

# 556: MATHEMATICAL STATISTICS I

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Office Hours : Tuesday 12:00-13:30  
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Textbook : *Statistical Inference* (2nd Ed) by G. Casella and R. L. Berger.  
Evaluation : Bi-Weekly Coursework Assignments (25 %)  
Mid Term (25 %)  
Final (50 %)

## TARGET SYLLABUS

### 1 Preliminaries

- 1.1 Probability
- 1.2 Random Variables

### 2 Univariate and Multivariate Distributions

### 3 Transformations and Expectations

- 3.1 Transformations
- 3.2 Expectations

### 4 Families of distributions

- 4.1 Location-Scale Families
- 4.2 Exponential Families
- 4.3 Convolution Families and Exponential Dispersion Models
- 4.4 Hierarchical Models

### 5 Some Inequalities

- 5.1 Concentration inequalities
  - 5.1.1 Markov's inequality
  - 5.1.2 Chebyshev's inequality
  - 5.1.3 Chernoff bounds
- 5.2 Cauchy-Schwarz Inequality
- 5.3 Jensen's Inequality

### 6 Sampling Distributions

- 6.1 Definitions
- 6.2 Sampling from Families
  - 6.2.1 Sampling from a Location-Scale Family
  - 6.2.2 Sampling from an Exponential Family
  - 6.2.3 Sampling from a Normal Family

### 7 Convergence concepts

- 7.1 Convergence in Probability: The Weak Law of Large Numbers
- 7.2 Convergence Almost Surely: The Strong Law of Large Numbers
- 7.3 Weak Convergence
- 7.4 A Central Limit Theorem

### 8 The Delta Method

### 9 Pseudo-Random Generation

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