



Statistical Tests Reference

Parametric and Non-Parametric Tests with Examples and
Assumptions

Parametric vs Non-Parametric Tests

Parametric Tests

- Assume data follows a normal distribution
- Examples: Z-test, T-test, ANOVA
- Use interval/ratio data

Non-Parametric Tests

- No strict distribution assumption
- Examples: Chi-square, Mann-Whitney
- Use ordinal/nominal data

Z-Test

- **Use:** Compare sample mean to population mean (large n)
- **Formula:** $Z = (\bar{X} - \mu) / (\sigma / \sqrt{n})$
- **Example:** Average height of 100 students vs national average
- **Assumptions:** Normal distribution, known population variance (σ^2)

T-test

- **Use:** Compare means when σ is unknown (small n)
- **Types:** One-sample, Independent, Paired
- **Formula:** $t = (\bar{X} - \mu) / (s / \sqrt{n})$
- **Example:** Compare average exam scores of two classes
- **Assumptions:** Normal distribution, equal variances, independence

ANOVA (Analysis of Variance)

- **Use:** Compare means of 3 or more groups
- **Logic:** Between-group vs within-group variation
- **Formula:** $F = \text{MSB} / \text{MSW}$
- **Example:** Different teaching methods effect on marks
- **Assumptions:** Normality, equal variances, independent samples

Chi-Square Test (χ^2)

- **Use:** Association between categorical variables
- **Formula:** $\chi^2 = \sum ((O - E)^2 / E)$
- **Example:** Gender vs product preference
- **Assumptions:** Independent observations, expected frequency ≥ 5 , categorical data

Summary Comparison of Statistical Tests

Test	Type	Purpose	Formula / Logic	Example	Assumptions
Z-Test	Parametric	Compare sample mean to population mean (large n)	$Z = (\bar{X} - \mu) / (\sigma / \sqrt{n})$	Average height of 100 students vs national average	Normal distribution, σ known
T-Test	Parametric	Compare means when σ unknown (small n)	$t = (\bar{X} - \mu) / (s / \sqrt{n})$	Compare exam scores of two classes	Normal distribution, equal variances, independence
ANOVA	Parametric	Compare means of 3+ groups	$F = MSB / MSW$	Teaching methods effect on marks	Normality, equal variances, independent samples
Chi-Square (χ^2)	Non-Parametric	Test association between categorical variables	$\chi^2 = \sum((O - E)^2 / E)$	Gender vs product preference	Independent observations, expected freq ≥ 5 , categorical data