

Research Design and Analysis I

Syllabus 16:830:521

Fall 2022

Rutgers University

In-class session location: Tillet 102

In-class session time: Thursdays 9:30-12

Instructor: Dr. Gandalf Nicolas

Instructor's Office Location: Tillet Hall 607

Instructor's Office Hours: By appointment (email me!)

Instructor's Email: gandalf.nicolas@rutgers.edu

Goals

This course aims to teach you statistics as a tool that can be broadly used to applications both professional and personal. We will review basic probability and statistical logic, but the main focus will be on practical skills and critical statistical thinking. You will learn the basics of the R statistical programming language, including applications for cleaning, visualizing, and analyzing data. You will learn statistical methods that can be applied to problems relevant to your research interests and you will learn to consume statistical information with a more critical eye.

We will be using R to aid us in computations, and the math will be introduced incrementally and as needed to understand the concepts and techniques. We will use simulation and visualization as a complement to the math to help you achieve an intuitive understanding of the concepts. And of course, if you do not understand something, please ask me!

Course Format

During the first half of each class, we will have didactic instruction where I will introduce and demonstrate the skills that we'll be learning. The second half will be a "hands on" chance for you to try out the skills taught in the first part of the class.

Please note this course is a work in progress! Because everyone in this course may have different backgrounds and experience with statistics, we may need to adapt the class as we go so that everyone leaves with the same level of experience needed to succeed in a Ph.D. program.

Textbooks

We will be using various free resources throughout the semester, including the following free books:

R for data science: Import, tidy, transform, visualize, and model data. *Hadley Wickham & Garret Grolemund*. Available at: <https://r4ds.had.co.nz/index.html>

Learning statistics with R: A tutorial for psychology students and other beginners.

Danielle Navarro (bookdown translation: Emily Kothe). Available at:

<https://learningstatisticswithr.com/book/>

Requirements

For this class you will need access to a laptop!

It would be ideal if you came to third week of class with a dataset that you are interested in and could possibly write a paper from. The dataset should have some demographic variables, a few continuous variables, and some categorical variables. If you have a dataset that doesn't meet all of these criteria, this is okay. We can generate other data for you to use for the in-class examples. If you can't get data, reach out to me and we can explore alternative ways to get data for you.

Assessment

Final proposal	5%
Midterm	25%
Final	35%
Participation	10%
In-class assignments	25%

Grading: Final grades will be assigned according to the following scale:

A: 90.0 -100.0%

B+: 85.0-89.99%

B: 80.0-84.99%

C+: 75-79.99%

C: 70-74.99%

D: 60.0 - 69.99%

F: 0.0 - 59.99%

Final proposal: This should be a brief (~2 paragraph max) writeup of the background of the hypothesis you want to test (1 paragraph) and the analysis you'll need to test it (1 paragraph). You should strive to propose analyses no more complicated than a 2 x 2 interaction (so that the project fits within the scope of the class).

Midterm: This will involve a writeup of the “descriptive statistics” section of your midterm/final, including visualizations, correlations, measures of central tendency, and related statistics. You’ll have a clear sense (from me) about which specific statistics you’ll need for your specific project as the project gets closer.

Final: This will involve a complete writeup of your project’s method and results section. This will build on (and should include) what you turned in for your midterm.

Participation. This reflects your attentiveness, during the lecture, the quality (but not quantity) of your contributions during the discussion, and being a good citizen of class (e.g., helping others, not missing classes). Please let me know in advance if you plan to miss a class. You will be responsible for learning the material you will miss during class. Document your absences using the absence reporting system:

<https://sims.rutgers.edu/ssra/>

In-class assignments. Several of the labs will have hands-on activities that I will collect for points. You will usually be able to complete these before you leave class. More detail will be given early in the semester.

Schedule

Date	Topic/Event	Due (before class)
Week 1- Sept 8	Orientation and review of syllabus, Intro to R	
Week 2- Sept 15	Basics of R programming	RFDS Chapter 5 (it's ok if you don't understand some of it, we will review in class)
Week 3- Sept 22	Measure of variability Distributions z-scores Central Limit Theorem Intro to visualizations	RFDS Chapter 3 (it's ok if you don't understand some of it, we will review in class)
Week 4- Sept 29	Hypothesis testing Statistical tests	
Week 5- Oct 6	One sample Z-tests One sample t-tests	Final proposal
Oct 13	No class Maybe: exploratory factor analysis (online or book)	
Week 6- Oct 20	Independent samples t-test	

Week 7- Oct 27	1-way ANOVA	
Week 8- Nov 3	Factorial ANOVA	
Week 9- Nov 10	Simple linear regression	Midterm
Week 10- Nov 17	Correlation Multiple linear regression Logistic regression (brief intro)	
Nov 24	Thanksgiving break	
Week 11 – Dec 1	Multi-level modeling	
Week 12 – Dec 8	Model comparison (brief intro) Catch up- wrap up	
		FINAL: due by 11:59 pm on Dec 16th

Academic Integrity:

Rutgers University takes academic dishonesty very seriously. By enrolling in this course, you assume responsibility for familiarizing yourself with the Academic Integrity Policy and the possible penalties (including suspension and expulsion) for violating the policy.

As per the policy, all suspected violations will be reported to the Office of Student Conduct. Academic dishonesty includes (but is not limited to):

- Cheating

- Plagiarism

- Aiding others in committing a violation or allowing others to use your work

- Failure to cite sources correctly
- Fabrication

- Using another person's ideas or words without attribution—re-using a previous assignment

- Unauthorized collaboration

- Sabotaging another student's work

If in doubt, please consult the instructor

Please review the Academic Integrity Policy (See

<http://nbacademicintegrity.rutgers.edu/home-2/academic-integrity-policy> for specifics, and <http://nbacademicintegrity.rutgers.edu/home-2/for-students/> for additional resources).

Other resources

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901/

<http://health.rutgers.edu/medical-counseling-services/counseling/>

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professionals within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community, and consultation and collaboration with campus partners.

Crisis Intervention : **<http://health.rutgers.edu/medical-counseling-services/counseling/crisis-intervention/>**

Report a Concern: **<http://health.rutgers.edu/do-something-to-help/>**

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 /

www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.