Statistical Preliminary Exam Syllabus

Department of Mathematical Sciences

University of Cincinnati

(Updated July 2023)

The Statistics Prelim Exam consists of two parts, one based on material covered in STAT 7031 and the other based on material covered in STAT 7024, as listed below.

Material Covered in STAT 7031 Statistics Theory:

Exponential families, sufficient statistics, convex loss functions, UMVA estimators, the information inequality, the multiparameter case and other extensions, Bayesian inference, asymptotic efficiency, efficient likelihood estimation, likelihood ratio test, the Neyman-Pearson fundamental lemma, distributions with monotone likelihood ratio, a generalization of the fundamental lemma, two-sided hypotheses, least-favorable distributions, unbiasedness for hypothesis testing with one-parameter exponential families, similarity and completeness, UMP unbiased tests for multiparameter exponential families.

Texts:
Casella and Berger, *Statistical Inference* (2nd edition).
Lehmann and Casella, *Theory of Point Estimation*.
Lehmann, *Testing Statistical Hypotheses*.

Material covered in STAT 7024 Linear Models and Multivariate Analysis II:

Generalized inverses, solutions to linear systems, multivariate random variables, the multivariate normal distribution and its properties, some non-central distributions, distributions of quadratic forms, least squares (LS) estimation, estimable functions, the Gauss-Markov theorem, generalized LS estimation, estimation with linear restrictions, properties of LS estimates, the general linear test and its relationship with the likelihood ratio test, power of hypothesis tests in linear models, confidence intervals and multiple comparisons, underfitting and overfitting, model diagnostics, mixed-effect models.

Texts:
Ravishanker, *A First Course in Linear Model Theory*.
Searle, *Linear Models*.