



THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

SYLLABUS: STAT 3202 SP 2025

Statistical Inference for Data Analytics

Course overview

Instructor

Instructor: Dr. Steephanson Anthonyanthu

Email address: anthonymuthu.1@osu.edu

Virtual office hours via Zoom: Tuesday 12:30pm -1:30pm, or by appointment

Zoom link for office hours: Available on Carmen

In-person (Optional – CH321) - Office hours: Monday 12:30pm -1:30pm, or by appointment

Graders

TA: Alan Gan

Email address: gan.171@buckeyemail.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.

Prerequisite: C- or better in 3201, or permission of instructor. Not open to students with credit for 4202.

Course delivery

Course Lectures:

This course is delivered fully online through an asynchronous mode of learning. Lecture videos will be posted on Carmen on a weekly basis. Students are expected to watch the lectures and participate in class activities. These videos will be utilized to provide an in-depth investigation of the topics for the week. Also, lecture notes will be posted on Carmen with the video lectures.

Labs:

Lab meetings will be delivered online through Zoom on Mondays on the specified times. Lab tutorials and supplemental problems will be provided via Carmen. Lab assignments will be due roughly at the end of each week, typically on Saturdays.

Carmen

This class will use Carmen. In Carmen, you will find copies of the syllabus, lab and homework assignments, lecture notes and other important documents. Carmen will also be used to keep track of your assignment grades. Additionally, materials for lectures will be uploaded to Carmen.

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.

Course materials

Required

- 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.

Course technology

Necessary 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>.

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>.

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

Technology skills necessary for this specific course

- Basic computer and web-browsing skills
- Navigating Carmen
- Collaborating in CarmenWiki

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed (if virtual office hours)
- Microphone: built-in laptop or tablet mic or external microphone

Grading and faculty response

Grades

Assignment or category	Percentage
Quizzes	7
Homework	20
Labs	20
Midterm 1	15
Midterm 2	17.5
Final Exam	17.5
Statistical Inference Quote	3
Total	100

Quizzes will be administered inside and/or outside of the class frequently through **Carmen**. These short quizzes are designed to encourage active participation in the virtual classroom activities (watching video lectures and others activities), and to help you stay engaged with the material covered in the lectures.

Please note that quizzes cannot generally be made up. However, to account for any unforeseen circumstances, your lowest quiz score will be dropped when calculating your overall quiz grade for the semester. The quizzes are open book and open notes.

Homework will be assigned periodically and submitted through Carmen. Due dates will be announced alongside each homework assignment. Homework must be completed in R Markdown, and a knitted PDF or HTML file should be uploaded for submission. While collaboration with classmates is encouraged, each student must produce and submit their own original work. Copying any part of another student's homework is strictly prohibited. All homework assignments contribute to your final grade, so it is essential to ensure that all assignments are completed and submitted on time.

Labs /Recitation

Labs will be conducted every week on Mondays. Most weeks a **lab** assignment will be introduced during recitation, incorporating recent lecture topics with coding. You are encouraged to collaborate 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.

Note: Use of homework and Labs solutions distributed in previous offerings of the course or available on the web constitutes academic misconduct and will be handled according to university rules. Sharing or disseminating solutions, or in any way knowingly enabling others to commit academic misconduct also constitutes academic misconduct and will be reported.

Recitation Assignment and Recitation Attendance:

These are activities that we hope you will be able to work through each week, with your peers and your assigned teaching assistant, during recitation. We don't expect you to complete lab activities during recitation, but we will always allow time during recitation for you to get started on lab activities, talk through the activities with your peers, and get immediate assistance from your teaching assistant. You will then submit your final work through Carmen on the following Saturday, by 11:59pm. **Attendance is mandatory for submitting recitation activities.** If you do not attend a recitation session, you will not receive credit for that activity.

Please note that missed recitations cannot be made up, and we do not grant exceptions. It is recommended to reserve your allowed absences for situations where they are absolutely necessary.

The recitations will be graded out of 20 points based on both completion and accuracy and you can find the instruction in each assignment sheet posted on Carmen. At the end of the semester, the two lowest recitation grades will be dropped. Late work is not accepted unless there are extenuating long-term circumstances that are documented. The lowest 2 assignments are dropped to cover all work that is not turned in for any other reason. 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.

Recitation activities will involve R coding and answering related questions. Please ensure that you bring fully completed lecture notes to the recitation, as there will not be time to explain material from the beginning during the session.

Statistical Inference Quote

Please write a sentence, quote, or create a humorous message that reflects your thoughts about statistical inference. This should be your own original idea, and it does not need to be perfect. Feel free to express your understanding or perspective in a creative and fun way.

