SYLLABUS: STAT 3202 – DISTANCE LEARNING
INTRODUCTION TO STATISTICAL INFERENCE FOR DATA ANALYTICS
SUMMER 2021

Course overview

Instructor

Instructor: Thomas Metzger, PhD
Email address: metzger.181@osu.edu; **please do not use my Buckeyemail address.**
Office hours: Virtual Hours via Carmen Zoom, time/date TBD

Grader

Ningyi Liu, liu.5405@osu.edu

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:
- Use the Central Limit Theorem to model the sample distribution of a sample mean
- Compare the performance of estimators via bias, mean squared error, consistency, and sufficiency
- Propose estimators via the method of moments and maximum likelihood estimation

- Use Monte Carlo simulation to model the performance of estimators and testing procedures
- Use the normal, t, and F distributions to conduct hypothesis tests on single mean parameters, differences of mean parameters, single variance parameters, and ratios of variance parameters
- Determine and interpret the power and type-II error of a test
- Use bootstrapping to conduct inference
- Perform nonparametric hypothesis tests on mean parameters

Course materials

Required

Stat 3202 Course Notes (electronic, on Carmen)

Optional (recommended) materials

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.

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 (optional for Zoom office hours)

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection

- Microphone: built-in laptop or tablet mic or external microphone (optional for Zoom office hours)

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.
  - 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 – Remote Learning

In an online, summer course, it can be easy to feel very disconnected from your classmates and professor. I want to avoid this by speaking and working with students individually during class time and office hours, and I encourage you to collaborate with one another on labs, homeworks, lecture checks, and when studying. Please note that *collaboration* is different than, say, using solutions from a previous semester, posting solutions into a group chat, using Chegg or a similar online "hOmEwOrK hELp" service.

Live lectures will be held twice weekly: Tuesdays (Lecture "A") and Thursdays (Lecture "B") from 9:50 am – 11:25 am, EST. Lectures will be numbered by week. So for example, Lecture 7B corresponds to the Thursday lecture of week 7. To get the most out of the course, students are highly encouraged to attend these sessions. Lectures will be recorded and posted for students

to view at their convenience, but if you cannot attend due to illness or another reasonable health-related reason, please let me know in advance and follow all of Ohio State's guidelines on health and safety. For students who miss the live lectures, I would like to meet with these students during office hours to discuss the content with them and ensure they are actually

Lab tutorials and supplemental problems will be discussed during the remote lab sessions recorded by the TA. Lab assignments will be due at the end of each week. These sessions will be held remotely on Zoom all semester, recorded, and posted to Carmen.

Grading and Assignments

Grades

Assignment or category	Percentage
Homeworks	25%
Labs	20%
In-class assignments/Lecture checks	25%
Exam 1: Monday, June 14 (Covers Lectures 1B-5B)	15%
Exam 2: Thursday, July 29 (Covers Lectures 6A-12A)	15%
Total	100%

Assignment Information

Lecture checks: Each lecture will have a corresponding lecture check assignment comprising questions assessing key elements of the corresponding lecture. They may comprise coding problems, definitions, theoretical questions, and computational problems. The lowest lecture check grade will be dropped at the end of the semester. Lecture checks will generally be due at 11:59 pm one day after the lecture is recorded.

Homeworks: Tentatively, there will be six homework assignments. Assignments should be submitted to Carmen as a PDF file and organized according to the homework template. 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 homeworks will count toward your final grade** - the lowest homework grade will **not** be dropped.

Labs: each week a lab assignment will incorporate the recent topics with coding. Labs will 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. The lowest lab grade will be dropped at the end of the semester.

Exams: Exams will take place remotely. You'll have two options for a four-hour window of time that works best for your schedule. The week before exams are held, you will sign up for the appropriate window you prefer on a discussion page posted to Carmen. When your window of time opens, the exam document will be emailed to you. Students must work individually on these assignments, and may not use illicit resources such as online forums, group chats, or collaboration with other students. Students may use their own class resources such as their notes or previous assignments.

Late Assignments

Excluding exams, assignments including labs, lecture checks, and homeworks will be accepted for 12 hours after the deadline with a 10% deduction. **After this 12 hour grace period ends, no late assignments will be accepted.** Assignments must be submitted through the Carmen submission portal. Emailed assignments will not be accepted.

