

## Course Information for 22S:255 “Linear Models” Fall 2008

### Instructor

Dale Zimmerman, 233 Schaeffer Hall, Office phone 5-0818, Home phone 351-0520, E-mail dzimmer@stat.uiowa.edu

### Class Hours and Location

Tuesday and Thursday, 10:30 am – 12:20 pm; in 176 SH

### Office Hours

Monday 11 am – 12 noon; Tuesdays and Thursdays, 1:30 - 2:20 pm; or by appointment

### Department Information

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

### Department Executive Officer

Professor Luke Tierney, 241 Schaeffer Hall, Phone 335-0712, E-mail luke-tierney@uiowa.edu

### Text

The required textbook for this course is *Matrix Analysis for Statistics*, 2nd edition, authored by James Schott, published by Wiley. This text will be used to supplement material provided in lecture. Lecture notes will be available on Professor Zimmerman’s webpage, [www.stat.uiowa.edu/~dzimmer/](http://www.stat.uiowa.edu/~dzimmer/). Students are expected to read the assigned pages of the textbook and lecture notes *prior* to lecture.

### Exams

- 2 two-hour midterm exams; the first will be given in early October and the second will be given in mid-November.
- 1 two-hour final exam, currently scheduled for 2:15-4:15 pm, Friday, December 19, but we may move it to earlier in this week.

### 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 approximately every two weeks. 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%. You may work on homework problems together, provided that no outright plagiarism occurs.

### Attendance

Attendance at lectures and participation in discussions are expected. Failure to attend class regularly will affect your grade.

## Grading

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

A plus-minus grading system will be used.

## Course Objectives

1. To provide a fairly 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 aspect of linear models.

## Not a Course Objective

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

## Topics Considered

1. Matrix preliminaries: basic results on transposes, determinants, inverses, traces, ranks, etc.; linearly independent vectors and linear spaces; square-root and spectral decompositions; generalized inverses
2. Identifiability and estimability
3. Ordinary and generalized least squares for classical (fixed-effects, unconstrained) linear models: orthogonal projections, reparameterizations, Gauss-Markov Theorem, multi-part models, algebraic and geometric structure of the analysis of variance
4. Least squares for constrained linear models
5. Multivariate normal, noncentral chi-square, noncentral F and t distributions
6. Expectations, variances, covariances, moment generating functions, and distributions of linear and quadratic forms; independence of 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 (REML) approaches

### Academic Fraud

All forms of plagiarism and any other activities that result in a student presenting work that is not his or her own are academic fraud. All academic fraud is reported first to the departmental DEO and then to the Associate Dean for Academic Programs and Services. See Academic Fraud at [http://www.clas.uiowa.edu/students/academic\\_handbook/ix.shtml](http://www.clas.uiowa.edu/students/academic_handbook/ix.shtml) for the complete policy.

### Making a Suggestion or Complaint

Students have the right to make suggestions or complaints and should first visit with me, then with the departmental DEO (if necessary). All complaints must be made as soon as possible. For more information, visit Student Complaints at

[http://www.clas.uiowa.edu/students/academic\\_handbook/ix.shtml](http://www.clas.uiowa.edu/students/academic_handbook/ix.shtml)

### Students with Disabilities:

I would like to hear from anyone who has a disability that may require some modification of seating, testing, or other class requirements so that appropriate arrangements can be made. Please see me about this as soon as possible.

### Understanding Sexual Harassment

Sexual harassment is reprehensible and will not be tolerated by the University. It subverts the mission of the University and threatens the well-being of students, faculty, and staff. Visit this site (<http://www.sexualharassment.uiowa.edu/>) for definitions, assistance, and the full University policy.

### Reacting Safely to Severe Weather

The University of Iowa Operations Manual section 16.14 outlines appropriate responses to a tornado (see subsection (i)) or to a similar crisis. If a tornado or other severe weather is indicated by the National Weather Service radar, the Johnson County outdoor weather sirens will sound. If these sirens sound (and it is not the first Monday of the month at 9:00 am when the sirens are tested), members of the class will seek appropriate shelter immediately, continuing class if possible when the event is over.

### Student Classroom Behavior

The ability to learn is lessened when students engage in inappropriate classroom behavior, distracting others; such behaviors are a violation of the Code of Student Life. When disruptive activity occurs, a University instructor has the authority to determine classroom seating patterns and to request that a student exit the classroom, laboratory, or other area used for instruction immediately for the remainder of the period. One-day suspensions are reported to appropriate departmental, collegiated, and Student Services personnel (Office of the Vice President for Student Services and Dean of Students).