MATHEMATICAL STATISTICS I
MA 330

Catalogue Description

This course is an introduction to Calculus-based mathematics of statistics. Topics include basic combinatorial methods, random variables, probability distributions and densities, expectation, and the binomial and normal distributions. Prerequisites: Ma 290

Goals

A. To teach a knowledge of combinatorial reasoning.
B. To increase the student's appreciation of how combinatorial reasoning differs from other approaches to proof and problem solving.
C. To teach a knowledge of random variables that forms a basis for studying the most useful distributions.
D. To increase the student's ability to prove theorems.
E. To improve the student's ability to apply the Calculus.
F. To introduce the student to common notations for summations and products.
G. To increase the student's ability to use calculators and computers.
H. To encourage the student to attack interesting problems not presented in class, and to consider alternative approaches to solving problems.
I. 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.

Course Content

A. Combinatorics
1. Combinatorial methods
2. Binomial coefficients

B. Probability
1. Sample spaces
2. Events
3. Probability of an event
4. Some rules of probability
5. Conditional probability
6. Independent events
7. Bayes' Theorem

C. Probability Distributions & Probability Densities
1. Discrete random variables and probability distributions
2. Continuous random variables and probability density functions
3. Multivariate distributions

4. Marginal distributions
5. Conditional distributions

D. Mathematical Expectation

1. Expected value of a random variable
2. Moments
3. Chebyshev's Theorem
4. Moment-generating functions
5. Product moments
6. Moments of linear combinations of random variables
7. Conditional expectations

E. Special Probability Distributions

1. Discrete uniform distribution
2. Bernoulli distribution
3. Binomial distribution
4. Negative binomial & geometric distributions
5. Multinomial distribution

F. Special Probability Densities

1. Uniform density
2. Normal distribution
3. Normal approximation to the binomial distribution

Evaluation methods

1. Daily homework assignments. Students are expected to do their assignments and be prepared to discuss the problems in class.
2. Special take-home problems. Problems will be counted collectively as an additional test.
3. Quizzes. Quizzes will be counted collectively as an additional test. Quizzes will be given when necessary
4. Tests. Tests will be given every three to four weeks. The results will be discussed in class.
5. 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 possesses these skills at the conclusion of the course.

Tests	2/3
Final Exam	1/3

*** Grading procedures vary with Instructor.**

Bibliography

Required Text: Walpole, Ronald E, Myers, Raymond H & Myers, Sharon L., Probability and Statistics for Engineers and Scientists, 6th Ed., Upper Saddle River, N.J., Prentice Hall, 1998.

Feller, W., An Introduction to Probability Theory and its Applications, Volume I, 3rd Ed., New York, N.Y., John Wiley & Sons, 1968.

Freund, John E., Mathematical Statistics, 6th Ed., Englewood Cliffs, N.J., Prentice-Hall, 1999.

Freund, John E. & Miller, I., Probability and Statistics for Engineers, 3rd Ed., Englewood Cliffs, N.J., Prentice-Hall, 1985.

Hogg, Robert V. & Craig, Allen T., Introduction to Mathematical Statistics, 5th Ed., Englewood Cliffs, N.J. Prentice-Hall, 1995.

Hogg, Robert V. & Tanis, Elliot A., Probability and Statistical Inference, 3rd Ed., Macmillan Publishing Co., 1988.

Lindgren, B.W., Statistical Theory, 2nd Ed., New York, N.Y., Macmillan Publishing Co., 1989.

Port, Probability and Its Applications, New York, N.Y., John Wiley & Sons, 1988.

Rosenkrantz, Walter A., Introduction to Probability and Statistics for Scientists and Engineers, McGraw-Hill, 1997.

Watanabe, S. & Prokhorov, Y.V., Probability Theory and Mathematical Statistics, Springer-Verlag, 1988.

Software

Schaefer, Robert & Anderson, Richard Anderson, Student Edition of MINITAB, Release 9.5, Addison-Wesley, Reading Ma., 1996.