BIOST 509: Introduction to R for Data Analysis in the Health Sciences

Department of Biostatistics, University Of Washington

Autumn 2019

1 Instructor, teaching assistants & lecture information

- Instructor
  - Prof. Amy Willis, Ph.D.
  - Assistant Professor of Biostatistics
  - she/her
  - Office: F-657 Health Sciences
  - email: adwillis@uw.edu
- Teaching Assistants
  - Serge Aleshin-Guendel
    - PhD Candidate in Biostatistics
    - Office hours to be held in the Health Sciences Library
    - email: aleshing@uw.edu
  - Thayer Fisher
    - PhD Candidate in Biostatistics
    - Office hours to be held in the Health Sciences Library
    - email: thayerf@uw.edu
- Office hours
  - Amy Willis: Wednesdays 3-4pm in F-657 Health Sciences
  - Serge Aleshin-Guendel: Tuesdays 9:30-10:30 in Health Sciences Library
  - Thayer Fisher: Thursdays 12:30-1:30 in Health Sciences Library
- Lectures
  - Fridays 1:30pm - 3:20pm, Health Sciences Building T-wing, room 747
  - Please plan to bring a laptop to every class. You can check out a laptop for free from the UW Student Technology Loan Program (more information below).

2 Course description:

This course will introduce you to R for data analysis. The following specific topics are covered:

- installing R
- R scripts
- reading in data and writing output
- using help files
- using functions
- writing functions
- graphics
- R packages
- data manipulation
- loops
- permutation tests & bootstrapping
- fitting models

The course covers loading, transforming, summarising and plotting data. We will discuss fitting regression models; but interpretation, model specification, inference and prediction are not covered in this class. If you would like to learn about modeling/inference/prediction, you may be better served by BIOST 508, BIOST 511, BIOST 512, BIOST 517, or BIOST 518. **These courses use R too.** *More information about these options can be found at https://www.biostat.washington.edu/courses/sequences.*

3 Student learning goals

The objective of this course is to give you the **confidence** and **skills** to perform data analysis in `R`.

To achieve this goal, we will

- Learn the syntax of `R`
- Gain experience loading, transforming, summarising and plotting data
- Develop a repertoire of strategies to troubleshoot and expand your understanding of `R`, both within and beyond the scope of this class

4 Required texts and materials

This syllabus, the lecture slides, the in-class exercises, the homework materials, and other resources will be posted in our Canvas site: https://canvas.uw.edu/courses/1318439/announcements.

5 Prerequisites

An upper-division course in statistics/biostatistics, or permission of the instructor, is necessary for you to be enrolled in the course. *Please contact me to obtain permission to take the class if you have not completed an upper-division course in statistics/biostatistics.*

If you have not completed an upper-division course in statistics/biostatistics, BIOST 511, BIOST 514 and BIOST 517 are alternatives that do not have bio/statistics prerequisites and will introduce you to `R`.

6 Class schedule 2019

1. September 27 – Course logistics, intro to R syntax
2. **October 11** – `tidyverse`: Part 1
3. October 18 – `tidyverse`: Part 2
4. October 25 – Plotting data
5. November 1 – Linear regression in `R`
6. November 8 – Logistic regression and generalized linear models in `R`
7. November 15 – Advanced data manipulation
8. November 22 – Writing custom functions
9. **December 6** – Recap and further practice

There will be no lecture on October 4 (Week 2)

7 Class sessions

The general structure for lecture time will be approximately 60 minutes of lecture, approximately 5 minutes for a break, then approximately 45 minutes of in-class exercises. The TAs and I will be present to help you with the exercises, and your answers to the exercises will be due via Canvas at the end of the lecture time. Please plan to bring a laptop to every class. You can check out a laptop for free from the UW Student Technology Loan Program: https://stlp.uw.edu/equipment/laptops.

8 Course Grades

BIOST 509 is a CR/NC Class. In order to receive credit (CR) for this course, you must obtain at least 28 points out of a possible 32 points. There will be 8 homeworks (2 points each) and 8 in-class exercises (2 points each).

These points are easy to get! You get 2 points for a good effort on each homework (submitted on time), and 2 points for a good effort on each in-class exercise (submitted on time). Therefore to receive credit, simply attend class, complete 7 out of 8 in-class exercises, and 7 out of 8 homeworks.

8.1 In-class exercises

There will be in-class exercises made available at the beginning of every class and due at the end of every class (same day). Responses are due via Canvas. Each in-class exercise set is worth two points and graded as follows:

- 2 points: All responses are correct or show a thoughtful attempt at a solution; and the response is submitted on time
- 1 point: The response does not thoughtfully attempt all questions; and/or is turned in late
- 0 points: The response does not attempt any questions and/or is submitted more than one week late

The in-class exercises are short and are designed to be completed during class time.

8.2 Homeworks

There will be a homework set made available at the end of every class. It is to be submitted via Canvas before the next class. Each homework set is worth two points and is graded as follows:

- 2 points: All responses are correct or show a thoughtful attempt at a solution; and the response is submitted on time
- 1 point: The response does not thoughtfully attempt all questions; and/or is turned in late
- 0 points: The response does not attempt any questions and/or is submitted more than one week late

The homeworks are designed to reinforce your mastery of the skills covered in the lecture. They should be straightforward, and require less than 3 hours of work on average. If you are consistently spending more than 3 hours on the homeworks, please come to office hours so we can help you streamline your process.

8.3 Audit policy

Unfortunately we are unable to allow auditors for the class at this time.

9 Land Acknowledgment

I share the University of Washington's acknowledgement of the Coast Salish people of this land; the land which touches the shared waters of all tribes and bands within the Duwamish, Suquamish, Tulalip and Muckleshoot nations.

