Syllabus for STA 232A, Fall 2014

Course Website: www.stat.ucdavis.edu/~beran/s232a.html

Instructor: Rudolf Beran (rjberan@ucdavis.edu). No office telephone.
Instructor Office Hours: Mon and Wed 11 am–12 noon (and by appointment) in MSB 4242.

TA: Chunzhe Zhang (czzhang@ucdavis.edu).
TA Office Hours: Mon 3:30–4:30 pm and Fri 4–5 pm in MSB 1117.

Lectures: Mon 1:10–3:00 pm and Wed 1:10–2:00 pm in Wellman 230.
Discussion: Wed 2:10–3:00 pm in Wellman 230.

Prerequisites: This is a core course in the Statistics Ph.D. program. It presupposes an upper division background in regression and analysis of variance; linear algebra, including the singular value decomposition; ability to do numerically stable linear algebra using R or other professional software; advanced calculus; upper division probability theory, including joint distributions, the multivariate normal distribution, mean vectors and covariance matrices, central limit theorems and laws of large numbers.

Labs: The Lab assignments will be due in the Discussion Section on Wednesdays, starting Oct 15. These labs apply course techniques to the analysis of data sets.

Midterms: Midterm 1 (on Wed, Nov 5) and Midterm 2 (on Wed, Dec 10) will each be administered in class at 1:10–3:00 pm. There will be no final exam.

Course Sketch: The course will develop the theory and practice of adaptive hypercube estimators for the general linear model. These estimators include, as special cases, least squares estimators, penalized least squares estimators with multiple quadratic penalties, and (in complete balanced designs) Stein multiple shrinkage estimators. Course highlights are:


• Using the Moore-Penrose pseudoinverse in the theory and computation of least squares procedures for linear regression and analysis of variance. This material updates Chapters 1–6 of the classic book Analysis of Variance by Henry Scheffé (1959).

• Superior biased estimation in linear models through risk-adaptive submodel fits, adaptive penalized least squares fits, and their embedding within the class of adaptive hypercube estimators for linear models. See Hypercube estimators: Penalized least squares, submodel selection, and numerical stability at http://dx.doi.org/10.1016/j.csda.2013.05.020 from a campus login.


Software: Solution code for the Labs will be provided solely in R. Though students may use any professional-level software that can perform the numerical linear algebra required in the Lab assignments, learning R is strongly encouraged. The site http://cran.r-project.org offers binaries and documentation for R. The Art of R Programming by Norman Matloff (2011) describes the use of R as a programming language.

Text: None. Lectures will outline ideas and results. References cited above or mentioned in class are in-depth resources for more.

Grading: The course grade will be based 35% on Midterm 1, 35% on Midterm 2, and 30% on the Lab assignments.