Stat 01: Statistical Hypothesis Tests

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Course Description:

This course provides a comprehensive introduction to statistical hypothesis testing, a fundamental concept in statistics and data analysis. Students will learn the theory and practical application of hypothesis testing, including choosing appropriate tests, conducting tests in statistical software, interpreting results, and making informed decisions based on statistical evidence. The course will cover a wide range of hypothesis tests commonly used in various fields, from t-tests to chi-square tests.

Prerequisites:

- Basic understanding of statistics and probability.
- Familiarity with descriptive statistics and data visualization.
- Familiarity with the statistical software R.

Course Objectives:

By the end of this course, Course participants should be able to:
1. Understand the fundamental principles of hypothesis testing.
2. Choose appropriate hypothesis tests for different scenarios.
3. Conduct hypothesis tests using statistical software.
4. Interpret the results of hypothesis tests.
5. Apply hypothesis testing to real-world problems and draw meaningful conclusions.

Course Outline:

Module 1: Introduction to Hypothesis Testing
- The role of hypothesis testing in statistics.
- Null and alternative hypotheses.
- Significance level and p-values.

Module 2: One-Sample Hypothesis Tests
- One-sample t-tests for mean.
- One-sample z-tests.
- Hypothesis tests for proportions.

Module 3: Two-Sample Hypothesis Tests
- Independent samples t-tests.
- Paired samples t-tests.
- Hypothesis tests for two proportions.

Module 4: Analysis of Variance (ANOVA)
- One-way ANOVA.
- Two-way ANOVA.
- Post hoc tests and pairwise multiple comparisons.

Module 5: Chi-Square Tests
- Chi-square goodness-of-fit test.
- Chi-square test for independence.
- Chi-square test for homogeneity.

Module 6: Nonparametric Tests
- Wilcoxon signed-rank test.
- Mann-Whitney U test.
- Kruskal-Wallis test.
- Pairwise multiple comparisons.

Module 7: Real-World Applications
- Applications to real-world datasets.
- Case studies and examples from various fields.

Assessment Methods:
1. Quizzes and Homework Assignments: Assessing understanding of theoretical concepts.
2. Final Exam: Covering material from the entire course.
3. Group Projects: Applying hypothesis testing to real-world data analysis.
4. Class Participation: Active engagement in discussions and activities.

Grading:
- Quizzes and Homework Assignments: 30%
- Final Exam: 30%
- Group Projects: 30%
- Class Participation: 10%

Textbook:
- Christian Heumann, Michael Schomaker, Shalabh. Introduction to Statistics and Data Analysis with Exercises, Solutions and Applications in R. ISBN 978-3-031-11832-6, ISBN 978-3-031-11833-3 (eBook) https://doi.org/10.1007/978-3-031-11833-3