QUANTITATIVE SOCIAL SCIENCE
LDST 249 - Fall 2024

Class Time Wednesday/Friday 9.00-10.15
Location   Jepson Hall 107

Instructor and contacts

Guzel Garifullina
guzel.garifullina@richmond.edu

Jepson Hall 130
Office hours: Monday 4-6 pm (drop-in) and by appointment
Schedule an in-person or Zoom meeting.

Course website: https://blackboard.richmond.edu

Contents

Course Description

Quantitative Social Science is designed to help you build data analysis skills sufficient for interpreting research findings in modern social sciences and conducting your original research. To achieve that goal, we will discuss fundamental statistical concepts and specific procedures during lectures, and practice them during labs. You will have numerous opportunities to work independently and in groups to practice the necessary skills. The course culminates in a final research project, which would require you to come up with a question, do some background research on it, find relevant data, and perform all the necessary steps to analyze and interpret the data. The course fulfills the Quantitative Data Literacy (QDL) general education requirement.

Learning outcomes

After completing this course, students will be able to independently analyze quantitative data to address questions about society they are interested in. Doing so would involve identifying appropriate data and steps/procedures that will allow one to answer the question - and then conducting the analysis, with a focus on descriptive statistics and data visualization, hypothesis testing, and regression analysis.

1. Students will represent information and formulate questions in forms amenable to quantitative analysis, recognizing multiple approaches to communicating quantitative information.

2. Students will apply relevant quantitative approaches to solve problems and analyze data.

3. Students will evaluate assumptions, limitations, biases in, and/or ethical implications of particular analytical frameworks and/or study designs.

4. Students will formulate results, draw appropriate conclusions, and communicate findings using relevant quantitative evidence.

Prerequisites

This course does not have any prerequisites.

Reading

We will be using one textbook – Imai, Kosuke. Quantitative social science: an introduction. Princeton University Press, 2018 (ISBN: 9780691175461). The textbook is available at the university bookstore. Make sure you have a copy by the first week of class.
You need to do the assigned reading before class. In our first meeting, we will talk about how you would *work through* a stats textbook chapter.

Using *R* for data analysis

We will use *R* – a programming language and statistical environment widely used by data analysts across disciplines and industries. The course does not require any programming experience on your part – we will start by installing the software in class, and you will practice your *R* skills in weekly labs and at home.

As with any language – *R* comes with a learning curve. We will use *R* for several reasons.

(1) It is free. Whether it's for this class, another project during your time in college, or to analyze some data in a few years – you will be able to use R without additional costs to you.

(2) It is versatile. *R* is open-source, and thousands of people facing a variety of questions continue to contribute to it and develop packages (specific instruments) that are extremely helpful. Whatever your data needs are – you can be sure there is a solution in *R*. If you decide to develop that skill further, you might become one of the people who develop new packages for others to use!

(3) It is a programming language, meaning that to perform the procedures we will be learning, you will need to "spell out" what you are doing. As a result, using it reinforces the statistical knowledge you will be acquiring – with every exercise and homework, with every problem set you will be going through the necessary analysis steps and immediately see, looking back at your code, what you did and why.

(4) It is extremely popular and widely used both in (social) sciences and outside academia, such as in business analytics. Having that skill can be a real asset.

What to expect in this course

The most important thing about any course focusing on quantitative skills is that it is cumulative. That is, knowledge builds on previous knowledge – this is true both for the statistical elements and applied analysis in *R*. It is therefore harder to catch up if you missed something. I will expect you to work consistently throughout the semester and will provide many opportunities to ask questions in class and outside the classroom. Use these opportunities to make sure you are confident about one week's material before we proceed to the next.

We will have two weekly meetings – a lecture on Wednesday and a lab on Friday. In lectures, we will work through the key elements of the week's topic, focusing on understanding the concepts and the logic behind the statistical operations. In labs, we will work on applied problems and exercises in R, reinforcing the concepts we discussed in the lecture. There will be weekly assignments (see below) to make sure you stay on top of readings and exercises.

To help you stay on track, I will hold open office hours every Monday. Stop by with any questions or doubts you have, whether it's your homework, something in the chapter, or the problem set. I am also available for one-on-one meetings, you will just need to schedule those using the link in the syllabus.

