STAT:6510 (22S:162) Applied Generalized Regression, Fall 2013

**Course Web Pages:** Start at [http://www.stat.uiowa.edu/~jblang/s162](http://www.stat.uiowa.edu/~jblang/s162) not on ICON
[ username: xxxxxxx password: xxxxxxxxx ]

**Lecture/Discussion/Lab:** 10:30-11:20 MWF, 66 SH

**Instructor:** Joseph B. Lang, 207 SH, 335-3129, joseph-lang@uiowa.edu

**Office Hours:** 11:30-12:00 M, 1:30-2:30 T, 8:00-9:00, 11:30-12:00 W, or by appointment

**Pre-Requisites:** Intro Statistics, Applied Regression

**Department, College:** Statistics and Actuarial Science, Liberal Arts and Sciences

**DEO:** Luke Tierney, 241 SH, 335-0712, luke-tierney@uiowa.edu

**Main Office:** 241 Schaeffer Hall

**Text Books**


*None of these books are considered required, only recommended. Many of these books are on reserve in the main
COURSE DESCRIPTION and OBJECTIVES

Using a "hands-on" approach, you will learn about several "generalized regression models," including normal linear models, semi-parametric linear models, generalized linear models, semi-parametric generalized linear models, non linear models, and multiple-response regression models. The semi-parametric models are robust relatives of normal and generalized linear models; we will discuss large-sample estimation methods such as quasi-likelihood and estimating equations for analyzing them. Some important generalized linear models are normal linear regression, Poisson loglinear regression, and binary/binomial logistic regression models. The normal linear mixed (or multi-level) models make up a useful class of multiple-response regression models. We will use these mixed models to analyze multi-level responses, repeated measures, and longitudinal data. The statistical packages SAS and R will be used extensively in this applications-based course.

The primary objective of this course is to gain a general understanding of the logic behind the multivariable technique called regression. The following is a sample list of some of the specific concepts you will learn about.

- Weighted least squares estimators along with empirically-adjusted standard errors are reasonable for a wide range of linear regression models.

- Many seemingly unrelated models can be viewed as regression models and analyzed via the same basic approach; you will learn about this unifying approach, which is based on the maximum likelihood method.

- Asymptotic approximations are often used to describe sampling distributions; you will learn the general idea behind likelihood-based asymptotic theory and how to determine when the asymptotic approximations work reasonably well. We will also discuss large-sample likelihood-based tests and the delta method.

- When asymptotic approximations are questionable, bootstrap approximations can be an attractive alternative.

- At times, we wish to avoid specifying the data-generating mechanism completely. We describe estimation methods, such as quasi-likelihood and estimating equation estimation, that are valid under these partially-specified (or semi-parametric) models.

- When clustered data are analyzed, the correlation must be accommodated. We describe semi-parametric marginal models (and use GEE to fit them), parametric marginal models, subject-specific fixed- and random-effects models.

- In applied research, it is important to interpret regression parameters "in the words of the problem." You will learn to interpret parameters, effects, interactions, etc. for less-standard models such as logistic, loglinear, and non-linear models.

- You will learn how to use statistical packages to fit many different regression models.

- You will learn to better understand what an estimation procedure is doing when it is "fitting" the model.

- You will learn what all the computer output really means (and whether it is at all relevant to your analysis.)
• You will learn how to write up and communicate the results of your analyses.

COURSE ORGANIZATION and COURSE PACE

The course can be viewed as having two components: lecture and practice. We will meet in the classroom every Monday, Wednesday, and Friday. Lectures will cover material from my own notes—the majority of these notes represent personal summaries of ideas from many articles and textbooks (see, e.g., the textbooks above). We will discuss the details of how you actually apply the ideas to real data. In particular, you will see how to use R and SAS to analyze data. Web-based notes that include sample SAS and R programs along with interpretations will be available throughout the semester. These sample programs should serve as templates for your own analyses.

The freeware package R will also be used to perform calculations, create graphics, and carry out small-scale simulation studies. The software R can be downloaded from http://cran.us.r-project.org to your personal computer.

To get a rough idea of the course coverage and pace, see the course outline from one of the last times the course was taught.

COMPONENTS FOR EVALUATION

Homework (including Directed Projects): You will hand in weekly homework and short data analysis projects over the course of the semester. The projects are directed, which means they will include specific directions as to what you will be turning in.

Un-Directed Projects: You will hand in two undirected data analysis projects. For these un- (or self-) directed projects, you will analyze a data set and provide a careful data analysis report. The report will comprise two main sections and an appendix. The main sections are (1) Introduction to the Problem and (2) Summary of Conclusions. The appendix will include technical details of the data analysis along with supporting documentation such as graphics and computer input/output. The appendix must to well-organized, with an index and logical labeling system.

Portfolios. You will include all of your worked exercises (graded and un-graded) in a portfolio. You will be asked to hand in your portfolio at different times during the semester. The quantity, quality, and neatness of the work in this portfolio will be assessed and will count toward your participation score.

Class Participation: You are expected to ask lots of questions and contribute to discussions. You are also expected to turn in your portfolio at announced times during the semester. Point-earning opportunities (PEO) will be given on occasion. PEO's, which include attendance checks and short-answer in-class worksheets, typically will not be pre-announced.

COURSE POLICIES

Course Web Page. Reading assignments, announcements, homework, and supplementary materials will be made available on the password-protected course web page; start at http://www.stat.uiowa.edu/~jblang/s162 [not on ICON!]. You should check the course pages daily.

