



THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

# **SYLLABUS: STAT 4302 COMPUTATIONAL STATISTICS SPRING 2024**

## **Course overview**

### **Instructor**

Instructor: Kartik Lovekar

Email address: [lovekar.1@osu.edu](mailto:lovekar.1@osu.edu)

Meeting time/venue: Cockins Hall 312, Tuesdays and Thursdays 11:10 AM to 12:30 PM

Office hours: Tuesdays and Thursdays 9 AM to 10 AM online (link in Carmen)

### **Teaching Assistant**

Jiahao Ping

[ping.24@osu.edu](mailto:ping.24@osu.edu)

Office hours: Wednesdays 3:00 PM to 4:00 PM online (link in Carmen)

Thursdays 4:10 PM to 5:10 PM in Cockins Hall 0122

## **Course description**

This course covers a number of 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.

Prerequisites: Stat 3301 and Stat 4301 or permission of the instructor.

## 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.

## Course materials

### Required

Maria L. Rizzo (2019), Statistical Computing with R, 2<sup>nd</sup> Edition, CRC Press, Boca Raton, FL.

**Note that this is the second edition of the book**

I will highlight other useful references as the course progresses.

## 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](mailto: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

### Necessary equipment

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

## 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 will be given in recorded lectures and on the class web site.

## Course delivery

For the Spring 2024 offering, the course will be taught in-person in Cockins Hall 312 on Tuesdays and Thursdays from 11:10 AM to 12:30 PM.

Also, homework assignments and readings will be posted on the class website. You will be given ample time to complete the assignments.

## Grading and faculty response

Assignment or category	Percentage
<b>Homework</b>	<b>30</b>
<b>Midterm 1</b>	<b>20</b>
<b>Midterm 2</b>	<b>20</b>
<b>Final exam</b>	<b>30</b>
<b>Total</b>	<b>100</b>

Grades will be recorded on the class website.

**Homework** will be assigned most weeks during the semester. No late homework will be accepted. However, if you are unable to complete an assignment on time, please get in touch with me **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

his/her own homework to be handed in. All homework must be submitted online through the class website. Feel free to ask me for help after you have made an attempt of the questions.

The teaching assistant for the course does not have the time to provide detailed explanations on each question that is graded. To make up for this, I will endeavor to create homework solutions that are detailed enough to allow you to understand how the question could be approached.

**Homework preparation rules: Homework should be typed up, preferably using Rmarkdown. Handwritten homework will not be accepted.** Put your name at the top of your assignment. Submit the problems in order, making sure that the computer output and discussion is placed together (do not put the computer output at the end of homework). Make it clear what parts of the output are relevant and show how they answer the questions posed in the homework.

**Exams:** There will be three take-home exams:

Midterm 1	During part of week of February 12
Midterm 2	During part of week of March 18
Take-home Final	During part of week of April 24 (Exam week)

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. Further details will be given in class and posted on the class website.

## 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 **7-10 days**.

**If you have any questions about your graded assignments or exams, please send me an email – PLEASE DO NOT USE CARMEN.**

### E-mail

I will reply to e-mails within **24 hours on school days**.

## Attendance, participation, and discussions

### Student participation requirements

Because this is a distance-education course your attendance is based on your online activity and participation. The following is a summary of everyone's expected participation:

- **Logging in: AT LEAST THREE TIMES PER WEEK**  
Be sure you are logging in to the course in Carmen each week, including weeks with holidays. (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: OPTIONAL OR FLEXIBLE**  
All office hours, are optional. If you are required to discuss an assignment with me, please contact me at the beginning of the week if you need a time outside my scheduled office hours.

## 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 correct grammar, spelling, and punctuation. Informality (including an occasional emoticon) is fine for non-academic topics.
- **Tone and civility:** Let us maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm does not always come across online.
- **Citing your sources:** 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 text editor or word processor, where you can save your work, and then copying into Carmen.

## 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 are published on the Safe and Healthy website (<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 online course

- **Exams:** You must complete the midterms, and final exam yourself, without any external help or communication.
- **Written assignments:** Your written assignments should be your own original 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.
- **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 will include opportunities for formal collaboration with your classmates. While study groups are encouraged, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.

### 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.

## 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](mailto:titleix@osu.edu)

## **Accessibility accommodations for students with disabilities**

**The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. 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](mailto:slds@osu.edu); 614-292-3307; <http://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](http://ccs.osu.edu) or calling 614- 292-5766. CCS is located on the 4th Floor of the Younkun 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](https://suicidepreventionlifeline.org)

## Disclaimer

This syllabus should be taken as a reliable guide for the course content. However, you cannot claim any rights from it and I 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)

Week	Week of (date)	Topics
1	Jan 9	Introduction to R
2	Jan 16	<b>(No classes on Jan 15)</b> Working with Data in R
3	Jan 23	Working with Data in R
4	Jan 30	Methods for Simulating Random Variables
5	Feb 6	Methods for Simulating Random Variables
6	Feb 13	Methods for Simulating Random Variables <b>Midterm 1</b>
7	Feb 20	Monte Carlo Methods
8	Feb 27	Monte Carlo Methods
9	Mar 6	Monte Carlo Methods Bootstrap & Jackknife, Permutation tests
	Mar 11-15	<b>Spring break – no classes</b>
10	Mar 19	Bootstrap & Jackknife, Permutation tests <b>Midterm 2</b>
11	Mar 26	Bootstrap & Jackknife, Permutation tests
12	Apr 2	Numerical Methods
13	Apr 9	Numerical Methods Dependent data
14	Apr 16	Dependent data