10 Course Policies

10.1 Course communication

10.1.1 Course updates

I will post any updates for the class using the Canvas Announcements. Please make sure that your Canvas settings for an "Announcement" will alert you "ASAP."

10.1.2 Contacting me

My contact info is on page 1 of this syllabus or you can contact me via Canvas. I will do my best to respond to emails as soon as possible, and within 48 hours (M-F).

If you have a question about `R`, to clarify a homework question, or have another question related to the course material, please post your question to the Discussion forum on Canvas. It is very likely that someone else will have the same question as you, and sharing your question with the class allows everyone to benefit. You are encouraged to help answer your peers' questions, too.

10.2 Use of technology in the classroom

Please plan to bring a laptop to every class to complete the in-class exercises. You can check out a laptop for free from the UW Student Technology Loan Program: https://stlp.uw.edu/equipment/laptops.

Laptops and other devices may be used for purposes directly related to class activities (e.g., in-class exercises and polls). Using devices for other activities (e.g., checking email or working on something else) detracts from our learning environment.

10.3 Learning environment

I take seriously my role as an advocate for your learning in this class. In addition to providing information, assignments and activities that I hope will support your learning, I will do my best to help us maintain the classroom as a supportive learning environment that respects diversity. On our first day of class *we will create ground rules together* to follow in promoting a productive learning environment for all members of the class. If you have a concern at any point in the course, I encourage you to communicate it to me. **Please let me know of ways to improve the effectiveness of the course for you personally, or for other students.**

10.4 Accommodations for students

10.4.1 Disability accommodations

I share the University of Washington's commitment to providing access, equal opportunity, and reasonable accommodation for students with disabilities. I am happy to work in conjunction with the Disabilities

Resources for Students office. If you would like information or to request disability accommodations, contact Disability Resources for Students (Seattle Campus) at 206.543.8924/V, 206.543.8925/TTY, or via email at uwdrs@uw.edu. If you have a letter from the Disabilities Resources for Students office indicating you have a disability that requires academic accommodations, please present the letter so we can ensure that you have the appropriate accommodations. **Regardless** of whether you have an official letter, please feel free to talk with me about any aspect of accommodations or accessibility.

10.4.2 Religious accommodations

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/).

10.5 Diversity and inclusion

Diverse backgrounds, embodiments, and experiences are essential to the critical thinking endeavor at the heart of university education. Therefore, I expect you to follow the UW Student Conduct Code in your interactions with your colleagues and us in this course by respecting the many social and cultural differences among us. These may include, but are not limited to: age, cultural background, disability, ethnicity, family status, gender identity and presentation, citizenship and immigration status, national origin, race, religious and political beliefs, sex, sexual orientation, socioeconomic status, and veteran status.

On our first day of class *we will create ground rules together* to follow in promoting a productive learning environment for all members of the class. I am committed to making this class an equitable learning environment. Please talk with me right away if you experience disrespect in this class, and I will work to address it as best I can. I hope you will feel comfortable speaking with me if you feel that I could make my classroom more inclusive. If you do not feel comfortable speaking with me, I encourage you to contact DCinfo@uw.edu, a resource for students with classroom climate concerns. If you make a request to me and you do not feel my response has been adequate, please contact the chair of the Biostatistics department: bchair@uw.edu.

10.6 Academic integrity

UW students are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity. The School of Public Health (SPH) is committed to upholding standards of academic integrity consistent with the academic and professional communities of which it is a part. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-120). I expect you to know and follow the university's policies on cheating and plagiarism, and the SPH Academic Integrity Policy. Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington Community Standards and Student Conduct website.

In this class, the following specific expectations apply:

- You are welcome to discuss the in-class exercises and homeworks with your classmates, but *e-mailing or copying of code from classmates is prohibited*
- You must submit your own solutions individually to the in-class exercises and homeworks

11 Learning Resources

UW has a number of free resources to support you as a student:

- UW Student Technology Loan Program
  - Loans laptops for free; bookings are required
  - https://stlp.uw.edu/equipment/laptops
- Statistical Consulting Services
  - Faculty and graduate students in the Consulting Program of the Departments of Biostatistics and Statistics offer free statistical advice to University of Washington faculty, staff, and students
  - 50 minute consultations are available by appointment
  - https://www.stat.washington.edu/news-resources/consulting
- Information Technology (UW-IT)
  - For any technology help, please call 206.221.5000 or email help@uw.edu.
  - http://www.washington.edu/itconnect/
- Counseling Center
  - For free counseling, assessment, referrals, etc.
  - http://www.washington.edu/counseling/
- Diversity Allies
  - Includes contact information for a number of networks, including the Q Center, Native and Tribal Relations, Southeast Asian Community, Education & Leadership Network, the Women's Center, and more: http://www.washington.edu/diversity/
- Student Parent Resource Center
  - Offering resources for student parents, including childcare assistance: https://osfa.washington.edu/wp/sprc/
- Veterans Center
  - Offering support for student veterans and their dependents: https://osfa.washington.edu/wp/veterans/
- UW Dream Project
  - Offering support for undocumented students: http://www.washington.edu/dreamproject/students/undocumented/

If you are looking for something that you don't see offered here, please let me know and I will do my best to help.

12 BIOST 509 Resources Acknowledgement

The course materials for BIOST 509 have benefited from many instructors' input. I am especially grateful to Lyn Brumback, Brian Leroux, Ken Rice, Mauricio Sadinle and Timothy Thornton. All errors are my own. If you see any errors, please let me know by email: adwillis@uw.edu.