

MATH 4420 - Probability and Statistics II

Course description: Statistical models; point estimation; interval estimation; testing statistical hypotheses; analysis of discrete data; nonparametric methods.

Prerequisite: C or better in MATH 4410.

Schedule: Spring. 3 credit hours.

Textbook: *Introduction to Mathematical Statistics and Its Applications*, 4th edition, Larsen and Marx, Prentice Hall.

Overview of the MATH 4410/4420 sequence:

Math 4420 is the second course in a two-course sequence in mathematical statistics for undergraduate students in mathematics, statistics and actuarial science. This sequence also provides an excellent preparation for undergraduate students who are preparing for graduate study in statistics or statistically based areas such as econometrics, psychometrics, or biostatistics. It lays the essential mathematical basis for graduate-level courses in statistics or statistically based courses and many graduate programs from a variety of disciplines require or strongly recommend it for prospective students. The sequence is vital for Actuarial Science students.

The topics in MATH 442 cover standard topics in estimation of parameters, hypothesis testing, and goodness of fit tests, with coverage of regression and analysis of variance as time permits.

Topics covered (Chapters 5, 6, 9, 10, 11, 12):

5. Estimation

Estimating Parameters: The Method of Maximum Likelihood and the Method of Moments. Interval Estimation. Properties of Estimators. Minimum-Variance Estimators: The Cramer-Rao Lower Bound. Sufficiency. Consistency.

6. Hypothesis Testing

The Decision Rule. Testing Binomial Data— $H_0: p = p_0$. Type I and Type II Errors. A Notion of Optimality: The Generalized Likelihood Ratio.

9. Two-Sample Problems

Testing $H_0: \mu_x = \mu_y$ —The Two-Sample t Test. Testing $H_0: \sigma_x^2 = \sigma_y^2$ —The F Test. Binomial Data: Testing $H_0: p_x = p_y$. Confidence Intervals for the Two-Sample Problem.

10. Goodness-of-Fit Tests

The Multinomial Distribution. Goodness-of-Fit Tests: All Parameters Known. Goodness-of-Fit Tests: Parameters Unknown. Contingency Tables.

11. Regression (if time allows)

The Method of Least Squares. The Linear Model. Covariance and Correlation. The Bivariate Normal Distribution.

12. The Analysis of Variance (if time allows)

The F Test. Multiple Comparisons: Tukey's Method. Testing Subhypotheses with Orthogonal Contrasts. Data Transformations.