Syllabus for STAT 445-446 Part of Qualifier

Casella and Berger, Second Edition

Ch. 1
Ch. 2 except 2.4
Ch. 3 except 3.6
Ch. 4 except 4.7
Ch. 5 except 5.6
Ch. 6 except 6.3 and 6.4
Ch. 7 except 7.2.3 and 7.2.4
Ch. 8 except 8.2.2, 8.2.3, 8.3.3 and 8.3.5
Ch. 9 except 9.2.4, 9.3.3 and 9.3.4

Chapter 1 – Probability Theory

Set theory
Basics of probability theory
Conditional probability and independence
Random variables
Distribution functions
Density and mass functions

Chapter 2 – Transformations and Expectations

Distributions of functions of a random variable
Expected values
Moments and moment generating functions

Chapter 3 – Common Families of Distributions

Discrete distributions
Continuous distributions
Exponential families
Location and scale families
Probability inequalities

Chapter 4 – Multiple Random Variables

Joint and marginal distributions
Conditional distributions and independence
BIvariate transformations
Hierarchical models and mixture distributions
Covariance and correlation
Multivariate distributions
Inequalities

Chapter 5 – Properties of a Random Sample

Order Statistics
Distributions of some sample statistics
Definitions of chi-square, t and F distributions
Large sample methods
    Convergence in probability
    Convergence in law
    Continuity Theorem for mgfs
Major Theorems
    WLLN
    CLT
    Continuity Theorem
    Corollaries
Delta Method

Chapter 7 – Point Estimation

Method of Moments
Maximum Likelihood Estimation
Transformation Property of MLE
Comparing statistical procedures
    Risk function
    Inadmissibility and admissibility
    Mean squared error
Properties of Estimators
    Unbiasedness
    Consistency
    Mean-squared error consistency
Sufficiency (CH 6)
    Definition
    Factorization Theorem
Minimal SS
Finding a SS in exponential families
Search for the MVUE or best unbiased estimator
    Rao-Blackwell Theorem
    Completeness
    Lehmann-Scheffe
Location and scale invariance
Location and scale parameters
Cramer-Rao lower bound

Chapter 8 – Hypothesis Testing

Notation and terminology
- 0-1 loss function
- Risk
- Critical region
- Types of errors
- Power function

Randomized tests
Size of a test
Testing simple versus simple hypotheses
- Most powerful test
- Neyman-Pearson Theorem

Testing simple versus composite hypotheses
- Uniformly most powerful test

Testing composite versus composite hypotheses (one-sided)
- Monotone likelihood ratio increasing and decreasing
- UMP test

Other
- Likelihood ratio test

Chapter 9 - Interval Estimation

Pivotal Method for finding a confidence interval
Method for finding the "best" confidence interval
Large sample confidence intervals