MATH 250 Introduction to Probability

Learning Objectives

After taking this course, the student should be able to:

- understand the meaning of probability and probabilistic experiment

- familiarize himself/herself with the four approaches to probability theory and particularly, the axiomatic approach

- use and manipulate the four axioms of probability comfortably to derive the results of other set operations

- use Venn diagrams to represent the result of set operations

- understand the meaning of conditional probability, conditioning, and reduced sample space

- understand the concept of a random variable

- distinguish between independent and uncorrelated random variables

- distinguish between discrete, continuous, and mixed random variables and be able to represent them using probability mass, probability density, and cumulative distribution functions

- partially characterize a distribution using expected value, variance, and moments

- represent joint distributions of multiple random variables

- derive the distributions of functions of a random variable

- identify important types of distributions such as exponential, geometric, Poisson, Gaussian (normal), and multi-variate Gaussian, and use them as suitable models in basic science and engineering problems

- use (Laplace) transforms of distributions for moment generation and for problems where the results may be difficult to find by manipulating PDFs

- apply convolution operation to find the resulting PDF of sums of independent rvs

- understand the concept of a random sequence and distinguish between different types of convergence for random sequences

- understand the sample mean estimator and have some familiarity with estimation problems

- understand limit theorems such as Weak Law of Large Numbers, Strong Law of Large numbers, and the Central Limit Theorem

- extend the concept of a random variable to a random process and understand the basics of random processes