Revised 12/21/19

BROWN SCHOOL
WASHINGTON UNIVERSITY IN ST. LOUIS
Spring 2019
Skill Lab: Introduction to the R Statistical Programming Language and Environment
S55 MPH 5962

CREDIT HOURS: 1
GRADE: L/G
ROOM: Goldfarb 246
DAY/TIME: Wednesday/2-5pm
Dates: 1.16.2019-2.13.2019

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OFFICE HOURS: Tuesday 10-11:30am
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I. COURSE DOMAIN AND BOUNDARIES

This course will introduce students the fundamentals of the R language and RStudio environment. The first session will cover basic operations and data objects in R. The second session will cover importing and managing data from different sources, and the third will cover descriptive and exploratory analysis. The fourth session will cover common data analyses (t-tests, ANOVAs, correlations, regressions, etc.). The fifth session will cover presentation of data and results, the basics of R Markdown and how to write simple functions. Students are expected to have taken at least one introductory statistics course, but need no prior computer programming experience. *Students should bring a laptop to class that has the most current versions of R and RStudio installed. As of December 20, 2018, R version 3.5.1 & RStudio version 1.1.463 are the current versions.*

II. MPH FOUNDATIONAL KNOWLEDGE AND COMPETENCIES ADDRESSED IN THIS COURSE:

B**. Foundational Competencies (and or Specialization Competencies as applicable)**

1. Select quantitative and qualitative data collection methods appropriate for a given public health context.
2. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate.
3. Interpret results of data analysis for public health research, policy or practice.
4. Apply and interpret common statistical methods for inference (e.g., ANOVA, linear and logistic regression, survival analysis) found in public health studies.

III. BROWN SCHOOL ACADEMIC POLICIES

Academic Integrity: If a faculty member or student suspects that academic or professional integrity has been violated, they are required to submit an Academic Integrity or Professional Integrity Violation form found on Inside Brown for review by the Assistant Dean of the program. The Assistant Dean or designated representative will aid in the investigation of the violation,

which includes but is not limited to gathering relevant evidence; conversations with the instructor, student(s) involved, witnesses, and others as necessary. Depending on the seriousness of the case, the Assistant Dean may choose to refer the matter directly to the University Student Conduct Board. This referral procedure will generally be followed if it is believed that the penalty is likely to involve suspension or expulsion from the University. The Assistant Dean for the program or designated representative will offer to meet privately with the student(s) against whom the complaint has been made. It is the student's responsibility to familiarize themselves with the behaviors that constitute an academic integrity violation requiring referral.

Student Handbook 2018

Accommodations: If you have a learning, sensory, or physical disability or any other diagnosis that requires accommodations and/or assistance in lectures, reading, written assignments, and/or exam taking, please work with the Disability Resource Center, a University-wide resource that provides academic accommodations support and referrals. Students are required to provide a Verification of Individual Student Accommodation (VISA) letter to the instructor and are encouraged to work directly with the instructor to discuss specific course needs. The Director of Student Affairs can assist with coordination between the Disability Resource Center and the Brown School.

Pronouns: The Brown School embraces and promotes gender expansiveness as reflective of the lived experiences of many students, staff, faculty and members of our expanded community. The correct use of an individual's pronouns is a critical part of an individual's identity and of building an inclusive community. Students, faculty and staff are encouraged to use pronouns during introductions, are expected to use expressed pronouns of all Brown School community members, and are encouraged to apologize when mistakes are made. Educational resources are available at: https://campuslife.wustl.edu/lgbtqia/lgbt-resources/gender-pronouns/

English Language Proficiency: If your English language proficiency is such that you may need special assistance in lectures, reading, written assignments, and/or exam taking, please communicate these needs to your instructor who may refer you to the English Language Program (ELP). ELP is a University-wide resource that provides classes and academic English language support designed to increase non-native English speaking students' English language proficiency and to facilitate their academic success at Washington University. You may also find the Academic Assistance resources available through the Office for International Students and Scholars to be helpful.

Professional Use of Electronic Devices in the Classroom: Computers or other electronic devices, including "smart pens" (devices with an embedded computer and digital audio recorder that records the classroom lecture/discussion and links that recording to the notes taken by the student), may be used by students at the discretion of the faculty member to support the learning activities in the classroom. These activities include taking notes and accessing course

readings under discussion. If a student wishes to use a smart-pen or other electronic device to audio record lectures or class discussions, they must notify the instructor in advance of doing so. Permission to use recording devices is at the discretion of the instructor, unless this use is an accommodation approved by Disability Resources.

Nonacademic use of laptops and other devices and use of laptops or other devices for other coursework is distracting and seriously disrupts the learning process for other people in the classroom. Neither computers nor other electronic devices are to be used in the classroom during class for nonacademic reasons or for work on other coursework. Nonacademic use includes emailing, texting, social networking, playing games, instant messaging, and use of the Internet. Work on other coursework may include, but is not limited to, use of the Internet, writing papers, using statistical software, analyzing data, and working on quizzes or exams. The nonacademic use of cell phones during class time is prohibited, and they should be set on silent before class begins. In the case of an emergency, please step out of the room to take the call. The instructor has the right to hold students accountable for meeting these expectations, and failure to do so may result in a loss of participation or attendance points, a loss of the privilege of device use in the classroom, or being asked to leave the classroom.