Important Notes:

1. This assignment must be based entirely on your own thoughts. You are not required to provide a perfect or technically accurate answer—it's meant to be a fun exercise.
2. Do not use any external resources such as internet searches, ChatGPT, or other AI tools. Your submission must be entirely original.
3. Copying from any source, including internet or web-based platforms, will result in a score of zero.

All submissions that are original will receive full credit, regardless of accuracy. This assignment is intended to encourage creativity and individuality.

Late assignments

Late assignments (Homework and Labs) will be accepted for 24 hours after the original due date with a **1% 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 24 extra hours, with a 1% deduction per hour. Beyond that, no late assignments will be accepted.

However, in case of an emergency or exceptional circumstances (sudden onset of illness, unexpected family situations, etc.) arise and you are unable to submit by the original due date, contact the instructor to discuss the possibility of an extension.

Exams:

There will be two midterms, and one final exam administered during the semester to assess your understanding of the course material as the semester progresses. The final exam will take place at the time and date established by the University. Information about the exams will be posted well in advance on Carmen. **Exams must be completed without any external help or communication.** The information about the exams given below.

Midterm Exam 1:

Thursday February 06, 2025

Midterm Exam 2:

Thursday March 06, 2025

Final exam:

Tuesday April 29, 2025

Generally, make-up exams will not be given. However, make-up exams may be given in case of an emergency or exceptional circumstances (sudden onset of illness, unexpected family situations, etc.) or due to conflicts with other university activities with proper documentation which must be submitted. If for some reason you are unable to make the exams, please contact me as soon as possible. Late requests may be denied, or penalties may be assessed.

If you find a discrepancy in the grading of a midterm exam (e.g., incorrect addition/subtraction, correct answer marked incorrect, etc.) then you must bring it to my attention (through email) no later than **one week** from the day the exams are returned. After that grades will typically not be changed.

Grade Disputes

It is extremely important that you pay attention to your grades on a regular basis. If you feel that an assignment has been graded incorrectly or unfairly, you must speak with your instructor within **one week** of getting your grade on that assignment. We will not re-grade assignments at the end of the semester or offer any extra credit if you are not satisfied at that time with your final course

grade, especially since you will have known all semester what is expected of you to earn your desired grade in this course.

We believe strongly that grades are earned, not given. If you need to achieve a certain grade in this course, be careful to complete all assignments, plan appropriate time for studying, come to office hours/tutor room and ask questions, review feedback you receive on graded activities so you can talk to us about any problems you missed, and get help as needed in order to achieve your goal. We hope your grade in the course will be just as important to you on Day 1 as it is at the end of the semester, especially since you will have known the expectations of this course all semester and are in control of deciding what grade to earn. We do not bump grades at the end of the semester, we do not have extra credit and we cannot change grades based on a person's circumstances. Do not expect your exams to be curved; they may or may not depending on how the class does. We do not curve the final total points at the end.

IMPORTANT! Keep track of your grades!!

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** if you have a technical problem.)

Grading and feedback

For large weekly assignments, you can generally expect feedback within **7 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 office hours if your question isn't easily answerable over email.

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

The following is a summary of everyone's expected participation:

- **Logging in: REGULARLY**
Be sure you are logging in to the course in Carmen each week, including weeks with holidays. You will need to log in to Carmen to complete quizzes, view lecture content and upload homework assignments. (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:**
You are encouraged to attend office hours for assistance. 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.

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:** While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. Informality (including an occasional emoticon) is fine for non-academic topics.
- **Tone and civility:** Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **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 copying into the Carmen discussion.
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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.

I expect that you will read and follow the guidelines and requirements for campus safety, which are available at <https://safeandhealthy.osu.edu>.

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 course

- **Exams:** You must complete the midterm and final exams yourself, without any external help or communication.
- **Written assignments:** Your written assignments, should be your own original work. In formal assignments, you should cite the ideas and words of your research sources. You are encouraged to ask a trusted person to proofread your assignments before you turn them in, but no one else should revise or rewrite your 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.
- **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 to ask the instructor.

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, quizzes, 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 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.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the [Safe and Healthy Buckeyes site](#) for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu."

Accessibility of course technology

This 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

Weather or other short-term closing University

Should in-person classes be canceled, I will notify you as to which alternative methods of teaching (Zoom lectures or other modes) will be offered to ensure continuity of instruction for this class. Communication will be via Carmen, email or other mode of communication.

Religious Accommodations

Our inclusive environment allows for religious expression. If you need to request accommodations based on faith, religious or a spiritual belief system in regard to examinations, other academic requirements or absences, please provide your course instructor with written notice of specific dates for which you need alternative accommodations at the earliest possible date.