Assignments and grading

These are all the assignments you will need to complete and their contribution to your final grade.

1. Weekly assignments

There will be weekly quizzes and homework. These are designed to help you test your understanding of the class material. Use them to see what you missed or need help with, and to ask follow-up questions in class. These are graded on submission, so as long as you submit them on time, you get full points. There are no extensions or make-up options on these.

Weekly quizzes and homework assignments are also a low-key way of practicing before graded assignments. Skills you practice in homework will be necessary for the problem sets (see below). A random subset of questions from the quizzes will be included in the final exam you will complete in class.

a. Chapter quiz (due Tuesday 11.59 pm): 50 points

A portion of the textbook chapter will be assigned for each Wednesday class. You will work through the chapter, doing all the included calculations and tests in R. Once you're done with the assigned portion for that week – go to Blackboard and take the quiz. The quizzes consist of multiple-choice and short-answer questions and focus on the major statistical concepts introduced in the text.

You will receive feedback on the quiz immediately after submission. See what you got wrong – and check with the chapter to clarify things you missed. Note any remaining questions to ask in class.

b. Homework (due Thursday 11.59 pm): 50 points

Weekly homework will be similar to the exercises you see in the textbook chapter. It will include a series of tasks you need to perform in R. As with the quiz – note any questions or problems you have. Submit your homework on Thursday and bring the questions to our Friday class.

2. Problem sets: 300 points

There will be 5 (five) problem sets throughout the semester. These assignments test your understanding of concepts and analysis methods covered in a specific section of the course. You will need to submit an *R* code and a document with a detailed explanation of your analysis for grading.

You can work on the problem sets in groups – I will randomly assign you into groups early in the semester, and I encourage you to discuss the problems and work on the solutions together (you can, if you want, work on your own as well). The assignments are submitted and graded individually.

Each problem set is worth 75 points. Once all the problem sets are graded, I will drop your lowest score – and the remaining 4 (four) will constitute your problem set grade.

3. Midterm exam: 100 points

The midterm exam will consist of an in-class *R* exercise. Similarly to your weekly homework and the problem sets, you will need to answer a set of questions by performing operations in *R*. You can have all the *R* code files from the previous homework assignments and problem sets open on your computer when working on the midterm exam. No outside sources or help are allowed. You will need to submit an *R* code and a document with a detailed explanation of your analysis for grading.

4. Final project: 400 points

This is an independent data analysis project that is scaffolded and includes several elements:

Element	What it is	Due date	Point value
Research question, literature review, and data sources	Your research question, 3-4 relevant studies that help you narrow it down, and one or more potential data sets that you think will allow you to answer that question. 2 pages	September 23rd, 11.59 pm	50 points
Analysis plan	An outline of specific tests and operations you plan to perform on your data to address your question. 1-2 pages	October 28th, 11.59 pm	50 points
Text	The final paper includes a (revised) research question, a brief literature review, and the analysis of your data with necessary tables and graphs. 7-10 pages, including graphs and tables integrated into your text	November 25th, 11.59 pm	150 points
R code	This should be a clear code that will allow me to replicate the analysis you conducted exactly. Submit it together with the dataset used.		100 points
Presentation	Explain your main findings to the class. Be ready to answer questions about the analysis you conducted. I will finalize the grades for your final paper's text and R code after your presentations.	December 4th, in class	50 points

