



# THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

## STAT 6450: APPLIED REGRESSION ANALYSIS AUTUMN 2024

### Course overview

**Instructor**

Xinyi Xu

Email address:

[xinyi@stat.osu.edu](mailto:xinyi@stat.osu.edu)

Lectures:

TTh 9:05–10:55am, University Hall 082

Office hours:

Virtual Hours via CarmenZoom, Thursday 11:30am-12:30pm

**Teaching Assistant**

Fangdi Chang

Email address:

[Chang.1703@buckeyemail.osu.edu](mailto:Chang.1703@buckeyemail.osu.edu)

Role:

Grading homework assignments and answering questions about homework

Office hours:

Virtual Hours via CarmenZoom, Monday TBD

### Course description

Statistics 6450 is intended to be an introduction to regression analysis techniques. We assume that students are familiar with organizing and summarizing data, the nature of relationships between variables, sampling distributions and the underlying rationale for hypothesis tests and confidence intervals. This course will focus on the application of linear regression models in practice but will also cover basic theory of the linear model. Core topics include simple linear regression, multiple linear regression, model diagnostics and model selection, regression analysis with categorical variables and generalized linear models.

**Prerequisite:**

Statistics 6201 or equivalent. Knowledge of matrix algebra and computing skills will be helpful.

## Course learning outcomes

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

- Understand the motivation of regression analysis
- Understand the theoretical assumptions behind the linear model and their importance in properly conducting a regression analysis
- Know how to estimate the parameters in regression models
- Be able to validate the modeling assumptions with formal tests and visual diagnostic tools
- Know how to make inferences regarding the linear model
- Be able to build and validate regression models in a principled manner
- Be able to apply the above knowledge and techniques in on your own data or problems

## Course materials

**Required:** *Applied Linear Regression Models*, 4th edition, by Kutner, Nachtsheim, and Neter, 2004.

**Note:** An alternative book is *Applied Linear Statistical Models (5th edition)* by Kutner, Nachtsheim, Neter and Liwith, McGraw-Hill. 2004.

- *Applied Linear Regression Models* is a subset (14 first chapters) of *Applied Linear Statistical Models*. The latter covers additional chapters on analysis of variance (ANOVA) and the design of experiments.
- The chapters common to the two books are identical, so practically either book would be ok for this course.

## 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

### Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Carmen

### Technology skills necessary for this specific course

- CarmenZoom

### Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

### 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 in-depth introduction to R is available at <http://cran.r-project.org/doc/manuals/R-intro.pdf>
  - Hands-on tutorials are available in the Swirl system, which you can learn about at <http://swirlstats.com/>. In particular, “R Programming: The basics of programming in R” is an appropriate first tutorial for students who have never used R.
- An easier 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.**
- [Microsoft Office 365 ProPlus](#) All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft’s Student Advantage program. Each student can install Office on five PCs or Macs, five tablets (Windows, iPad® and Android™) and five phones.
  - Students are able to access Word, Excel, PowerPoint, Outlook and other programs, depending on platform. Users will 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 <https://ocio.osu.edu/kb04733>.

### Course delivery

The course will be **delivered in person** at the scheduled class times. Students are expected to attend all lectures as well as studying the material that is assigned.

Also, the instructor will hold weekly office hours and will post homework assignments on the course website. Please check the course website frequently for important announcements, lecture material, homework assignments and solutions.

## Grading and faculty response

### Homework and exams

Assignment or category	Percentage
Homework	30
Midterm Exam	30
Final Exam	40
Total	100

#### Homework:

Homework will be collected approximately bi-weekly. It will consist of both written problems and computer programming/data analysis problems. **NO late homework will be accepted unless prior exception has been sought.** If you are unable to complete an assignment on time, please get in touch with the instructor as soon as possible so we can discuss your situation.

You are encouraged to work together on the problems, but each student must hand in their own work, written in their own words. Do not copy any part of another student's homework including computer output. Use of homework solutions distributed in previous offerings of the course or available on the web constitutes academic misconduct and will be handled according to university rules. **All homework must be submitted online as a PDF file through the course website.** Please be sure that the questions are clearly labeled, all supporting work (including computer code) can be easily identified, and that all figures/tables are referenced and interpreted in the text.

#### Exams:

There will be one midterm exam and one comprehensive final exam.

Midterm (tentative): October 8, Tuesday, 9:05-10:55am

Final (Comprehensive): December 6, Friday, 8-9:45am

- If you cannot be available at these times for unavoidable reasons, you must speak with the course instructor immediately. **If you fail to take an exam during the time when it is available without any communication with us to explain, we will not allow you to make up the exam unless there is an emergency that you can document.**
- Both exams will be **closed-book/closed-notes**; however, you will be allowed a calculator and double-sided 8.5" × 11" formula sheets (one page for the midterm and two pages for the final). We take academic honesty very seriously in this course. You may communicate with only the instructor if you have any questions during the exam periods.

## Faculty feedback and response time

We are 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.)

### Preferred contact method

- If you have questions about the lectures or notice any typos in the materials, please email the instructor. I will reply to e-mails within **24 hours on school days**.
- **If you have questions about the grading of homework assignments, please email the teaching assistant directly.**

## Attendance, participation, and discussions

Students may miss class, for a variety of reasons related to COVID-19. As much as possible, please stay in contact with the instructor so that we can discuss accommodations should they be needed.

## 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. Informality (including an occasional emoticon) 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.
- **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.

## Other course policies

### 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.

## Potential disruptions to instruction

- As much as is possible, students will have access to material online if they are unable to attend class because of positive diagnosis, symptoms, or quarantine required following contact tracing.
- If the instructor is unable to be present in person because of positive diagnosis, symptoms, or quarantine following contact tracing a new instructor will be assigned to the course. Details will be given on the course website.

## 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 the midterm and final exams yourself, without any external help or communication.
- **Written assignments:** Your written assignments, including discussion posts, should be your own original work.
- **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.
- **Falsifying research or results:** All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was.
- **Collaboration and informal peer-review:** The course includes many opportunities for formal collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on assignments is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.

## 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 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

## 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.

## 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)

## 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 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. SLDS contact information: [slds@osu.edu](mailto: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](#)
- [CarmenZoom accessibility](#)
- Synchronous course tools

## **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)

## **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)

Week	Dates	Topics, Readings, Assignments, Deadlines
1	Aug 20, 22	Simple linear regression (SLR) – introduction and estimation
2	Aug 27, 29	SLR – inference and ANOVA
3	Sep 3, 5	SLR – inference and ANOVA
4	Sep 10, 12	SLR – graphical diagnostics and lack of fit test
5	Sep 17, 19	SLR- remedies, transformations, and simultaneous inference
6	Sep 24, 26	Recap of Linear Algebra, SLR in matrix form
7	Oct 1, 3	Multiple Linear Regression (MLR) –introduction and estimation
8	Oct 8	<b>Midterm Exam</b>
*	Oct 10	<b>Autumn break (no class)</b>
9	Oct 15, 17	MLR – inference, diagnostics and remedy, general linear test
10	Oct 22, 24	MLR – extra sum of sums and multicollinearity
11	Oct 29, 31	MLR – polynomial regression, interaction regression
12	Nov 5, 7	MLR -- regression models with qualitative predictors
13	Nov 12, 14	MLR -- Model selection and validation
14	Nov 19, 21	MLR – model diagnostics
15	Nov 26	MLR – model diagnostics Generalized Linear Models (if time permits)
*	Nov 28	<b>Thanksgiving Day (no class)</b>
16	Dec 3	Final review