

MATHEMATICS 272
INTERMEDIATE APPLIED STATISTICS

I. Introduction

A. Catalog Description

The course uses cases to understand statistical methods as collection and assessment of, and reporting of evidence regarding questions posed by scientists, researchers, lawyers, engineers, and managers. The course also exposes the students to many of the more advanced statistical methods. Satisfies the mathematical reasoning core

B. Objectives

The course will teach the students more statistical methods, but more importantly, how to approach statistical analysis and how to evaluate statistical evidence. A significant emphasis will be placed on effectively presenting and communicating findings based on statistical evidence.

C. Prerequisites

Math 271 or equivalent

II. Components

A. Unifying themes

1. The case method and communication of statistical results
 - Question of interest
 - Display of the data
 - Communication of findings
 - Scope of Inference
2. Inferential issues
 - Observational studies versus planned experiments
 - Enumerative versus inductive arguments
 - Informal logic of significance testing
 - Generalizability of findings
3. General issues
 - Use and abuse of statistics
 - Model assumptions
 - Assessing model assumptions
 - Robustness and resistance
 - Efficiency and power

B. Topics

1. One and two sample tests
 - t-tests
 - matched pairs
 - non-parametric tests
 - randomization tests
 - log transformations

B. Topics (continued)

2. One-way analysis of variance
 - residuals analysis
 - non-parametric alternatives
 - ANOVA tables
 - comparisons
3. Simple regression
 - least squares regression
 - ANOVA tables
 - residuals and diagnostics
 - hypothesis tests
 - prediction intervals
 - log transformations
 - time series and correlated observations
4. Multiple regression
 - multiple variables
 - indicator variables
 - interaction
 - quadratic terms
 - ANOVA tables
 - testing and prediction
 - model selection
5. (as time permits) Two-way analysis of variance
 - the regression model
 - residuals
 - ANOVA table
 - testing and prediction

III. Bibliography

Introduction to the Practice of Statistics, Moore & McCabe (Freeman)

Introduction to Statistical Reasoning, Gary Smith (McGraw-Hill)

The Statistical Sleuth, Ramsey & Schafer (Duxbury)

A Second Course in Statistics, Mendenhall & Sincich (Prentice Hall)

Statistics: A Guide to the Unknown, Tanur et al, (Duxbury)