Beyond this, late assignments are not accepted. Start assignments early in case an emergency comes up. Partially completed assignments will at least get some credit.

Grading Scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70 –72.9: C-
67 –69.9: D+
60 –66.9: D
Below 60: E

Attendance, participation, and discussions

Student participation requirements

Students are expected to attend or watch every lecture. Students who do not attend live lectures must periodically meet with me during office hours so I can check that you are actually keeping up with the work yourself.

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**: Please remember to use appropriate grammar, spelling, and punctuation. Your written comments on Carmen discussions are visible to all students, and emails are visible to me, so please make efforts to communicate professionally.
- **Tone and civility**: Please maintain a supportive learning community where everyone feels safe and where people can disagree amicably.
- **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 pasting 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.

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

- "A daily health check to report body temperature and health status will be required for all faculty, staff and students each day they intend to be on Ohio State's campuses in the autumn."

- Face masks must be worn in indoor settings, including classrooms. Noncompliant students will be asked to leave. I will have no patience whatsoever with students who put myself and others at risk.
- Members of the campus community will be required to sign a pledge "to affirm their understanding of what is needed to help fight the spread of the virus and their intention to do their part."
- "Accountability measures will be in place for those who refuse to abide by required health and safety guidelines."

Potential disruptions to instruction

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.

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

- **Lecture checks**: You are encouraged to collaborate remotely on lecture check assignments, but ultimately the work you submit must be your own. I will submit violations to the Committee on Academic Misconduct, as I have done in the past.
- **Labs:** You are encouraged to collaborate remotely on lab assignments, but ultimately the work you submit must be your own. I will submit violations to the Committee on Academic Misconduct, as I have done in the past.
- **Exams:** Exams must be your own unique and singular work. You may not work with other students or use online resources such as Chegg to solicit solutions. I will submit violations to the Committee on Academic Misconduct, as I have done in the past.
- **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.

- **Reusing work from another section**: you may not use solutions or work from another section of this course. I specifically look for this in solutions and submissions and will submit violations to the Committee on Academic Misconduct, as I have done in the past.
- **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/.

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 at titleix@osu.edu.

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.

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)

Dates	Lecture	Topic	Wackerly & Mendenhall Sections
R 5/13	1B	Course intro; Statistics Vocabulary; Expectation and Variance	3.2, 3.3, 4.2, 4.3
T 5/18	2A	Frequently Used Probability Distributions; Frequency Used Statistics	3.4, 3.8, 4.4, 4.5, 4.6
R 5/20	2B	The Central Limit Theorem; Monte Carlo Simulation and Custom R Functions	
T 5/25	3A	Bias	8.2, 8.3
R 5/27	3B	Mean Squared Error	8.2, 8.3
T 6/1	4A	Consistency	9.1, 9.3
R 6/3	4B	Likelihood	9.4
T 6/8	5A	Sufficiency; Plotting the Likelihood Function	9.4
R 6/10	5B	Maximum Likelihood; Method of Moments	9.6, 9.7
T 6/15	6A	Intro to Inference; Confidence Intervals for the Mean	8.5, 8.6
R 6/17	6B	Interpreting Confidence Intervals; CIs for Proportions	8.6
T 6/22	7A	The t Distribution	8.8
R 6/24	7B	Confidence Intervals for a Difference in Means; Paired and Two-Sample Data	8.8
T 6/29	8A	Pooled Variance and Welch-Satterthwaite Confidence Intervals	8.8
R 7/1	8B	CIs for a Single Variance & a Ratio of Variances; Chi-Square and F Distributions	8.9
T 7/6	9A	Bootstrapping	
R 7/8	9B	Introduction to Hypothesis Testing with Confidence Intervals	10.1, 10.2, 10.3
T 7/13	10A	Hypothesis Testing with rejection regions and p-values	10.5, 10.6
R 7/15	10B	Power and Type-II Error Part I	10.4
T 7/20	11A	Power and Type-II Error Part II	10.4
R 7/22	11B	Nonparametrics I	15.1, 15.3
T 7/27	12A	Nonparametrics II	15.4, 15.5, 15.6
R 7/29	12B	Contingency Day	