

EDUC 263: Introduction to Data Management Using R

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Location: Moore Hall 3120 (computer lab)

Class Room: Moore Hall 2120

Class Hours: Fridays 12 - 4 pm

Class Website: ozanj.github.io/rclass/ Class Discussion: piazza.com/class/jlo6477nzqo2j0

Course Description

This course has two foundational goals: (1) to develop core skills in “data management,” which are important regardless of which programming language you use, and (2) to learn the fundamentals of the R programming language.

Data management consists of acquiring, investigating, cleaning, combining, and manipulating data. Most statistics courses teach you how to analyze data that are ready for analysis. In real research projects, cleaning the data and creating analysis datasets is often more time consuming than conducting analyses. This course teaches the fundamental data management and data manipulation skills necessary for creating analysis datasets.

The course will be taught in R, a free, open-source programming language. R has become the most popular language for statistical analysis, surpassing SPSS, Stata, and SAS. What differentiates R from these other languages is the thousands of open-source “libraries” created by R users. R is one of the most popular languages for “data science,” because R libraries have been created for web-scraping, mapping, network analysis, etc. By learning R you can be confident that you know a programming language that can run any modeling technique you might need and has amazing capabilities for data collection and data visualization. By learning fundamentals of R in this course, you will be “one step away” from web-scraping, network analysis, interactive maps, quantitative text analysis, or whatever other data science application you are interested in.

Students will become proficient in data manipulation tasks through weekly “problem sets” that you complete in groups of three. These problem sets will account for 80% of your grade for the course. Each week class will begin with one group will leading a discussion of challenges they encountered while completing the problem set. The rest of class time will be devoted to learning new material. The instructor will provide students with lecture notes, and also data and code used during lecture. Therefore, student can follow along by running code from their own computers.

Course Learning Goals

1. Understand fundamental concepts of object oriented programming
 - What are the basic object types and how do they apply to statistical analysis
 - What are object attributes and how do they apply to statistical analysis
2. Become familiar with Base R approach to data manipulation and Tidyverse approach to data manipulation
3. Investigate data patterns
 - Sort datasets in ways that generate insights about data structure
 - Select specific observations and specific variables in order to identify data structure and to examine whether variables are created correctly
 - Create summary statistics of particular variables to diagnose errors in data
4. Create variables
 - Create variables that require calculations across columns
 - Create variables that require processing across rows
5. Combine multiple datasets
 - Join (merge) datasets
 - Append (stack) datasets
6. Manipulate the organizational structure of datasets
 - summarize and collapse by group
 - Tidy untidy data
7. Automate iterative tasks
 - Write your own functions
 - Write loops
8. Learn habits of mind and practical strategies for cleaning dirty data and avoiding errors when creating analysis variables

Prerequisite Requirements

1. Students must have taken at least a one-semester introductory statistics course.
2. Students should have some very basic experience using statistical programming software (e.g., SPSS, Stata, R, SAS)
3. [General computer skills] Students should be able to download files from the internet, rename these files, save them to a folder of your choosing, and open this folder.
 - During this course we will often be downloading datasets, opening .Rmd files and .R scripts, changing directories to the folder where we stored the data, and then opening the dataset we just downloaded. Therefore, it is important that students feel comfortable doing these tasks.

Course Readings

Course readings will be assigned from:

- Grolemund, G., & Wickham, H. (2018). *R for Data Science*. Retrieved from <http://r4ds.had.co.nz/> [FREE!]

- Xie, Y., Allaire, J. j., & Grolemund, G. (2018). *R Markdown: The Definitive Guide*. Retrieved from <https://bookdown.org/yihui/rmarkdown/> [FREE!]

Required Software and Hardware

Software [FREE!]

Instructions on downloading software can be found [here](#)

Please install the following software on your laptop

- R
- RStudio
- MikTeX/MacTeX

Hardware

- Please bring in laptop with above software installed each week

Course Website and Resources

Course Website can be found [here](#). We will use this website to download course materials such as lecture slides in pdf and .Rmd formats, data, weekly problem sets, and other class resources.

We are using Piazza as our class discussion forum. Piazza is a learning forum where folks can customize questions/comments to share with instructors or the entire class. Folks have the option to insert code, images, videos, tables, links, and text to their Q&A posts. Additionally, posts can be configured to be anonymous. We strongly encourage all questions related to course content to be posted on the Piazza discussion forum.

