



B.Com Honours

Semester III

Calicut University

DATA ANALYTICS WITH STATISTICAL SOFTWARE

Course Code: COM3MN210 • Module 3 Notes

Module III: Statistical Analysis (Parametric Tests & ANOVA)

Parametric statistical tests evaluate population mean parameters under normality assumptions, providing robust inferential testing via t-tests and Analysis of Variance (ANOVA).

Unit 9: T-Test Procedure & One Sample T-Test

One-Sample t-Test: Compares sample mean ($\bar{X}$) against a known population benchmark value (μ_0).

$$t = \frac{\bar{X} - \mu_0}{s / \sqrt{n}} \quad | \quad (df = n - 1)$$

Unit 10: Paired Samples T-Test (Pre-Test vs. Post-Test)

Compares two related measurement means taken from the same subjects at two different time intervals (e.g., employee sales performance before vs. after training program).

Unit 11: Independent Samples T-Test & Levene's Test

Compares means between two independent groups (e.g., Male vs. Female average spending). Uses *Levene's Test for Equality of Variances* to select equal or unequal variance t-formulas.

Unit 12: One-Way Analysis of Variance (One-Way ANOVA) & Post-Hoc Tests

1. One-Way ANOVA: Evaluates mean differences across 3 or more independent categorical groups.

$$F = \frac{\text{Mean Square Between Groups (MSB)}}{\text{Mean Square Within Groups (MSW)}}$$

2. Post-Hoc Tests (Tukey's HSD): Identifies exactly which specific pair of groups differs significantly following a significant F-test.

Unit 13: Two-Way Analysis of Variance (Two-Way ANOVA)

Examines the simultaneous impact of two independent categorical factors (e.g., Store Size & Ad Campaign Type) and their *Interaction Effect* on a continuous outcome variable.

Practical Problem 1 (One-Way ANOVA Solved Computation & SPSS Output Interpretation): A retail chain tests product sales across 3 Store Formats: Format A (Supermarket, $n_1 = 5$), Format B (Hypermarket, $n_2 = 5$), Format C (Convenience Store, $n_3 = 5$). Sum of Squares Between Groups (SSB) = 400 ($df_{\text{between}} = 2$). Sum of Squares Within Groups (SSW) = 240 ($df_{\text{within}} = 12$). Calculate (a) Mean Square Between (MSB), (b) Mean Square Within (MSW), (c) F-statistic value, and (d) Test significance at 5% level (Critical ($F_{0.05, 2, 12} = 3.89$)).

Step-by-Step Solved One-Way ANOVA:

- **1. Mean Square Between (MSB):**

$$MSB = SSB / df_between = 400 / 2 = 200.0$$

- **2. Mean Square Within (MSW):**

$$MSW = SSW / df_within = 240 / 12 = 20.0$$

- **3. F-Statistic Computation:**

$$F = MSB / MSW = 200.0 / 20.0 = 10.00$$

- **4. Statistical Conclusion:**

Calculated F-ratio (10.00) > Critical F-value (3.89) at ($p < 0.05$).

Decision: Reject H0. Product sales differ significantly across store formats!

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