Religious Holidays: The Brown School recognizes the individual student's choice in observing religious holidays that occur during periods when classes are scheduled. Students are encouraged to arrange with their instructors to make up work missed as a result of religious observance, and instructors are asked to make every reasonable effort to accommodate such requests.

IV. WASHINGTON UNIVERSITY ACADEMIC SUPPORT POLICIES

Accommodations based upon sexual assault: The University is committed to offering reasonable academic accommodations to students who are victims of sexual assault. Students are eligible for accommodation regardless of whether they seek criminal or disciplinary action. Depending on the specific nature of the allegation, such measures may include but are not limited to: implementation of a no-contact order, course/classroom assignment changes, and other academic support services and accommodations. If you need to request such accommodations, please direct your request to Kim Webb, Director of the Relationship and Sexual Violence Prevention Center, or Jen Durham Austin, Support Services Counselor. Both Kim Webb and Jen Durham Austin are confidential resources; however, requests for accommodations will be shared with the appropriate University administration and faculty. The University will maintain as confidential any accommodations or protective measures provided to an individual student so long as it does not impair the ability to provide such measures.

If a student comes to me to discuss or disclose an instance of sexual assault, sex discrimination, sexual harassment, dating violence, domestic violence or stalking, or if I otherwise observe or become aware of such an allegation, I will keep the information as private as I can, but as a faculty member of Washington University, I am required to immediately report it to my Department Chair or Dean or directly to Ms. Jessica Kennedy, the University's Title IX

Director. If you would like to speak with directly Ms. Kennedy directly, she can be reached at (314) 935-3118, jwkennedy@wustl.edu, or by visiting the Title IX office in Umrath Hall. Additionally, you can report incidents or complaints to the Office of Student Conduct and Community Standards or by contacting WUPD at (314) 935-5555 or your local law enforcement agency. See: Title IX

You can also speak confidentially and learn more about available resources at the Relationship and Sexual Violence Prevention Center by calling (314) 935-3445 for an appointment or visiting the 4th floor of Seigle Hall. See: RSVP Center

Bias Reporting: The University has a process through which students, faculty, staff and community members who have experienced or witnessed incidents of bias, prejudice or discrimination against a student can report their experiences to the University's Bias Report and Support System (BRSS) team. See: brss.wustl.edu.

Mental Health: Mental Health Services' professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression.

Center for Diversity and Inclusion (CDI): The Center of Diversity and Inclusion (CDI) supports and advocates for undergraduate, graduate, and professional school students from underrepresented and/or marginalized populations, creates collaborative partnerships with campus and community partners, and promotes dialogue and social change. One of the CDI's strategic priorities is to cultivate and foster a supportive campus climate for students of all backgrounds, cultures and identities. See: diversityinclusion.wustl.edu/

Additional Issues or Concerns: If you feel that you need additional supports in order to be successful in your time at Brown, beyond the mentioned accommodations, please contact Essie Rochman, Director of Student Affairs at erochman@wustl.edu. She can assist you in navigating a myriad of concerns. Her office is in Brown Hall, room 320.

V READINGS

Textbook

Wickham, Hadley & Garrett Grolemund. (2017) *R for Data Science: Import, Tidyu, Transform, Visualize, and Model Data*. O'Reilly Media Inc: Sebastopol, CA.
Online Version available at: http://r4ds.had.co.nz/

Software

Students should bring a laptop to class that has the most current versions of R (http://cran.wustl.edu/) and RStudio (https://www.rstudio.com/products/rstudio/download/#download) installed. As of December 20, 2018, R version 3.5.1 & RStudio version 1.1.463 are the current versions.

