MATHEMATICAL STATISTICS II
MA 331

Catalogue Description

An analysis of applications of probability and mathematical statistics is presented in this course. Topics include sampling distributions, point estimation, interval estimation, hypothesis testing, regression and correlation, and analysis of variance. 3 credits. Prerequisite: Math 330 Mathematical Statistics or equivalent.

Goals

A. To apply the knowledge of probability and random variables learned in Ma 330 to sampling distributions, estimation theory, and hypothesis testing.
B. To understand the mathematical model and assumptions which underlie regression and correlation and the analysis of variance.
C. To solve problems using commonly available statistical packages.
D. To increase the student's ability to prove theorems.
E. To increase the student's ability to use calculators and computers.
F. To encourage the student to attack interesting problems not presented in class, and to consider alternative approaches to solving problems.
G. To encourage the student to use criteria of consistency and reasonableness in evaluating his solutions to problems.

Procedures

A. Lecture/Discussion
B. Step-by-step problem calculations with calculators or computers.
C. Cooperative assignments.
D. Student critiques of erroneous solutions.
E. Daily homework assignments and in-class discussion of solutions.
F. Applied Projects. Projects will be assigned for which the student must present a problem, formulate a hypothesis, collect data, and test his statistics using a common software package. Project assignments may include applications of difference in means, simple linear regression and correlation, and analysis of variance.

Course Content

A. Functions of Random Variables
   1. Distribution function techniques
   2. Transformation technique: one variable
   3. Transformation technique: two variables
   4. Moment-generating function technique

B. Sampling Distributions
   1. Distribution of the mean
   2. The Chi-square distribution
   3. The t distribution
   4. The F distribution
   5. The Poisson distribution
C. Point Estimation
   1. Point estimation
   2. Unbiased estimators
   3. The Method of moments
   4. The Method of maximum likelihood

D. Interval Estimation
   1. Confidence intervals for means
   2. Confidence intervals for difference in means
   3. Confidence intervals for proportions
   4. Confidence intervals for differences in proportions
   5. Confidence intervals for variances
   6. Confidence intervals for ratios of two variances

E. Hypothesis Testing Theory
   1. Testing a statistical hypothesis
   2. Losses and risks
   3. Power function of a test

F. Hypothesis Testing: Applications
   1. Tests concerning means
   2. Differences between means
   3. Tests concerning variances
   4. Tests concerning proportions
   5. Differences among K proportions
   6. r x c tables
   7. Goodness of fit

G. Regression and Correlation
   1. Linear Regression
   2. Method of least squares
   3. Normal regression analysis
   4. Normal correlation analysis
   5. Multiple Linear regression (opt)
   6. Multiple Linear regression (Matrix notation)

H. Analysis of Variance
   1. One-way anova; uses of variance
   2. Experimental Design
   3. Two-way analysis of variance

Evaluation methods
   1. Daily homework assignments. Students are expected to do their assignments
      and be prepared to discuss the problems in class.
   2. Quizzes. Quizzes will be given if necessary. All quizzes will count
      collectively as an additional test.
   3. Special take-home problems. Individual or group problems may be assigned
      and counted collectively as an additional test.
   4. Tests. Unit tests will be given every three or four weeks. The results will be
      discussed in class.
   5. Projects. A maximum of three projects will be assigned and graded.
6. Comprehensive final exam. This will test whether the student has finally learned to do the problems which are representative of the course and to what extent he possess these skills at the conclusion of the course.

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*Grading procedures vary with instructor.*

**Bibliography**


**Software**