



TOOLBOX

THE CENTRAL LIMIT THEOREM

MACQUARIE
University
SYDNEY · AUSTRALIA

Central Limit Theorem

The Central Limit Theorem states that **when you take a large enough sample size from any population (with a finite mean and variance), the distribution of the sample means will be approximately normal (bell-shaped), regardless of the original population's distribution.**

Why is CLT important?

It allows us to make inferences about population parameters using sample statistics.

It justifies the use of the normal distribution in hypothesis testing and confidence intervals, even when the underlying data is not normal.

Sample Means: If you repeatedly take samples of size n from a population and calculate their means, those means will form their own distribution.

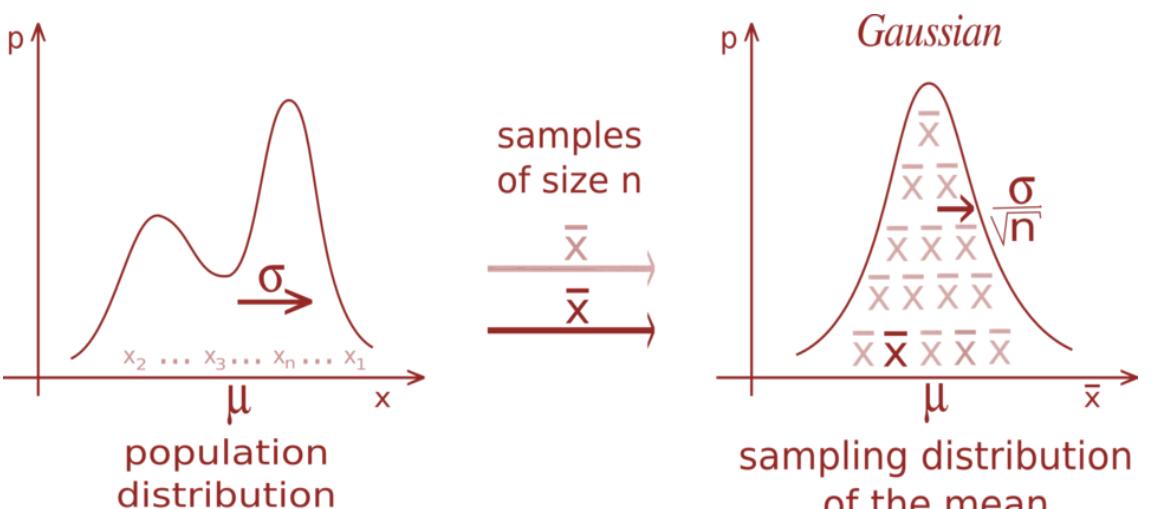
Normal Distribution: As the sample size increases (usually $n \geq 30$ is considered sufficient), the distribution of these sample means will approach a normal distribution.

Population Independence: This works even if the original population is not normally distributed.

Mean and Standard Error: The mean of the sample means will be equal to the population mean (μ), and the standard deviation of the sample means (called the standard error) will be $\frac{\sigma}{\sqrt{n}}$, where σ is the population standard deviation.

Example

- Suppose you have a population of exam scores that is heavily skewed. If you take many random samples of 50 scores each and plot the means of those samples, the resulting distribution of means will look approximately normal.



Sum of Dice and Probabilities

