

Outline of Topics Covered in Stat 6650

Fall Term 2007

Many references are used in this course, including the four listed next. In this list, the first two are the primary references and the last two were used in two of the topics.

1. **HMC**: Hogg, R. V., McKean, J. W. and Craig, A. T. (2005), *Introduction to Mathematical Statistics*, Upper Saddle River, N.J.: Pearson.
2. **LC**: Lehmann, E. L. and Casella, G. (1998), *Theory of Point Estimation, 2nd Ed*, New York: Springer.
3. **L1**: Lehmann, E. L. (1986), *Testing Statistical Hypotheses, 2nd Ed*, New York: Springer.
4. **L2**: Lehmann, E. L. (1999), *Elements of Large-Sample Theory*, New York: Springer.

1. Basic Asymptotic Theory (Primary Reference: Chapter 4 of HMC)

- (a) Convergence in probability and distribution.
- (b) Properties of these convergences.
- (c) Central Limit Theorem, Δ -Method.
- (d) Extension to Multivariate Distributions.

2. Review of Statistical Inference. (Primary Reference: Chapter 5 of HMC).

- (a) Order Statistics. Quantiles and CIs for quantiles.
- (b) Confidence Intervals.
- (c) Hypotheses Tests. Power curve.
- (d) Method of Monte Carlo. Generation of rv's. Accept-Reject Algorithm. Empirical studies of levels and powers of tests and confidences of CIs.
- (e) Bootstrap. Percentile CIs. Bootstrap p -values. Different bootstrap methods (general, model building).

3. Likelihood Inference Theory (Primary Reference: Chapter 6 of HMC).

- (a) Estimation: Consistency, asymptotic distribution, Fisher Information, Rao-Cramer Lower Bound, Efficiency, ARE.
- (b) Testing: Likelihood ratio tests, Wald's Test, Scores Test. Asymptotic Theory.
- (c) Multivariate Extensions.

4. Sufficiency and Completeness (Primary Reference: Chapter 1 of LC).
 - (a) Exponential Family.
 - (b) Sufficiency and completeness. Factorization Theorem. Convexity and Jensen's Inequality.

5. MVUE's. (Primary Reference: Chapter 2 of LC).
 - (a) Lehmann-Scheffe Theorem.
 - (b) Rao-Blackwell Theorem.
 - (c) Theory of minimal sufficient statistics.
 - (d) Methods for MVUEs: Recognition, Solving, Conditioning on a sufficient and complete statistic.
 - (e) Nonparametric models.
 - (f) Basu's Theorem.
 - (g) Hogg's Adaptive Inference.

6. Bayesian Statistics, (Primary References: Chapter 4 of LC and Chapter 11 of HMC).
 - (a) Bayes Model: prior and posterior distributions.
 - (b) Bayes estimates (under square-error-loss).
 - (c) Families of Priors: Ignorance, conjugate priors, Jeffrey's Priors.
 - (d) Monte Carlo Methods: general for estimation, Gibb's sampler.
 - (e) Hierarchical Bayes and Empirical Bayes.

7. Density Estimation, (Primary Reference: Chapter 6 of L2).
 - (a) Rectangular and general kernels.
 - (b) Bandwidth, bias and variance. Plug-in-procedures.

8. Classical Theory of Testing: (L1 and Chapter 8 of HMC).
 - (a) Neyman-Pearson lemma.
 - (b) Monotone-likelihood-ratio: General rule for all one sided tests.
 - (c) Unbiased and similar tests.
 - (d) Two-sided hypotheses.