California State University, Long Beach
Department of Mathematics and Statistics

Syllabus for the Statistical Inference Comprehensive Examination

1. Topics

   (a) *Measure-Theoretical Probability.* Convergence in distribution, convergence in probability, almost sure convergence, delta method, law of large numbers, central limit theorem, order statistics, transformation of random variables.

   (b) *Point Estimation.*

   - maximum likelihood estimator, method of moments estimator, unbiased estimator, Fisher information, Cramèr-Rao inequality, minimum variance unbiased estimator (best unbiased estimator), efficiency, relative efficiency;
   - sufficient and minimal sufficient statistics, factorization criterion, exponential family, ancillary and complete statistics;
   - loss function, mean squared error, prior and posterior distributions, conjugate families of distributions, bayesian estimator;

   (c) *Interval Estimation.*

   - methods of finding interval estimators: pivotal quantity, inverting the test statistic, pivoting the cumulative distribution function, bayesian interval;
   - methods of evaluating interval estimators: coverage probability;

   (d) *Hypothesis Testing.*

   - methods of finding tests: likelihood ratio test, bayesian test;
   - methods of evaluating tests: type I and type II errors, power of a test, uniformly most powerful test, Neyman-Pearson lemma p-value.

2. References

   (a) Casella, G. and Berger, R.L. *Statistical Inference*, 2nd ed., Duxbury, 2002, Chapters 5–10.

   (b) Hogg, R.V. and Craig, A.T. *Introduction to Mathematical Statistics*, 5th ed., Prentice Hall, 1995, Chapters 5–10.

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