

Portfolio II - Expectation

Figures 1, 2, and 3 show distribution of sample means for an exponential distribution with rate parameter $\lambda = 1$. I generated samples of exponential random variables for different sample sizes $n = 5, 20, \text{ and } 1000$. Each figure shows how sample means are distributed, and the true mean is shown by the red dashed line.

For each sample size n , I calculated the sample mean and the sample's 90% confidence interval (CI):

Sample Size (n)	Mean	90% Confidence Interval
5	2.0753	(1.3329, 2.8176)
20	0.8210	(0.5428, 1.0993)
1000	1.0213	(0.9725, 1.0700)

Table 1: Means and 90% Confidence Intervals for different sample sizes

In producing this plot I learned:

- As the sample size increases, the CI becomes narrower. For $n = 5$, the CI is wide showing smaller sample sizes lead to lower precision, even though the mean is relatively accurate.
- For $n = 1000$ the CI is narrow, showing larger sample sizes lead to accurate and precise sample means that are close to the true mean.
- Showcase my findings in a way to align with our teachings on the Central Limit Theorem.
- Built on my knowledge to generate random variables and finding CIs by calculating sample variance and finding lower and upper bounds.

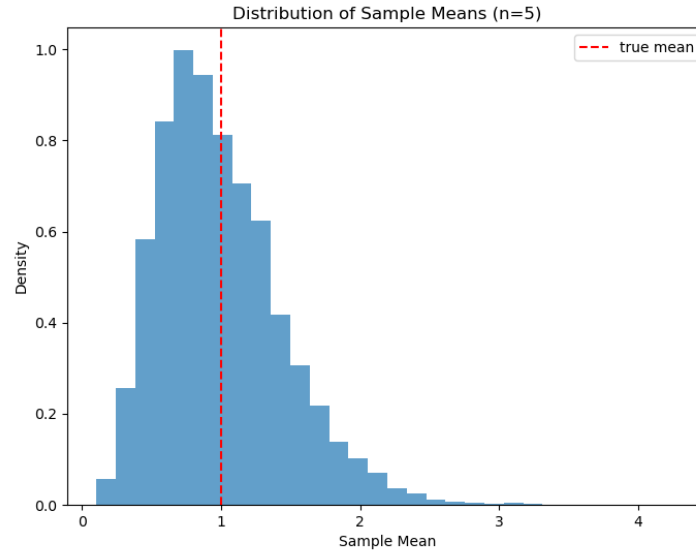


Figure 1: Distribution of sample means for an exponential distribution with $\lambda = 1$ and $n = 5$. The red dashed line represents the true mean.

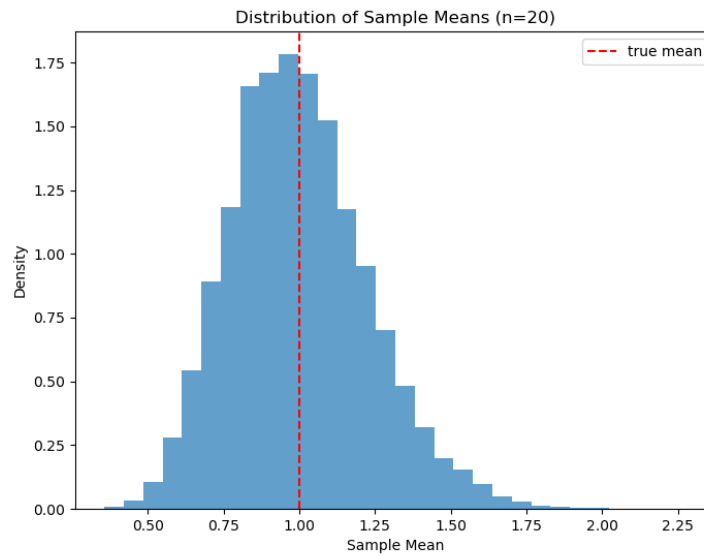


Figure 2: Distribution of sample means for an exponential distribution with $\lambda = 1$ and $n = 20$. The red dashed line represents the true mean.

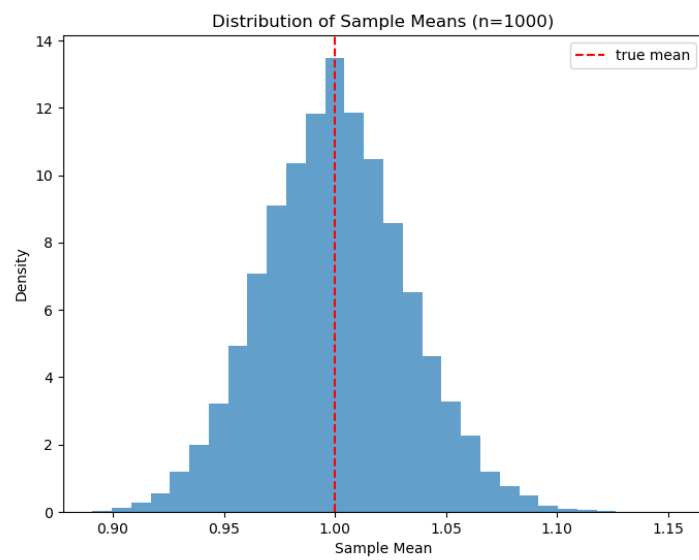


Figure 3: Distribution of sample means for an exponential distribution with $\lambda = 1$ and $n = 1000$. The red dashed line represents the true mean.