Course Information for STAT:7200 “Linear Models”  
Fall 2019

Instructor
Dale Zimmerman, a.k.a. “Dr. Z,” 217 Schaeffer Hall, Office phone 5-0818, Home phone 351-0520, E-mail dale-zimmerman@uiowa.edu

Class Hours and Location
Tuesday and Thursday, 9:30 am – 11:20 am; in 22 SH

Office Hours
1:00 – 2:00 pm Mondays, 1:00 – 3:00 pm Wednesdays, or by appointment

Department Information
Department of Statistics and Actuarial Science, 241 Schaeffer Hall, Phone 335-2082

Department Executive Officer
Professor Kung-Sik Chan, 241 Schaeffer Hall, Phone 335-0712, E-mail kung-sik-chan@uiowa.edu

Lecture Notes/Text
Lecture notes for the course have recently been put into book form and will soon be published by Springer (they’re currently ”in press”). Reading will be assigned from them. Copies of the book manuscript are available for purchase for $18.75 at the Copy Center in C102 PBB. With one exception, the notes/book are self-contained, i.e., there is no need to do any reading outside of them. The exception is the material on matrix algebra useful for linear models; for this, frequent reference will be made to Matrix Algebra from a Statistician’s Perspective, by David A. Harville (Springer). Purchasing this book is recommended, but not required.

Exams
• 2 two-hour, in-class, midterm exams; the first will be given in early October and the second will be given in mid-November. Exact dates TBD.

• 1 two-hour final exam, time and place TBD.

Homework
Written assignments are an essential component of the course. Assignments generally consist of 5-10 problems, some of which are lengthy, and will be given at intervals of approximately 10-14 days. Assignments must be turned in by the beginning of class on the day they are due. Unless prior arrangements are made, late homework will receive a score no higher than 50%. Students may work on homework problems together, provided that no outright plagiarism occurs. Dr. Z is more than willing to provide homework help during office hours.

Attendance
Attendance at lectures and participation in discussions are expected. Failure to attend class regularly will adversely affect your grade, and no help will be offered on homework problems requiring material in class that you miss (unless you have a valid excuse).
Grading

- Homework, 25%
- Midterm exams, 50% (25% each)
- Final exam, 25%

A plus-minus grading system will be used. In the past, all students who have achieved a percentage of 50% or higher on exams have earned at least a B- grade, and all who have achieved a percentage of 75% or higher on exams have earned at least an A- grade.

Course Objectives

1. To provide a rigorous presentation of the theory underlying statistical applications of linear models (regression, ANOVA, BLUE, multiple comparisons, BLUP, variance component estimation, etc.).

2. To equip the Ph.D. student in Statistics (or related fields) to read journal articles and begin thesis research, possibly on some topic that overlaps with linear models.

Not a Course Objective

To analyze data or become familiar with “linear models methods” for data analysis and interpretation through the use of statistical computing packages.

Topics Considered

1. Matrix preliminaries, e.g., basic results on linear spaces, linear independence, transposes, ranks, inverses, traces, determinants, nonnegative definite and positive definite matrices

2. Generalized inverses and systems of linear equations

3. Expectations, variances, and covariances of linear and quadratic forms

4. Estimability and unbiasedness

5. Ordinary least squares for classical (fixed-effects, unconstrained) linear models: orthogonal projections, reparameterizations, Gauss-Markov Theorem, algebraic and geometric structure of the analysis of variance, partitioning the ANOVA

6. Generalized least squares

7. Best linear unbiased prediction (BLUP), random and mixed linear models

8. Model misspecification and its consequences

9. Multivariate normal, noncentral chi-square, noncentral F and t distributions

10. Distributions of linear and quadratic forms; independence of quadratic forms; Cochran’s Theorem
11. Hypothesis testing, confidence intervals and regions, simultaneous confidence intervals and multiple comparisons

12. Estimation of variance components, including maximum likelihood and restricted maximum likelihood (REML) approaches

13. Empirical BLUE/BLUP

14. Other topics as time permits?