

SYLLABUS
General Linear and Mixed Effects Models (EPID/CPH 684)
Fall 2008

Time: Monday and Wednesday 10:30 AM -12:00 PM

Location: MEZCOPH Computer Lab A319

Instructor:

Duane Sherrill, Ph.D.

Office: Room 317C, Drachman Hall

Phone: 626-7513

Office Hours: Monday and Wednesday 2:00-3:00, Appointment Recommended

Email: duane@arc.arizona.edu

Course Description:

This course introduces basic concepts of linear algebra that are essential for understanding more advance statistical modeling methodology. This knowledge is used to understand the General Linear Model which includes ordinary linear regression, ANOVA, and other special applications and General Linear Mixed Models for analysis of repeated measures, correlated outcomes and longitudinal data, including the unbalanced and incomplete data sets characteristic of biomedical research. Topics include an introduction to matrices for statistics, general linear models, analysis of correlated data, random effects models, and generalized linear mixed models.

Course Prerequisites:

CPH 576A Biostatistics for Public Health; CPH 576B Biostatistics for Research

Course Objectives:

Students completing this course will gain an understanding of matrix operations and how they are utilized in more advanced statistical models. They will expand their understanding of ordinary linear regression in the context of general linear models and learn new methods of testing linear combinations of the parameter estimates. They will learn how to analyze correlated data that often arise as data collected over time (longitudinal), as a result of group randomizations (community trials) or cluster sample surveys or for nested designs.

Course Notes:

Online Class Notes – D2L

Required Texts:

Applied Mixed Models in Medicine, Helen Brown and Robin Prescott (Second Edition)

Multilevel and Longitudinal Modeling Using Stata, Sophia Rabe – Hesketh and Anders Skrondal (Second Edition)

These texts are available in the University Medical Center bookstore.

On Loan From Dr. Sherrill:

Matrices for Statistics (second edition) M.J.R. Healy. Clarendon Press Oxford.

Course Requirements:

Successful completion of all home works and examinations, and active class participation on team projects.

Grading/Student Evaluation:

Homework assignments will be from the text, and readings and problems provided by the instructor. Due dates will be given for each assignment. Late homework will not be accepted.

On both homework and examinations, partial credit will be given, so always show your work and be as neat and clear as possible. Exams and homework contribute to your final grade as follows:

Homework	30%
Examination #1	20%
Examination #2	20%
Final Exam	30%

Final grades are based on the following point system:

- A = 90 - 100%
- B = 80 – 89%
- C = 70 –79%
- D = 60 – 69%
- E = 59% or less

Class Attendance/Participation:

I am not going to keep track of attendance, but you are responsible for everything that goes on in class, including any alteration to the syllabus. If I make an announcement in class, you are responsible for it. .

All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean’s designee will be honored.)

Communications: You are responsible for reading emails sent to your UA account from your professor and the announcements that are placed on the course web site. Information about readings, news events, your grades, assignments and other course related topics will be communicated to you with these electronic methods. The official policy can be found at: <http://www.registrar.arizona.edu/emailpolicy.htm>

Disability Accommodation: If you anticipate issues related to the format or requirements of this course, please meet with me. I would like us to discuss ways to ensure your full participation in the course. If you determine that formal, disability-related accommodations are necessary, it is very important that you be registered with Disability Resources (621-3268; drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations. The official policy can be found at: <http://catalog.arizona.edu/2008%2D09/policies/disability.htm>

Academic Integrity: All UA students are responsible for upholding the University of Arizona Code of Academic Integrity, available through the office of the Dean of Students and online: The official policy found at: <http://dos.web.arizona.edu/uapolicies/scc5308abcd.html> and <http://dos.web.arizona.edu/uapolicies/cai1.html>.

Classroom Behavior: (Statement of expected behavior and respectful exchange of ideas) Students are expected to be familiar with the UA Policy on Disruptive Behavior in an Instructional Setting found at <http://web.arizona.edu/~policy/disruptive.pdf> and the Policy on Threatening Behavior by Students found at <http://web.arizona.edu/~policy/threatening.pdf>

Grievance Policy: Should a student feel he or she has been treated unfairly, there are a number of resources available. With few exceptions, students should first attempt to resolve difficulties informally by bringing those concerns directly to the person responsible for the action, or with the student's graduate advisor, Assistant Dean for Student and Alumni Affairs, department head, or the immediate supervisor of the person responsible for the action. If the problem cannot be resolved informally, the student may file a formal grievance using the [Graduate College Grievance Policy](http://grad.arizona.edu/catalog/policies/academic-policies/grievance-policy) found at <http://grad.arizona.edu/catalog/policies/academic-policies/grievance-policy>

Grade Appeal Policy: <http://catalog.arizona.edu/2008%2D09/policies/gradappeal.htm>

Syllabus Changes: Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate.

Telephone Use: Turn your cell phones to silent or vibrate in order to not disrupt the class and disturb your fellow students and professor.

