PubH 7461-001

Exploring and Visualizing Data in R

Fall 2017

Credits: 2

Meeting Days: Friday

Meeting Time: 10:10 a.m. - 12:05 p.m.

Meeting Place: Bruininks Hall 432B

Instructor: Julian Wolfson

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Office Hours: TBD

Course Description

This course is intended for students, both within and outside the School of Public Health, who want to learn how to manipulate data, perform simple statistical analyses, and prepare basic visualizations using the statistical software R. While the tools and techniques taught will be generic, many of the examples will be drawn from biomedicine and public health.

Course Prerequisites

Familiarity with concepts from introductory statistics: mean/median, continuous vs. categorical variables, basic probability, Normal and binomial distribution. While the course is not designed to teach basic programming concepts, no prior programming experience is necessary.

Course Goals and Objectives

Upon completing this course, students should be able to:

- Use RStudio and its features efficiently and appropriately
- Read in and manipulate raw data into R using multiple file types
- Create and implement functions in R
- Understand and implement approaches in R to reshaping and restructuring data for analysis
- Understand and implement approaches in R to visualize data both for exploratory analyses and reports
- Understand and implement approaches in R to process dates and strings

Methods of Instruction and Work Expectations

This course is a mixture of lecture, demonstration and hands on activities, with time spent outside of class on programming activities. Students are expected to attend class, participate in class discussions, and complete the assigned homework and project. **Working together on homework assignments is permitted, but each student is expected to independently write-up homework assignments, using their own computing and in their own words.**

Course Text and Readings

There is no required text and no formal readings for this course; students will learn from hands-on in-class exercises and by consulting help documentation and online sources (e.g., StackOverflow, DataCamp). However, you may find the following additional references useful:

- Hadley Wickham. "ggplot2: Elegant graphics for data analysis". Available through SpringerLink on campus (http://link.springer.com.ezp3.lib.umn.edu/book/10.1007%2F978-0-387-98141-3)

- Hadley Wickham. "R for Data Science". (http://r4ds.had.co.nz/)

- Garrett Grolemund. "Hands-On Programming with R". (http://shop.oreilly.com/product/0636920028574. do#)

- Norman Matloff. "The Art of R Programming". (https://www.nostarch.com/artofr.htm)

Course Outline

Tentative schedule:

- **Week 1 (Sep 8)**
  - Introduction to R
  - Assignment 1 (due Sep 15): Install RStudio. Complete the "Introduction to R" course on DataCamp
- **Week 2 (Sep 15)**
  - Getting comfortable with R. Reading and writing data.
  - Assignment 2 (due Sep 22): Import and export data in multiple formats (CSV, Excel, etc.)
- **Weeks 3-4 (Sep 22, 29)**
  - Data Representation: Data frames, variable types
  - Assignment 3 (due Sep 29): Explore data frames, identify and manipulate variable types
- **Weeks 5-6 (Oct 6, 13)**
  - The `dplyr` package
  - The `apply` family
  - Assignment 4 (due Oct 13): Use `dplyr` and `apply` to manipulate, filter, and transform data frames
- **Weeks 7-8 (Oct 20, 27)**
  - Base graphics
  - Assignment 5 (due Oct 24): Use base graphics to make some simple plots
- **Week 9-11 (Nov 3, 10, 17)**
  - The `ggplot2` package
  - Assignment 7 (due Nov 17): Practice creating simple and more complex plots using `ggplot`
- **Weeks 12-13 (Nov 24, Dec 1)**
  - Dates and times
  - Processing strings
  - Assignment 8 (due Dec 1): Summarize and visualize a dataset involving dates, times, and "messy" strings
- **Weeks 14-15**
  - Special topics TBA
  - Final project: Summarize and visualize a provided dataset (due Dec 15)

Evaluation and Grading

There will be 8 homework assignments which focus on application of a major skill for the course. Each week, students will complete and submit an in-class "challenge" assignment to practice skills they have learned on previous homework assignments. Students will also complete a final project which will involve applying the programming skills they have learned to summarize and visualize a provided dataset.

For assignment and project due dates, please see the course website.

The final grade will be determined by:

60% homework, 10% in-class challenges, 30% project

No make-up work will be allowed for missed assignments or projects.

