

## Course Information for 22S:255 “Linear Models” Fall 2009

### Instructor

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

### Class Hours and Location

Tuesday and Thursday, 10:30 am – 12:20 pm; in 130 SH

### Office Hours

MWF 11 am – 12:20 pm; Tuesday, 1:00 pm - 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, in-class, midterm exams; the first will be given in early October and the second will be given in mid-November. Exact dates TBA.
- 1 two-hour final exam, given 7:30-9:30 am, Wednesday, December 16, in 130 SH.

### 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%. 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

### Administrative Home

The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall or see the CLAS Student Academic Handbook

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

### Electronic Communication

University policy specifies that students are responsible for all official correspondences sent to their standard University of Iowa e-mail address (@uiowa.edu). Students should check this account frequently. (Operations Manual, III.15.2. Scroll down to k.11.)

### Academic Fraud

Plagiarism and any other activities when students present work that is not their own are academic fraud. Academic fraud is a serious matter and is reported to the departmental DEO and to the Associate Dean for Undergraduate Programs and Curriculum. Instructors and DEOs decide on appropriate consequences at the departmental level while the Associate Dean enforces additional consequences at the collegiate level. See the CLAS Student Academic Handbook.

### Making a Suggestion or a Complaint

Students with a suggestion or complaint should first visit the instructor, then the course supervisor, and then the departmental DEO. Complaints must be made within six months of the incident. See the CLAS Student Academic Handbook.

### Accommodations for Students with Disabilities

A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See <http://www.uiowa.edu/~sds/> for more information.

### Understanding Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment at

<http://www.uiowa.edu/~eod/policies/sexual-harassment-guide/index.html>  
for assistance, definitions, and the full University policy.

### Reacting Safely to Severe Weather

In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Public Safety web site,

<http://www.uiowa.edu/~pubsfty/intlinks.htm>