



THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

# **SYLLABUS: STAT 3301**

## **STATISTICAL MODELING FOR DISCOVERY I**

### **AUTUMN 2024**

## **Course overview**

### **Instructor**

Instructor: Dr. Isa Marques

Email address: [marques.130@osu.edu](mailto:marques.130@osu.edu)

Office: CH205B

Office hours: Mondays and Fridays 3:20—4:15pm, or by appointment.

### **Graders**

Contact information: provided on Carmen.

Office hours: information available on Carmen.

### **Class Meetings**

Mondays, Wednesdays and Fridays in Room PO0250 from 1:50–2:45pm.

### **Course description**

Statistical models for data analysis in the linear regression framework. The challenges of developing meaningful models for data are explored, with emphasis on the model building process, the use of numerical and graphical diagnostics for assessing model fit, and interpretation and communication of results. Statistical foundations are introduced along with basic inferential techniques.

Prerequisite: C- or better in 3202; or 4202 and 5730; or permission of the instructor. Prereq or concur: Math 2568; or permission of the instructor.

## Course learning outcomes

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

- Use graphical and numerical summaries of data to describe relationships between variables.
- Formulate, fit, evaluate and compare regression models that describe relationships between variables.
- Understand and be able to describe the statistical foundations of standard regression models.
- Identify common violations of the assumptions that underly standard regression models.
- Perform a complete regression analysis and communicate the results in both statistical and problem-specific terms.
- Distinguish between descriptive and causal interpretations of regression.

## Course delivery

The course will be delivered in-person. You are expected to attend lectures and participate in class. Required content will be delivered on **Mondays, Wednesdays and Fridays from 13:50–14:45**. On Mondays, I will also provide an overview of what you should expect to learn as we work through the rest of the week's content.

Each week's content will be made available each Monday on Carmen. This material will include:

- Slides that provide in-depth discussion of the topics for the week. The slides will typically have unfilled portions that we will fill out together during class lecture as we explore the topic being discussed. Each set of slides is associated with a chapter in the textbook, and this is usually indicated in the opening slide.
- Homework problems to help assess your understanding of the material are released every week. These are typically due on Thursday of the following week.

I will be holding office hours twice during the week. The schedule and location will be posted on Carmen. If none of the times work for you, contact me via email and we can arrange an alternative time.

## Course materials

### Required

We will use the textbook *Applied Linear Regression, Fourth Edition* (2014) by Sanford Weisberg. An electronic version of the book can be accessed for free through The Ohio State University Libraries at <https://library.ohio-state.edu/record=b8665795~S7>. You will need to click on "Connect to resource EBSCOhost"; you may also need to supply your OSU credentials. The

online resource is best suited for screen reading; each individual is allowed to print/e-mail/save/download a limited number of pages.

## Course technology

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at <https://ocio.osu.edu/help/hours>, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** <http://ocio.osu.edu/selfservice>
- **Phone:** 614-688-HELP (4357)
- **Email:** [8help@osu.edu](mailto:8help@osu.edu)
- **TDD:** 614-688-8743

## Technology skills necessary for this specific course

- Navigating Carmen
- Basic computer and web-browsing skills

## Necessary software

- This class requires you to use the statistical software package called R (The R Project for Statistical Computing; <http://www.r-project.org/>). This software package 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 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 <http://rstudio.org>. **Note that RStudio requires R to be installed.**
- This class requires the use of the (free) R Markdown authoring framework to complete assignments. Information about R Markdown will be provided in class; an online guide with overview information can be found at <https://rmarkdown.rstudio.com>.

# Grading and faculty response

## Grades

Assignment or category	Percentage
Homework	20
Midterm 1	20
Midterm 2	20
Data Analysis Assignment	15
Final Exam	25
Total	100

**Homework** will be assigned approximately weekly on Mondays and will be due on Carmen the following week on Thursdays by 11:59pm. Homework should be completed in R Markdown and a knitted html file should be uploaded to Carmen (information on this will be provided at the start of the semester). **You are encouraged to work together on homework; however, each student must produce their own assignment to be handed in. Do not copy any part of another student's homework.** I will drop your lowest homework score (which could be an assignment that was never turned in) when calculating your final homework grade for the semester.

**Exams:** There will be two midterms and one final exam administered during the semester to assess your understanding of the course material as the semester progresses. The final exam will take place at the time and date established by the University. Information about the exams will be posted well in advance on Carmen. **Exams must be completed without any external help or communication.** The information about the exams given below:

Midterm Exam 1:

**Friday October 4, 2024**

Midterm Exam 2:

**Monday November 4, 2024**

Final exam:

**Wednesday Dec 11, at 2-3:45pm**

**Data Analysis Assignment:** A data analysis assignment will be due near the end of the semester. Students will receive a data set that can be used to answer specific questions about a general problem area that will be described in the assignment. The goal is to use the methods and techniques learned in Stat 3301 to help answer the questions posed in the description of the problem. Students will complete the assignment by using R Markdown to prepare a written report that includes appropriate graphics and statistical analysis. More detailed information about the assignment and guidelines for preparing the report will be provided midway through the semester. The assignment will be due end of the semester and there will be no homework due during the week or two leading up to the due date for the data analysis assignment.

