PHP 1560/2560 Syllabus

Instructor:
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Teaching Assistants:
TBD
Lectures: Tuesdays and Thursdays 9-10:20

Course Goals

Statistical computing is an essential part of analysis as it enables us to pose and answer meaningful questions. Statisticians need to not only be able to run existing computer software but understand how that software functions and how to interact with data in a computational setting. As programmers, we will practice constructing a solution through logic and translating that logic into code with a focus on using these skills in statistical applications. This course will ask you to think in a computational manner by giving you a peek under the hood of R, focusing on key building blocks, and developing good coding practices. You will also learn to read and evaluate other's code through group exercises and using existing libraries in R.
After you complete this course, you will be able to:

- employ good coding practices by writing clear, efficient, documented, and tested code.
- be creative in writing programs using the key logical building blocks and available libraries.
- know how to analyze data, create compelling visualizations, and implement statistical simulations and optimizations to answer proposed questions.
- present your results and explain your computational approach.
- read, interpret, and critique other's code.

Course Logistics

This course will be taught in a "flipped" format. In a typical week, students will start by reading a series of computational notebooks that will include some short practice coding examples before coming to class. In class, students will start work on the weekly programming lab by working in small groups interspersed with class discussion. After class, students will complete and submit the notebook. The goal for the in-class work is to get you started applying the techniques and discussing different approaches. This practice will prepare you for the out-of-class questions which will then ask you to integrate these skills. Students should expect that the out-of-class portion will be shorter than in non-flipped classrooms to compensate for the pre-class preparation. Last, students will periodically complete a short peer review of another student's submitted notebook.

Prerequisites: Probability and statistical inference at the level of PHP 2510.

Course Websites (Canvas): The canvas site will contain all the information for this course including this syllabus, office hours, weekly course info, and posted grades. You will submit your jupyter notebooks through Canvas as well. Make sure that you are enrolled and that you check the site regularly.

Reading: The course will cover material found in the textbook below. The pre-class notebooks may also contain short video demonstrations and links to additional resources.

(Required) Irizarry, RA (2018). *Introduction to Data Science*. Free online.
`rafalab.github.io/dsbook`

If your Brown undergraduate financial aid package includes the Book/Course Material Support Pilot Program (BCMS), concerns or questions about the cost of books and course materials for this or any other Brown course (including RISD courses via cross-registration) can be addressed to bcms@brown.edu. For all other concerns related to non-tuition course-related expenses, whether or not your Brown undergraduate financial aid package includes BCMS, please visit the Academic Emergency Fund in E-GAP (within the umbrella of "E-Gap Funds" in UFunds) to determine options for financing these costs, while ensuring your privacy.

Course Assessment

Your course grade will be based on:

Pre-Class Assignments	10%
Weekly Labs	30%
Midterm Project	30%
Final Project	30%
Total	100%

Pre-Class Assignments To prepare for class, students will complete a series of computational notebooks that will include some short practice coding exercises. These exercises will be graded on a 0/1/2 scale. This will ensure that all students are prepared to work on the material in class. Students are expected to submit all pre-class assignments prior to class, and no late work will be accepted.

Weekly Labs and Participation The start of the weekly programming labs will be completed in class in small groups, but some problems will be left for students to work on outside of class. Completed labs should be submitted to Canvas by the end of the week. Further, students will be asked to periodically peer review another submission to reflect on good coding practices and to see another approach to the same problem. Students will have a bank of seven late days that they can use towards the weekly labs at their discretion.

With a flipped class, students are expected to participate in class. The instructor will coordinate with students who need to take this course remotely to create adjusted participation expectations.

Midterm Project (Due 10/28/22) The midterm project will be an individual project designed to help students integrate their programming and data skills through coding a larger scale problem and providing an accompanying computational notebook. The project should start with a question that can be answered using data and the programming skills acquired in the first-half of the course. An important aspect of the project will also be the clarity and documentation of the code.

Final Project (Due 12/15/22) The final project will be a group project building a Shiny App. Your app should will be an interactive and informative website focused on a topic of your choice. You will also create documentation so that others understand how to use your app and interpret any results.

Credit Hours and Time Expectations Over 14 weeks, students are expected to spend a total of 3 hours per week in class, 7 hours per week on class preparation and completing weekly labs, 15 hours on the midterm project, and 25 hours on the final project, for an overall total of 180 hours.

Course Expectations Students are expected to submit all pre-class assignments prior to class, and no late work will be accepted. Students are expected to participate in class with their small groups. Students will have seven late days that they can use towards the in-class weekly labs at their discretion.

The following schedule is tentative.

Week	Topics
Week 1 (9/8)	Class Intro
Week 2 (9/13, 9/15)	R Basics
Week 3 (9/20, 9/22)	Tidyverse
Week 4 (9/27, 9/29)	Working with Data
Week 5 (10/4, 10/6)	Logic and Loops
Week 6 (10/11, 10/13)	Graphics
Week 7 (10/18, 10/20)	Functions
Week 8 (10/25, 10/27)	Midterm Project Check-Ins
Week 9 (11/1, 11/3)	More Complex Functions
Week 10 (11/8, 11/10)	Debugging and Efficiency
Week 11 (11/15, 11/17)	Simulations and Optimization
Week 12 (11/22)	Simulations and Optimization II
Week 13 (11/29, 12/1)	Shiny Apps
Week 14 (12/6, 12/8)	Extra Topics, Project Help

Additional Information

Public Health Competency (Masters Level): Use statistical software for data management, implementation of comprehensive statistical analysis, and presentation of results.

This competency will be assessed through (1) weekly programming notebooks, (2) the midterm project addressing a larger question in a computational notebook, and (3) a final project creating a Shiny App. All of these assignments will involve data management and statistical analysis using student-developed, computational tools. The latter two assignments will be partially graded on presentation of the results through the notebook and app, respectively.

Academic Integrity You are expected to maintain the highest level of academic integrity in the course. Any violation will be penalized according to the Brown academic integrity code: `https://www.brown.edu/academics/college/degree/policies/academic-code`. In particular, sharing materials outside of this class will be treated as an academic code violation.

You are expected to communicate and interact with your classmates. You are welcome and encouraged to discuss projects and exercises with others as long as these interactions are consistent with your educational goals. For example, if you read someone else's code in order to learn a new technique and apply it to your own implementation, that is a good way to learn. But if you copy code you don't understand instead of learning to develop your own, you are violating the academic integrity code and undermining your own education.

Accessibility and Accommodations

Brown University is committed to full inclusion of all students. Please inform us early in the term if you have a disability or other conditions that might require accommodations or modification of any of these course procedures. You may speak with me after class or during office hours. For more information, please contact Student and Employee Accessibility Services at 401-863-9588 or SEAS@brown.edu. Students in need of short-term academic advice or support can contact one of the deans in the Dean of the College office.

It is our intent that students from all diverse backgrounds and perspectives will be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. We expect students to conduct themselves in a way that respects the experiences and identities of all members of the class. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let us know so that we can make arrangements for you.