Stat 3302 – Statistical Modeling for Discovery II   Spring 2025

Instructor
R. Scott Linder (linder.5@osu.edu) ← Please only send email through the Carmen page.
Office Hours: M 5–6, T R 6:30-7:15 (Via Zoom as linked on Carmen site)

Class support
Kiljae Lee (Lee.10428@buckeyemail.osu.edu)
Office Hours: TBA (Via Zoom as linked on Carmen site)

Course Description
This course continues to investigate statistical models for data analysis and discovery in big-data settings. In Stat 3301, you learned about regression methods. In this class we extend those methods to setting in which data have binary or multiple category outcomes. An introduction to some of the most commonly used statistical methods for exploring and analyzing multivariate data is provided, with emphasis on interpretation and communication of results of analyses.

Course Learning Outcomes
At the end of this course, students should successfully be able to:
1. Understand how to conceptualize, construct, fit, analyze, and interpret statistical models with binary response variables;
2. Distinguish between nominal and ordinal outcomes, and be able to fit regression models appropriate to each;
3. Recognize the kinds of questions that can be addressed by regression models for multiple-category data, and able to conceive of model structures intended to address them;
4. Understand the statistical principles that underlie regression models for multiple-category data.

Course Delivery
We meet synchronously on Carmen Zoom each Tuesday and Thursday 5:30–6:25pm. During these meetings we will discuss course concepts and examine applications through example. Supporting handouts and other materials will be posted to the class Canvas page before class meetings.

Each week supplemental materials will be posted, along with an organizational email message with details about things you should be doing (textbook readings, assignments, etc.), always keeping you informed about deadlines and expectations.

Between class meetings, you'll be asked to (1) complete some readings, and (2) work assignments (due approximately each 7 to 10 days). Supporting class materials will be posted to the class Carmen site. These include lecture notes, supplemental lesson videos, and recordings of previous class meetings, along with any handouts relating to those class meetings.

Attendance Expectations for Students

You are expected to be at all scheduled class meetings. These class meetings are recorded and posted later as a resource for students to review and revisit class material… but you're expected to attend class anyway.

You wouldn't attend an in-person class meeting while hiding under a blanket or in a closet. Similarly, it's rude to attend our live Zoom class meetings out of sight. You need to have your camera on. I understand you will need to occasionally turn your camera off for very brief periods… but if your camera is off for a sustained period of time, you'll be removed from the classroom.

I hope you'll ask questions during our class meetings. Please just speak up: It's not rude to interrupt class with a polite question. In fact, asking your question will be helpful to everybody, including the instructor.

Course Materials

We will use two textbooks, both freely available through the OSU Libraries:

1. A.J. Dobson and A. Barnett (2008), *An Introduction to Generalized Linear Models*, Fourth Edition, Chapman & Hall/CRC Texts in Statistical Science link

2. A.C. Rencher and W.F. Christensen (2012), *Methods of Multivariate Analysis*, Third Edition, Wiley. link

Course Technology

For help with any technology issues, (email, Carmen, etc.), contact the OSU IT Service Desk:

       Hours: https://ocio.osu.edu/help/hours
              Email: 8help@osu.edu
              Phone: 614–688–HELP (4357)
              TDD: 614–688–8743

Necessary technical skills

Students need to be able to use Carmen, CarmenZoom, and email. Students need to be able to open read pdf files, and use a web browser.

Necessary computing equipment

Students need access to a computer with a web browser, microphone and camera. Refer to the policy above regarding having your camera on during class meetings.

Necessary computer software

This class requires you to use the statistical software program **R** (The R Project for Statistical Computing: http://www.r-project.org):

- You can download R for free here (Linnux, OSX, Windows): https://cran.r-project.org
- If you're new to R, some nice hands-on tutorials are available here: http://swirlstats.com/ . In particular, the tutorial "*R programming: The Basics of Programming in R*" is a good first tutorial.
- More in depth manuals on R are available here: http://cran.r-project.org/doc/manuals/R-intro.pdf *
- RStudio is a version of R that some find easier to use. It's available for Windows, Mac and Linnux, and functions as a pull-down menu driven version that requires R to be installed. http://rstudio.org
- Class assignments may be completed using the (free) **R Markdown** authoring framework. Information about R Markdown will be provided in class, and an online guide with overview information can be found here (https://rmarkdown.rstudio.com). Using R Markdown is an option, not a requirement.

