Course Outline

Topic (order varies in the lecture notes)	Textbook Section
1. Introduction to Probability	
A. Interpretation, experiments, sample space, events, set theory	1.1 – 1.2
B. Definition and properties of probability models	1.2 – 1.3
C. Finite sample spaces, counting methods, combinatorial methods	1.4
D. Conditional probability, independence, Bayes theorem	1.5
2. Random Variables and Distributions	
A. Random variables and distributions	2.1-2.2
B. Discrete random variables, continuous random variables	2.3-2.4
C. Cumulative distribution functions	2.5
D. Functions of a random variable	2.6
E. Joint distributions, conditional distributions, and independence	2.7-7.8
F. Functions of multiple random variables	2.9
G. Simulating random variables	2.10
3. Expected Values	
A. Expectation of discrete and continuous random variables	3.1-3.2
B. Variance, covariance and correlation	3.3
C. Moments and generating functions	3.4
D. Conditional expectations	3.5
E. Inequalities for probability and expectation	3.6
4. Sampling Distributions and Limit Theorems	
A. Sampling distribution of a statistic	4.1
B. Convergence in probability and the weak law of large numbers	4.2
C. Convergence in distribution and the central limit theorem	4.4
D. Monte Carlo approximations	4.5
E. Normal random samples and related distributions	4.6
5. Introduction to Statistical Inference	
A. Introduction to statistical models	5.1-5.3
B. Data collection and summary, types of statistical inference	5.4-5.5
6. Likelihood Inference	
A. Likelihood function and maximum likelihood estimation	6.1-6.2
B. Bias, variance, mean squared error	6.3.1
C. Confidence intervals, construction using pivots	6.3.2
D. Hypothesis testing and construction of tests	6.3.3
E. Method of moments estimators, the bootstrap	6.4
F. Large sample properties of maximum likelihood estimators	6.5
G. Large sample approximate confidence intervals	6.5
H. Bootstrap confidence intervals	6.4
7. Bayesian Inference	
A. Prior and posterior distributions	7.1
B. Inferences based on the posterior distribution	7.2
8. Topics in Hypothesis Testing	
A. Neyman-Pearson approach to hypothesis testing	8.2.1-8.2.4
B. Generalized likelihood ratio tests, applications	8.2.5
C. Wald and score tests	
D. Applications of likelihood ratio tests	