Syllabus: STAT 7430

Generalized Linear Models
Spring 2025
3 credit hours

# Course overview

## Instructor

Massimiliano Russo

**Email address:** russo.325@osu.edu

**Class website:** <https://osu.instructure.com/courses/183051>

**Lectures:** Tuesdays and Thursdays, 9.35-10.55am, in Cockins Hall 228. In-person lectures are not recorded.

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

**Note:** My preferred method of contact is by email.

## Graduate teaching assistant

Biqing Yang

**Email address**:  yang.5733@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 6. 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 25. 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 28 (during exam week). Further details, including a list of possible topics, will be given after the midterm.

**Use of GenAI tools in assignments:** The Internet plays a significant role in learning, especially when dealing with coding and debugging. It is acceptable to use online resources, including generative artificial intelligence (GenAI), for tasks such as clarifying lecture material, seeking examples, and brainstorming ideas. Just as you would consult with a classmate for these purposes without violating academic integrity, you may also turn to GenAI. Students are permitted to use GenAI tools with this declination for most course assignments, **except for exams.**

If you use GenAI in any of your assignments, please include a statement in your assignment specifying the name of the tool you used (e.g. Copilot, ChatGPT, Grammarly, etc..) and how you used it. You are responsible for ensuring that the information you submit based on a GenAI query does not contain misinformation, unethical content, or violate intellectual property laws. Submission of GenAI-generated content as your own work is considered a violation of Ohio State’s Academic Integrity policy and [Code of Student Conduct](https://trustees.osu.edu/bylaws-and-rules/code) because the work is not your own. The use of unauthorized GenAI tools will result in referral to the [Committee on Academic Misconduct.](https://oaa.osu.edu/academic-integrity-and-misconduct)

If I suspect that you have used GenAI inappropriately on an assignment for this course, I will ask you to communicate with me to explain your process for completing the assignment in question.

**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 7, 9 | **I**ntroduction to generalized linear models (GLMs) |
| 2 | Jan 14, 16 | Parameter estimation for GLMs Goodness of ﬁt for GLMs Binary GLMs for binary data |
| 3 | Jan 21, 23 | Binary GLMs for binary data |
| 4 | Jan 28, 30 | Binary GLMs for binary data |
| 5 | Feb 4, 6 | Binary GLMs for binary dataPoisson GLMs |
| 6 | Feb 11, 13 | Poisson GLMs |
| 7 | Feb 18, 20 | Overdispersion |
| 8 | Feb 25, 27  | OverdispersionGamma GLMs and inﬂuence for GLMs |
| 9 | Mar 4, 6 | Bayesian inference for generalized linear models (GLMs) **Midterm exam (Thu Mar 6)** |
|  | Mar 10-14 | **Spring break – no classes** |
| 10 | Mar 18, 20 | Quasi-Likelihood and Inference |
| 11 | Mar 25, 27 | Empirical variance estimatesGeneralized linear models for dependent data |
| 12 | Apr 1, 3 | Generalized linear models for dependent dataMarginal GLMs |
| 13 | Apr 8, 10 | Marginal GLMsRandom eﬀects GLMs |
| 14 | Apr 15, 17 | Project presentations |
|  |  | **Group project reports due on Monday Apr 28** **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 Policies

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### Academic integrity policy

See **Descriptions of major course assignments**, above, for my specific guidelines about collaboration and academic integrity in the context of this online class.

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, 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. 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 the instructor for this course.

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

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

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

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:

Online reporting form at [equity.osu.edu](http://equity.osu.edu/),

Call 614-247-5838 or TTY 614-688-8605,

Or Email equity@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

* All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
* The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

### 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.

### 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](http://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 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 ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

### Religious accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students’ religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student’s religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students’ sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student’s presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student’s request for time off shall be provided if the student’s sincerely held religious belief or practice severely affects the student’s ability to take an exam or meet an academic requirement **and** the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity.

Policy: [Religious Holidays, Holy Days and Observances](https://oaa.osu.edu/religious-holidays-holy-days-and-observances)