STAT 4302 Computational Statistics

Spring Semester 2026

Lecture

TR 9:35am-10:55pm in Cockins Hall 312, first instructional day is Jan 13

Instructor

Paul Wiemann
Office: Cockins Hall 219
Email: wiemann.3 at osu.edu

Office Hours

Thursdays at 11:15am to 12:15pm or by appointment

For individual scheduled office hours please arrive on time. For the weekly office hours, please arrive within the first 10 minutes hours or let me know by email if you plan to arrive later.

Teaching Assistant

Dhruv Arora
Email: arora.343 at buckeyemail.osu.edu

Prerequisites

Stat 3301 and Stat 4301 or permission of the instructor.

Description

This course covers several topics in the area of computational statistics, using the R statistical software package. Students will use their knowledge in theoretical and applied statistics to design and perform classical and modern Monte Carlo experiments. The students will also be exposed to statistical inference based on resampling methods (bootstrap, jackknife and permutation tests). Throughout the course students will be working with data sets. Students will get exposure to retrieving data from online

repositories as well as collecting their own. The course will put emphasis on effective and efficient functional programming techniques which will be taught throughout the course via tutorials and examples. Students will also gain experience in communicating their findings.

Course learning outcomes

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

1. Import data sets of various formats into R.
2. Design and perform simple Monte Carlo experiments.
3. Use resampling methods to carry out statistical inference.
4. Produce numerical and graphical summaries of their analysis.
5. Communicate findings through written reports and online tools.

Textbook

Maria L. Rizzo (2019), Statistical Computing with R, 2nd Edition, CRC Press, Boca Raton, FL.
Note: This is the second edition of the book.

Website

The course has a web page on CarmenCanvas. You will find the class schedule, homework assignments, and other course announcements on the web page. Please check it on a regular basis.

Course delivery

The class is scheduled to be delivered in person.

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" is an appropriate first tutorial for students who have never used R.
- Students will be required to use RStudio software. RStudio can be downloaded for free at https://www.rstudio.com/. Before downloading RStudio, you must also download and install R first. You are expected to install R and RStudio on your personal computer by downloading the software from the links above.
- Students will be required to submit compiled RMarkdown or Quarto notebooks. The required software can be installed as an R package from CRAN or downloaded at https://quarto.org.
- More details may be given in lectures and on the class web site.

Classroom engagement

To make our time together more focused and productive, this will be a "dumb" classroom, which simply means that smart devices (e.g., phones, tablets, laptops) should stay closed unless you're using them for class purposes. You're welcome to use your device if it helps you, for example,

- to take notes in a way that works best for you,
- to answer polls or in-class questions,
- view class materiel

If you're using your device for anything outside of these purposes (like texting, browsing, or checking social media), it can be distracting for both you and others. In those cases, we may ask you to close it or step out for the rest of class.

Use of recording devices in class

In accordance with Ohio Administrative Code Rule 3357-15-13-37, electronic recording (for example, photo, audio, or video) of class lectures or activities is prohibited. Exceptions may only be granted when a student has a documented accommodation approved by Student Life Disability Services and has informed the instructor of the accommodation, or has obtained prior written permission from the instructor.

Homework

There will be approximately one assignment every week. Homework problems and will be posted on Carmen. They are to be submitted online through Carmen. No late assignments

will be accepted. However, if you are unable to complete an assignment on time, please get in touch with me **at least one school-day before the deadline** so we can discuss your situation. You are encouraged to work together on the homework, but do not copy any part of a homework. Each student must produce their own homework to be handed in.

Rules

Homework must be typed up, preferably submitting a compiled RMarkdown or Quarto file. Handwritten submissions will not be accepted. Please adhere to the following guidelines:

- Include your name at the top of your assignment.
- Submit the problems in the order they are assigned.
- Ensure that computer output and the corresponding discussion are presented together for each problem. Do not place all computer output at the end of the homework.
- Clearly indicate which parts of the output are relevant and explicitly demonstrate how they address the questions posed in the homework.
- Do not include code or output that is unrelated to the problem or does not contribute to answering the questions. Ensure your submission is concise and focused.
- A 5% penalty per hour will apply to late submissions.
- We will place emphasis on presentation. This means, your solutions should be clear, well-structured, concise, to-the-point and readable. Specifically, please ensure the following:
    - Avoid ambiguity: Ensure that your final answers are explicitly stated and easy to identify.
    - Remove unnecessary output: When working with R, hide warnings, messages, and any unrelated output that does not contribute to your answer. Only include relevant results to support your conclusions. However, make sure that the relevant code is completely visible in your submission and format code consistently adhering to a standard of your choice (RStudio includes tools to help you with formatting).
    - Format your RMarkdown or Quarto reports appropriately.
    - Mathematical derivations must be logical, structured, easy to follow and provide a reasonable amount of detail. To ensure clarity, please adhere to the standards of the field. This is part of the professionalism expected from you in a 4000 level class. As examples consider the following:
        - Present your work sequentially in logically coherent order; meaning each step follows logically from the previous one. Avoid large leaps in reasoning unless they are trivial.

