BIOSTATISTICS II (E10.2996)

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Required Texts: Introductory Biostatistics, Chap T. Le
The Research Methods Knowledge Base, William M. K. Trochim
British Medical Journal Statistics at Square One (online book)

Optional Text: Data Analysis for the Behavioral Sciences using SPSS, Weinberg&Abramowitz

This course is the second course in the Biostatistics sequence and is intended for consumers of statistics in the biological and medical fields as well as researchers. It will concentrate on more advanced methods of statistical analysis and research design that are typical biological and medical applications of statistics. It is assumed that the student will be familiar with basic statistics and statistical techniques as presented in E10.2995. We will be using the statistical program SPSS to perform statistical processing. It is assumed that the student has basic skills in the use of SPSS for entering data sets and performing basic analyses and graphics. There will be assignments that require the use of SPSS. SPSS is installed on the computers in the Tisch Hall computer lab. You will have a class account that gets you access to the lab during prime access hours.

Objectives: At the conclusion of this course the student will be able to:

1) Apply critical evaluation skills to the reading of scientific research presentations as they relate to: Measurement, categorical data analysis, common epidemiological measures, ANOVA, survival analysis and non-parametric analysis.
2) Understand the principle of the use of research design and its role in scientific investigation.
3) Combine their knowledge of statistical analysis and use of SPSS to perform an analysis of real data to answer scientific hypotheses.
4) Undertake further study of statistics based on the Advanced Quantitative Methods sequence.

Course requirements:

Homework: It is essential that the student practice the skills covered in class sessions. In addition, some material not covered in class will be presented in homework problems. Homework sets will be assigned over the course, which concentrate on the interpretation of statistical results. In addition, there will be assignments that require the use of SPSS to perform simple statistical calculations. Homework will be collected and graded.

Projects: There will be two projects consisting of the analysis of medically oriented data sets. The student will be given a series of hypotheses and asked to perform a statistical analysis that will either support or refute the hypotheses. The student will then write up these analyses in the form of a results section of a scientific paper.

Exams: There will be both a midterm and final exam. Each will take the form of a series of statistical analyses with questions relating to the theory used, assumptions made and interpretation of the statistical data presented.

Grades

Homework	20%
Project	30%
Midterm	20%
Final	30%

09/04/03 Review of material from 1st semester (Le, review chapters 1,2,3,5,7) (Norman)
1) Descriptive statistics
2) Probability
3) Hypothesis testing
4) Correlation

09/11/03 Regression (Le, Chapter 8) (Norman)
1) Simple linear regression
2) Assumptions in regression
3) Diagnostics, residual analysis, tests for non-linearity
4) Examples

09/18/03 Regression II (Norman)
1) Multiple regression
2) Interaction
3) Dummy Coding and categorical predictors
4) Examples

09/25/03 Measurements (Trochim, Chapter 3) (Norman)
1) Review of concept of measurement.
2) Psychometric theory of measurement.
3) Reliability. Definition, ICC, Kappa
4) Validity
5) Threats to validity.

10/02/03 Cross tabulation and nominal measurement. (Le, Chapters 1,6) (Scott)
1) The contingency table. Counts, percentages, marginal totals.
2) Tests of independence.
3) Introduction to relative risk and odds ratio.
4) Other simple calculations for 2x2 tables.
5) Simpson's paradox

10/09/03 Categorical data analysis. (Scott)
1) Odds ratios, relative risk, risk difference.
2) Attributable risk.
3) Brief introduction to logistic regression
4) Brief introduction to loglinear models.
5) 2 x 2 x 2 tables.
6) Tests of population proportions

10/16/03 Diagnositic tests. Rates, ratios and epidemiology. (Scott)

1) Sensitivity, specificity, PPV, NPV.
2) Receiver operator characteristic curves.
3) Pre test probability and Bayes' theorem
4) Prevalence and incidence
5) Mortality and other rates.
6) Standardization techniques.

10/23/03 Analysis of variance (Norman)

1) Introduction and rationale
2) Hypotheses
3) Mathematical derivation.
4) 1 way analysis of variance.

10/30/03 Analysis of variance and post hoc analysis (Norman)

1) 2 way analysis of variance. Additive effects vs interaction.
2) Profile plots.
3) Post hoc analysis.

11/06/03 Non-parametric tests. Permutation and randomization tests. (Norman)

1) Descriptive statistics.
2) Mann, Whitney, Wilcoxon and Wilcoxon matched pairs test.
3) Freidman rank anova.
4) Permutation test concept.
5) Permutation test equivalent of 2 sample T test.

11/13/03 Survival analysis (Le, Chapter 11) (Scott)

1) Graphic techniques.
2) Kaplan-Meier curves
3) Hypothesis tests.

11/20/03 Experimental design (Trochim, Chapters 7,8) (Scott)

1) Longitudinal designs and cohort studies
2) Case control studies
3) Examples of experiments.
4) Statistical control
5) Examples of experimental designs

12/04/03 Practical research problem. (Scott/Norman)

1) Class will design and analyze several different research problems.

12/09/03 Final examples and review (Scott/Norman)

NOTE – This is a Tuesday running on a Thursday schedule.