MATH 5128: Applied Probability I
Syllabus


- **Chapter 1: Probability**
  - Sample spaces, events, and axioms of probability
  - Conditional probability and Bayes’ Rule

- **Chapters 2: Random Variables**
  - Discrete and continuous random variables, expectation and variance
  - Joint distributions, expectation of a function of several random variables, and covariance
  - Variance of linear combinations of random variables

- **Chapter 3: Conditional Probability and expectation**
  - Discrete and continuous cases
  - Conditional expectation as a random variable
  - Computing probability, expectation, and variance by conditioning
  - Random sums of random variables

- **Chapter 4: Markov Chains**
  - Basic definitions
  - Classification of states, transient vs. recurrent states, absorbing states, periodicity
  - Regular Markov chains, stationary and limiting distributions, Law of Large number for regular MCs
  - Fundamental Matrix, Number of visits to transient states
  - Absorbing MCs

- **Chapter 5: Exponential Distribution and Poisson Process**
  - Memoryless property of the exponential
  - Counting processes
  - Relation between the Poisson process and the gamma process
  - Thinning Poisson processes
  - Compound Poisson process