

PRELIMINARY EXAMINATION TOPICS LIST FOR STATISTICS

1. Probability and distributions
 - (a) The probability set function
 - (b) Conditional probability and independence
 - (c) Random variables
 - (d) Distribution functions
 - (e) Expectations
 - (f) Chebyshev's inequality
2. Multivariate distributions
 - (a) Distributions of several random variables
 - (b) Conditional distributions and expectations
 - (c) Correlation, independence
3. Special distributions
 - (a) The binomial and related distributions
 - (b) The poisson distribution
 - (c) The gamma and chi-square distributions
 - (d) The univariate and bivariate normal distributions
 - (e) The beta, t , and F distributions
4. Transformations of random variables
 - (a) The change-of-variable technique
 - (b) Order statistics
 - (c) The moment-generating-function technique
 - (d) The distribution of \bar{X} and nS^2/σ^2
 - (e) Expectations of functions of random variables
5. Limiting distributions
 - (a) Convergence in distribution and convergence in probability
 - (b) Limiting moment-generating functions
 - (c) The central limit theorem and other related theorems
6. Statistical inference
 - (a) Point estimation and confidence intervals
 - (b) Tests of statistical hypotheses, Chi-square test
7. Sufficient statistics
 - (a) Measures of quality of estimators

- (b) Sufficient statistics
 - (c) Completeness and uniqueness
 - (d) The exponential class of probability density functions
 - (e) Functions of a parameter,
 - (f) The case of several parameters
 - (g) Minimal sufficient and ancillary statistics
 - (h) Sufficiency, completeness, and independence
8. Estimation
- (a) Bayesian estimation
 - (b) Fisher information and the Rao-Cramer inequality
 - (c) Limiting distributions of maximum likelihood estimators
 - (d) Robust M-Estimation
9. Theory of statistical tests
- (a) Certain best tests
 - (b) Uniformly most powerful tests
 - (c) Likelihood ratio tests
 - (d) The sequential probability ratio test
 - (e) Minimax, Bayesian and classification procedures
10. Inferences about normal models
- (a) The distributions of certain quadratic forms
 - (b) A test of the equality of several means
 - (c) Noncentral χ^2 and noncentral F
 - (d) Multiple comparisons
 - (e) The analysis of variance
 - (f) A regression problem
 - (g) A test of independence
 - (h) The distribution of certain quadratic forms
 - (i) The independence of certain quadratic forms
11. Nonparametric methods
- (a) Confidence intervals for distribution quantiles
 - (b) Tolerance limits for distributions
 - (c) The sign test
 - (d) A test of Wilcoxon
 - (e) The equality of two distributions
 - (f) The Mann-Whitney-Wilcoxon test
 - (g) Distributions under alternative hypotheses
 - (h) Linear rank statistics
 - (i) Adaptive nonparametric methods