

# Exponential Distribution and the Central Limit Theorem

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## Introduction

In this report, we investigate the properties of the exponential distribution and compare it with the Central Limit Theorem (CLT). Specifically, we will explore the distribution of the averages of 40 exponentials through simulation.

## Simulation and Analysis

## Sample Mean: 5.011911

## Theoretical Mean: 5

## Sample Variance: 0.6004928

## Theoretical Variance: 0.625

## Sample Mean

The sample mean of the distribution of 40 exponentials is `r sample_mean`, while the theoretical mean is `r theoretical_mean`. These values are very close, illustrating the Law of Large Numbers.

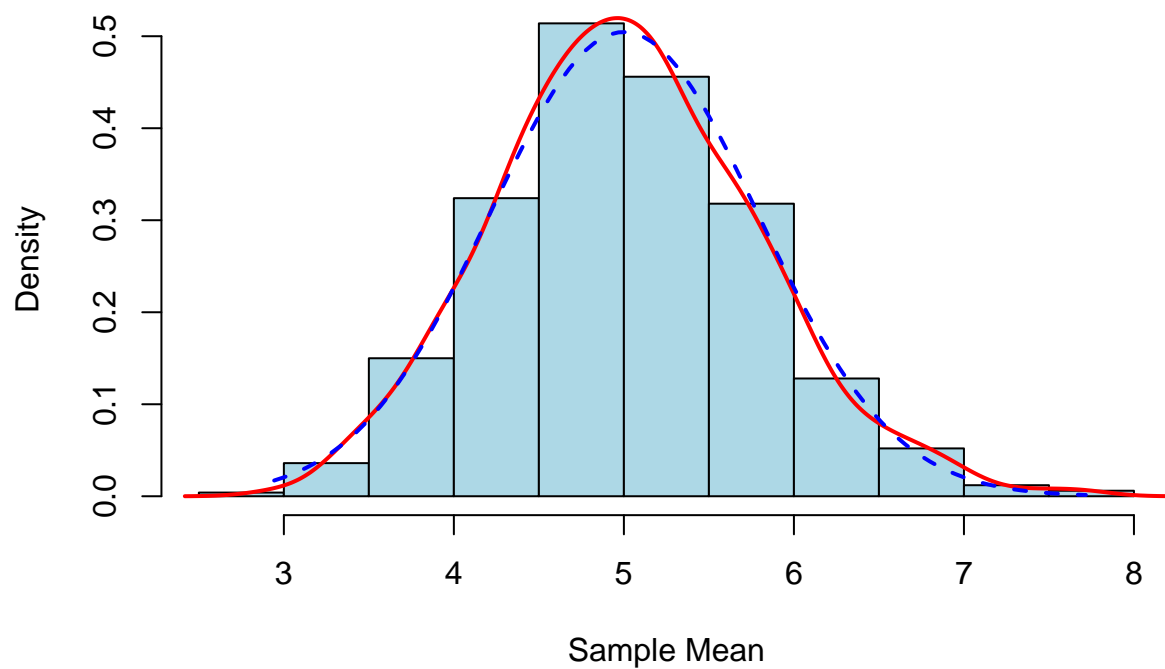
## Sample Variance

The sample variance is `r sample_variance`, which is also close to the theoretical variance of `r theoretical_variance`.

## Distribution of Sample Means

The histogram below shows the distribution of the sample means. We also overlay the theoretical normal distribution to illustrate the Central Limit Theorem.