- Clearly indicate transformations, applications of theorems, etc. if not trivial.
- Use clear and conventional mathematical symbols to convey meaning precisely. For example, use $\Rightarrow$ (implies) to indicate logical progression (in particular, use it for multi-line progressions) and use $=$ (equal to) to indicate equality in multiline equations.

Grading-related Questions

The teaching assistant is the primary point of contact for grading-related inquiries. Should additional clarification be needed after consulting with the grader, or if the issue remains unresolved, you are welcome to bring the matter to the instructor.

Exams

There will be three exams, two midterms and one final. The format of exams can either be an in-class exam or a take-home exam. No make-up exams will be given.

Midterm I	tentatively during part of week February 17
Midterm II	tentatively during part of week March 26
Final	During part of week April 29 to May 05 (Exam week) An in-class exam would be on May 04, 8:00am -- 9:45am

All take home exams will be in the format of a small statistical project. You will be asked to write a report which must be word-processed, and you may be asked to include numerical and graphical summaries of your analyses as well as your computer code.

Specific exam rules will be announced in class.

Attendance

Students are expected to attend all classes as they are delivered in person. If a student is unable to attend, it is their responsibility to stay informed about what was discussed during the missed class. They should first reach out to their peers to obtain notes, updates on assignments, or information about discussions and announcements shared during the missed session. If further clarification is needed, they may then contact the instructor.

Grading

Your course grade will be based on homework assignments, two midterms, and a comprehensive final exam.

Homework	20%
Midterm I	25%
Midterm II	25%
Final	30%

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

Faculty feedback and response time

I am providing the following list 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 assignments, you can generally expect feedback within 7-14 days.

Email

I aim to reply to emails within 2 school days.
If you have any questions, please sent me an email – do not use Carmen.

Tentative Course Schedule

Week	Topics	Midterm / Final	No. of Lectures
1	Introduction / R refresher / Quarto		2
2	Methods for Simulating Random Variables		2
3	Methods for Simulating Random Variables		2
4	Methods for Simulating Random Variables / Monte Carlo Methods		2

Week	Topics	Midterm / Final	No. of Lectures
5	Monte Carlo Methods		2
6	Monte Carlo Methods	x	1
7	Monte Carlo Methods Bootstrap & Jackknife, Permutation tests		2
8	Bootstrap & Jackknife, Permutation tests		2
9	Numerical Methods		2
10	Numerical Methods		2
11	Spring break		0
12	Numerical Methods	x	1
13	Numerical Methods		2
14	Numerical Methods / MCMC		2
15	MCMC / Dependent data [Optional]		2
16	Exam	x	0

Academic integrity policy

The main purpose of this course is for you to learn the material and to increase your understanding of Statistics. For the homework assignments, you are encouraged to talk with fellow students and to work on the problems with them. However, your write-up should be your own. For exams, you are to work solely on your own, and you may not use materials other than those designated by the instructor. Note that this policy of open discussion on the homework is specific to this course. Other instructors and other courses may well have a different policy. Make sure that you understand the policy for each course that you take.

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 3335-5-48.7 (B)). For additional information, see the Code of Student Conduct[1].

Generative Artificial Intelligence Statement

Given that the learning goals of this class are to develop skills in computational statistics, in this course, students are welcome to explore innovative tools and technologies for deepening their understanding of concepts, checking derivations, seeking alternative

[1] http://studentlife.osu.edu/csc/

explanations of proofs, or coding assistance, including generative artificial intelligence (GenAI). Students are permitted to use GenAI tools as they desire for most coursework outside of class.

All in-class assignments will be completed without access to computers or AI tools. Moreover, all submitted work must be written by you, in your own words, even if you consulted AI in the process of finding answers or clarifying ideas.

If I suspect that you have used GenAI on an assignment for which it is prohibited, I will ask you to explain your process for completing the assignment in question. Submission of GenAI-generated content as your own original work is considered a violation of Ohio State's Academic Integrity policy and Code of Student Conduct because the work is not your own. The unauthorized use of GenAI tools will result in referral to the Committee on Academic Misconduct.

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.

OSU statement on religious accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity. (Policy: Religious Holidays, Holy Days and Observances)

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 ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where

illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Mental health statement

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 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Diversity statement

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.