Chapter 1

Probability

1.1 Basic concepts and results

- Random experiment
- Sample space
- Event
- Probability measure and its properties
- Conditional probability
- Total probability theorem
- Bayes' theorem
- Random variable
- Distribution function of a random variable
- Discrete random variable
- Continuous random variable
- Functions of a random variable
    1. Expected value
    2. Raw moment of order k
    3. Central moment of order k
    4. Moment generating function
- Bivariate random variables
    1. Marginal distributions
    2. Expectation of $Z = h(X, Y)$
    3. Conditional distributions
    4. Conditional expectations
    5. Raw moment of order (r, s)
    6. Central moment of order (r, s)
    7. Covariance
- Law of iterated expectation
- Stochastic independence

- Other forms of independence
    1. Mean independence
    2. Uncorrelatedness

1.2 Convergence of sequences of random variables

- Notions of Convergence
    1. Pointwise convergence
    2. Uniform convergence
    3. Convergence in L^P
    4. Convergence in measure
- Convergence for random variables
    1. Almost surely
    2. In the rth mean
    3. In probability
    4. In distribution
- Skorokhod representation theorem
- Continuous mapping theorem
- Slutsky theorem

1.3 Important asymptotic results

- Weak law of large numbers
- Strong law of large numbers
- Central limit theorem
- Lévy's continuity theorem
- Applications
    1. Bernoulli
    2. Simple Monte Carlo
- Delta method and its applications
    1. Log odds
    2. Variance stabalizing