Supplemental resources for R

- dplyr:
  - https://cran.r-project.org/web/packages/dplyr/vignettes/dplyr.html
- Exploratory data analysis in R:
  - https://www.r-bloggers.com/exploratory-data-analysis-in-r-introduction/amp/?__twitter_impression=true
- ggplot2:
  - http://t-redactyl.io/blog/2016/01/creating-plots-in-r-using-ggplot2-part-4-stacked-bar-plots.html
  - https://www.r-bloggers.com/bar-plot-of-group-means-with-individual-observations/
  - https://www.r-bloggers.com/plotting-background-data-for-groups-with-ggplot2/
  - https://www.r-bloggers.com/plotting-likert-scales/
  - https://www.r-bloggers.com/make-a-bar-plot-with-ggplot/
  - http://t-redactyl.io/blog/2016/01/creating-plots-in-r-using-ggplot2-part-3-bar-plots.html
- Hints for the R beginner:
  - http://www.portfolioprobe.com/user-area/some-hints-for-the-r-beginner/
- HTML text & other formatting for R Notebooks:
  - https://www.w3schools.com/html/html_formatting.asp
- Introduction to R from the R Core Team:
  - https://cran.r-project.org/doc/manuals/R-intro.pdf
- Introduction to RStudio by Oscar Torres-Renya:
  - http://dss.princeton.edu/training/RStudio101.pdf
- Learn R from Scratch - video tutorials:
  - http://datascienceplus.com/learn-r-from-scratch-part-1/
- Learning R in seven simple steps:
  - http://www.datasciencecentral.com/profiles/blogs/learning-r-in-seven-simple-steps
- List of free e-books for R:
  - https://r-dir.com/learn/e-books.html
- List of R resources from StatsExchange:
  - http://stats.stackexchange.com/questions/138/free-resources-for-learning-r
- Quick R:
  - http://www.statmethods.net/
- R for Dummies:
  - http://www.ievbras.ru/ecostat/Kiril/R/Biblio/R_eng/R%20dummies.pdf
- R Markdown cheat sheet
  - https://www.rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf
- Tables in R for R Markdown documents with stargazer:
  - https://www.jakeruss.com/cheatsheets/stargazer/
  - https://cran.r-project.org/web/packages/stargazer/vignettes/stargazer.pdf
- Thomas Leeper's margins package readme
  - https://github.com/leeper/margins
- UCLA extensive list of R help topics:
  - http://www.ats.ucla.edu/stat/r/
- Various resources for tidy in R:
  - http://www.tidyverse.org/
  - https://www.r-bloggers.com/tidyr-0-5-0/
  - https://cran.r-project.org/web/packages/tidyr/vignettes/tidy-data.html
  - http://vita.had.co.nz/papers/tidy-data.pdf
  - https://blog.rstudio.org/2014/07/22/introducing-tidyr/

VI. ORGANIZATION OF COURSE

In-class meetings are a mix of lectures and skill-building exercises. The day-by-day content of the course is shown in Section X.

VII. ROLE OF FACULTY AND STUDENT

Students will:

1. Attend each class and arrive on time.
2. Participate in class exercises.
3. Complete readings & assignments.
4. Consult list of resources and instructor for assistance.
5. Provide instructor with feedback about the effectiveness of the course.

Note on attendance:

Students should not enroll for this class unless they expect to attend all class sessions. This course is comprised of only five classes, and each class after the first meeting begins with reviews of peer problem set submissions. Note that there will be time in each class session to work on the problem set for the subsequent meeting. Also note that different coding strategies for tackling statistical situations will be explored and explained in class as needs and questions arise. Because of the intensive and participatory nature of this course, student absences are extremely disruptive to the learning process. Students are expected to notify the instructor in advance of an expected absence and take initiative to complete work on time by seeking clarification on subject matter or particular assignments. In fairness to other students and the learning environment, the following will apply without exception:

- Absences of two days will result in the reduction of the student's final grade by a full letter level, e.g., if a student's performance in the course otherwise would have earned a grade of B, and s/he misses two days, s/he will receive a C for the course.
- With the exceptions of death in the immediate family, severe illness or injury, any student who is absent for three full days of class or its equivalent will be expected to drop the course or will receive a failing grade.

Instructor will:

1. Arrive to class prepared to deliver course material.
2. Be available and responsive to students during office hours, by appointment and email.
3. Provide timely feedback to students.
4. Retain the right to change the content and order of the lectures and exercises to meet the needs of the students who are enrolled in the course.

VIII. ASSIGNMENTS AND GRADING CRITERIA

Peer critiques will be completed during approximately the first 20 minutes of class in sessions 2 through 5. Students will receive a rubric with which to complete peer critiques. Problem sets are due at 2pm on class days, sessions 2 through 5, and the final problem set is due February 20 at 2pm. All assignments should be submitted through canvas. The instructor will also score problem sets according to the same rubric.

Late assignments:

The period in which peers' materials are available for critique will be set in Canvas and these will only be available in class during this time. Grades for problem sets turned in after 2pm on the due date will

result in the reduction of the problem set grade by a full letter grade, and another letter grade for each additional day past the time and date due.

Percentage	*Letter*
90 – 100	A
80 – 89	B
70 – 79	C
Below 70	F

Item	*Points*	*Total*
Peer critiques	4 @ 5 points each	20
Problem sets	5 @ 16 points each	80
Course evals	1 point	1

IX. MPH COMPETENCY ALIGNMENT TO ASSESSMENT OPPORTUNITY

MPH Competency(ies)	**Assessment Opportunity**
Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate.	Problem sets & peer critiques
Apply and interpret common statistical methods for inference (e.g., ANOVA, linear and logistic regression, survival analysis) found in public health studies.	Problem sets & peer critiques

X. COURSE OUTLINE

Readings are to be completed prior to the class session in which they are listed.

Date	*Topics*	*Readings*
1.16	Overview; basic operations & objects	1. Introduction; 3. Data Visualization; 4. Basics; 6. Scripts; 8. Projects
1.23	Data importing & management	5. Data Transformation; 11. Data import; 12. Tidy Data; 13. Relational Data; 18. Pipes
1.30	Data description & exploration	7. Exploratory Data Analysis; 28. Graphics for Communication
2.6	Statistical tests & models	Peruse “Statistics” sections online @ http://www.statmethods.net/
2.13	Data presentation, R Markdown, function	19. Functions; 29. R Markdown Formats