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 $nS^2/\sigma^2$
   (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 χ² 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