

Investigating Exponential Distributions and CLT

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Overview

It will be shown comparisons about Exponential distribution and Central Limit Theorem (CLT). Investigation is about assumption that under a large number of simulations (i.e. Law of Large Numbers), Exponential distribution converges to Gaussian distribution. The theoretical mean and standard deviation are $1/\lambda$, so I will compare...

Simulations

First, let's simulate an exponential distribution with $n = 40$ and $\lambda = 0.2$ and repeat simulation in 1000 times:

```
#Reproducible seed
set.seed(17)

lambda <- 0.2
n = 40
rep <- 1000

#exponential distribution replicated 1000 times
exp <- replicate(rep, rexp(n, lambda))

#Resultant mean
means_exp <- apply(exp, 2, mean)
```

Sample Mean versus Theoretical Mean

1. Show the sample mean and compare it to the theoretical mean of the distribution. After simulation, we compare sample mean and theoretical mean:

```
sample_mean <- mean(means_exp)
sample_mean
```

```
## [1] 4.961683
```

```
theoretical_mean <- 1/lambda
theoretical_mean
```

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

Sample Variance versus Theoretical Variance

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

```
sample_variance <- var(means_exp)
sample_variance
```

```
## [1] 0.6408254
```

```
theoretical_variance <- (1/lambda)^2
theoretical_variance
```

```
## [1] 25
```

Distribution

3. Show that the distribution is approximately normal.

Summary