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Study Guide

for the Ph.D. Comprehensive Exam

Linear Models (22S:255)

The following texts are suggested as references:

Ravishanker and Dey, *A First course in Linear Model Theory*

Schott, *Matrix Analysis for Statistics*

Searle, *Linear Models*

Stapleton, *Linear Statistical Models*

Topics

1. Matrix preliminaries: generalized inverses, Cholesky, spectral decomposition, basic results on partitioned matrices, ranks, determinants, trace, nonnegative definiteness, etc.

2. Identifiability and estimability

3. Ordinary and generalized least squares for classical (fixed effects, unconstrained) linear models: orthogonal projections, reparametrizations, Gauss-Markov Theorem, multi-part models, algebraic and geometric structure of the analysis of variance

4. Constrained linear models

5. Multivariate normal, noncentral chi-square, noncentral F-distributions

6. Expectations, variances, covariances, moment generating functions, and distributions of linear and quadratic forms, Cochran's Theorem

7. Hypothesis testing, confidence intervals and regions, simultaneous confidence intervals and multiple comparisons

8. The general mixed linear model, best linear unbiased prediction (BLUP)

9. Estimation of variance components, including maximum likelihood and restricted maximum likelihood approaches