Piazza website can be found [here](#)

Communication with Instructor and Teaching Assistant

Use Piazza discussion forums for all questions related to course content. All students can then benefit from my response. We will aim to respond within 24 hours of your post Monday through Friday and 48 hours on Saturday and Sunday. Email me directly if you have a question regarding any personal issue

I encourage students to answer questions your classmates post on Piazza discussion forums. Writing out explanations to student questions will improve your own knowledge and will benefit your classmates.

Assignments & Grading

Your final grade will be based on the following components:

- Weekly problem sets (80 percent of total grade)

- Your homework group leads a discussion about how you completed the problem set (10 percent of total grade)
- Attendance and participation (10 percent of total grade)

Weekly problem sets

Students will complete 10 problem sets. Problem sets are due by 12PM each Friday (right before the class meeting). Late submissions will not receive points because we will discuss solutions during class. The lowest grade will be dropped from the calculation of your final grade.

In general, each problem set will give your practice using the skills and concepts introduced during the previous lecture. For example, after the lecture on joining (merging) datasets, the problem set for that week will require that students complete several different tasks involving merging data. Additionally, the weekly problem sets will require you to use data manipulation skills you learned in previous weeks.

Students will work on problem sets in groups of three people (groups assigned in week 2; same group throughout the semester). However, each student will submit their own assignment. You are encouraged to share ideas and get help from your group. However, it is important that you understand how to do the problem set on your own, rather than copying the solution developed by group members. If I find compelling evidence that a student merely copied solutions from a classmate, I will consider this a violation of academic integrity and that student will receive a zero for the homework assignment.

A general strategy I recommend for completing the problem sets is as follows: (1) after lecture, do the reading associated with that lecture; (2) try doing the problem set on your own; (3) meet with your group to work through the problem set, with a particular focus on areas group members find challenging.

Group led discussion about problem set (10 percent of total grade)

Each week a student group (groups of three) will lead a discussion on the problem set. Groups have a lot of autonomy in how they want to approach this discussion (e.g., can have slides, handouts, or neither). However, my preference is that this is more of an open discussion than a presentation. In terms of topics to cover, the group can invite class members to share what challenges/problems they encountered while completing the homework, how they were able to overcome these problems, alternative ways to overcome data manipulation challenges, and what concepts or tasks remain confusing.

For now, we'll allot 40 minutes (at beginning of class) for these discussions. But this allotted time may increase to 50 minutes or decrease to 30 minutes.

Attendance and Participation (10 percent of total grade)

Students are required to attend the weekly class meetings. Each unexcused absence results in a loss of 20% from your attendance/participation grade. Three or more unexcused absences will result in a failing grade for the course.

An excused absence is a professional opportunity that you discuss with me beforehand or a medical, or family emergency. Excused absences will not result in a loss of attendance points. However,

you will be responsible for all material covered in that class and you will be expected to turn in homework assignments on time.

Students are expected to participate in the weekly class meetings by being attentive, by asking questions, by answering questions posed by classmates and by the professor. In addition to participation during class meetings, students can receive strong participation grades by asking questions and answering questions on Piazza.

Course Policies

Classroom environment

We all have a responsibility to ensure that every member of the class feels valued, safe, and included.

With respect to the course material, learning programming and the essential skills of data manipulation is hard! This stuff feels overwhelming to me all the time. So it is important that we all create an environment where students feel comfortable asking questions and talking about what they did not understand.

With respect to creating an inclusive environment, be mindful that what you say affects other people. So express your thoughts in a way that doesn't make people feel excluded and does not disparaging generalizations about a group.

As an instructor, I am responsible for setting an example through my own conduct. I hope to create an environment where students feel comfortable voicing concerns about the classroom environment. I will endeavor to present materials that are respectful of diversity: race, color, ethnicity, gender, age, disability, religious beliefs, political preference, sexual orientation, gender identity, citizenship, or national origin among other personal characteristics. The diversity of student experiences and perspectives is essential to the deepening of knowledge in a course. Any suggestions that you have about other ways to include the value of diversity in this course are welcome. During the quarter, I will also create forums where students can voice concerns anonymously.

