PubH 8401/STAT 8311: Linear Models

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Grading
Homework: 40%
Midterm Exam (Oct. 25, 2017): 30%
Final Project: 30%

Covered topics

Weeks 1 and 2: Review of Linear Algebra
Linear Subspaces, Linear Transformations, Projections, Inner
Products, Orthogonality, Coordinates with respect to an
Orthonormal Basis, Orthogonal Projections, Orthogonal
transformations, Matrices, Eigenvectors and Eigenvalues, Matrix
Decompositions

Week 3-4: Linear Models

Estimation, Best Estimators, Gauss-Markov theorem, Estimability,
Linear Restrictions, Generalized Least Squares, OLS vs
Generalized Least Squares

Week 4-5: Distribution Theory

Consistency of Least Squares, Characteristic Functions,
Multivariate Normal, Chi-Squared and Quadratic forms, and F
distributions

Week 6-7: Inference

Log-likelihood, Hypothesis testing, Geometry of F tests,
Likelihood ratio tests, General Coordinate Free hypotheses,
Parametric hypotheses, Relation of least squares estimators under
NH and AH, Analysis of Variance Tables, F tests and t tests,
Power and Sample Size, Simultaneous confidence intervals
(Scheffe method, Bonferroni method, Tukey’s method, and related
methods)

Midterm

Week 8-10: Generalized Linear Models

Review of MLE; Properties of exponential families; Estimation:
IWLS, MLE; Hypothesis test: LRT, Wald, score test; Goodness-
of-fit: deviance, Pearson X2; Overdispersion: definition, mixture
model example; Other models for binary data; Case-control vs.
population-based; Quasi- likelihood: estimation (IWLS), linkage
with estimating equations, statistical inference; robust standard error

**Week 10-12: Linear Mixed Models**

Hierarchical modeling of random effects; Modelling the covariance structure; Marginal models arising from random effects; Inferential issues: shrinkage, estimation, prediction.

**Week 13-15: Additional Topics**

Generalized linear mixed models (GLMM) Generalized estimating equations (GEE) Missing data in linear models

**Final project**