All OSU students are eligible for free **Microsoft Office 365 ProPlus** through Microsoft's Student Advantage program. Students may install the Office Suite (Word, Excel, PowerPoint, Outlook, etc.) on up to five machines and five phones. Users also receive 1 TB of OneDrive for Business storage. Office 365 is installed within your BuckeyeMail account. Full instructions for downloading and installation can be found here: https://ocio.osu.edu/kb04733

Course Grades

Your course average will be computed according to the following weights:

Average Homework Assignment Score (lowest score dropped)	20%
Project	15%
Midterm Exam 1	20%
Midterm Exam 2	20%
Final Exam	25%

Grading scale: 93%–100% A, 90%–93% A–, 87%–90% B+, 83%–87% B, 80%-83% B–, 77%–80% C+, 73%–77% C, 70%–73%, C–, 67%–70% D+, 60%–67% D, Below 60% E.

This is a "minimum guaranteed grade" scale. So, for example, if your course average is 92.7%, you're guaranteed a grade of A– or higher.

<u>Details about Assessments</u>

<u>Homework Assignments</u>
Homework assignments are intended to help learn and to apply class concepts to data sets. They will cover a mix of problem types, some of which will require use of R. Your lowest assignment score will be dropped.

Assignment solutions must be uploaded to Canvas <u>as a single file</u>. You may handwrite or type solutions to problems not requiring R. For problems that require R, please organize your solutions, pasting R material (graphs, output, commands) neatly and in a manner that supports your work. That is, you should provide written answers to questions, and provide R materials neatly in a manner that supports your answer. You may choose to place all R output in an appendix at the end of the assignment submission, but be sure to reference the output appropriately in your written solution. Finally, do not attach large volumes of R output (data files, long lists of printed numbers, etc.) in your assignment solution. Highlight any numbers in the output that you reference.

Feel free to collaborate with fellow current Stat 3302 students on homework assignments. You may also reference support materials found inside or outside of the class materials. You may <u>not</u> use solutions to any assignment problems others have produced. Any work you submit must be substantively your own work, and if you work on any problem with a fellow Stat 3302 student, you should reference this.

<u>Project</u>
You will work within a team of 4–5 students to complete a project. The project will consist of analyzing a data set using models we discuss in class. Details about this project will be provided early in the semester.

Students on the same team will attach their name to a single project submission, and all students on the team will earn the same project grade. In good faith, each member of a team will contribute a fair share of labor to the group's effort. If a team member is not contributing a fair share of effort, the other team members may collectively notify the instructor to this effect. If this happens, the instructor will move points *from* the unsupportive student *to* others in the group that have contributed more work.

<u>Exams</u>
We have three exams. Two of them are midterm exams that cover some of the class material. The final exam will be comprehensive, covering the entire semester. All exams will be given during class meeting times, and all via an exam posted to the Canvas site. You may use class notes and materials during the exam. You will not be asked to use R to compute anything during the exam, but you will be asked to use R output that has been provided. You will also be asked to write short answers and compute things using an ordinary calculator. You must work entirely alone on the exams, with no help from any other person. You must take the exams using a computer that has a working camera that is turned on throughout the exam.

What you should do to be successful

1. You're expected to attend all class meetings. Please be part of the class community by (1) having your camera on throughout the class; and (2) feeling free to ask questions.
2. Read posted class materials and textbook reading assignments between class meetings, and compare them to notes from class meetings. Do this every week, as the class proceeds.
3. Do assignments early enough to be able to seek help as required through office hours.
4. Visit office hours occasionally just to discuss class material.
5. Log in to the class canvas page at least twice per week.

Late Assignments

In general, late assignments will not be accepted. That said, emergencies do occur. If you are unable to complete an assignment on time, please contact the instructor by email as soon as possible, and we will discuss your situation. Late assignments cannot be accepted once solutions have been posted. Only one late assignment will be accepted per semester, but note that your lowest assignment score will be dropped.