Online Collaboration/Netiquette

You will communicate with instructors and peers virtually through a variety of tools such as discussion forums, email, and web conferencing. The following guidelines will enable everyone in the course to participate and collaborate in a productive, safe environment.

- Be professional, courteous, and respectful as you would in a physical classroom.
- Online communication lacks the nonverbal cues that provide much of the meaning and nuances in face-to-face conversations. Choose your words carefully, phrase your sentences clearly, and stay on topic.
- It is expected that students may disagree with the research presented or the opinions of their fellow classmates. To disagree is fine but to disparage others' views is unacceptable. All comments should be kept civil and thoughtful.

Academic accomodations

Students needing academic accommodations based on a disability should contact the Center for Accessible Education (CAE) at (310)825-1501 or in person at Murphy Hall A255. When possible, students should contact the CAE within the first two weeks of the term as reasonable notice is needed to coordinate accommodations. For more information visit www.cae.ucla.edu.

Academic Honesty:

UCLA is a community of scholars. In this community, all members including faculty, staff and students alike are responsible for maintaining standards of academic honesty. As a student and member of the University community, you are here to get an education and are, therefore, expected to demonstrate integrity in your academic endeavors. You are evaluated on your own merits. Cheating, plagiarism, collaborative work, multiple submissions without the permission of the professor, or other kinds of academic dishonesty are considered unacceptable behavior and will result in formal disciplinary proceedings usually resulting in suspension or dismissal.

Course Schedule and Required Reading

All reading is required reading. I have worked hard to keep reading load light, focusing only on essentials, because weekly problem sets will be time consuming.

In the below schedule, I lecture on a topic, and then you do the reading about that topic and are required to complete a problem set about that topic. However, if you would prefer to the reading about a topic **prior** to me lecturing about that topic, feel free to do so.

Lecture 1, 09/28: Course introduction; objects in R

- Reading (after class): Grolemond and Wickham (GW) 1; GW 2; GW 4; GW 20.1 - 20.3

Lecture 2, 10/05: Investigating data patterns

- Problem set due (before class): Yes
- Reading (after class):
 - GW 5.1 - 5.4
 - Xie, Allaire & Grolemond (XAG) 3.1 [LINK HERE](#)
 - Spend 15 minutes studying the “R Markdown Reference Guide” [LINK HERE](#)

Lecture 3, 10/12: Pipes and variable creation

- Problem set due (before class): Yes
- Reading (after class):
 - GW 5.5 (creating variables)
 - XAG 3.3 (R Markdown, creating PDF documents) [LINK HERE](#)
 - * note: sections 3.3.5 through 3.3.8 will feel somewhat cryptic and are not required for this course; so just do the best you can with those

Lecture 4, 10/19: Processing across rows

- Problem set due (before class): Yes
- Reading (after class):
 - GW 5.6 - 5.7 (grouped summaries and mutates)
 - XAG 4.1 (R Markdown, ioslides presentations) [LINK HERE](#) and 4.3 (R Markdown, Beamer presentations) [LINK HERE](#)

Lecture 5, 10/26: Augmented vectors, Survey data, and exploratory data analysis

- Problem set due (before class): Yes
- Reading (after class):
 - GW 15.1 - 15.2 (factors) [this is like 2-3 pages]
 - [OPTIONAL] GW 15.3 - 15.5 (remainder of “factors” chapter)
 - [OPTIONAL] GW 20.6 - 20.7 (attributes and augmented vectors)
 - [OPTIONAL] GW 10 (tibbles)

Lecture 6, 11/02: Tidy data

- Problem set due (before class): Yes
- Reading (after class):
 - Work through slides we from lecture 6 that we don’t get to in class
 - * [REQUIRED] slides from section 4 “Tidying data”
 - * [OPTIONAL] slides from section 5 “Missing data”
 - [OPTIONAL] GW chapter 12 (tidy data)
 - * Lecture 6 covers this material pretty closely, so read chapter if you can, but I get it if you don’t have time
 - [OPTIONAL] Wickham, H. (2014). Tidy Data. *Journal of Statistical Software*, 59(10), 1-23. [doi:10.18637/jss.v059.i10](https://doi.org/10.18637/jss.v059.i10)
 - * This is the journal article that introduced the data concepts covered in GW chapter 12 and created the packages related to tidying data
 - * Link to article here: [LINK](#)

