THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

SYLLABUS: STAT 6950
APPLIED STATISTICS II
SPRING 2021

Course overview

Instructor

Instructor: Christopher Hans
Email address: hans.11@osu.edu

Class website: Carmen
Lectures: On CarmenZoom
Tuesdays and Thursdays, 9:05am–10:55am
Office hours: Virtual office hours via Carmen Zoom (link provided on Carmen)
Tuesdays 11:00am–12:00pm
Wednesdays 3:00pm–4:00pm
Office Location: Virtual
Due to the COVID-19 pandemic, I do not plan to be in my office regularly. Instead, I will be available virtually over email and Zoom.

Grader

Xiaohan Fu (fu.688@osu.edu)

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, 4th 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 other useful resources as the course progresses.

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
- **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" provides interactive courses that can be used to review working with R.
- 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.

Course delivery

The course will be delivered primarily **synchronously**, presented live over CarmenZoom during the scheduled class time. On occasion, a synchronous class meeting may be replaced with **asynchronous** content in the form of a video posted to Carmen covering a specific topic. The majority of content will be delivered synchronously, with asynchronous delivery reserved for

specific topics for which recorded video content is expected to facilitate learning. Details of the weekly schedule will be announced at the start of each week.

Each week we will cover approximately 220 minutes of content in total. You will responsible for attending and participating synchronously in live class sessions, viewing asynchronously any recorded videos, and studying the material that is assigned.

The instructor will hold weekly office hours via CarmenZoom. The times are given above.

Grading and faculty response

Grades

Assignment or category	Percentage
Homework	**15**
Midterm	**30**
Project	**20**
Final Exam	**35**
Total	**100**

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 data analysis project. While adjustments may need to be made, I expect that homework assignments will be due on Carmen on Thursdays by 11:59pm. You will use R Markdown to prepare your homework solutions; instructions for this will be given at the beginning of the semester. Guidelines for preparing and submitting your solutions on Carmen will be provided with the homework assignments.

Project: A data analysis 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: There will be one midterm examination administered during the semester to assess your understanding of the course material as the semester progresses. The midterm is **tentatively** scheduled to be on **Tuesday, March 9th** during our regularly scheduled class time. The date and time for the final exam will be announced at the beginning of the semester.

All exams are closed book/closed notes and will be proctored online. Further details will be given in advance of each exam. A basic calculator is allowed; tablets, laptops, cellphones, and other communication devices are not.

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** at any time if you have a technical problem.)

Grading and feedback

For homework assignments, you can generally expect feedback within **7-10 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 one of the virtual office hours that will be spread out during the week if your question isn't easily answerable over email.

Attendance, participation, and discussions

Student participation requirements

Because this is a distance-education course, your attendance is based on your online activity and participation. The following is a summary of everyone's expected participation:

- **Attending online, synchronous class meetings**:

  Students are expected to attend and participate in the online, synchronous class meetings on Tuesdays and Thursdays.
- **Logging in**: **AT LEAST THREE TIMES PER WEEK**
  Be sure you are logging in to the course in Carmen each week, including weeks with holidays. (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 OR FLEXIBLE**
  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

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. Guidelines and requirements for campus safety from the University's COVID-19 Transition Task Force were published on July 1, 2020, on the Safe and Healthy website (https://safeandhealthy.osu.edu).

Potential disruptions to instruction

- The instructor will work to accommodate any student who is unable to participate in class for a period of time because of a positive diagnosis, symptoms, or quarantine required following contact tracing related to COVID-19.
- A back-up instructor has been assigned to this course. In the event the principal instructor is unable to participate in class activities due to a positive diagnosis, symptoms, or quarantine required following contact tracing related to COVID-19, the back-up instructor will take over course duties until the principal instructor is able to resume instruction.

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 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.**

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

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; 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
- Streaming audio and video
- 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 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

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.

Week	Dates	Topics, Readings, Assignments, Deadlines
1	Jan 12, 14	Introduction, EDA, statistical models
2	Jan 19, 21	Simple linear regression
3	Jan 26, 28	Testing, techniques for model validation
4	Feb 2, 4	Regression diagnostics, transformations
5	Feb 11	Multiple linear regression intro
6	Feb 16, 18	Multiple linear regression inference and diagnostics
7	Feb 23, 25	Multicollinearity, weighted least squares
8	Mar 2, 4	General linear F test, polynomial regression
9	Mar 11	Regression with categorical predictors
10	Mar 16, 18	Variance functions and mixed models
11	Mar 23, 25	Variable selection and model comparison
12	Mar 30, Apr 1	Flexible regression methods (trees, splines)
13	Apr 6, 8	Logistic regression, deviance and testing
14	Apr 13, 15	Binomial regression, residuals and diagnostics
15	Apr 20	Poisson regression