

# STAT 4302 Computational Statistics

Spring Semester 2025

## Lecture

TR 11:10am-12:30pm in Cockins Hall 312, first instructional day is Jan 07

## Instructor

Paul Wiemann

Office: Cockins Hall 219

Office Hours: T 12:35PM-1:35PM or by appointment

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## Teaching Assistant

Zhenbang Jiao

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## 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 modern data sets, including but not limited to: spatio-temporal data and experimental data. 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*, 2<sup>nd</sup> 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.
- More details may be given in lectures and on the class web site.

## Use of electronic devices in class

Recording of any kind -- including but not limited to video, audio, still photography, or screen recordings -- is strictly prohibited during class unless explicit prior approval has been obtained 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.

## 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 10

**Midterm II** tentatively during part of week March 17

**Final** During part of week April 23 to April 29 (Exam week)

An in-class exam would be on April 28, 10:00am-11:45am

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.

<b>Homework</b>	25%
<b>Midterm I</b>	25%
<b>Midterm II</b>	25%
<b>Final</b>	25%

## 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 to R		2
2	Working with Data in R		2
3	Working with Data in R		2
4	Methods for Simulating Random Variables		2
5	Methods for Simulating Random Variables		2
6	Methods for Simulating Random Variables	x	1
7	Monte Carlo Methods		2

Week	Topics	Midterm / Final	No. of Lectures
8	Monte Carlo Methods		2
9	Monte Carlo Methods		2
10	Bootstrap & Jackknife, Permutation tests		2
11	Spring break		0
12	Bootstrap & Jackknife, Permutation tests	x	1
13	Numerical Methods		2
14	Numerical Methods Dependent data		2
15	Dependent data / Exam	x	1
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<sup>1</sup>.

## 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

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<sup>1</sup> <http://studentlife.osu.edu/csc/>

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](mailto: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](mailto:slds@osu.edu); 614-292-3307; or [slds.osu.edu](http://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](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 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.