## Late assignments

Generally, late homework assignments are not accepted. Please plan your time so that you can complete assignments far enough in advance to avoid any last-minute problems uploading your completed work; last minute requests for extensions will generally not be granted. If exceptional circumstances (sudden onset of illness, unexpected family situations, etc.) arise, contact the instructor to discuss the possibility of an extension. I will drop your lowest homework score (which could be an assignment that was never turned in) when calculating your final homework grade for the semester.

## 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

## Faculty feedback and response time

I am providing the following to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** if you have a technical problem.)

### Grading and feedback

For large weekly assignments, you can generally expect feedback within **7 days**.

## E-mail

I will reply to e-mails within **24 hours on school days**. Specific technical questions about the course material that require significant back-and-forth communication are not well suited for e-mail; while I will do my best to answer such questions, I may ask that you attend virtual office hours if your question isn't easily answerable over email.

# Attendance, participation, and discussions

## Student participation requirements

The following is a summary of everyone's expected participation:

- **Attend class meetings: THREE TIMES PER WEEK**

Students are expected to attend and participate in class meetings.

- **Logging in: AT LEAST ONCE PER WEEK**

Be sure you are logging in to the course in Carmen each week, including weeks with holidays. You will need to log in to Carmen to view the reading assignments and upload homework assignments. (During most weeks you will probably log in many times.) If you have a situation that might cause you to miss an entire week of class, discuss it with me as soon as possible.

- **Office hours: OPTIONAL**

All office hours are optional. If you need to speak with me privately about a topic that cannot be easily discussed during office hours, please contact me to schedule a time to meet.

## Other course policies

### 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 policy

### Policies for this online course

- **Exams:** You must complete all midterm and final exams on your own without assistance from anyone other than the course instructor. You may not assist anyone on an exam.
- **Written assignments:** Your written assignments should be your own original work. In formal assignments, you should cite the ideas and words of your research sources.
- **Reusing past work:** In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with me.
- **Collaboration and informal peer-review:** While study groups and peer-review of major written projects are permitted, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please feel free to ask the instructor.

### Ohio State's academic integrity policy

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 3335-5-48.7 (B)). For additional information, see the Code of Student Conduct <https://trustees.osu.edu/bylaws-and-rules/code>.

## Copyright disclaimer

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. **No course materials provided by the instructor (notes, videos, recordings, computer code, homework assignments, homework solutions, quizzes, exams, etc.) may be distributed publicly or privately to anyone outside of the class.**

## 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, Kellie Brennan, at [titleix@osu.edu](mailto:titleix@osu.edu)

## Diversity statement

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](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 also available through the 24/7 National Suicide Prevention Hotline at 1-800-273- TALK or at [suicidepreventionlifeline.org](https://suicidepreventionlifeline.org)

## 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>)

## **Accessibility accommodations for students with disabilities**

**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. You can connect with them at [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; or [slds.osu.edu](http://slds.osu.edu).**

### **Accessibility of course technology**

This 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](#)
- Streaming audio and video
- Synchronous course tools

### **Disclaimer**

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular we reserve the right to change due dates or the methods of grading and/or assessment if necessary. Any changes will be communicated to you through official course announcements.

## Course schedule (tentative)

The following tentative course schedule is subject to change. The schedule for each week will be posted on Carmen on Mondays.

Week	Dates	Topics, Readings, Assignments, Deadlines
1	Aug 20-23	Introduction, summarizing data in R
2	Aug 26-30	Relationships between variables
3	Sep 2-6	Intro to simple linear regression (SLR), parameter estimation
4	Sep 9-13	Inference and prediction under SLR models
5	Sep 16-20	Sources of variability, coefficient of determination, residuals
6	Sep 23-27	Transformations of regressors and response variables
7	Sep 30-Oct 4	Multiple linear regression: introduction, estimation
8	Oct 7-11	Interpreting coefficients; inference and prediction
9	Oct 14-18	Correlated predictors, regression with categorical predictors
10	Oct 21-25	Categorical and continuous regressors
11	Oct 28-Nov 1	Interaction effects 1, multiple categorical predictors
12	Nov 4-8	Interaction effects 2, nested models, non-linear regression
13	Nov 11-15	Residuals, leverage, outliers, and influence
14	Nov 18-22	Common violations of independence
15	Nov 25-29	Causal inference, model comparison, cross validation
16	Dec 2-4	Model selection: all subsets and stepwise regression

### Holidays:

Sep 2, 2014: Labor Day - no classes

Oct 11, 2024: Autumn break - no classes

Nov 11, 2024: Veterans Day - no classes

Nov 27-28, 2024: Thanksgiving - no classes

Nov 29, 2024: Indigenous Peoples' Day/Columbus Day - no classes

### Syllabus version

August 19, 2024: original