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B.Com Honours

Semester III

Calicut University

DATA ANALYTICS WITH STATISTICAL SOFTWARE

Course Code: COM3MN210 • Module 2 Notes

Module II: Inferential Statistics & Non-Parametric Tests

Covers hypothesis testing fundamentals, Chi-Square non-parametric test for independence of attributes, and Pearson correlation analysis in SPSS.

Unit 6: Hypothesis Testing with SPSS – Null & Alternative Formulation

1. Definitions: Null Hypothesis (H_0): No significant effect/difference) vs. Alternative Hypothesis (H_1): Significant effect exists).

2. Decision Rule (Sig. / p-value):

If p-value (Sig. 2-tailed) < 0.05 → Reject H_0 (Statistically Significant) | If $p \geq 0.05$ → Accept H_0

Unit 7: Chi-Square Test (χ^2) for Independence of Attributes

1. Purpose: Tests whether two categorical (nominal/ordinal) variables are independent.

2. Test Statistic & Expected Frequency Formula:

$$(\chi^2 = \sum \frac{(O - E)^2}{E}) \quad | \quad (E = \frac{\text{ext}\{\text{Row Total}\} \times \text{ext}\{\text{Column Total}\}}{\text{ext}\{\text{Grand Total}\}})$$

Degrees of Freedom: $(df = (r - 1)(c - 1))$.

Unit 8: Correlation Analysis – Pearson's (r) & Spearman's Rho

Measures strength and direction of linear association between two continuous scale variables. Pearson coefficient (r) ranges from -1.0 (perfect negative correlation) to +1.0 (perfect positive correlation).

Practical Problem 1 (Chi-Square Test Solved Calculation): A retail store tests whether Gender (Male/Female) is independent of Preferred Payment Method (Cash/UPI). Survey sample $N = 200$ respondents.

Observed Frequencies (O): Male Cash = 40, Male UPI = 60 (Total Males = 100); Female Cash = 20, Female UPI = 80 (Total Females = 100). Total Cash = 60, Total UPI = 140. Calculate (a) Expected Frequencies (E) for each cell, (b) Chi-Square Statistic (χ^2), and (c) Test significance at 5% level (Critical $\chi^2_{(0.05, 1 df)} = 3.841$).

Step-by-Step Solved Chi-Square Test:

• 1. Expected Frequencies (E):

$(E_{\text{Male, Cash}}) = (100 \times 60) / 200 = 30$; $(E_{\text{Male, UPI}}) = (100 \times 140) / 200 = 70$.
 $(E_{\text{Female, Cash}}) = (100 \times 60) / 200 = 30$; $(E_{\text{Female, UPI}}) = (100 \times 140) / 200 = 70$.

• 2. Chi-Square (χ^2) Computation:

Cell 1 (Male Cash): $((40 - 30)^2 / 30 = 100 / 30 = 3.333)$.
Cell 2 (Male UPI): $((60 - 70)^2 / 70 = 100 / 70 = 1.429)$.
Cell 3 (Female Cash): $((20 - 30)^2 / 30 = 100 / 30 = 3.333)$.
Cell 4 (Female UPI): $((80 - 70)^2 / 70 = 100 / 70 = 1.429)$.

Calculated (χ^2) = $3.333 + 1.429 + 3.333 + 1.429 = 9.524$

- **3. Statistical Decision:**

Calculated (χ^2) (9.524) > Critical (χ^2) (3.841) at ($p < 0.05$).

Decision: Reject H0. Payment Method is significantly dependent on Gender!

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