



THE OHIO STATE UNIVERSITY

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COLLEGE OF ARTS AND SCIENCES

# SYLLABUS: STAT 6950 APPLIED STATISTICS II SPRING 2024

## Course overview

### Instructor

Instructor: Christopher Hans

Email address: [hans.11@osu.edu](mailto:hans.11@osu.edu)

Class website: Carmen

Lectures: Tuesdays and Thursdays, 9:05am–10:55am

Classroom: ML 173

Office hours: Tuesdays 11:30am–12:30pm

Wednesdays 10:30am–11:30am

Office hours location: CH 428D

### Grader

Zhenbang Jiao ([jjiao.180@osu.edu](mailto:jjiao.180@osu.edu))

### Format of instruction

STAT 6950 is a four-credit hour course with two in-person, 110-minute lectures each week. Two in-person office hours are offered by the instructor each week. Students are expected to attend both lectures each week; attendance at office hours is optional.

## Course description

Simple and multiple linear regression, diagnostics, model selection, the mixed model, and generalized linear models. Intended primarily for students in the PhD program in Statistics or Biostatistics.

Stat 6950 is an applied statistics course that emphasizes principles of data analysis in the linear model setting. While the focus is applied, the methods of data analysis are presented and motivated in the context of statistical theory at a level appropriate for first year graduate students in Statistics. The theoretical background assumes facility with multivariable calculus and basic matrix operations from linear algebra. The R language and environment for statistical computing and graphics will be used as the main tool for data analysis.

Prereq: 6801 and 6910, or permission of the instructor. Not open to students who have taken 6450.

## Course learning outcomes

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

- use an exploratory analysis of data to guide the linear regression modeling process.
- fit, interpret, and perform statistical inference based on linear regression models.
- use appropriate diagnostics for model checking and case-influence analysis to identify deficiencies with a fitted model.
- recognize and employ appropriate modeling strategies for common examples of nonconstant variance functions.
- employ appropriate strategies for regression modeling with many predictors.
- perform basic logistic and Poisson regression analyses.

## Course materials

### Required

S. Weisberg (2014), Applied Linear Regression, 4<sup>th</sup> Edition, John Wiley & Sons, Inc., NJ.

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.

Errata and more information about the textbook can be found at <http://users.stat.umn.edu/~sandy/alr4ed/>.

I will highlight any other useful resources as the course progresses.

## Course technology

### 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>
- 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/>. **Note that RStudio requires R to be installed.**
- You may choose to use 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	15
Midterm 1	15
Midterm 2	25
Project	15
Final Exam	30
<b>Total</b>	<b>100</b>

**Homework** will be assigned approximately weekly, with a few weeks off during the semester. There will be fewer homework assignments near the end of the semester when you are working on the project. While adjustments may need to be made, I expect that homework assignments will be due on Carmen on Thursdays by 11:59pm. Instructions for how to prepare and turn in your homework solutions will be given at the beginning of the semester.

**Project:** A group project will be due near the end of the semester. The project will tie together the concepts learned throughout the course. Details will be provided in the beginning of March.

**Exams:** The first midterm is **tentatively** scheduled for **Thursday, February 15<sup>th</sup>** during our regularly scheduled class time. The second midterm is tentatively scheduled for **Thursday, March 28<sup>th</sup>** during our regularly scheduled class time. The final exam has been scheduled by the registrar for **Monday, April 29<sup>th</sup>** from **8:00am–9:45am**.

All exams are closed book/closed notes. Further details will be given in advance of each exam. A basic calculator is allowed.

## Other course policies

### Academic integrity policy

#### Policies for this course

- **Exams:** You must complete the midterm and final exams on your own without assistance from anyone other than a course instructor.
- **Homework:** You may work together on the homework, but do not copy any part of your solutions from another person or another source. While study groups are allowed, remember that you must produce your own, original work. If you're unsure about a particular situation, please feel free to ask ahead of time.
- **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.

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

## **Religious accommodations**

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

## **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](mailto:titleix@osu.edu)

## **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.

## Accessibility of course technology

This course requires use of Carmen (Ohio State's learning management system). If you need additional services to use these technologies, please request accommodations with your instructor ([Carmen \(Canvas\) accessibility](#)).

## 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 by dialing 988 to reach the Suicide and Crisis Lifeline.

## Disclaimer

This syllabus should be taken as a reliable guide for the course content. However, you cannot claim any rights from it, and 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.

Week	Dates	Topics, Readings, Assignments, Deadlines
1	Jan 9, 11	EDA, statistical models, simple linear regression intro
2	Jan 16, 18	Simple linear regression
3	Jan 23, 25	Testing, techniques for model validation
4	Jan 30, Feb 1	Regression diagnostics
5	Feb 6, 8	Transformations

<b>Week</b>	<b>Dates</b>	<b>Topics, Readings, Assignments, Deadlines</b>
<b>6</b>	Feb 13, 15	Multiple linear regression intro, Midterm 1
<b>7</b>	Feb 20, 22	MLR inference, added variable plots, multicollinearity
<b>8</b>	Feb 27, 29	Nested models, general linear F test
<b>9</b>	Mar 5, 7	Regression with categorical predictors
<b>10</b>	Mar 12, 14	Spring break
<b>11</b>	Mar 19, 21	Weighted least squares, generalized least squares
<b>12</b>	Mar 26, 28	Residuals and diagnostics, Midterm 2
<b>13</b>	Apr 4, 6	Polynomial regression, interaction effects
<b>14</b>	Apr 9, 11	Model selection and comparison
<b>15</b>	Apr 16, 18	Logistic and binomial regression