

Confidence interval:

A confidence interval is a statistical concept used to estimate the range within which a population parameter, such as a population mean or proportion, is likely to fall. It provides a range of values along with a level of confidence that the true parameter value lies within that range. The level of confidence is typically expressed as a percentage, such as 95% or 99%.

Here's how to calculate a confidence interval for a population mean (μ) using a common method, assuming you have a sample of data:

1. **Collect and Summarize Your Data:** Gather a sample of data from the population of interest and calculate the sample mean (\bar{x}) and sample standard deviation (s). The larger your sample size (n), the better your estimate will be.
2. **Select a Confidence Level:** Choose a level of confidence, often denoted as " $1 - \alpha$," where α is the significance level or the probability of making a Type I error (usually set at 0.05 for a 95% confidence level or 0.01 for a 99% confidence level).
3. **Find the Critical Value:** Determine the critical value (z^*) from the standard normal distribution table or using a calculator or software. For example, for a 95% confidence level ($\alpha = 0.05$), the critical value is approximately 1.96. For a 99% confidence level ($\alpha = 0.01$), it's approximately 2.58.
4. **Calculate the Margin of Error (MOE):** The margin of error is calculated as:

$$\text{MOE} = (z^*) * (s / \sqrt{n})$$

Where:

- z^* is the critical value from step 3.
 - s is the sample standard deviation.
 - n is the sample size.
5. **Calculate the Confidence Interval:** Construct the confidence interval by adding and subtracting the margin of error from the sample mean:

$$\text{Confidence Interval} = \bar{x} \pm \text{MOE}$$

This interval represents the range within which you are confident (at the chosen confidence level) that the population mean (μ) lies. In other words, you can say, "I am 95% (or 99%) confident that the true population mean falls within this interval."