Stastical Inference - Course Project - Part 1

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Exponential Distribution Problem 1

0. Set parameters and Simulate data

We first set the parameters for the simulation. This includes: seed = 11111 lambda = 0.2 number of observations = 40 number of simulations = 1000

```
set.seed(11111)
lambda <- .2
n <- 40
nosim <- 1000
means <- NULL
```

Now we simulate the data

```
for (i in 1:1000) {
        means[i] <- mean(rexp(n, lambda))
}
```

1. Show where the distribution is centered at and compare it to the theoretical center of the distribution.

The simulation distribution is centered at:

```
mean(means)
```

```
## [1] 5.021
```

The theoretical center is:

```
1/lambda
```

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

2. Show how variable it is and compare it to the theoretical variance of the distribution.

Because the Central Limit Thoerem applies, the theoretical variance is σ^2/n

Using this, we can compare the distribution variance:

```
var(means)
```

```
## [1] 0.6305
```

To the theoretical variance:

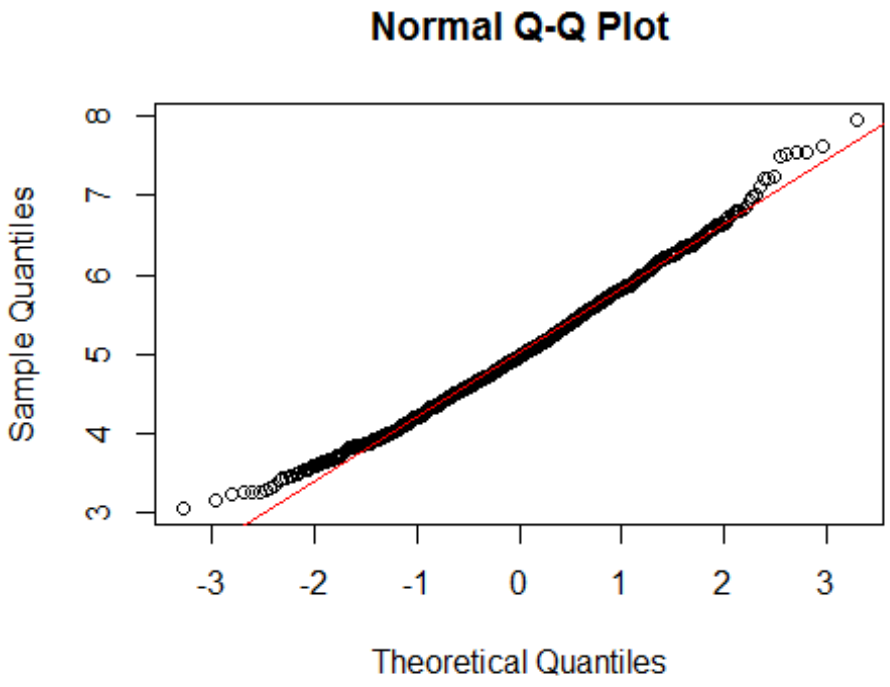
```
((1/lambda)^2)/n
```

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

3. Show that the distribution is approximately normal.

We can use qqnorm to test for a normality. qqnorm produces a normal QQ plot of the values in y. qqline adds a line to a "theoretical", by default normal, quantile-quantile plot which passes through the probs quantiles, by default the first and third quartiles.

```
qqnorm(y=means); qqline(y=means, col=2)
```



4. Evaluate the coverage of the confidence interval for 1/lambda: $\bar{x} \pm 1.96 \frac{s}{\sqrt{n}}$.

```
s <- sd(means)
mean(means) + c(-1,1) * 1.96* s/sqrt(length(means))
```

```
## [1] 4.971 5.070
```