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.

For more information about religious accommodations at Ohio State, visit odi.osu.edu/religious-accommodations.

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.

Red: no meeting

Italics: recitation meeting

Date	Meeting	Topic	Wackerly & Mendenhall Sections
Monday, January 06	<i>Recitation 1</i>	Creating R Markdown reports	
Tuesday, January 7	Lecture 1	Course intro; statistics vocab; expectation and variance	3.2, 3.3, 4.2, 4.3
Thursday, January 9	Lecture 2	Common probability distributions	3.4, 3.8, 4.4, 4.5, 4.6, 4.7
Monday, January 13	<i>Recitation 2</i>	<i>Simple Monte Carlo and sampling distributions lab</i>	
Tuesday, January 14	Lecture 3	Frequently used statistics and sampling distributions	7.1, 7.2, 7.3
Thursday, January 16	Lecture 4	Monte Carlo and custom R functions; intro to estimators	8.1
Monday, January 20	<i>Holiday</i>	<i>No Recitation - Martin Luther King Jr. Day</i>	
Tuesday, January 21	Lecture 5	Bias and Mean Squared Error	8.1, 8.2
Thursday, January 23	Lecture 6	Common unbiased point estimators	8.2, 8.3
Monday, January 27	<i>Recitation 3</i>	<i>Illustrating the CLT, Bias, and MSE lab</i>	
Tuesday, January 28	Lecture 7	Consistency	9.1, 9.3
Tuesday, January 30	Lecture 8	Likelihood I	9.4
Monday, February 3	<i>Recitation 4</i>	<i>Exam 1 review; no lab assignment</i>	
Tuesday, February 4	Lecture 9	Sufficiency	9.4
Thursday, February 6	Exam 1	Exam 1 (Lectures 1-8)	
Monday, February 10	<i>Recitation 5</i>	<i>Consistency lab</i>	
Tuesday, February 11	Lecture 10	Method of moments estimation	9.6
Thursday, February 13	Lecture 11	Maximum likelihood estimation	9.7
Monday, February 17	<i>Recitation 6</i>	<i>Computational maximum likelihood lab</i>	
Tuesday, February 18	Lecture 12	<i>Introduction to statistical inference and confidence intervals</i>	8.5, 8.6
Thursday, February 20	Lecture 13	Small-sample CIs for a mean and for paired data	8.8
Monday, February 24	<i>Recitation 7</i>	<i>Mean confidence interval coverage lab</i>	8.8
Tuesday, February 25	Lecture 14	<i>Small-sample CIs for a difference in means</i>	
Thursday, February 27	Lecture 15	CIs for proportions and differences in proportions	
Monday, March 3	<i>Recitation 8</i>	<i>Exam 2 review; no lab</i>	
Tuesday, March 4	Lecture 16	<i>CIs for variances and ratios of variances</i>	
Thursday, March 6	Exam 2	Exam 2 (Lectures 9-15)	
Monday, March 10	<i>No Recitation</i>	<i>Spring Break</i>	
Tuesday, March 11	<i>No Lecture</i>	<i>Spring Break</i>	
Thursday, March 13	<i>No Lecture</i>	<i>Spring Break</i>	
Monday, March 17	<i>Recitation 9</i>	<i>Small-sample Confidence intervals lab</i>	
Tuesday, March 18	Lecture 17	One-sided confidence intervals and practice	8.5, 8.6, 8.8
Thursday, March 20	Lecture 18	Introduction to hypothesis testing	10.1, 10.2, 10.3
Monday, March 24	<i>Recitation 10</i>	<i>One-sided confidence intervals lab</i>	
Tuesday, March 25	Lecture 19	Rejection regions and p-values	10.5, 10.6
Thursday, March 27	Lecture 20	Type-I error	10.4

Monday, March 31	Recitation 11	Type-I error lab	
Tuesday, April 16	Lecture 21	P-values, Power and type-II error	10.4
Thursday, April 3	Lecture 22	Hypothesis tests on variances and ratios of variances	10.8
Monday, April 7	Recitation 12	P-values, type-I error and type-II error	
Tuesday, April 8	Lecture 23	Hypothesis tests on variances and ratios of variances	10.8
Thursday, April 10	Lecture 24	Hypothesis tests on variances and ratios of variances	10.8
Monday, April 14	Recitation 13	Power and type-II error lab	
Tuesday, April 15	Lecture 25	Hypothesis tests continued	
Thursday, April 17	Lecture 26	Bootstrapping	
Monday, April 21	Recitation 14	Exam 3 review; no lab	