

Stat 3202: Statistical Inference for Data Analytics

Summer 2022 (19178)

Version 2: 5/9/2022

What's new: fixed the percentage for homeworks, from 15% to 25%; change 24-hour grace period to 50 hours.

Course Overview

Instructor Information

Instructor: Thomas Metzger, PhD

Email: metzger.181@osu.edu; please do not use my Buckeyemail address.

Office hours: Virtual or in-person meetings by appointment, Tuesdays and Thursdays 11 am - 12 pm

Teaching Assistants: TBD

Course Delivery

Topics will be divided into modules. Students are responsible for watching videos and working through the required content at their own pace before each deadline. Flipped-format live sessions will meet remotely Tuesdays and Thursdays from 9:55 am - 11:25 am. These sessions are optional and will serve to the supplement pre-recorded content videos that you are responsible for viewing on your own time. Lab tutorials and supplemental problems will be provided during recitation videos, hosted weekly on Mondays at TBD. Attendance in these sessions is encouraged but is not mandatory, and they will be recorded and posted to Carmen. Lab assignments will be due at the end of each week.

Course Description

Foundational inferential methods for learning about populations from samples, including point and interval estimation, and the formulation and testing of hypotheses. Statistical theory is introduced to justify the approaches. The course emphasizes challenges that arise when applying classical ideas to big data, partially through the use of computational and simulation techniques. Prereq: C- or better in 3201, or permission of instructor. Not open to students with credit for 4202.

Course learning outcomes

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

- Compare the performance of estimators via bias, mean squared error, consistency, and sufficiency
- Use Monte Carlo simulation to model the performance of estimators and testing procedures
- Propose estimators via the method of moments and maximum likelihood estimation
- Use the Central Limit Theorem to model the sample distribution of a sample mean
- Conduct hypothesis tests on mean and variance parameters, including t-tests, chi-square tests, and F tests
- Determine and interpret the power and type-II error of a test
- Use bootstrapping to conduct inference
- Perform nonparametric hypothesis tests on mean parameters

Materials

Text

- Required text: Stat 3202 Course Notes (electronic, on Carmen)
- Recommended text: Mathematical Statistics with Applications, 7th edition, by Wackerly, Mendenhall, and Scheaffer, Brooks/Cole, Cengage Learning, 2008. eBook PDFs are much cheaper and are highly encouraged.

Software

- Required software: we will extensively use the statistical software package called R (The R Project for Statistical Computing; <http://www.r-project.org/>). This software package is available for free. 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>. Tutorials are available in the Swirl system, which you can learn about at <http://swirlstats.com/>. “R Programming: The basics of programming in R” is an appropriate first tutorial for students who have never used R.
- Required software: we will also use the R interface 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.
- Required software: 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>.

Grades and Assignments

Homework (25%)

Homework assignments will comprise 25% of your grade for the course. Assignments will only be accepted through Carmen as a .pdf file submission, with clear and organized work and relevant code and output provided. Every assigned problem should be completed, but only a subset of problems may be graded. You are encouraged to collaborate remotely on homework assignments, but ultimately the work you submit must be your own. All homework assignments will be included in your final grade, so be sure they are all submitted.

Labs (25%)

Lab assignments will comprise 25% of your grade for the course. Most weeks a lab assignment will be introduced during recitation, incorporating recent lecture topics with coding. Labs will generally be due Fridays before 11:59 pm. You are encouraged to collaborate remotely on lab assignments, but ultimately the work you submit must be your own. Labs will be completed in R Markdown and must be compiled into organized, professional PDF documents. Relevant plots should be included and labeled, code should be organized and clear, and supporting answers and text should be properly formatted and professionally written. The lowest lab grade will be dropped.

Content Checks (25%)

Content checks will comprise 25% of your grade for the course. These short, graded assignments will check your understanding of the recorded content. The purpose of these assignments is to give you practice, ensure

you are staying up to date with course content, and to give me a chance to quickly find and address any misconceptions. You'll have 3 attempts for each assignment. The lowest content check grade will be dropped.

Oral Exams (25%)

Three oral exams, each comprising 8.3% of your grade, will take place during the semester.

Exam 1, covering Lectures XX-XX, will take place Week X by appointment. Exam 2, covering Lectures XX-XX, will take place Week X by appointment. Exam 3, covering Lectures XX-XX, will take place Week X by appointment. The purpose of these exams is to ensure that you personally are achieving the required course outcomes and engaging with the course material.

Oral exams will be conducted over Zoom. Your webcam and microphone must be enabled for the entire duration of the assignment. Oral exams can also be held in person on campus depending upon my availability. Each exam will last a maximum of 15 minutes. Practice oral exams can be conducted upon request. These are not meant to be high-pressure or detail-oriented. Rather, they will focus on big-picture definitions and explanations. Topics will generally be more conceptual in nature than computational. If you are regularly watching the content and completing assignments with your own knowledge and unique work, you should not worry about these assignments.

Late Assignments

Late homeworks and labs will be accepted for 50 hours after the original due date with a 2% deduction per hour. **After this, no late assignments will be accepted.** Do not wait until the last moment to begin working on assignments. Unexpected obstacles will occur in life - it is your responsibility to be prepared for them. If something unexpected comes up 2 hours before an assignment is due that impedes your ability to submit on time, then you should have started the assignment earlier. Submitting the wrong document - such as the blank assignment template, an incomplete version, or a corrupted version of the file - is not a valid excuse. It is your responsibility to ensure you have submitted the correct document in the correct format to the correct Carmen submission location.

"Can I please have an extension on my assignment?"

Yes! You may have up to 50 extra hours, with a 2% deduction per hour. Beyond that, no late assignments will be accepted.

Academic Integrity

I take academic integrity very seriously, particularly in online courses. There is no place at The Ohio State University for academic misconduct, and I have submitted many students in the past for violations including copying other students' work and receiving unauthorized assistance on exams.

- Content checks: these assignments are to gauge **your** understanding of the course material. You are encouraged to collaborate with other students in small groups if you are comfortable doing so, but ultimately the work you submit must be your own. Directly copying another student's work is not permitted.
- Labs: You are encouraged to collaborate on lab assignments, but ultimately the work you submit must be your own. Directly copying another student's code, work, or file is not permitted.
- 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 an exam is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.

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/>.

Health, Safety, and Accommodations

COVID Information

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. Be sure to review policies for students that can be found here: <https://safeandhealthy.osu.edu/current-students>.

In the event you are unable to attend class for an extended period of time, please reach out to me as soon as possible. In the event I am unable to participate for an extended period of time, I will let students know as soon as possible. A replacement instructor will be available through the Department of Statistics.

Absence from Class

If illness prevents you from attending class, please reach out **with documentation** as soon as possible. We are of course required to accommodate illnesses such as COVID, but they must be documented appropriately. If you have issues such as a chronic illness, reach out **before** it becomes a problem that prevents you from fulfilling your responsibilities for the course. Plan ahead so that you are prepared for such contingencies. For personal events such as weddings, vacations, work, or other commitments, it is your responsibility to reach out **before** these events and work **ahead**, not from behind. Extensions will not be given, but work will be accepted in advance.

Title IX Policy

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.

Student Services and Accessibility Accommodations for Students with Disabilities

The University strives to make all learning experiences as accessible as possible. 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; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

If you have accommodations, it is your responsibility to communicate these with me in a timely and efficient manner.

Student academic services: <http://advising.osu.edu/welcome.shtml>

Student support services: <http://ssc.osu.edu>

Diversity and Inclusion

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.

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

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.

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.