5. Final exam: 100 points

The final exam will test your conceptual knowledge. Can you explain the central limit theorem or confidence intervals in your own words? Can you identify the types of variables in a dataset? Drawing primarily from the weekly quizzes you've been completing throughout the semester, the final exam will consist of multiple-choice and short-answer questions and will be completed in class and on paper. It is a closed book and closed notes exam focusing on the fundamentals of what we've covered in this course.
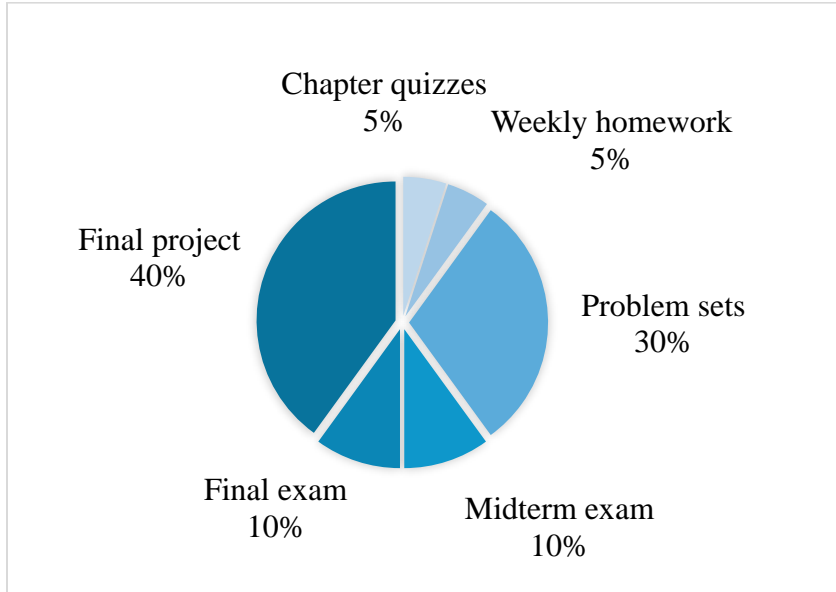
Point range	Letter grade
980-1000	A+
940-979	A
900-939	A-
870-899	B+
830-869	B
800-829	B-
770-799	C+
730-769	C
700-729	C-
670-699	D+
630-669	D
600-629	D-
0-599	F

Chapter quizzes 5%

Weekly homework 5%

Final project 40%

Problem sets 30%

Final exam 10%

Midterm exam 10%

All assignments add up to 1000 points – that is the maximum you can earn throughout the semester. There are no extra credit assignments. Your final course grade will be calculated by adding up the points you earn for each of the assignments throughout the semester. I will use the scale above to convert this final number into a letter grade. You need to cross the threshold to earn a specific grade (e.g. 979 is an "A", but 980 is an "A+").

Semester at a glance

Here are all the assignments and deadlines for the semester so you know what to expect and plan your time.

As you see, all the take-home assignments are due on Monday, by the end of the day.

Assignment	Due date	Day of the week
Problem set 1	September 16th, 11.59 pm	Monday
Research project: question, literature, and data	September 23rd, 11.59 pm	Monday
Problem set 2	September 30th, 11.59 pm	Monday
Midterm exam	October 11th, in class	Friday
Problem set 3	October 21st, 11.59 pm	Monday
Research project: analysis plan	October 28th, 11.59 pm	Monday
Problem set 4	November 4th, 11.59 pm	Monday
Problem set 5	November 18th, 11.59 pm	Monday
Research project: R code and text	November 25th, 11.59 pm	Monday
Research project: presentation	December 4th, in class	Wednesday
Final exam	December 13th, in class (9 AM)	Friday

See the late submission policy in the syllabus.

Course Schedule

Weeks	Lecture date	Lecture (Wednesday)	Lab date	Lab (Friday)
1	28-Aug-24	Course introduction. READ: Course syllabus (on Blackboard)	30-Aug-24	Variables. Introduction to R. WATCH: Variables and types of variables READ: Data Science: What the Educated Citizen Needs to Know
2	4-Sep-24	Causality. Causal inference, factual and counterfactual outcome. Experiments and causality. WATCH: Randomized Trials: The Ideal Weapon READ: Chapter 2 (pp.32-54)	6-Sep-24	Workshop: Causal and descriptive questions. Practice: Analyzing experimental data in R. READ: Chapter 2 (pp.32-54)
3	11-Sep-24	Causality. Causal inference with observational data. Confounding bias. Difference-in-difference designs. WATCH: Observational vs Experimental Studies READ: Chapter 2 (pp.54-69)	13-Sep-24	Workshop: Finding published research and data to narrow down and answer your questions. Practice: Descriptive statistics in R. READ: Chapter 2 (pp.54-69)
4	18-Sep-24	Measurement I. WATCH: Calling Bullsh*t: Manipulating Bin Sizes READ: Chapter 3 (pp.75-96)	20-Sep-24	Practice: Visualizing survey results (univariate data) in R. READ: Chapter 3 (pp.75-96)