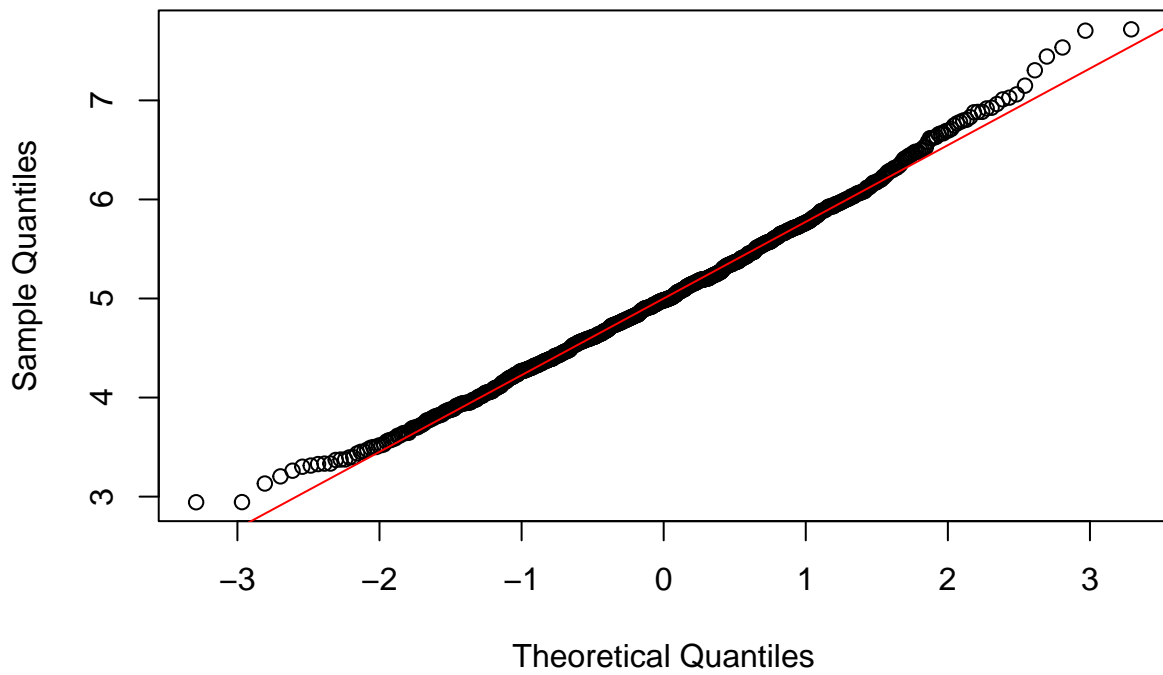
## Distribution of Sample Means of 40 Exponentials



### Normality Check

The QQ-plot below shows that the distribution of the sample means is approximately normal.

### QQ-Plot of Sample Means

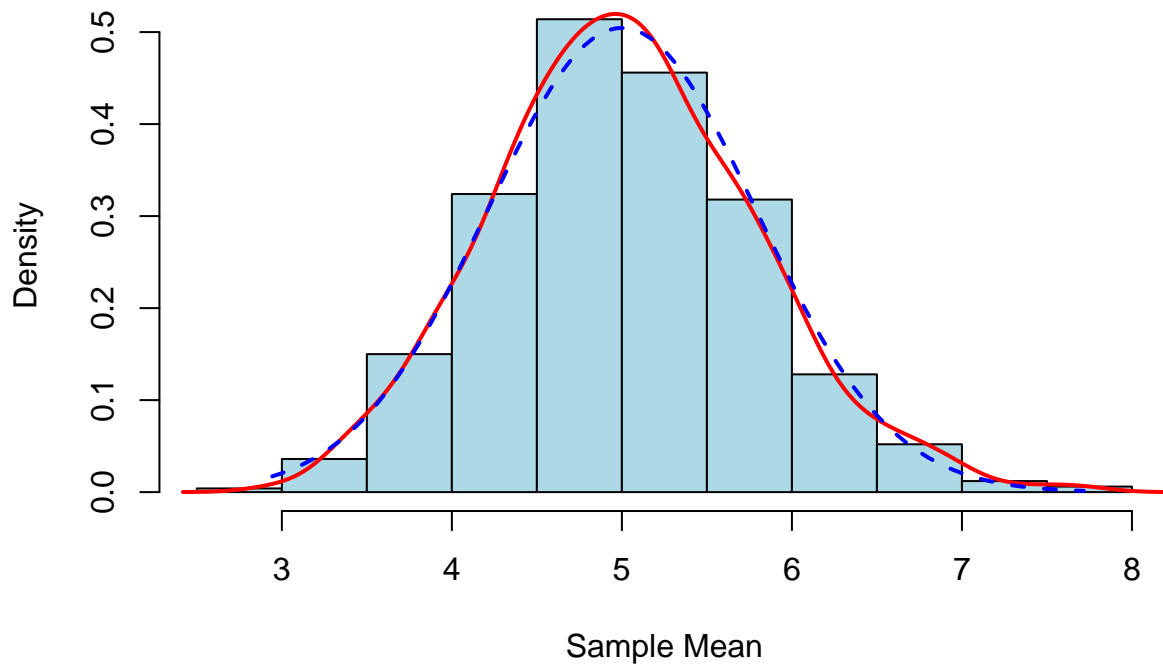


### Conclusion

The sample mean and variance of the distribution of 40 exponentials closely match the theoretical values. The distribution of the sample means is approximately normal, as expected from the Central Limit Theorem.

## Appendix

### Distribution of Sample Means of 40 Exponentials



### QQ-Plot of Sample Means

