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

Massimiliano Russo

Email address: russo.325@osu.edu

Class website: https://osu.instructure.com/courses/160304

Lectures: Tuesdays and Thursdays, 9.35-10.55am, in McPherson Lab 1021. In-person lectures are not recorded.

Office hours in 317 Cockins Hall: Tuesdays, 11am-12pm; Thursdays, 11am-12pm; or by appointment.

Graduate teaching assistant

Pashmeen Kaur

Email address: kaur.138@osu.edu

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/). This software packages are available as Free Software with versions compatible with current macOS, Windows, and Linux operating systems. The RStudio (https://posit.co/) IDE can be also helpful. 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, Windows, or Linux operating system.

GRADING AND FACULTY RESPONSE

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

Total	**100**

Assignment Information

Homework will be due at the end of the day (midnight) on the day it is due. **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 the homework. Each student must produce their 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 at 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 are 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 7. The midterm will be closed book/closed notes. There is no make-up exam. A basic calculator is allowed – tablets, laptops, cell phones, and other communication devices are not. The midterm covers the material up to and including Tue Feb 27. 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 5 pm on Monday, Apr 29 (during exam week). Further details, including a list of possible topics, will be given after the midterm.

Grading Scale:
93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70–72.9: C-
67–69.9: D+
60–66.9: D
Below 60: E

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 typically 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 9, 11	**I**ntroduction to generalized linear models (GLMs)
2	Jan 16, 18	Parameter estimation for GLMs Goodness of fit for GLMs Binary GLMs for binary data
3	Jan 23, 25	Binary GLMs for binary data
4	Jan 30, Feb 1	Binary GLMs for binary data
5	Feb 6, 8	Binary GLMs for binary data Poisson GLMs
6	Feb 13, 15	Poisson GLMs
7	Feb 20, 22	Overdispersion
8	Feb 27, Feb 29	Overdispersion Gamma GLMs and influence for GLMs
9	Mar 5, 7	Bayesian inference for generalized linear models (GLMs) **Midterm exam (Thu Mar 7)**
	Mar 11-15	**Spring break – no classes**
10	Mar 19, 21	Quasi-Likelihood and Inference
11	Mar 26, 28	Empirical variance estimates Generalized linear models for dependent data

Week	Dates	Topics
12	Apr 2, 4	Generalized linear models for dependent data Marginal GLMs
13	Apr 9, 11	Marginal GLMs Random effects GLMs
14	Apr 16, 18	Project presentations
		Group project reports due on Monday Apr 29 at 5pm

OTHER COURSE POLICIES

Discussion and Communication Guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style:** While there is no need to participate in class discussions, as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.

- **Tone and civility:** Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online. I will provide specific guidance for discussions on controversial or personal topics.

- **Citing your sources:** When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.

- **Backing up your work:** Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Academic integrity policy

See Descriptions of Major Course Assignments for specific guidelines about collaboration and academic integrity in the context of this class.

Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's Code of Student Conduct (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's Code of Student Conduct is never considered an excuse for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

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

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/.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

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.

Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct

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.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at equity.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or email equity@osu.edu

Religious accommodations

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, 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.

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

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting Accommodations

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. 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.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations.

Disability Services Contact Information

- Phone: 614-292-3307
- Website: slds.osu.edu
- Email: slds@osu.edu

- In person: Baker Hall 098, 113 W. 12th Avenue

Accessibility of Course Technology

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

- CarmenCanvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)