📊 1. A/B Testing

Definition: A method to compare two versions (A and B) of something (e.g., website, ad, product) to see which performs better.

Use when: You want to test the effect of a change.

Example: Testing two different website button designs to see which one gets more clicks.

🟥 2. Chi-Square Test (χ^2)

Definition: A test to check the association between two categorical (qualitative) variables.

Types:

Goodness of Fit: Is the distribution what we expect?

Test of Independence: Are two variables related?

Use when: You're working with categorical data (e.g., gender, color).

Example: Is there a relationship between gender and preference for a product?

📏 3. T-Test

Definition: Compares the means (averages) of groups to see if they are significantly different.

Types:

One-sample T-test: Compare one sample mean to a known value.

Independent T-test: Compare two separate groups.

Paired T-test: Compare the same group before and after a condition.

Use when: You have small sample size and normally distributed data.

🔁 4. Paired T-Test

Definition: A specific T-test used when comparing the same group under two different conditions (before & after).

Example: Measuring blood pressure before and after taking a medication.

⚖️ 5. Z-Test

Definition: Similar to T-test but used when the sample size is large (n > 30), and population variance is known.

Use when: Testing differences in means or proportions in large samples.

Example: Comparing test scores of a large group to a national average.

📉 6. Regression Analysis

Definition: A method to explore the relationship between a dependent variable and one or more independent variables.

Types:

Simple Linear Regression: One independent variable.

Multiple Regression: More than one independent variable.

Use when: You want to predict values or understand the impact of variables.

Example: Predicting house price based on size and number of rooms.

🔗 7. Correlation

Definition: Measures the strength and direction of the relationship between two continuous variables.

Correlation coefficient (r):

+1 → strong positive

-1 → strong negative

0 → no correlation

Use when: You want to know if variables move together.

Example: Hours studied vs. exam score.

🧪 8. ANOVA (Analysis of Variance)

Definition: Compares means of 3 or more groups to see if at least one group is significantly different.

Types:

One-way ANOVA: One factor.

Two-way ANOVA: Two factors (e.g., age and gender).

Use when: Comparing multiple groups.

Example: Comparing test scores of students in three different classes.