THE OHIO STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

Stat 3302 (Spring 2025)
Statistical Modeling for Discovery II

Course information

3 credit hours
Lectures: Mon, Wed, Fri, 12.40–1.35pm in Pomerene Hall 250 in person.
Holidays: Martin Luther King Jr. Day is Mon 20 Jan; Spring break is Mon 10—Fri 14 Mar.

In person lectures won't be recorded or streamed over zoom.

Instructor

Name:	Sally Paganin
E-mail:	paganin.1@osu.edu
Office:	229 Cockins Hall
Office hours:	Mon, 3:30 — 4:30 pm, or by appointment

TA - Grader

Biqing Yang
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Communications

My preferred method for questions is email.
My class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your notification preferences to be sure you receive these messages.

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 multi-category 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. Upon successful completion of the course, students will 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 multi-category 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); (Math 2568) Linear Algebra.

Textbooks

The following two textbooks are required for this course:

A. J. Dobson and A. Barnett (2018), An Introduction to Generalized Linear Models, Fourth Edition,
Chapman & Hall/CRC Texts in Statistical Science.
https://library.ohio-state.edu/record=b8615141~S7

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

Other useful references

The following book contains many examples that we will also discuss in class.

Alan Agresti (2006), Introduction to Categorical Data Analysis, 2nd Edition
https://library.ohio-state.edu/record=b10764759~S8.

I will highlight other useful references as the course progresses.

Required equipment

- Computer: current Mac (macOS) or PC (Windows or Linux) with high-speed internet connection, capable of running R and RStudio (described below)

Required software

- This class requires you to use the statistical software called R (The R Project for Statistical Computing; http://www.r-project.org/ . This software is available as free Software.
  - You can download R for Windows, Mac, and Linux, from the CRAN archive at https://cran.r-project.org.
  - An in-depth introduction to R is availableat http://cran.r-project.org/doc/manuals/R-intro.pdf
- An easy-to-use interface to R is available in the software package RStudio. This package is available for Windows, Mac, and Linux and can be downloaded for free from https://posit.co/downloads/. Note that RStudio requires R to be installed.

Assignment, grading and attendance

Assigment information

Homeworks	20%	Almost biweekly
Midterm 1	20%	Mon 17 Feb 2025 (in class)
Midterm 2	20%	Fri 28 Mar 2025 (in class)
Project	10%	Fri 21 Apr 2025 (last day of class)
Final Exam	30%	Tue Apr 29,12:00pm-1:45pm

Homework will be assigned to Carmen approximately biweekly and will be due at the **beginning of class on the day it is due.**

Your answers must be submitted on Carmen as a **single PDF** produced from an R Markdown file template provided with the assignment. Homework problems that that do not require R may be handwritten (electronically, or on paper and scanned) but they must be combined together 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.

You are encouraged to work together on the homework, but **do not copy any part of a homework**; your submitted answers (code, prose, solutions) must be your own work. For example, I encourage you to discuss strategies for solving problems, but the actual solution that you write must be your own. Keep in mind the university policies on plagiarism. Do not copy or plagiarise anything from others or that you may find on the Internet.

Exams. There will be **two midterms** and **one 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 exceptional circumstance, e.g. medical or family emergency, then please contact me as soon as possible before the exam date to make potential arrangements.

Project. There will be a project that you will complete in groups of maximum 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, but under some circumstances, you can do so. Please email me so we can discuss and find a way.

Late Assignments

For the Homeworks there is a 5% deduction per hour past the deadline.

If there are extenuating circumstances beyond your control, please get in touch with the course instructor immediately.

Use of GenAI tools

Using online resources, including generative artificial intelligence (GenAI), is acceptable 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.

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 because the work is not your own. The use of unauthorized GenAI tools will result in referral to the Committee on Academic 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

Class Attendance Policy

You are expected to attend all lectures.

Academic policies

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

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/.

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)

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 ill and need to miss class, including if you are staying home and away from others

while experiencing symptoms of a 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.

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

Course schedule (tentative)

Week	Dates	Topics
1	01/06—01/10	Introduction and Motivation, Review of Binomial Model and Maximum likelihood estimation
2	01/13—01/17	Simple Logistic Regression: Model Formulation
	01/20	**No class** (Martin Luther King Day)
3	01/22—01/24	Estimation of Parameters, intrepretation
4	01/27—01/31	Model Evaluation and Diagnostics in Logistic Regression
5	02/03—02/09	Model Building in Logistic Regression
6	02/10—02/14	Binomial Regression
	02/17	**Midterm Exam 1**
7	02/19—02/21	Poisson Regression
8	02/24—02/28	Models for Ordinal and Multicategory Data
9	03/03—03/07	Introduction to Multivariate Data
	03/10—03/14	**No class (Spring break)**
10	03/17—03/26	Multivariate Numerical Summaries
	03/28	**Midterm Exam 2**
11	03/24—03/28	The Multivariate Normal Distribution
12	03/21—04/04	More on the Multivariate Normal Distribution
13	04/07—04/11	Principal Components Analysis
14	04/14—04/18	Linear Discriminant Analysis
15	04/21	Review and Further Directions
	04/21	**Project due** (last day of class)
16	04/30	**Final Exam** 12:00pm — 1:45pm