5		Measurement II. WATCH: Correlation: The Basic Idea Explained READ: Chapter 3 (97-107)	27-Sep-24	Practice: Visualizing bivariate relationships. Correlation. READ: Chapter 3 (97-107)
	25-Sep-24			
6		Prediction. Linear regression. The logic of a linear regression. WATCH: Introduction to Simple Linear Regression READ: Chapter 4 (139-161)	4-Oct-24	Practice: basic linear regression in R. Interpreting regression coefficients and R squared. READ: Chapter 4 (139-161)
	2-Oct-24			
7		Midterm review. Making sense of statistics: mapping the previous 6 weeks. READ: Review all previous readings and materials, prepare questions.	11-Oct-24	Midterm exam (in class)
	9-Oct-24			
Fall break here (in between class sessions – none skipped)				
8		Prediction. Linear regression (continued). Can regression prove causality? Multivariate regression. WATCH: Using Regression to Get Causal Effects READ: Chapter 4 (pp.161-181) Understanding Interaction Effects in Statistics	18-Oct-24	Workshop: writing an analysis plan Practice: Running and interpreting multiple regression in R. READ: Chapter 4 (pp.161-181) Understanding Interaction Effects in Statistics
	16-Oct-24			
9		Probability. Conditional probability WATCH: Conditional probability (Bayes' Theorem) explained visually	25-Oct-24	Practice: Using probability and conditional probability. Bayes' theorem and updating your beliefs.
	23-Oct-24			

		READ: Chapter 6 (pp.244-247 [section 6.1.2] and 254-277)		READ: Chapter 6 (pp.244-247 [section 6.1.2] and 254-277)
10		Probability. Random variables and their distributions. Laws governing random variables. WATCH: Random Variables and Probability Distributions READ: Chapter 6 (277-307)		Practice: Using random variable distribution to make sense of the world and data READ: Chapter 6 (277-307)
	30-Oct-24		1-Nov-24	
11		Uncertainty. Population and sample estimates. Confidence intervals. WATCH: Population and Estimated Parameters, Clearly Explained!!! READ (in the following order): Chapter 7 (pp.314-317 [until the definition]) Standard error Chapter 7 (pp.326-336)		Practice: Estimation error for population parameters. The use of confidence intervals. READ (in the following order): Chapter 7 (pp.314-317 [until the definition]) Standard error Chapter 7 (pp.326-336)
	6-Nov-24		8-Nov-24	
12	13-Nov-24	Uncertainty. Hypothesis testing. WATCH: Hypothesis Testing and The Null Hypothesis, Clearly Explained!!! READ: Chapter 7 (pp. 342-363)	15-Nov-24	Practice: Hypothesis testing. T-tests. READ: Chapter 7 (pp. 342-363)
13	20-Nov-24	Linear regression and uncertainty. Coefficients and predicted values. WATCH:	22-Nov-24	Practice and Q&A. Workshop: final projects

		Confidence intervals for regression coefficients READ: Chapter 7 (pp.370-375) How to Interpret P-values and Coefficients in Regression Analysis		READ: Chapter 7 (pp.370-375) How to Interpret P-values and Coefficients in Regression Analysis
14	*27-Nov-24*	*Thanksgiving break*		
15	4-Dec-24	Final project presentations	6-Dec-24	Final review

Resources

If you experience difficulties in this course, do not hesitate to consult with me. There are also other resources that can support you in your efforts to meet course requirements.

Quantitative Resource Center
Want to talk through a statistical concept or struggling with R? While I will always be available to help you, sometimes a different approach or explanation, or talking to someone with a different level of experience is exactly what you need for it all to make sense. I encourage you to seek out resources and help that work for you – and that includes the University's new Quantitative Resource Center (qrc.richmond.edu).
It provides assistance to students with diverse quantitative needs. This encompasses support in quantitative courses such as calculus, economics, and chemistry, as well as assistance with programming software and languages like Excel, Python, and R. Peer consultants can be accessed by appointment or during open drop-in sessions. In addition to general academic support, the QRC offers statistical assistance for research projects. For information on additional support options, contact Dr. Erica Modeste at erica.modeste@richmond.edu.

