22S:162 Applied Generalized Regression, Fall 2011

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Course Web Pages:	Start at http://www.stat.uiowa.edu/~jblang/s162 *...not on ICON* [username: xxxxx password: xxxxx]
Lecture/Discussion/Lab:	10:30-11:20 MWF, 71 SH
Instructor:	Joseph B. Lang, 207 SH, 335-3129, joseph-lang@uiowa.edu
Office Hours:	11:30-12:30 M W, 9:30-10:30 R, 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	Course Description and Objectives	Course Organization	Course Pace
Components for Evaluation	Course Policies	Grading Policies	Misc

TEXT BOOKS*

Agresti, A. *An Introduction to Categorical Data Analysis*. NY: John Wiley and Sons, 1996.

Davis, C.S. *Statistical Methods for the Analysis of Repeated Measurements.* NY: Springer-Verlag, 2002.

Fitzmaurice, G.M., Laird, N.M., and Ware, J.H. *Applied Longitudinal Analysis*. Hoboken, NJ: John Wiley and Sons, Inc. 2004.

Frees, Edward W. *Longitudinal and Panel Data: Analysis and Applications in the Social Sciences*. Cambridge, UK: Cambridge University Press, 2004.

Gelman, A. and Hill, J. *Data Analysis Using Regression and Multilevel/Hierarchical Models*, NY: Cambridge University Press, 2006.

McCullagh, P. and Nelder, J.A. *Generalized Linear Models*, 2nd edn. NY: Chapman and Hall, 1989.

McCulloch, C.E. and Searle, S.R. *Generalized, Linear, and Mixed Models*, NY: John Wiley and Sons, Inc. 2001.

Myers, R.H., Montgomery, D.C., and Vining, G.G. *Generalized Linear Models With Applications in Engineering and the Sciences*, NY: John Wiley and Sons, Inc. 2002.

Neter, J., Kutner, M.H., Nachtsheim, C.J. and Wasserman, W. *Applied Linear Statistical Models*, 4th edn. Chicago: Irwin, 1996.

Raudenbush, S.W. and Bryk, A.S. *Hierarchical Linear Models: Applications and Data Analysis Methods*, 2nd edn. Thousand Oaks, CA: Sage Publications, Inc. 2002.

Seber, G.A.F. and Wild, C.J. *Nonlinear Regression*, NY: John Wiley and Sons, 1989.

Verbeke, G. and Molenberghs, G. (editors) *Linear Mixed Models in Practice: A SAS-Oriented Approach.* Lecture Notes in Statistics (126), NY: Springer-Verlag, 1997.

**None of these books are considered* required*, only* recommended*. Many of these books are on reserve in the main library.*

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.

For more information, see a detailed summary of the course when it was last taught.

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 text books above). We will discuss the details of how you actually apply the ideas to real data. In particular, you will see how to use SAS and R 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 the last time the course was taught.

COMPONENTS FOR EVALUATION

Homework (including Directed Projects): You will hand in around eight 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.

Class Participation: You are expected to ask lots of questions and contribute to discussions. 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

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. **You must work INDEPENDENTLY on the two UN-directed projects, *unless otherwise instructed*.**

Late Work has a 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.

Questions about Grading must be asked within one week of the graded works return.

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 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:

- SimpleR. Go to http://www.math.csi.cuny.edu/Statistics/R/simpleR/index.html
- An Introduction to R, by Elizabeth Slate and Elizabeth Hill.

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 Fraud
Academic fraud, including plagiarism and other forms of cheating, is a serious matter and is reported by the instructor to the departmental DEO and to the Associate Dean for Undergraduate Programs and Curriculum. All students in the College of Liberal Arts and Sciences should review and understand the CLAS Code of Academic Honesty.

CLAS Final Examination Policies
Final exams may be offered only during finals week. No exams of any kind are allowed during the last week of classes. Students should not ask their instructor to reschedule a final exam since the College does not permit rescheduling of a final exam once the semester has begun. Questions should be addressed to the Associate Dean for Undergraduate Programs and Curriculum.

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.

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