A letter grade will be determined from the percentage of points each student receives. The following translation of number grades to letters represents the strictest possible scheme that could be used; the instructor may make the scheme less strict (e.g., A = 91-100%, B = 86-90%, etc.) depending on the final distribution of numerical grades:

Letter	% range
A	93-100%
A-	88-92%
B+	83-89%
B	78-82%
B-	73-77%
C+	69-72%
C	65-68%
C-	62-64%
D+	59-61-%
D	56-58%
F	0-55%

The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

Grade	Points
A	4.000 - Represents achievement that is outstanding relative to the level necessary to meet course requirements
A-	3.667
B+	3.333
B	3.000 - Represents achievement that is significantly above the level necessary to meet course requirements
B-	2.667
C+	2.333
C	2.000 - Represents achievement that meets the course requirements in every respect
C-	1.667
D+	1.333
D	1.000 - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements

Grade	Points
S	Represents achievement that is satisfactory, which is equivalent to a C- or better (i.e, > 61%).

For additional information, please refer to: http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html

Course Evaluation

The SPH will collect student course evaluations electronically using a software system called CoursEval: www.sph.umn.edu/courseval. The system will send email notifications to students when they can access and complete their course evaluations. Students who complete their course evaluations promptly will be able to access their final grades just as soon as the faculty member renders the grade in SPHGrades: www.sph.umn.edu/grades. All students will have access to their final grades through OneStop two weeks after the last day of the semester regardless of whether they completed their course evaluation or not. Student feedback on course content and faculty teaching skills are an important means for improving our work. Please take the time to complete a course evaluation for each of the courses for which you are registered.

Incomplete Contracts

A grade of incomplete "I" shall be assigned at the discretion of the instructor when, due to extraordinary circumstances (e.g., documented illness or hospitalization, death in family, etc.), the student was prevented from completing the work of the course on time. The assignment of an "I" requires that a contract be initiated and completed by the student before the last official day of class, and signed by both the student and instructor. If an incomplete is deemed appropriate by the instructor, the student in consultation with the instructor, will specify the time and manner in which the student will complete course requirements. Extension for completion of the work will not exceed one year (or earlier if designated by the student's college). For more information and to initiate an incomplete contract, students should go to SPHGrades at: www.sph.umn.edu/grades.

Other Course Information and Policies

Grade Option Change (if applicable)

For full-semester courses, students may change their grade option, if applicable, through the second week of the semester. Grade option change deadlines for other terms (i.e. summer and half-semester courses) can be found at http://onestop.umn.edu.

Course Withdrawal

Students should refer to the Refund and Drop/Add Deadlines for the particular term at onestop.umn.edu for information and deadlines for withdrawing from a course. As a courtesy, students should notify their instructor and, if applicable, advisor of their intent to withdraw.

Students wishing to withdraw from a course after the noted final deadline for a particular term must contact the School of Public Health Office of Admissions and Student Resources at sph-ssc@umn.edu for further information.

Student Conduct Code

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: Student Conduct Code. To review the Student Conduct Code, please see: http://regents.umn.edu/sites/default/files/policies/Student_ Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Use of Personal Electronic Devices in the Classroom

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: http://policy.umn.edu/Policies/Education/Education/ STUDENTRESP.html.

Scholastic Dishonesty

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to

falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf)

If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: http://www1.umn.edu/oscai/integrity/student/index.html. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Makeup Work for Legitimate Absences

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html.

Appropriate Student Use of Class Notes and Course Materials

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf

Equity, Diversity, Equal Opportunity, and Affirmative Action

The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center Student Services is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DRC at 612-626-1333 or drc@umn.edu to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course.

For more information, please see the DS website, https://diversity.umn.edu/disability/.

Mental Health and Stress Management

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 and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

The Office of Student Affairs at the University of Minnesota

The Office for Student Affairs provides services, programs, and facilities that advance student success, inspire students to make life-long positive contributions to society, promote an inclusive environment, and enrich the University of Minnesota community.

Units within the Office for Student Affairs include, the Aurora Center for Advocacy & Education, Boynton Health Service, Central Career Initiatives (CCE, CDes, CFANS), Leadership Education and Development -Undergraduate Programs (LEAD-UP), the Office for Fraternity and Sorority Life, the Office for Student Conduct and Academic

Integrity, the Office for Student Engagement, the Parent Program, Recreational Sports, Student and Community Relations, the Student Conflict Resolution Center, the Student Parent HELP Center, Student Unions & Activities, University Counseling & Consulting Services, and University Student Legal Service.

For more information, please see the Office of Student Affairs at http://www.osa.umn.edu/index.html.

Academic Freedom and Responsibility:

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, (Dr Kristin Anderson, SPH Dean of Student Affairs), or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".

Student Academic Success Services (SASS): http://www.sass.umn.edu

Students who wish to improve their academic performance may find assistance from Student Academic Support Services. While tutoring and advising are not offered, SASS provides resources such as individual consultations, workshops, and self-help materials.