Statistical Inference Course Project

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Overview

This is a course project needed to learn some basics in statistical inference such as Central Limit Theorem, confident intervals, etcetera.

Variables statement

```
lambda <- 0.2
mns <- NULL
vars <- NULL
```

Creating the distribution

```
for (i in 1 : 1000) {
    distributions <- rexp(40, lambda)
    mns <- c(mns, mean(distributions))
    vars <- c(vars, var(distributions))
}
```

Comparison to theoretical values

```
experimental_mean <- mean(mns)
experimental_variance <- mean(vars)

theoretical_variance <- 1/lambda**2
theoretical_mean <- 1/lambda

difference_mean <- theoretical_mean - experimental_mean
difference_variance <- theoretical_variance - experimental_variance
```

So we can see, both mean difference and variance difference between theoretical and simulating values are about to 0:

```
paste0('Mean difference is ', difference_mean)
```

```
## [1] "Mean difference is -0.0141307731316012"
```

```
paste0('Variance difference is ', difference_variance)
```

```
## [1] "Variance difference is -0.167265048531672"
```

So we will assume that experimental mean and variance are equal to theoretical using confidence intervals:

```
mean_confidence_interval <- experimental_mean +
    c(-1, 1)*qnorm(.975)*sqrt(experimental_variance/1000)
variance_confidence_interval <- experimental_variance +
    c(-1, 1)*qnorm(.975)*sqrt(experimental_variance/1000)
```

```
paste0('Confidence interval for mean is (', mean_confidence_interval[1],
       ', ', mean_confidence_interval[2], ')')
```

```
## [1] "Confidence interval for mean is (4.70319828477854, 5.32506326148467)"
```

```
paste0('Confidence interval for variance is (', variance_confidence_interval[1],
       ', ', variance_confidence_interval[2], ')')
```
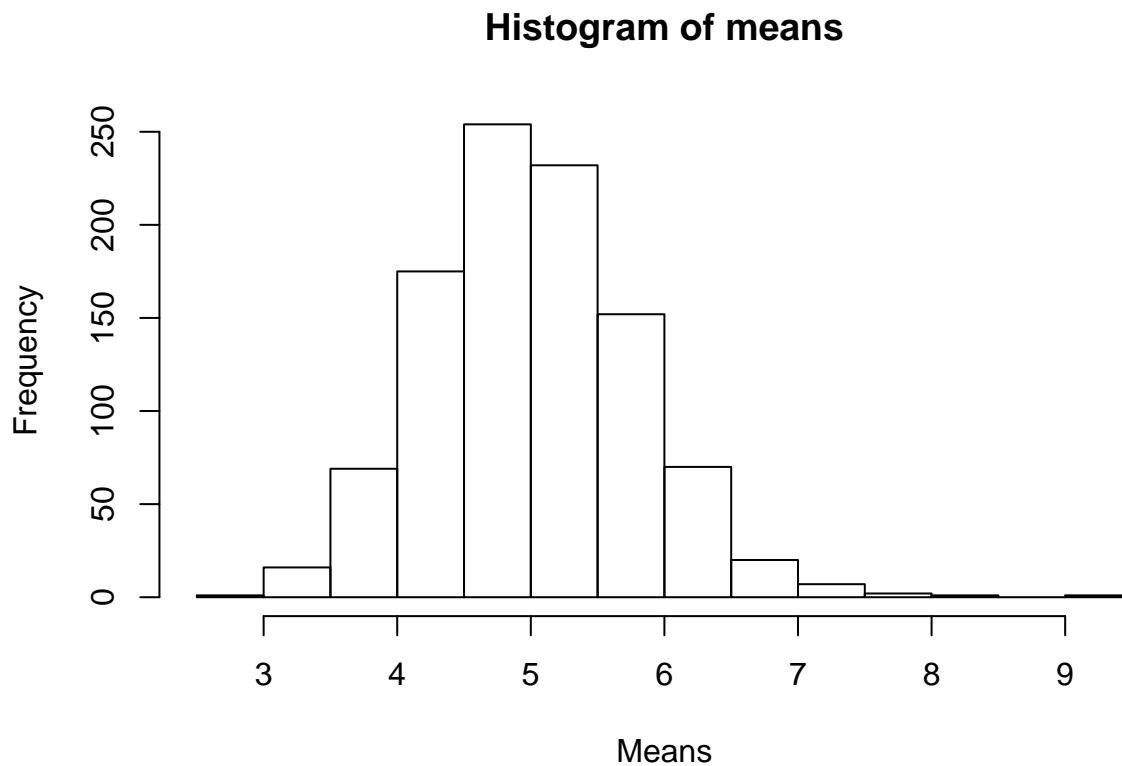
```
## [1] "Confidence interval for variance is (24.8563325601786, 25.4781975368847)"
```

And we can see, that experimental mean and variance lies inside of each confidence interval:

```
paste0('Theoretical mean is ', theoretical_mean)
```

```
## [1] "Theoretical mean is 5"
```

```
paste0('Theoretical variance is ', theoretical_variance)
```

```
## [1] "Theoretical variance is 25"
```

Distribution plot

According to this plot, distribution approximates by normal distribution very good.