Syllabus

STAT 3302

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Statistical Modeling for Discovery II

- Spring 2025

- 3 credit hours

- In-person lectures

    - Time: Monday, Wednesday, Fridays 1:50pm – 2:45pm

    - Location: Pomerene Hall (PO) 250

    - Lectures will not regularly be recorded

Course overview

Instructor

- Vincent Q. Vu

- Email: vqv@stat.osu.edu

- Office hours

    - Time: Wednesday 3:00pm – 4:00pm

    - Location: Cockins Hall (CH) 428B

Note: My preferred method of contact is e-mail.

Course Description

This course continues to investigate statistical models for data analysis and discovery in big-data settings. The regression methods developed in STAT 3301 are extended to data settings with binary and multicategory outcomes. An introduction to some of the most commonly used statistical methods for exploring and analyzing multivariate data is provided. Interpretation and communication of the results of analyses is emphasized.

Course expected learning outcomes

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

1. Build, fit and interpret statistical models for binary outcomes

2. Understand the difference between nominal and ordinal outcomes and build regression models that are appropriate for each

3. Recognize the types of questions that can be answered by regression models for multicategory data and structure models to answer those questions

4. Comprehend the statistical principles that underlie basic methods of multivariate data analysis

Prerequisites

STAT 3301 (Statistical Modeling for Discovery I) and MATH 2568 (Linear Algebra); or permission of instructor.

Course materials and technologies

Textbooks

The following two textbooks are required for this course:

- A. J. Dobson and A. G. Barnett (2018), **An Introduction to Generalized Linear Models**, Fourth Edition, CRC Press. *Available online at https://library.ohio-state.edu/record=b8615141~S7*

- A. C. Rencher and W. F. Christensen (2012), **Methods of Multivariate Analysis**, Third Edition, Wiley. *Available online at https://library.ohio-state.edu/record=b7149844~S7*

I will highlight other useful references as the course progresses.

Software

Please install the **latest** versions of the following software on your computer. Even if you have installed these programs before, it is a good idea to check for updates. I will not provide support for outdated software.

- **R** https://cloud.r-project.org

We will use several add-on R packages in this course that you will need to download and install. I will provide details in lecture.

You may also want to interact with R using the RStudio Desktop IDE and write your assignments using Quarto documents:

- **RStudio** Desktop IDE https://posit.co/download/rstudio-desktop

- **Quarto** https://quarto.org/docs/get-started

Grading and instructor response

How your grade is calculated

Assignment category	Percentage
Homework	20%

Assignment category	Percentage
Midterm Exam 1 (February 14, 2025)	20%
Midterm Exam 2 (March 28, 2025)	20%
Project	10%
Final Exam (April 29, 2025; 4:00pm – 5:45pm)	30%
Total	**100%**

Description of major course assignments

Homework

- Description

  Homework will be assigned on an approximately biweekly basis and made available on Carmen. Your answers must be submitted on Carmen as a **single PDF**. Some homework problems will require computing and data analysis in R. For those problems, you may use a Quarto document template provided with the assignment. Homework problems that do not require R may be handwritten (electronically, or on paper and scanned) but they must be combined with the rest of your submission into a **single PDF**. You can use Adobe Acrobat (see https://it.osu.edu/adobe) to combine PDF files before submitting to Carmen.

- Academic integrity and collaboration guidelines

You may collaborate with classmates on your homework, but ultimately the code that you write and submission that you make must be your own work. For example, I encourage you to discuss strategies for solving problems, but the actual code and explanations that you write must be your own. Moreover, keep in mind the university policies on plagiarism. Do not copy or plagiarize anything you may find on the Internet. You may use generative AI tools, e.g. ChatGPT or Claude, to help you understand concepts, but you should not copy and paste code from the internet or any AI tool. **If you do collaborate and/or use generative AI tools, then you must include a disclosure statement at the beginning of your submission indicating with whom you collaborated and what generative AI tools you used and how you used them.**

Exams

- Description

  There will be two in-class midterm exams and a cumulative final exam. All exams will be closed book/closed notes. You will not need a calculator. Computers, smartphones, and similar devices are not allowed to be used. If there is an an exceptional circumstance, e.g. medical or family emergency, then please contact me as soon as possible before the exam date to make potential arrangements.

