# SYLLABUS

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<th>Course Web Pages:</th>
<th>Start at <a href="http://www.stat.uiowa.edu/~jblang/s162">http://www.stat.uiowa.edu/~jblang/s162</a> [ username: stat password: s16207 ]</th>
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<tr>
<td>Lecture/Discussion/Lab:</td>
<td>10:30-11:20 MWF, 71 SH; Lab 41 SH</td>
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<tr>
<td>Instructor:</td>
<td>Joseph B. Lang, 207 SH, 335-3129, <a href="mailto:joseph-lang@uiowa.edu">joseph-lang@uiowa.edu</a></td>
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<tr>
<td>Office Hours:</td>
<td>11:30-12:30 M W, 1:30-2:30 R, or by appointment</td>
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<tr>
<td>Pre-Requisites:</td>
<td>Intro Statistics, Applied Regression</td>
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<tr>
<td>Department, College:</td>
<td>Statistics and Actuarial Science, Liberal Arts and Sciences</td>
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<tr>
<td>DEO:</td>
<td>Luke Tierney, 241 SH, 335-0712, <a href="mailto:luke-tierney@uiowa.edu">luke-tierney@uiowa.edu</a></td>
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<td>Main Office:</td>
<td>241 Schaeffer Hall</td>
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## TEXT BOOKS*

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**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.**


**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.**


*None of these books are considered required, only recommended. Most of these books are on reserve in the math library (MacLean Hall).*

**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 correlated response 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. Examples of non-linear models include growth curve models and drug clearance models, which are both mechanistic models derived from ecological and physical/chemical laws. The normal linear mixed (or multi-level) models make up a useful class of correlated response models. We will use these mixed models to analyze multi-level responses, repeated measures, and longitudinal data. The statistical package SAS 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 generation 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 SAS (PROC REG, GLM, NLIN, GENMOD, MIXED) to fit many different regression models.
• You will learn to better understand what SAS is doing when it is "fitting" the model.
• You will learn what all that SAS output really means (and whether it is at all relevant to your analysis.)
• You will learn how to write up 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 textbooks above). Most of the meetings will include a practice component as well. Here, we will discuss the details of how you actually apply the ideas to real data. In particular, you will see how to use SAS to analyze data. Web-based notes that include sample SAS programs along with interpretations will be available throughout the semester. These sample programs should serve as templates for your own analyses.

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 directions as to what output to include.

Un-Directed Projects: You will hand in two or three 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 regularly. PEO's, which include 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 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.

CLAS/University Policy Information:
**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 a Complaint**
Students have the right to make suggestions or complaints and should first visit with the instructor, then with the course supervisor if necessary, and next with the departmental DEO. 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#5](http://www.clas.uiowa.edu/students/academic_handbook/ix.shtml#5)

**Accommodations for Disabilities**
Under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, instructors must provide reasonable academic accommodations for qualified students with disabilities. Students seeking academic accommodations first register with Student Disability Services and meet with a counselor in that office who reviews documentation and determines eligibility for services. Students approved for accommodations arrange to meet privately with course instructors. Visit Student Disability Services at [http://www.uiowa.edu/~sds/](http://www.uiowa.edu/~sds/).

**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/](http://www.sexualharassment.uiowa.edu/)) for definitions, assistance, and the full University policy.

**Other**...UI Student Resources, Classroom Behavior, and Exam Policy Statements (start at [http://www.clas.uiowa.edu/faculty/teaching/classroom_p&p/policytemplate.shtml#2](http://www.clas.uiowa.edu/faculty/teaching/classroom_p&p/policytemplate.shtml#2))

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