Stat 539: Generalized Linear Models
Spring 2017

Course Hours and Location: Tue/Thurs 10:50am-12:05pm in Wilson Hall 1-134

Instructor Contact Information

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Office Hours: Tue/Thur 3-4pm, Wed 9-10am, also available by appointment.

D2L Course Webpage

- Course information, R links and references, material covered in class, additional handouts, homework assignments, data sets, and study material for the exams will be posted on the course webpage in D2L.
- Rather than emailing the instructor, please post questions about the course material on our D2L Discussion board. If you have a question on the material, many other students probably do too!

Course Description and Learning Outcomes

This course will provide an introduction to the principles of generalized regression models, with an emphasis on categorical data models. Categorical data occurs extensively in both observational and experimental studies, as well as in industrial applications. The course will focus on both theory and application of methods for data analysis. Problems will be motivated from a scientific perspective. Topics covered include logistic regression, log-linear models, analysis of deviance, extrabinomial variation, quasi-likelihood, and models for correlated responses.

Upon successful completion of the course, students will be able to:

- Describe the general structure of a GLM and similarities and differences with linear models
- Estimate and interpret a logistic regression model
- Estimate and interpret a Poisson regression model
- Know of issues and some strategies for dealing with overdispersion in some GLMs
- Estimate and interpret a GLM for continuous responses that are not normally distributed

Prerequisite

STAT 422 (Mathematical Statistics) and STAT 411/511 (Methods for Data Analysis I) are required for this course.

Required Textbook: Agresti, A. (2015). *Foundations of Linear and Generalized Linear Models*. Wiley-Interscience.

We will cover most of Chapters 1-9, including supplementary material. Chapter 10 will be covered as time allows.

Additional Reference Texts

The following are helpful reference texts; they are not required for the course.

- Agresti, A. (2002). *Categorical Data Analysis*. Wiley-Interscience.
- Casella, G. and Berger, R. (2001). *Statistical Inference,* 2nd ed. Duxbury Press.
- Kutner, M., Nachtsheim, C., Neter, J., and Li, W. (2005). *Applied Linear Statistical Models*. McGraw Hill Irwin.
- McCullagh, P. and Nelder, J. (1989) *Generalized Linear Models,* 2nd ed. Chapman & Hall/CRC.

Computing/Technology

- We will be using the open-source statistical software R and the interface RStudio. Download the most recent version of R from http://www.r-project.org. Then download RStudio at https://www.rstudio.com/.
- At times, we may work on an analysis in R together in class. Bring your laptop (with R installed) to each class period. If you do not own a laptop, share with another student in class. While not using R, laptops should be put away during class. (See http://www.npr.org/2016/04/17/474525392/attention-students-put-your-laptops-away)
- Any computer output handed in with homework must be concisely summarized with answers clearly identified. No one likes to wade through pages of computer output looking for answers.
- Please silence cell phones and put them away during class. Having your cell phone out is distracting to the instructor, other students, and yourself, and detracts from the classroom learning environment.

Assessment Summary

Grades will be posted in D2L as they become available. We will have weekly (approximately) homework assignments including problems from the textbook, problems using R, and longer data analysis problems. The course consists of two in-class midterm exams and a semester-long data analysis project.

Category	**Percent of Final Grade**
Homework	30%
Midterm Exam 1 *Tentative date: Thursday, February 23*	25%
Midterm Exam 2 *Tentative date: Thursday, April 6*	25%
Data Analysis Project	20%

In general, late homework will not be accepted. If you have an emergency or extenuating circumstances that keep you from completing the homework on time, speak to Prof. Hancock as soon as possible.

Midterm exam questions will be similar to the homework with a few short answer and multiple choice questions; any required R output will be provided. You may use two *hand-written* 8.5"x11" sheets of notes for each exam. The first midterm exam will cover material up to that date; the second midterm exam will cover material after the first midterm exam up to the date of the second exam.

The data analysis project will be comprised of a statistical analysis of a data set of your choice (subject to certain constraints), a written report, and a 10 minute presentation (given during the last week of class). You are encouraged to work in a group of two, though you may choose to work on the project individually. Detailed project instructions and deadlines will be provided.

Academic Integrity Policies and Guidelines

"Integrity without knowledge is weak and useless, but knowledge without integrity is dangerous and dreadful." – Samuel Johnson (1709-1784)

Academic misconduct will not be tolerated in any form. Students are responsible for adhering to the MSU academic integrity standards. Read them here:

- http://www.montana.edu/facultyexcellence/Papers/cheating.html
- http://www.montana.edu/policy/student_conduct/#studentrespon

I encourage students to form study groups and collaborate on work, *after attempting the work individually*, however, the work that is handed in should reflect only that student's work. That is, discussing the METHODS of a solution with other students is allowed, but copying another student's answer or copying from prior course solutions is NOT.

Consequences of academic misconduct:
In Prof. Hancock's courses, any instance of academic misconduct, whether it is on homework, quizzes, exams, or other parts of the course, will be reported and may go on your student record, *without exception*. Copied homework or lab assignments will result in zero credit for the assignment for all parties involved. Academic misconduct on an exam or final project will result in zero credit for the entire exam/project. Egregious instances of academic dishonesty may be subject further penalties.

Guidelines to avoid plagiarism and cheating:

- **Do not look at another person's homework.** Instead you should prefer to discuss the problem orally or on a white board. This helps you to communicate clearly, practice technical jargon as it applies to your problem, and to identify how your solution exhibits behavior different from what you expect.
- **Do not write down the solution in your notes.** Working in a group is a rewarding experience, and definitely a necessary skill in any professional career. Collaboration between students can include drawing diagrams and perhaps solving the problem on a whiteboard. However, you should avoid writing the solution in your notes. It is very useful to rethink the problem and go through the details and logic when you solve it again on your own.
- **Do not look at another student's paper during an exam.** This one is obvious. Avoid the urge for wandering eyes and stick to your integrity.
- **Focus your efforts on learning.** Many instances of academic misconduct involve students that are too focused on their grade, rather than on building knowledge and ideas. Additionally, time spent trying to figure out how to cheat on an exam is better used studying for the exam. Grades come and go, but knowing that you learned something, and using that knowledge to better yourself will remain with you.

It is expected that:

- **You will monitor each other and enforce these rules among yourselves.** Making sure that others follow these guidelines will help to ensure that they don't pass off your work as their own.
- **Your work honestly represents your efforts.** The entire purpose of obtaining an education is so that you can accumulate a body of skills and experience that are inherently valuable and will help you in your career and life. If you do not perform the work yourself, then you have cheated yourself out of your education. Employers in our field can (and do) screen applicants for skills and knowledge. You will perform poorly (and discredit MSU) if you do not practice now by doing your own work.

Above all, a college education is a huge individual accomplishment, and you should be proud of this accomplishment, knowing that you approached this time in your life with honesty and integrity.