Academic Skills Center (asc.richmond.edu):
Assists students in assessing their academic strengths and weaknesses; honing their academic skills through teaching effective test preparation, critical reading and thinking, information conceptualization, concentration, and related techniques; working on specific subject areas (e.g., calculus, chemistry, accounting, etc.); and encouraging campus and community involvement. Tutors will be available virtually. The on-call peer tutors available for these appointments are listed in the Box file: On-Call Online Tutors
(https://richmond.box.com/s/dpe37chr2zodr3o1amtj8omjk72v2ktb). Email Roger Mancastroppa (rmancast@richmond.edu) and Hope Walton (hwalton@richmond.edu) for appointments in academic and life skills to request a Zoom conference.

Boatwright Library Research Librarians: (library.richmond.edu/help/ask/ or 289-8876):
Research librarians help students with all steps of their research, from identifying or narrowing a topic to locating, accessing, evaluating, and citing information resources. Librarians support students in their classes across the curriculum and provide library instruction, tutorials, research guides, and individual help. All research support will be provided online or by appointment and students can contact a librarian for help via email (library@richmond.edu), text (804-277-9ASK), chat, or Zoom (by appointment).

Career Services: (careerservices.richmond.edu or 289-8547):
Can assist you in exploring your interests and abilities, choosing a major or course of study, connecting with internships and jobs, and investigating graduate and professional school options. We encourage you to schedule an appointment with a career advisor early in your time at UR.

Counseling and Psychological Services (caps.richmond.edu or 289-8119):
Assists currently enrolled, full-time, degree-seeking students in improving their mental health and well-being, and in handling challenges that may impede their growth and development.

Services include brief consultations, short-term counseling and psychotherapy, skills-building classes, crisis intervention, psychiatric consultation, and related services.

Disability Services (disability.richmond.edu)

The Office of Disability Services works to ensure that qualified students with a disability (whether incoming or current) are provided with reasonable accommodations that enable students to participate fully in activities, programs, services, and benefits provided to all students. Please let your professors know as soon as possible if you have an accommodation that requires academic coordination and planning.

Speech Center (speech.richmond.edu or 289-6409):

Assists with preparation and practice in the pursuit of excellence in public expression. Recording, playback, coaching, and critique sessions offered by teams of student consultants trained to assist in developing ideas, arranging key points for more effective organization, improving style and delivery, and handling multimedia aids for individual and group presentations. Remote practice sessions can be arranged; we look forward to meeting your public speaking needs.

Writing Center (writing.richmond.edu or 289-8263):

Assists writers at all levels of experience, across all majors. Students can schedule appointments with trained writing consultants who offer friendly critiques of written work.

Course Policies

Academic Integrity and Collaboration
Discussion and the exchange of ideas are vital for any intellectual community. For the oral or written assignments in this course, you are encouraged to consult with your classmates on the choice of paper topics or seek advice from your peers. However, you should ensure that any written work you submit is the result of your own research and writing. You should also adhere to standard citation practices in the discipline by properly citing any written works that you reference in your assignments. You will be expected to pursue your academic studies with integrity and must follow the Honor Code. The shortened version of the honor pledge is the following: "I pledge that I have neither received nor given unauthorized assistance during the completion of this work."
All assignments are expected to be the student's original work. The Jepson School follows the provisions of the Honor System as outlined by the School of Arts and Sciences. This means that no student is to use, rely on or turn in work that was paid-for, copied, excessively summarized without citation, created in collaboration (without permission), produced by AI, or is otherwise not the original work of the student for the specific assignment (without explicit permission).

Late Policy for Assignments
All assignments are due at 11:59 pm on the designated date.
- 10% of the total points for the assignment will be deducted for each 24-hour period that the assignment is late. For example:
    - The final paper analysis plan (worth 50 points) can get a maximum of 45 points (50-5=45) if turned in 24 hours late, and a maximum of 40 points if turned in 48 hours late – before any points are deducted based on the grading criteria.
    - If a final paper text and code (150 and 100 points, 250 total) are both 24 hours late, they can get a maximum of 135 and 90 points (225 instead of 250), meaning a student lost 2.5% of their final grade.
    - If the assignment is less than 24 hours late, the deduction will be proportional (e.g. 6 hours late=1/4 of 24 hours=1/4 of the penalty).
- Each of you has 2 (two) no-penalty 24-hour extensions to use on graded assignments (problem sets and paper assignments). You do not need to ask me or explain anything – just put a written note in your submission indicating that you chose to use one of your extensions. These extensions are available to all, because life happens.
- If you need an additional or longer extension, discuss it with me at least 48 hours before the deadline (the earlier, the better). I reserve the right to grant or deny an extension on a case-by-case basis.

