Syllabus

STAT 6730

Introduction to Computational Statistics

Autumn 2026

Credit Hours: 2

Course times and location: Monday and Wednesday, 1:50 pm – 2:45 pm, Cockins Hall 228 (CH0228)

Mode of delivery: In-Person

Course overview

Instructor

- **Name:** Sally Paganin
- **Email Address:** paganin.1@osu.edu
- **Office location:** 229 Cockins Hall
- **Office Hours:** Wednesdays 3:00 pm – 4:00 pm or by appointment
- **Note:** My preferred method of contact is e-mail

Teaching Assistant

Name: Tomy Fan

Email Address: fan.1317@buckeyemail.osu.edu

Course description

Computational statistics is an area within statistics that encompasses computational and graphical approaches to solving statistical problems. Students will learn how to manipulate data, design and perform simple Monte Carlo experiments, and use resampling methods such as the bootstrap. They will be introduced to technologies that are useful for statistical computing. By creating customized graphical and numerical summaries, students will be able to discuss the results obtained from their analyses.

Course expected learning outcomes

By the end of this course, students should be able to:

- Produce dynamic and reproducible reports with Quarto
- Visualize various types of data in R using the ggplot2 package
- Import, manipulate, and summarize data in R
- Write and execute R functions that involve iteration or conditional statements
- Apply computational methods including Monte Carlo, smoothing and density estimation, the bootstrap, and permutation methods

Prerequisites

This course is intended to be taken during the second year of the MAS program. Students are expected to have exposure, at a mathematical level, to foundational concepts in probability and statistics including random variables, estimation, hypothesis testing, and linear regression. The formal prerequisites are Stat 6301 and 6302 or equivalent; Stat 6410 and 6450, or Stat 6910 and 6950, or permission of the instructor. Previous programming experience is not required, but familiarity with computer systems is expected.

Course delivery

Monday sessions are lecture; Wednesday sessions are a hands-on computer lab — bring a laptop capable of running R and RStudio. Slides and materials are posted on Carmen before each class.

Credit hours and work expectations

This is a 2-credit-hour course. According to Ohio State policy (go.osu.edu/credithours), students should expect around 6 hours of engagement with the class each week (class time plus independent work) to receive a grade of C average. Actual hours spent will vary by student learning habits and the assignments each week.

Course materials and technologies

Textbooks

Required

1. [**R4DS2E**] Wickham H., Çetinkaya-Rundel M., and Grolemund G. (2023). *R for Data Science* (2nd edition). Electronic version: r4ds.hadley.nz. This web version of the book can be accessed freely from any web browser.
2. [**ADVR**] Wickham H. (2019). *Advanced R* (2nd edition). Electronic version: https://adv-r.hadley.nz/. This web version of the book can be accessed freely from any web browser.

Recommended (optional)

1. Robert C.P. and Casella, G. (2004). *Monte Carlo Statistical Methods* (2nd edition). Springer.
2. Rizzo M. (2007). *Statistical Computing with R*. Chapman & Hall/CRC.

Course technology

Required Equipment

- **Computer:** a current Mac (macOS) or PC (Windows or Linux) with a high-speed internet connection, capable of running R and RStudio.
- You will need to bring a laptop to class on the days of labs and exams. If you do not have a laptop, please request a Microsoft Surface loaner device from the Student Technology Loan Program

Required software

You will need to install or have access to the **latest** versions of the following software. Even if you have installed these programs before, it is a good idea to check for updates.

- **R** https://cloud.r-project.org
- **RStudio** Desktop IDE https://posit.co/download/rstudio-desktop

- **Quarto** https://quarto.org/docs/get-started

Use of generative AI (GenAI) tools

In a hands-on class like this one, the internet plays a significant role in learning, especially when it comes to coding and debugging. Generative AI tools, such as ChatGPT, Gemini, and Claude, can be very powerful aids, but **they are not a substitute for learning**. Relying on them from the beginning can hinder your development. Importantly, these tools often produce incorrect or misleading information, and they can be overly confident in their answers. Experienced R programmers and data scientists can usually catch these errors, but as a beginner, you may not be able to. For that reason, it's important to first learn how to do things yourself. Once you've completed this course and built that foundation, AI tools can be a great help with the more tedious, non-creative parts of your work.

It is acceptable to use online resources, including GenAI, for clarifying lecture material, seeking examples, and brainstorming ideas, much as you would consult a classmate. **However, you are not permitted to use AI tools to write code or produce text for your assignments, except for the final project.**

If I suspect that you have used an AI tool on an assignment for this course, I will ask you to explain your process for completing the assignment in question. The unauthorized use of AI tools will result in referral to the Committee on Academic Misconduct.

See Description of major course assignments for more details on the use of AI tools in specific assignments and policies.

Grading and instructor response

How your grade is calculated

Assignment Category	Description	Percentage
Homework	Roughly biweekly problem sets, submitted as Quarto (.qmd + .html)	15%

Assignment Category	Description	Percentage
Labs	In-class Wednesday exercises, due within 24 hours	15%
Exam 1	In class Wed, October 7	25%
Exam 2	Take home + oral exam on Mon, November 16	25%
Final Project	Wed, December 16	20%
Total		**100**%

Description of major course assignments

Homework

- ### Description

Homework is assigned roughly every other week. Students are **required to use Quarto** for their homework submissions. The result should be human-readable, not just computer output with no explanation. Submit both the Quarto source (.qmd) and HTML output to Carmen.

