



# THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

## STAT 5302: INTERMEDIATE DATA ANALYSIS II AUTUMN 2020

### Course overview

#### **Instructor**

Xinyi Xu

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

Lectures: On CarmenZoom, MWF 10:20-11:15am EST

Office hours: Virtual hours via CarmenZoom: MW 11:15-11:45am

#### **Teaching Assistant**

Zixuan Chen

Email address: [chen.4747@osu.edu](mailto:chen.4747@osu.edu)

Role: Grading homework assignments, monitoring the course discussion board and answering questions about homework

Office hours: Virtual hours by appointment only

### **MSLC Free Tutoring Hours**

Mathematics and Statistics Learning Center (MSLC) offers free online tutoring for students enrolled in selected courses including STAT 5302. The details and tutoring hours can be found at <https://mslc.osu.edu/online-tutoring>

### **Course description**

Statistics 5302 is the second course in a two-semester sequence in Intermediate Data Analysis. 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. We also assume that students are comfortable with a variety of models and inferential procedures. Specifically, the material in 5302 relies heavily on the additive model (see the early part of the text for a description of this model) and one-way ANOVA. The course will cover (simple and multiple) linear regression and ANOVA designs beyond the one-way layout. For each of the common statistical methods covered in the course, we will focus on generation of appropriate models for data, estimation of the model parameters and their inference, and model diagnostics. Applications of the methods will be illustrated with data analysis.

**Prerequisites:** STAT 5301 or permission of instructor.

## Course learning outcomes

Upon successful completion of the course, students will be able to:

- Identify an appropriate analysis for data collected in a study
- Carry out such an analysis
- Examine whether the assumptions behind the analysis are reasonable, and
- Recognize the strengths or weaknesses of the study based on how the data were collected.

## GE Course Information

- This course satisfies the GE Data Analysis requirement
- The expected learning outcomes are:
  - ELO1: Students understand basic concepts of statistics and probability
  - ELO2: Students comprehend methods needed to analyze and critically evaluate statistical arguments, and
  - ELO3: Students recognize the importance of statistical ideas.
- These goals will be achieved by detailed study utilizing example data from a variety of scientific fields

## Course materials

**Required:** *The Statistical Sleuth – A Course in methods of data analysis*, 3rd Edition, by Ramsey and Schafer, Duxbury Press, 2012 (<http://www.statisticalsleuth.com>)

The electronic version of this textbook is being provided via CarmenBooks, which is an Inclusive Access program that offers digital copies of selected textbooks for a fraction of the cost of a new physical copy. The fee for this material is included as part of tuition and is listed as CarmenBooks fee on your Statement of Account. Materials provided through CarmenBooks are available immediately on or before the first day of class. You can access this eBook through the CarmenBooks reader link in the course navigation. More details about CarmenBooks can be found on <https://affordablelearning.osu.edu/carmenbooks/students>.

## Course delivery

The majority of the course will be delivered **synchronously via CarmenZoom** during our scheduled class meeting times. All lectures will be recorded and posted on Carmen by the end of the day of the class. The instructor may elect to asynchronously use **pre-recorded videos** in place of live zoom lectures for certain topics, which will be announced on the course website. A tentative schedule of the course can be found at the end of this syllabus.

Please check the course webpage regularly for important announcements, homework assignments and solutions and data examples. The instructor and teaching assistant will also manage active discussion boards via Carmen and will hold virtual office hours.

## 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; the following website may help you if you encounter difficulties with Carmen: <https://resourcecenter.odde.osu.edu/canvas/> .

### 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

- In this course, you will be required to do some basic statistical analyses on the computer using the statistical software package 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.**

## Grading and faculty response

### Homework and exams

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

#### Homework:

Homework will be collected approximately bi-weekly. Allow sufficient time to complete these assignments so that you can get help if you need it. **NO late homework will be accepted.** We automatically drop your lowest homework assignment grade. If you miss a homework assignment deadline, we will automatically take your first missed homework assignment to be your lowest grades (in that you will receive 0 for not completing the assignments), no matter what the reason for missing these assignments is, so please do not ask to make up the assignment. We allow for the assignment grades to be dropped because we recognize that sometimes, unavoidable things happen that might affect your ability to complete your work and we do not want you to worry about having to make up work in these situations.

When you put together your homework solutions, make sure that you put your name and the homework assignment number on the first page. Submit the problems in order, making sure that the computer output and discussion is placed together (do not put the computer output at the end of homework). Computer output alone without proper interpretation of the result would not be considered a complete answer either and you may lose points. You don't need to include R script itself in your homework unless it is necessary to justify your answer.