Plagiarism: What counts as plagiarism?

- Copying and pasting information from a web site or another source, and then revising it so that it sounds like your original idea.
- Doing an assignment/essay/take home test with a friend and then handing in separate assignments that contain the same ideas, language, phrases, etc.
- Quoting a passage without quotation marks or citations, so that it looks like your own.
- Paraphrasing a passage without citing it, so that it looks like your own.
- Hiring another person to do your work for you, or purchasing a paper through any of the on- or off-line sources.

Course Schedule:

Date	Topic/Lessons	Reading/Homework Assignment
August 25 Monday	Review syllabus and course outline- Concepts in Linear Algebra- Lesson 1	Matrices for Statistics pages 1-15
August 27 Wednesday	Concepts in Linear Algebra cont. Multiplication determinants Lessons 1-2	Matrices for Statistics pages 22-27 HW- Handout Lesson 1
September 1 Monday	No Class Labor Day	
September 3 Wednesday	Concepts in Linear Algebra cont. Inverse of the matrix Lesson 2 Matrix function in STATA	Matrices for Statistics pages 33-36 (optional reading on Reserve) HW- Handout Lesson 2
September 8 Monday	General Linear Model GLM – using matrix operations to do Multiple Regression – Lesson 3 Generating and solving the normal equations	Study class notes – Lesson 3 – pages 1-20
September 10 Wednesday	General Linear Model GLM – using matrix operations to estimate the covariance matrix	Study class notes- Lesson 3 – pages 21-28 HW – handout Lesson 3
September 15 Monday	Special Applications of GLM – learning to manipulate the design matrix – piecewise linear or breakpoint models – Example fitting breakpoint model in STATA Lesson 4	Study class notes – Lesson 4 and read selection manuscript Sherrill et al. HW – handout Lesson 4
September 17 Wednesday	Examination #1 over Lessons 1-4	NONE
September 22 Monday	Review Exam #1, In class demonstration of HW L3B, Finish breakpoint models L4	Study class notes – Lesson 4 and read selection manuscript Sherrill et al. HW – handout Lesson 4
September 24 Wednesday	Introduction to Mixed Models – Lesson 5	Applied Mixed Models – pages 1-30
September 29 Monday	Introduction to Mixed Models – Lesson 5 cont.	Applied Mixed Models – pages 1-30 HW handout Lesson 5
October 1 Wednesday	Normal Mixed Models –Lesson 6 Understanding the essential components of the Random Effects and Covariance Pattern Models cont.	Applied Mixed Models- Pages 33-57, 70-94 HW handout Lesson 6
October 6 Monday	Normal Mixed Models –Lesson 6 Continued	Applied Mixed Models- Pages 33-57, 70-94 HW handout Lesson 6

October 8 Wednesday	Data file structure and Time dependent covariates – reshaping a data set from wide to long – in class applications – Lesson 7	Read class notes Lesson 7
October 13 Monday	Fitting Mixed Effects Models using STATA – Lesson 8	Read class notes for Lesson 8 HW Group Project #1 handout Lesson 8 - Group oral reports next Monday and independent written reports handed in the following Wednesday.
October 15 Wednesday	Linear Variance Components Models – Lesson 9	Read Chapter 1 (MLLM Multilevel and Longitudinal Modeling) HW in text 1.1 (parts 1,2) 1.5 (parts 1-3)
October 20 Monday	Group Oral Reports on Project #1	
October 22 Wednesday	Presentation of GLMM Results Patterns of missing data Plotting within subject curves Plotting fitted curves Assessing residuals & random effects (In class examples file demo_684)) Lesson 9B	Written reports on Project #1 due Lesson 9B.
October 27 Monday	Linear Intercept Model or Random Effects Model – Lesson 10	Lesson 10 Read Chapter 2 MLLM HW 1. Problems in MLLM 2.1 and 2.4 2. Group Project #2 handout
October 29 Wednesday	Random Coefficient Models and Growth Curve Models Lesson 11	Lesson 11 Read MLLM (Chapter 3) Applied Mixed Models (Chapter 6 skip section 6.4) HW Problems in MLLM 3.2 and 3.5

November 3 Monday	Group Oral Reports on Project #2	
November 5 Wednesday	Random Coefficient Models and Growth Curve Models Lesson 11 continued	Lesson 11 Read MLLM (Chapter 3) Applied Mixed Models (Chapter 6 skip section 6.4) Written reports on Project #2 due.
November 10 Monday	Review for Examination #2	Study for Examination #2
November 12 Wednesday	Examination #2	
November 17 Monday	TBD	TBD
November 19 Wednesday	TBD	TBD
November 24 Monday	TBD	TBD
November 26 Wednesday	TBD	TBD
December 1 Monday	TBD	TBD
December 3 Wednesday	TBD	TBD
December 8 Monday	TBD	TBD
December 10 Wednesday	Last day of classes Review for Final Exam ?	