Lecture 7, 11/09: Joining multiple datasets

- Problem set due (before class): Yes
- Reading (after class): GW 13

Lecture 8, 11/16: Acquiring data

- Problem set due (before class): Yes
- Reading (after class): GW 11

Thanksgiving, 11/23: No class**Lecture 9, 11/30: Writing functions**

- Problem set due (before class): Yes
- Reading (after class): GW 19

Lecture 10, 12/07: Accessing object elements and looping

- Problem set due (before class): Yes
- Reading (after class): GW 20.4 - 20.5; 21.1 - 21.3

Finals Week, 12/14: No class

- Problem set due: Yes

Campus Resources**Counseling and Psychological Services (CAPS)**

This is a multidisciplinary student mental health center for the UCLA campus. CAPS offers an array of free services including individual counseling. If you suspect you are experiencing mental health problems or just need someone to talk to, you can make an appointment at John Wooden Center West, facing Drake Stadium, second floor, 310-825-0768. <http://www.counseling.ucla.edu>

Report Discrimination UCLA is committed to maintaining a campus community that provides the strongest possible support for the intellectual and personal growth of all its members- students, faculty, and staff. Acts intended to create a hostile climate are unacceptable. To file an online incident report, visit: <https://equity.ucla.edu/report-an-incident/>

Sexual harassment

Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the CARE Advocacy Office for Sexual and Gender-Based Violence. 1st Floor Wooden Center West, via email CARE.advocate@careprogram.ucla.edu or by phone (310) 206-2465. In addition, Counseling and Psychological Services (CAPS) provides confidential counseling to all students and can be reached 24/7 at (310) 825-0768. You can also report sexual violence or sexual harassment directly to the University's Title IX Coordinator, 2241 Murphy Hall, via email at mcato@equity.ucla.edu, or via phone at (310) 206-3417. Reports to law enforcement can be made to UCPD at (310) 825-1491. *Faculty and TAs are required under the UC Policy on Sexual Violence and Sexual Harassment to inform the Title IX Coordinator should they become aware that you or any other student has experienced sexual violence or sexual harassment.*

LGBTQ Resource Center This resource center provides a range of education and advocacy services supporting intersectional identity development. It fosters unity; wellness; and an open, safe, inclusive environment for lesbian, gay, bisexual, intersex, transgender, queer, asexual, questioning, and same-gender-loving students, their families, and the entire campus community. Find it in the Student Activities Center, or via email lgbt@lgbt.ucla.edu. Visit their website for more information: <https://www.lgbt.ucla.edu/>

International Students

The Dashe Center provides a range of programs to promote cross-cultural learning, language improvement, and cultural adjustment. Their programs include trips in the LA area, performances, and on-campus events and workshops. Visit their website for more information: <https://www.internationalcenter.ucla.edu/>

Undocumented Student Program

This program provides a safe space for undergraduate and graduate undocumented students. USP supports the UndocuBruin community through personalized services and resources, programs, and workshops. Visit their website for more information: <https://www.usp.ucla.edu/>

Student legal services

UCLA student legal services provides a range of legal support to all registered and enrolled UCLA students. Some of their services include:

- Landlord/Tenant Relations
- Accident and Injury Problems
- Domestic Violence and Harassment
- Divorces and Other Family Law Matter

For more information visit their website: <http://www.studentlegal.ucla.edu/index.php>

Students with dependents

UCLA Students with Dependents provides support to UCLA students who are parents, guardians, and caregivers. Some of their services include:

- Information, referrals, and support to navigate UCLA (childcare, family housing, financial aid)
- Access to information about resources within the larger community
- On-site application and verification for CalFresh (food stamps) & MediCal and assistance with Cal Works/GAIN
- A quiet study space
- Family friendly graduation celebration in June

For more information visit their website: <https://www.deanofstudents.ucla.edu/Portals/16/Documents/studentsdependents.pdf>

Lactation Rooms

[Map to lactation rooms on campus](#)

Gender Inclusive restrooms

[Map to gender inclusive restrooms](#)

Campus accessibility

[Campus accessibility map](#)