You are encouraged to use the Carmen discussion board to post questions about homework assignments and to answer questions from your peers. This will provide you with opportunities to interact with each other. However, do not copy any part of other's homework. Each student must produce his/her own homework to be handed in. All homework must be **submitted online as a PDF file through the course website**, following the instructions on <https://community.canvaslms.com/docs/DOC-9539-421241972>.

#### Exams:

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

Midterm (tentative): October 12, Monday, 10:20-11:15 EST

Final (Comprehensive): December 9, Wednesday, 10-11:45am EST

- 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 situation that you can document.**

- Both exams will be **close-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). Your formula sheets need to be submitted with your answers as a PDF file through the class website. 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.

You have until one week after receiving your grades on the exams to dispute the grade; the same applies to any homework grade. Note that when asking for a question to be re-graded, the entire assignment/exam may be re-graded, and so you run the risk of losing more points than you gain back.

## Faculty feedback and response time

We are providing the following list to give you an idea of our 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** – do NOT use the discussion board.

### Discussion board

The teaching assistant and instructor will regularly monitor and reply to messages in the discussion boards as appropriate.

## 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.

## 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 live lectures:**  
Students are expected to participate, discuss, and answer questions in online live lectures.
- **Logging in: AT LEAST ONCE PER WEEK**  
Be sure you are logging in to the course in Carmen each week, including weeks with holidays or weeks with minimal online course activity. (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*.

## Discussion and communication guidelines

A significant component of our interactions in this class will occur through Zoom videoconferencing. Because this mode of discussion has benefits and challenges that differ from in-person class sessions, I want to share my expectations for how we will meet and communicate:

- **Technical Issues:** If you encounter a technical issue with Zoom during a session, first make sure you are using the latest version of Zoom. Next, contact the IT Service Desk at [go.osu.edu/it](https://go.osu.edu/it) or 614-688-4357(HELP). If issues continue, contact me after the session to learn how to make up for the missed content either via a recording or other means. I will not be able to address technical issues during a live session.
- **Preparation:** Come to the session having completed any readings or pre-work and be ready to have open, civil, and supportive discussions in video and chat spaces. I ask that you update your Zoom profile with your preferred name and add a picture with your face.
- **Participation:** At the start of our sessions, I'll share specific expectations for how to use the chat, how to interact, and how to raise questions or concerns as we go. If you are unsure about expectations or are unsure about raising a question, please follow up with me afterward to make sure your questions are answered. Plan to be present during the entire class session as much as you are able. For some activities, I may ask you to share your faces on camera so that we can see each other and connect. Please feel encouraged to use a non-distracting virtual background. Many students and instructors prefer not to share their remote spaces for a variety of reasons. Mute your microphone when others are talking to minimize background noise in the meeting.
- **Recordings:** I will be recording our meetings for the benefit of students who may need to be absent. These links will only be shared with students in our class, and only when a student contacts me to make this arrangement.

If you have any concerns about participating in class over Zoom in this way, please let me know. My goal is to create a safe environment where we can benefit from seeing each other and connecting, but I want to prioritize your safety and well-being.

## 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 a quiz or assignment 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 (Recommended)

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](http://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](http://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	Reading
1	08/25-	Simple linear regression; least squares regression estimation	7.1-7.3
2	08/31-	Inferential tools for simple linear regression models	7.4
*	09/07	<i>Labor Day (no class)</i>	
3	09/09-	Model assessment for simple linear regression	8.4-8.6
4	09/14-	Model assessment for simple linear regression	8.1-8.3
5	09/21-	Multiple linear regression models	9.1-9.3
6	09/28-	Least squares estimation for multiple linear regression	9.4-9.5
7	10/5-	Inferential tools for multiple linear regression models	10.1-10.2
*	10/12	<b>Midterm Exam</b>	
8	10/14-	F-tests and ANOVA for multiple linear regression	10.3-10.4
9	10/19-	Model assessment for multiple linear regression	11.1-11.2, 11.5
10	10/26-	Influential observations; weighted least squares	11.3-11.4, 11.6
11	11/2-	Sequential variable/model selection	12.1-12.3
12	11/9-	All subsets variable/model selection	12.4-12.7
*	11/11	<i>Veteran's Day (no class)</i>	
13	11/16-	Two-way ANOVA	13.1-13.2
14	11/23-	Inferential tools for two-way ANOVA	13.3-13.5
*	11/27	<i>Indigenous Peoples' Day/Columbus Day (no class)</i>	
15	11/30-	More on inferential tools for two-way ANOVA	13.3-13.5
*	12/9	<b>Comprehensive Final Exam</b>	