- Academic integrity and collaboration guidelines

  You may not collaborate with anyone on the exams. You may not seek out or view previous exams or solutions to previous exams that I or other instructors may have given. The only exception is if I provide you with a practice exam or practice problems. I may allow you to bring a handwritten cheatsheet to the exam. If I do, then I will provide you with the details of what you can and cannot include on the cheatsheet. You may not use any notes, books, or electronic devices during the exams. You may not discuss the exam with anyone until after the exam is over and all students have completed the exam. You may not share any information about the exam with anyone who has not yet taken the exam.

Project

- Description

  There will be a project that you will complete in groups of 4 students. The group leader and members will be assigned automatically. The project will consist of finding a dataset, formulating questions that can be answered with the data, and performing an appropriate analysis to answer the questions posed.

  Proposals for the project will be due just before spring break. The complete project will be due before the final exam. Further details, including deadlines, will be given as the semester progresses and announced on Carmen. There are limited options to change your group, under some circumstances if you want to. Email me so we can discuss and find a way.

- Academic integrity and collaboration guidelines

  You are expected to cooperate with your group members on the project. Similarly to homework assignments, do not copy or plagiarize anything you may find on the Internet. You may use generative AI tools, e.g. ChatGPT or Claude, to assist with writing/coding, but ultimately you are responsible for what you submit and I expect that you understand completely everything that is part of your submission/presentation. **If you do use generative AI tools, then you must include a disclosure statement at the beginning of your presentation and submission indicating what what generative AI tools you used and how you used them.**

Late assignments

If you absolutely need turn in an assignment late and have a valid excuse, please see me for the necessary arrangements. However, you must notify me in advance in such a situation. Exceptions to this policy will be permitted only in extreme situations such as serious injury immediately prior to an assignment being due or severe illness requiring hospitalization.

Unexecused late assignments will automatically receive a deduction of 10 percentage points each day that they are late, rounded up to the next midnight. For example, if an assignment is due at at 11:59pm on a Monday and you turn it in at 12:01am on Tuesday, then you will receive a 10% deduction. After the fifth day, late assignments will not be accepted.

Grading Scale

Points	Grade
93–100	A
90–92	A-
87–89	B+
83–86	B
80–82	B-
77–79	C+
73–76	C
70–72	C-
67–69	D+
60–66	D

Points	Grade
00–60	E

Academic policies

Academic misconduct

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

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 https://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 here: 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 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.

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. 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

Course Schedule

This schedule is approximate. Refer to the Carmen course page for up-to-date assignment due dates.

Week	Dates	Topics	Assignment
1	1/6–1/10	Introduction; Review of Binomial Model and Maximum Likelihood Estimation	
2	1/13–1/17	Simple Logistic Regression: Model Formulation	
	1/20	**No class** (Martin Luther King, Jr. Day)	
3	1/22–1/24	Estimation of Parameters; Multivariable Logistic Regression	HW1
4	1/27–2/31	Model Evaluation and Diagnostics in Logistic Regression	
5	2/3–2/7	Model Building in Logistic Regression	HW2
6	2/10–2/14	Binomial Regression	Exam 1
7	2/17–2/21	Poisson Regression	HW3
8	2/24–2/28	Models for Ordinal and Multicategory Data	

Week	Dates	Topics	Assignment
9	3/3–3/7	Introduction to Multivariate Data	
	3/10–3/14	**No class** (Spring break)	
10	3/17–3/21	Multivariate Numerical Summaries	HW4, Proposal
11	3/24–3/28	The Multivariate Normal Distribution	Exam 2
12	3/31–4/4	More on the Multivariate Normal Distribution	HW5
13	4/7–4/11	Principal Components Analysis	
14	4/14–4/18	Linear Discriminant Analysis	HW6
15	4/21	Catch-Up, Review, and Further Directions	Project
	4/29	**Final Exam** (4:00pm – 5:45pm)	