Reading Ahead. It is vitally important that you read ahead (see the calendar page). If the material in a lecture is completely new to you, you will find it very difficult to get much out of lecture.
Effort Expectations. My effort expectations align with the guideline adopted by the college of LAS: "for each semester hour credit in the course, students should expect to spend two hours per week preparing for class sessions (e.g., in a three-credit-hour course, standard out-of-class preparation is six hours)." Of course, you need to keep in mind that the '6 hours per week' is an average taken over the weeks in the semester. It is also an average taken over a heterogeneous collection of students and courses. Thus, effort amounts will vary. It is fair to say, however, that the more effort you put in, the more you will get out of the course.

Attendance and Participation. Students are expected to attend and participate in lecture. You will be asked many questions, and you will be strongly encouraged to ask lots of questions. If you miss a class, you run the risk of missing a point-earning opportunity, which cannot be made-up.

Working Together. You may work together on homework and directed projects, and are encouraged to do so, unless otherwise instructed. However, you must INDEPENDENTLY write up, in your own words, your own solutions and reports. If you are personally asked to write up your own solutions and subsequently turn in material that is obviously in the same words as a fellow student, the work will be considered to be plagiarized. Plagiarism will be dealt with according to the policies of the College of Liberal Arts and Sciences and the University (see additional information at the end of this syllabus). You must work INDEPENDENTLY on the two UN-directed projects, unless otherwise instructed.

Late Homework. Unless otherwise instructed, homework is due at 10:30am. Any work has a discrete half-life of 24 hours; that is you get 50% credit if it is handed in late, but within 24 hours of the due time; you get 25% credit for the next 24 hours, etc. Homework not handed in directly to me must be handed in to a department secretary (located in 241 SH)--it must include a hand-in time and date, and must be signed by the department secretary. (It follows that you cannot hand in homework after the main office is closed.)

Grading Questions. Questions about grading must be asked within one week of the graded work's return.

Electronic Etiquette. While in the classroom, you will not be allowed to send or check text messages, send or check email, browse the web, or use a cell phone. Social networking of any kind is not allowed. Please keep cell phones in your bag/backpack. If your cell phone is visible, it will be taken from you and placed in the front of class until the period has ended.

GRADING POLICY

Your final score $S$ will be computed as follows:

$$S = 0.5*H + 0.4*U + 0.1*P,$$

$H = \%$ credit on homework and directed data analysis projects
$U = \%$ credit on un-directed projects.
$P =$ participation/attendance score on a 0-100 scale
[Point-earning opportunities and portfolios will be included in your participation score.]

Letter grades (including +'s and -'s) will be awarded according to a 90-80-70-60 schedule. These are guaranteed cutoffs, so it is possible (but unlikely) that everyone receives an 'A.' I do, however, reserve the right to lower, but not raise, the cutoffs. Note that with this grading scheme you are not "graded on a curve," and so you are not competing with fellow students. Therefore, you are not penalized for working together to better understand concepts.

MISCELLANEOUS
Help Outside Class:

- I have regular office hours. Sometimes it is effective to ask specific questions via email.
- Course web pages; start at http://www.stat.uiowa.edu/~jblang/s162.
- A list of tutors is maintained by the Department of Statistics and Actuarial Science at http://www.stat.uiowa.edu/courses/tutors.html.

Help with R software:

- An Introduction to R, by Elizabeth Slate and Elizabeth Hill.
- http://www2.coastal.edu/kingw/statistics/R-tutorials/
- http://www.statmethods.net/interface/
- etc., etc.... just google "help with R"

College of Liberal Arts and Sciences: Policies and Procedures

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.

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

Accommodations for 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 www.uiowa.edu/~sds/ for more information.

Academic Honesty
All CLAS students or students taking classes offered by CLAS have, in essence, agreed to the College's Code of Academic Honesty: "I pledge to do my own academic work and to excel to the best of my abilities, upholding the IOWA Challenge. I promise not to lie about my academic work, to cheat, or to steal the words or ideas of others; nor will I help fellow students to violate the Code of Academic Honesty." Any student committing academic misconduct is reported to the College and placed on disciplinary probation or may be suspended or expelled (CLAS Academic Policies Handbook).

CLAS Final Examination Policies
The final examination schedule for each class is announced by the Registrar generally by the tenth day of classes. Final exams are offered only during the official final examination period. No exams of any kind are allowed during the last week of classes. All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will be published on the Registrar's web site and will be shared with instructors and students. It is
the student's responsibility to know the date, time, and place of a final exam.

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.

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 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.

*These CLAS policy and procedural statements have been summarized from the web pages of the College of Liberal Arts and Sciences and The University of Iowa Operations Manual.

University Examination Policy

Final Examinations. An undergraduate student who has two final examinations scheduled for the same period or more than three examinations scheduled for the same day may file a request for a change of schedule before the published deadline at the Registrar's Service Center, 17 Calvin Hall, 8-4:30 M-F, (384- 4300).

Missed exam policy. University policy requires that students be permitted to make up examinations missed because of illness, mandatory religious obligations, certain University activities, or unavoidable circumstances. Excused absence forms are required and are available at the Registrar web site: http://www.registrar.uiowa.edu/forms/absence.pdf

I hope you all have an enjoyable and successful semester. Good luck in all of your courses.