Statistical Inference Course Project: Part 1

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January 24, 2015

Overview

In this project we will investigate the exponential distribution in R and compare it with the Central Limit Theorem. The exponential distribution can be simulated in R with rexp(n, lambda) where lambda is the rate parameter. The mean of exponential distribution is 1/lambda and the standard deviation is also 1/lambda. We will set lambda = 0.2 for all of the simulations, and will investigate the distribution of averages of 40 exponentials over 1000 simulations.

```
set.seed(7)
lambda <- 0.2
n <- 40
sims <- 1000
exp_sims <- replicate(sims, rexp(n, lambda))
exp_means <- apply(exp_sims, 2, mean)
```

1. Show the sample mean and compare it to the theoretical mean of the distribution.

Sample mean:

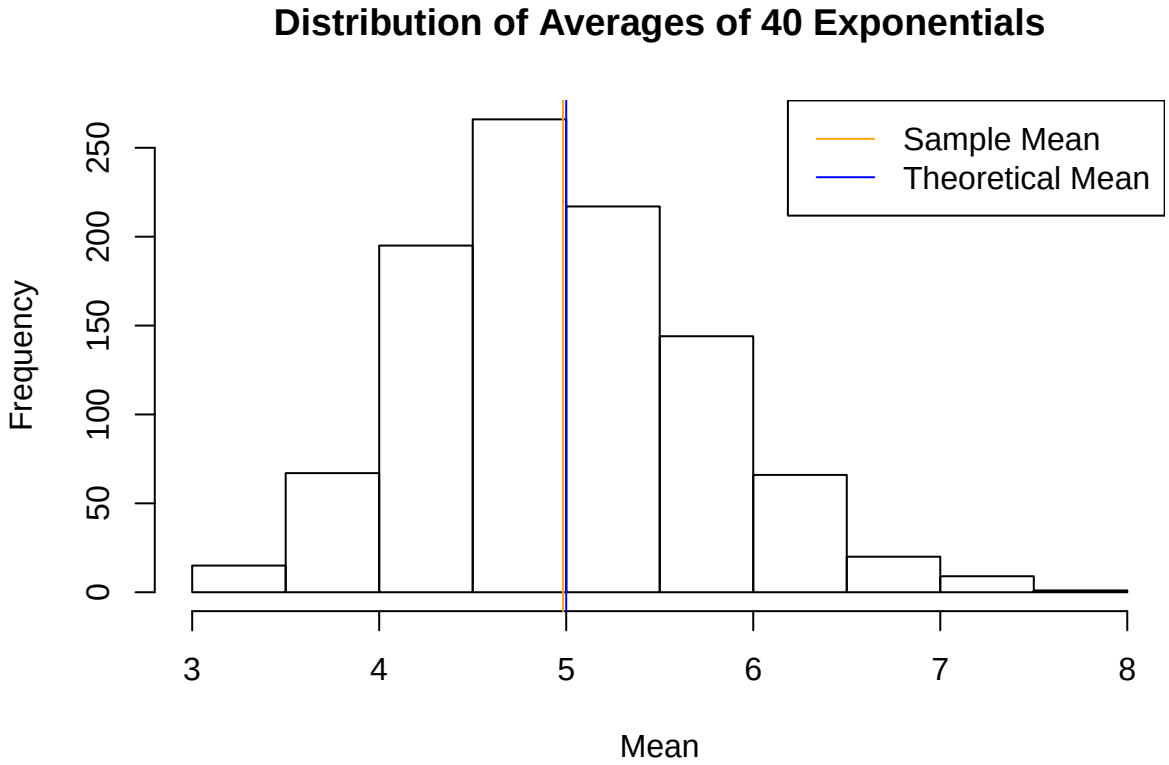
```
mean(exp_means)
```

```
## [1] 4.983294
```

Theoretical mean:

```
1/lambda
```

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



The center of the distribution of the sample is close to the theoretical center of the distribution, as illustrated in the above figure.

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2. Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution.

Sample Variance:

```
var(exp_means)
```

```
## [1] 0.5792547
```

Theoretical Variance:

```
((1/lambda)*(1/sqrt(n)))^2
```

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

The sample variance differs in value from the theoretical variance by only:

```
## [1] 0.04574529
```

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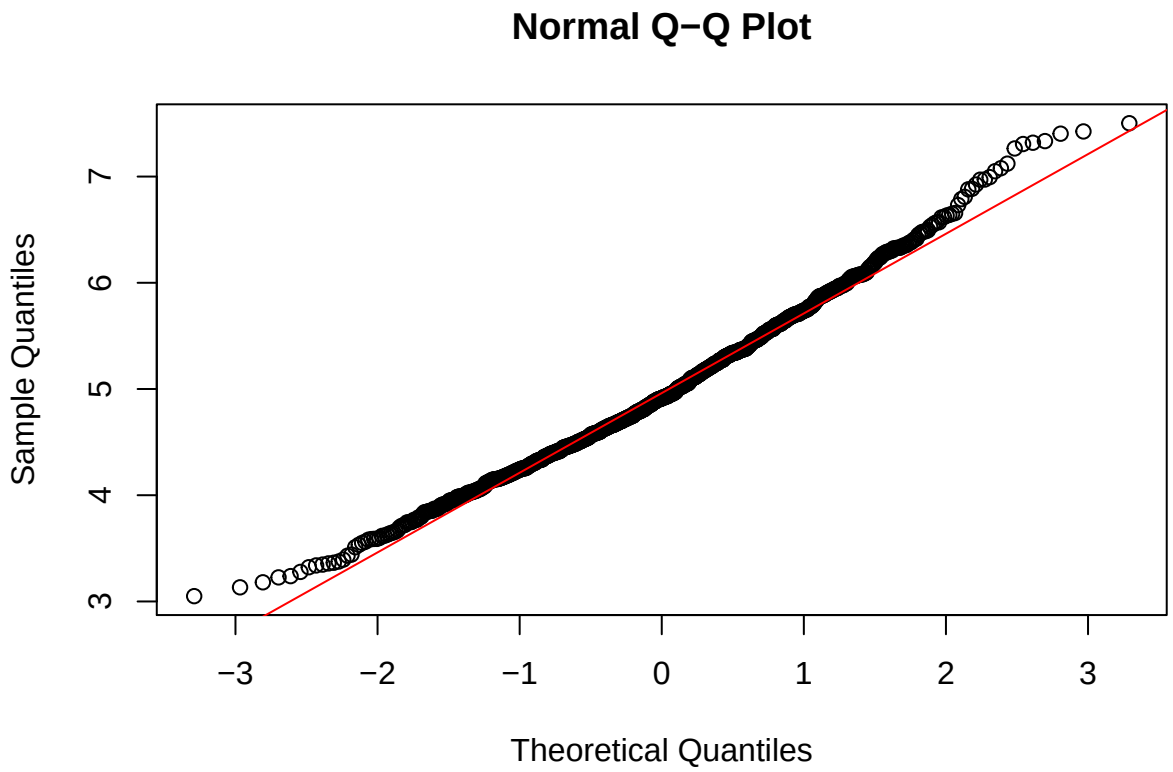
3. Show that the distribution is approximately normal.

```
qqnorm(exp_means)
qqline(exp_means, col = 2)
```



Since the points in the above figure adhere pretty closely to the straight line, the distribution is said to be approximately normal.