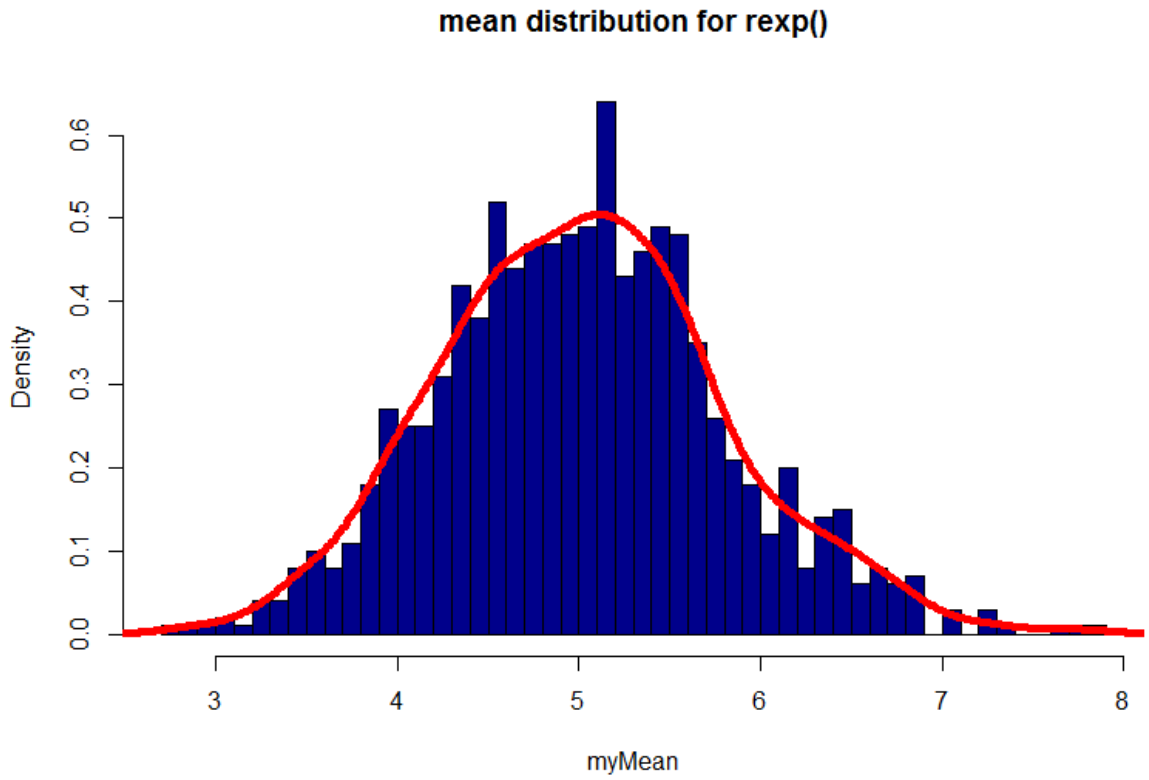
```
> round(sd(myMean) ,4)
```

```
[1] 0.7882
```

A decent match !!

4. Now, Checking if this distribution is normal

```
> hist(myMean, prob=TRUE, col="darkblue", main="mean distribution for rexp
()", breaks=50)
> lines(density(myMean), lwd=5, col="red")
```



The average of each sample pretty closely follows the normal curve, as per the central limit theorem, and hence it is proven that the dist. Is approximately normal.

The more the number of samples, more accurately it will follow the bell curve.