THE OHIO STATE UNIVERSITY

College of Arts & Sciences
Department of Statistics

SYLLABUS: STAT 7430

Generalized Linear Models

Spring 2023 (full semester)
3 credit hours

COURSE OVERVIEW

Instructor

Peter F. Craigmile

Email address: pfc@stat.osu.edu

Class website: https://osu.instructure.com/courses/135234

Lectures: Tuesdays and Thursdays, 9.35-10.55am, in Enarson Classroom Building, Room 312. Lectures are not recorded.

Office hours in 427 Cockins Hall: Tuesdays, 2-3pm; Thursdays, noon-1pm; or by appointment.

Graduate teaching assistant

Biqing Yang

Email address: yang.5733@osu.edu

Office hours in 312A Cockins Hall: Mondays, 1-2pm.

Course description

Stat 7430 introduces the statistical theory and methods to extend regression and analysis of variance to non-normal data. By the end of the course students should be able to use fixed effect generalized linear models to model data. In particular there will be a focus on model identification, building, diagnostics, and inference. This course covers extensions to longitudinal models.

Prerequisites: Stat 6910 and 6950 (Applied Statistics I and II) giving exposure to analysis of variance and experimental design, as well as regression modeling, Stat 7410 (Theory of Linear Models) provides the theory for these models. Stat 6801 and 6802 (Statistical Theory I and II), introducing distribution theory and methods for statistical estimation and testing.

Course learning outcomes

By the end of this course, students should successfully be able to:

1. Explain and rigorously derive key aspects of the theory of generalized linear models (GLMs), including the concepts of overdispersion and quasi-likelihood;
2. Interpret and use appropriate statistical notation and terminology;
3. Independently construct and implement an appropriate statistical analysis involving GLMs to answer a scientific question of interest;
4. Express statistical ideas in written English using vocabulary tailored to the audience.

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

Required: P. McCullagh and J.A. Nelder (1999), Generalized linear models, second edition, Chapman and Hall/CRC Press, London; New York. (This is a reprint of the 1989 Chapman and Hall book). The book is available to download from https://www-taylorfrancis-com.proxy.lib.ohio-state.edu/books/9780203753736

I will highlight other useful resources as the course progresses.

Necessary Software and Equipment

- This class requires you to use the statistical software packages called R (The R Project for Statistical Computing; http://www.r-project.org/) and RStudio (https://posit.co/). These software packages are available as Free Software with versions compatible with current macOS and Windows operating systems. More details will be given in lectures.
- Access to a computer capable of running the required software, which typically includes Mac and PC devices running the current macOS or Windows operating system.

GRADING AND FACULTY RESPONSE

ASSIGNMENT CATEGORY	PERCENTAGE
Homework	**30**
Midterm	**30**
Project	**40**
Total	**100**

Grades will be recorded on the class website.

Homework will be due at the beginning of class on the day it is due (9.35am). **Typically, no late homework will be accepted.** However, if you are unable to complete an assignment on time, please get in touch with me before the homework is due so we can discuss your situation. You are encouraged to work together on the homework, but do not copy any part of a homework. Each student must produce his/her own homework to be handed in. All homework must be submitted online as a PDF file through the class website. Feel free to ask me for help after you have made an attempt of the questions. The grader for the course does not have the time to provide detailed explanations on each question that is graded. To make up for this, I will endeavor to create homework solutions that are detailed enough to allow you to understand how the question could be approached.

Homework preparation rules: Put your name on your homework submission. Submit the problems in order, making sure that the computer output and discussion is placed together (do not put the computer output at the end of homework). Raw computer output is not acceptable. Make it clear what parts of the output are relevant and show how they answer the questions posed in the homework.

Midterm: The midterm will be held in class on Thu Mar 2. The midterm will be closed book/closed notes. There is no make-up exam. A basic calculator is allowed – tablets, laptops, cellphones, and other communication devices are not. The midterm covers the material up to and including Tue Feb 28. Further details will be given in advance of the exam.

Project: In groups, you will be responsible for producing a presentation and a 10–15 page report on a topic in generalized linear models. The report will be due by 5pm on Fri Apr 29 (during exam week). Further details, including a list of possible topics, will be given after the midterm.

Instructor feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call 614-688-HELP at any time if you have a technical problem.)

Grading and feedback: For large weekly assignments, you can generally expect feedback within 7-10 days. If you have any questions about your graded assignments, midterm or project, please send me an email – do not use Carmen.

E-mail: I will reply to e-mails within 24 hours on school days.

COURSE SCHEDULE

Refer to the Carmen course for assignment due dates.

Week	Dates	Topics
1	Jan 10, 12	Introduction to generalized linear models (GLMs)
2	Jan 17, 19	Parameter estimation for GLMs Goodness of fit for GLMs Binary GLMs for binary data
3	Jan 24, 26	Binary GLMs for binary data
4	Jan 31, Feb 1	Binary GLMs for binary data
5	Feb 7, 9	Binary GLMs for binary data Poisson GLMs
6	Feb 14, 16	Poisson GLMs
7	Feb 21, 23	Overdispersion
8	Feb 28, Mar 2	Overdispersion **Midterm exam (Thu Mar 2)**
9	Mar 7, 9	Gamma GLMs and influence for GLMs Bayesian inference for generalized linear models (GLMs)
	Mar 13-17	**Spring break – no classes**
10	Mar 21, 23	Quasi-Likelihood and Inference
11	Mar 28, 30	Empirical variance estimates Generalized linear models for dependent data
12	Apr 4, 6	Generalized linear models for dependent data Marginal GLMs
13	Apr 11, 13	Marginal GLMs Random effects GLMs
14	Apr 18, 20	Project presentations
		Group project reports due on Fri Apr 28 at 5pm

OTHER COURSE POLICIES

Academic integrity policy

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct **http://studentlife.osu.edu/csc/**.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.
If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.
Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu

Commitment to a diverse and inclusive learning environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Land Acknowledgement

We would like to acknowledge the land that The Ohio State University occupies is the ancestral and contemporary territory of the Shawnee, Potawatomi, Delaware, Miami, Peoria, Seneca, Wyandotte, Ojibwe and Cherokee peoples. Specifically, the university resides on land ceded in the 1795 Treaty of Greeneville and the forced removal of tribes through the Indian Removal Act of 1830. I/We want to honor the resiliency of these tribal nations and recognize the historical contexts that has and continues to affect the Indigenous peoples of this land.

More information on OSU's land acknowledgement can be found at https://mcc.osu.edu/about-us/land-acknowledgement

Your mental health

As a student you may experience a range of issues that can cause barriers to learn, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292--5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614--292--5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. **SLDS contact information:** slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This course requires use of CarmenCanvas (Ohio State's learning management system) and other communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)
- Collaborative course tools