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Psychology 611

Course Goals

The goal in the course is to present elementary statistics in terms of the general linear statistical model and to indicate the problems relating to the choosing the correct statistical test and appropriate error rate. The ANOVA and regression cases of the general linear model are presented and the mathematical redundancy of t and F tests and correlational methods illustrated. The logic of the F test, contrasts (interpreted as a t -test and as an F test between two groups), and orthogonal polynomials is presented. Contrast analysis as a way of yielding more focused comparisons in the one-way and two-way ANOVA are emphasized. Multiple comparison procedures as a means of controlling familywise error rate are taught. The course also introduces students to the use of mainframe SAS for statistical analysis.

- I. How probability enters into statistics
 - a. Elementary rules for calculating probabilities
 - b. Conditional probability and Bayes' theorem
 - c. Binomial distribution
 - d. Law of large numbers
 - e. Interpretation of two-dimensional tables
- II. Basic statistical concepts
 - a. Distinction between population parameters and sample statistics
 - b. Sampling distributions
 - c. Calculating the mean and variance of a statistic $y=f(x)$ where f is a linear function
 - d. Properties of estimators and definitions of error
 - e. Central limit theorem
 - f. Probability distributions: z , t , χ^2 , and F
 - g. Controlling type I and type II errors and power
- III. One sample hypothesis testing and estimation
 - a. One sample z test and t test
 - b. Mathematical equivalence of t test and confidence interval
 - c. One sample F test
 - d. Mathematical equivalence of t and F tests
 - e. Defining a one-parameter ANOVA model
- IV. Two sample hypothesis testing and estimation
 - a. Independent and dependent samples
 - b. Homogeneity of variances
 - c. Significance and effect size
 - d. Relation of t test, F test, and linear-correlation
 - e. Defining a two-parameter ANOVA and regression model
- V. One-way ANOVA comparing three or more groups
 - a. Partitioning of total sums of squares and model assumptions
 - b. Fixed effects model
 - c. Confidence Intervals
 - d. Effect size and Power
 - e. Robustness
 - f. Orthogonal and nonorthogonal comparisons
 - g. ANOVA and regression models
 - h. Multiple comparisons and controlling Familywise error
 - i. Trend analysis
- VI. Comparison of ANOVA and regression
 - a. Least-squares regression equation
 - b. Relation of regression to ANOVA
- VII. Two-way and three-way ANOVA
 - a. Partitioning of total sums of squares in a factorial design
 - b. Partitioning of total sums of squares in a within subjects design
 - c. Analyses of main effects and interactions
 - d. Contrasts of main effects and interactions