Health and Safety

The Ohio State University Wexner Medical Center's Coronavirus Outbreak site (https://wexnermedical.osu.edu/features/coronavirus) includes the latest information about COVID-19 as well as guidance for students, faculty and staff.

You are expected to understand and follow the guidelines and requirements for campus safety, which are available at https://safeandhealthy.osu.edu .

If you are unable to attend or participate in class for an extended period of time due to illness, please let the instructor know as soon as possible. Best efforts will be made to help you.

Student academic services

Student academic services offered on the OSU main campus: http://advising.osu.edu/welcome.shtml .

Student support services

Student support services offered on the OSU main campus: http://ssc.osu.edu .

Academic integrity

Academic integrity is a shared responsibility that is necessary to maintain a supportive and fair learning environment for all students. If you find yourself struggling with course material as the semester progresses, reach out to the instructor for assistance. Attend office hours. Violations of academic integrity standards on the part of even a single student have negative repercussions for all students. Refer to descriptions of exams, assignments and the project (above) for policies about collaboration. Violations of this academic integrity policy will be reported to the Committee on Academic Misconduct, which will decide whether to investigate further. For additional information about campus policies concerning academic misconduct, refer to the Code of Student Conduct: http://studentlife.osu.edu/csc/ .

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 applied to offenses against other protected categories (e.g. race). If you or somebody you know has been sexually harassed or assaulted, you may find appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator by email at titleix@osu.edu .

Accessibility accommodations for students with disabilities

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 the instructor know immediately so that options can be discussed. 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 manner. SLDS contact information: slds@osu.edu ; 614–292–3307; http://slds.osu.edu ; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of Carmen (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 with your instructor. **Carmen (Canvas) accessibility**: link

Your mental health

As a student you might experience a range of issues that can impose barriers to learning, such as strained relationships, anxiety, alcohol/drug use problems, depression, difficulty concentrating, 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 the addressing these and other concerns you may be experiencing. If you or somebody you know are suffering from any of these concerns, you can learn about the broad range of confidential mental health services available to you on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting   https://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 available through the 24/7 National Suicide Prevention Hotline at 1–800–273–TALK or at https://suicidepreventionlifeline.org/ .

<u>Disclaimer</u>
This syllabus should be taken as a fairly reliable guide for the course content. You cannot claim any rights from it, and in particular the instructor reserves the right to change due dates, exam dates, or the methods of grading and/or assessment if necessary. The instructor will be solely responsible for such changes, and will also be responsible for notifying you through official course announcements in advance.

<u>Tentative Course Schedule</u>

<u>Week</u>	<u>Dates</u>	<u>Topic</u>
1	T 1.07 R 1.09	Introduction, Motivation, Review of Binomial Model and Maximum Likelihood Estimation
2	T 1.14 R 1.16	Simple logistic regression model formulation and estimation of parameters
3	T 1.21 R 1.23	Simple logistic regression (continued); Multiple logistic regression
4	T 1.28 R 1.30	Model evaluation and diagnostics in logistic regression
5	T 2.04 R 2.16	Model building in logistic regression
6	T 2.11 R 2.13	Binomial regression; **Midterm Exam 1 R 2.13**
7	T 2.18 R 2.20	Poisson regression
8	T 2.25 R 2.27	Models for ordinal and multiple category data
9	T 3.04 R 3.06	Introduction to multivariate data
10	T 3.18 R 3.20	Multivariate numerical summaries
11	T 3.25 R 3.27	Multivariate Normal distribution; **Midterm Exam 2 R 3.27**
12	T 4.01 R 4.03	Multivariate Normal distribution; Principle Components Analysis
13	T 4.08 R 4.10	Principle Component Analysis; Linear Discriminant Analysis
14	T 4.15 R 4.17	Linear Discriminant Analysis; Supplemental topics or catch up
15	No regular class meeting. **Final Exam** F 4.25 8pm–9:45pm*	

*The OSU Final Exam schedule is unkind to this class meeting time: <u>Spring 2025 Exam Schedule</u>