Homework is graded on a 3-point scale: 1 point for good-faith effort, 1 point for technically correct working solutions, and 1 point for well-formatted, readable code. Assignments submitted in the wrong format (e.g. .pdf, plain text, .doc) receive 0 points automatically, no exceptions.

- ### Academic integrity and collaboration guidelines

You are encouraged to work collaboratively on homework assignments; however, **you must not copy any part of another student's work**

You **may use generative AI tools** (e.g., Gemini, ChatGPT, etc.) to help you understand concepts or clarify questions (the same way as you consult a classmate). However, **you may not copy and paste code, solutions, or written text** from the internet or from any AI tool into your submission.

If you collaborate with others and/or use generative AI tools, you **must include a disclosure statement in your submission** specifying i) with whom you collaborated, and ii) which generative AI tools you used, and how you used them.

Labs

Description

Labs consist of exercises completed during Wednesday class meetings and are **due within 24 hours after that class ends**. Please bring a laptop computer with R and RStudio installed to those meetings As with homework, submit both the Quarto source (.qmd) and HTML output to Carmen, and use the same integrated prose/code/graphics style.

Labs are graded on the same 3-point scale as homework; wrong-format submissions receive 0 points automatically.

Academic integrity and collaboration guidelines

You are encouraged to work collaboratively on homework assignments; however, **you must not copy any part of another student's work**

You **may use generative AI tools** (e.g., Gemini, ChatGPT, etc.) to help you understand concepts or clarify questions (the same way as you consult a classmate). However, **you may not copy and paste code, solutions, or written text** from the internet or from any AI tool into your submission.

If you collaborate with others and/or use generative AI tools, you **must include a disclosure statement at the beginning of your submission** specifying i) with whom you collaborated, and ii) which generative AI tools you used, and how you used them

Exams

Description

There will be two exams. Both exams are open book/internet access, but absolutely no communicating with other humans. Each exam is cumulative.

Academic integrity and collaboration guidelines

The exam is an individual assignment. You should complete the exam on your own and your submission should be your own original work. You should not discuss it with anyone else.

The use of AI tools is absolutely not permitted for the exams.

Final Project

- ### Description

Students work in small groups on a final data analysis project from a list of topics provided by the instructor. Each group will cooperate on the data analysis, report writing, and making a presentation on the project in class. Details will be announced on CarmenCanvas and during one of the lectures.

- ### Academic integrity and collaboration guidelines

You may use generative AI tools (e.g., ChatGPT, Claude, Gemini) to assist with all aspects of the project. However, **you must be able to explain and defend every part of your submitted work**, including any code, analysis, or writing produced with AI assistance.

Late assignments

Generally, late homework and labs are not accepted. If extenuating circumstances beyond your control arise, contact the instructor immediately.

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

Instructor 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 614-688-4357 (HELP) at any time if you have a technical problem.

Preferred contact method

If you have a question, please contact me first through my Ohio State email address. I will reply within 48 hours on days when class is in session.

Class announcements

I will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences to be sure you receive these messages.

Grading and feedback

For homework and lab assignments, you can generally expect feedback and grades within 10 days.

Academic policies

This course follows all required Ohio State University syllabus policies, including Academic Misconduct, Disability Services, Religious Accommodations, and Intellectual Diversity. Full statements are available at: ugeducation.osu.edu/academics/syllabus-policies-statements

Course Schedule

Refer to the Carmen course site for up-to-date information.

R4DS_2 (2nd edition): r4ds.hadley.nz

ADVR: https://adv-r.hadley.nz/

Date	Day	Topic	Reading	Homework / Exams
08/26	W	Course overview and introduction	R4DS_2 Intro, Ch. 2	
08/31	M	Data types in R	ADVR Ch. 3.2	
09/02	W	Lists and data frames in R	ADVR Ch. 3.5-3.6	
09/07	M	**NO CLASS - Labor Day**		
09/09	W	Data manipulation and summarization in R	R4DS_2 Ch. 3, 5.2; ADVR Ch. 4	
09/14	M	Grammar of graphics	R4DS_2 Ch. 1, 9	
09/16	W	Lab 1: ggplot2		HW1
09/21	M	Smoothing		
09/23	W	Lab 2: Smoothing		
09/28	M	Functions	R4DS_2 Ch. 25; ADVR Ch. 6	
09/30	W	Lab 3: Functions		HW2
10/05	M	Density estimation		
10/07	W	**Exam 1 (in class)**		

Date	Day	Topic	Reading	Homework / Exams
10/12	M	Generating random variables	ADVR Sec. 5.3 (Loops)	
10/14	W	Lab 4: Conditionals and iteration	ADVR Ch. 5	
10/19	M	Monte Carlo integration		
10/21	W	Lab 5: Monte Carlo		
10/26	M	The Bootstrap		HW3
10/28	W	Lab 6: The Bootstrap		
11/02	M	Permutation tests		
11/04	W	Lab 7: Permutation tests		
11/09	M	Functional programming with purrr	ADVR Ch. 9	HW4
11/11	W	**NO CLASS - Veterans Day**		
11/16	M	Exam 2		
11/18	W	Lab 8: purrr, applied to the permutation example		
11/23	M	Efficiency and projects in R		
11/25	W	**NO CLASS - Thanksgiving break**		
11/30	M	Cross-validation		
12/02	W	Lab 9: Cross-validation		HW5
12/07	M	Project presentations		

Date	Day	Topic	Reading	Homework / Exams
12/09	W	Project presentations		
12/16	W	**Final project due**		