Awarding of Credit
To be successful in this course, a student should expect to devote 10-14 hours each week, including class time and time spent on course-related activities.
registrar.richmond.edu/services/policies/academic-credit.html

Disability Accommodations
The University of Richmond's office of Disability Services strives to ensure that students with disabilities and/or temporary conditions (i.e., concussions & injuries) are provided opportunity for

full participation and equal access. Students who are approved for academic accommodations must complete the following steps to implement their accommodations in each class:

> 1) Submit their Disability Accommodation Notice (DAN) to each of their professors via the Disability Services Student Portal available at this link: sl.richmond.edu/be.

> 2) Request a meeting with each professor to create an accommodation implementation plan. Disability Services is available to assist, as needed.

It is important to complete these steps as soon as possible because accommodations are never retroactive, and professors are permitted a reasonable amount of time for implementation. Students who are experiencing a barrier to access due to a disability and/or temporary condition are encouraged to apply for accommodations by visiting disability.richmond.edu. Disability Services can be reached at disability@richmond.edu or 804-662-5001.

Honor System
The Jepson School supports the provisions of the Honor System. The shortened version of the honor pledge is: "I pledge that I have neither received nor given unauthorized assistance during the completion of this work."
https://studentdevelopment.richmond.edu/student-handbook/honor/index.html

Religious Observance
Students should notify their instructors within the first two weeks of classes if they will need accommodations for religious observance.
registrar.richmond.edu/planning/religiousobs.html

Addressing Microaggressions on Campus
Microaggressions are the everyday verbal, nonverbal, and environmental slights, snubs, or insults, whether intentional or unintentional, that communicate hostile, derogatory, or negative messages to target persons based solely upon their marginalized group membership[1]. Recent research has found that, when professors do not address microaggressions in class, microaggressions foster alienation of marginalized groups[2]. Furthermore, both students and faculty who are exposed to microaggressions more often are more likely to have depressive symptoms and negative affect (a negative view of the world)[3]. A comfortable and productive environment where meaningful learning happens can be collectively created through actions, words, or environmental cues that promote the inclusion and success of marginalized members,

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[1] Sue, S., Zane, N., Nagayama Hall, G. C., & Berger, L. K. (2009). The Case for Cultural Competency in Psychotherapeutic Interventions. *Annual Review of Psychology, 60*(1), 525–548.
https://doi.org/10.1146/annurev.psych.60.110707.163651
[2] Bergom, I., Wright, M.C., Brown, M.K. and Brooks, M. (2011), Promoting College Student Development through Collaborative Learning: A Case Study of Hevruta. *About Campus, 15*, 19-25.
https://doi.org/10.1002/abc.20044
[3] Nadal, K. L., Griffin, K. E., Wong, Y., Hamit, S., & Rasmus, M. (2014). The Impact of Racial Microaggressions on Mental Health: Counseling Implications for Clients of Color. *Journal of Counseling & Development, 92*(1), 57– 66.
https://doi.org/10.1002/j.1556- 6676.2014.00130.x

recognizing their embodied identity, validating their realities, resisting sexism, ableism, and racism[4].

The University of Richmond is committed to building an inclusive community. To this end, the Student Center for Equity and Inclusion (SCEI) was created in 2021 and offers ongoing support and assistance for a diverse student body.[5] With this in mind, as a community member at the University of Richmond, I pledge to address microaggressions in the classroom by holding myself, other students, and faculty accountable for what is said and being receptive to criticism when perpetuating these slights, snubs, or insults.

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[4] Rolón-Dow, R. (2019). Stories of Microaggressions and Microaffirmation: A Framework for Understanding Campus Racial Climate. *NCID Currents, 1*(1). http://dx.doi.org/10.3998/currents.17387731.0001.106

[5] https://inclusion.richmond.edu/