**Introduction to t-test**

**I. Problem with z-score**

- Requirement of Population Standard Deviation:

* The z-score formula needs the population standard deviation (or variance).
* In real-world scenarios, this value is often unknown.

- The Paradox:

* You need to know about the population to use the z-score, but the test aims to learn about the unknown population.

- The Solution:

* When the population standard deviation is unknown, replace it with the sample standard deviation.
* This replacement then leads to the use of the t-statistic instead of the z-statistic.

**II. T-test overview**

**- Definition:** A powerful statistical tool for comparing two means, especially when dealing with small samples and unknown population standard deviations.

**- Purpose:** Determines if there's a statistically significant difference between the means of two groups.

**- When to use:**

* Comparing two group means.
* Population standard deviation is

unknown.

* Small sample sizes (typically < 30).

**- Type of T-test:**

* One-Sample T-Test: Compares a sample mean to a known value.
* Independent Two-Sample T-Test: Compares means of two independent groups.
* Paired T-Test: Compares means of two related groups (e.g., before/after).

**III. T-test**

=> sample variance = s2 = = => standard sample variance = =

=> Standard error: σM = =

=> estimated standard error = sM =

The **t statistic** is used to test hypotheses about an unknown population mean, μ, when the value of σ is unknown. The formula for the t statistics has the same structure as the z-score formula, except that the t statistic uses the estimated standard error in the denominator

**t = = =**

**Differencr between t formula and z-score:**

t = = =

z = = =