3 Expected Values

- Expectations of a random variable
  - Expectation of a discrete rv
  - Expectation of a continuous rv
  - Expectations of functions of a rv
- Properties of expectation
  - Expectation of a linear function of rvs
  - Expectation of a product of independent rvs
- Variance of a rv
  - Standard deviation
  - Properties of variance and standard deviation
- Covariance and correlation
  - Properties of covariance and correlation
  - Variance of a linear combination of rvs
  - Covariance of two linear combinations of rvs
- Moments and moment generating functions
  - Moments and central moments
  - Moment generating function
  - Properties of mgfs
- Conditional expectation and conditional variance
- Markov's inequality and Chebyshev's inequality

4 Sampling Distributions and Limit Theorems

- Random sampling, statistics and sampling distributions
- Convergence in probability
- Weak law of large numbers
- Convergence in distribution

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- Central limit theorem
- Distributions derived from the normal distribution
  - Distribution of linear combinations of independent normal random variables
  - Chi-squared distribution
  - t distribution
  - F distribution
  - Sampling distribution of $\bar{X}$ and S^2 for normal random samples

5 Statistical Inference

- Inference using probability models
- Statistical models
- Data collection and data description

6 Likelihood inference

- Likelihood function
- Sufficient statistic
- Maximum likelihood estimation
  - Construction of maximum likelihood estimators
  - Invariance property of mles
- Construction of estimators using the method of moments
- Properties of estimators
  - Bias
  - Variance and standard error
  - Mean squared error

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