



Math 461: Introductory to Probability Theory (3 credit hours)

Course Description

This is an introduction to mathematical probability. Topics for this course include the calculus of probability, combinatorial analysis, random variables, expectation, distribution functions, moment-generating functions, and the central limit theorem.

Prerequisite: Calculus III

Course Objectives

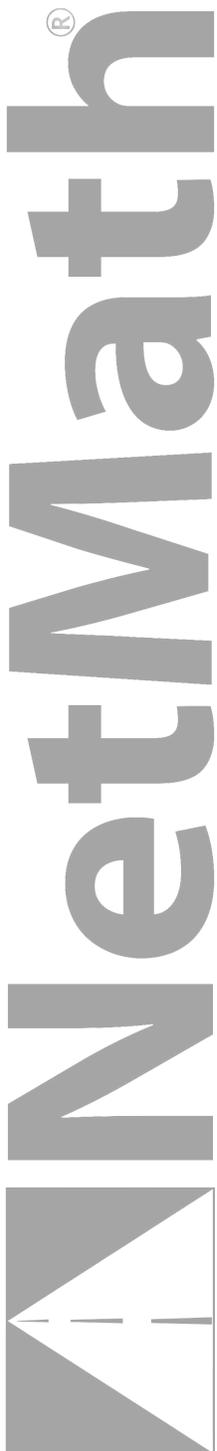
After completing this course a successful student will be able to understand and apply the topics listed above. He/she will also be able to apply numerical, computational, and estimation techniques. Through exploration, a successful student will be able to use probability models to analyze physical phenomena. He/she will also have the necessary tools to formulate and solve problems in mathematical situations and connect concepts to other disciplines. Most importantly, a student completing this course will be able to communicate ideas through descriptive language as well as mathematical symbols.

Course Content and Format

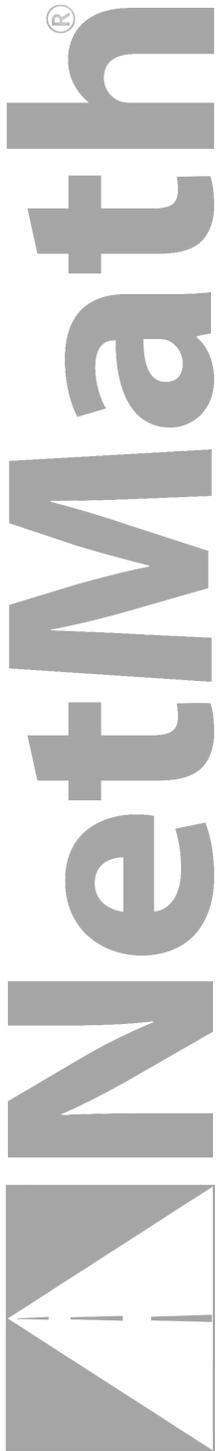
Content

A brief outline of topics for this course appears below:

- Tools for Data Analysis
 - Frequency plots
 - Expected value and variance of a data set
 - Cumulative distribution function
- Probabilities
 - Conditional probability
 - Independence of two events
 - Applications of probability
- Advanced Data Analysis
 - Markov's Inequality
 - Chebyshev's Theorem
 - Law of Large Numbers
 - Monte Carlo simulations



DEPARTMENT OF MATHEMATICS



- Normal and Exponential distribution
 - Approximating distributions
 - Quartiles
- Random Variables
 - Probability density functions
 - Various probability distributions
- Joint Distributions
 - Joint probability
 - Conditional expectations
 - Bivariate normal probability density functions
 - Minimizing conditional expected value
- Central Limit Theorem
 - Generating functions
 - Sample means
 - Fourier Transform application
- Binomial and Poisson distributions
 - Poisson counting process
 - Probability applications
 - Sampling with/without replacement
- Some Statistics
 - Estimate expected values and variance
 - Confidence intervals
 - Hypothesis testing

Format

Course content is drawn from *Probability and Statistics* written by Bill Davis, Horacio Porta and Jerry Uhl ©2006-2010.

Math 461 utilizes the CAS-ILE system. See <https://cas-ile.illinois.edu/> for more information. This online system helps students learn math topics through dynamic exploration and visualization.

Exams for Math 461 are taken online.