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- X. Liu

Psyc148a (Summer 2026) Syllabus: Applied Statistical Computing in R

Overview

This syllabus contains all relevant information about the course: description, grading criteria, schedules of course materials and weekly assignments and due dates. Consider this your roadmap for the course. Please read through the syllabus carefully and feel free to share any questions that you may have.

Course information

Course number and title: PSYC148a Applied Statistical Computing Using R

Instructor: Xiaodong Liu (email: xliu0806@brandeis.edu)

Office Hours/Availability: no fixed office hour time, email me for individual meeting. I will reply within 24-36 hours (unless otherwise noted in a particular week).
All the meetings will be through zoom, office hours zoom meeting ID: 955 836 31000.

Class time: This summer course is an asynchronous online course. No fixed course time. Students may choose their own time in each week to study/complete the weekly course materials.

The course materials will be in course website with 10-week session, the first week starts on 06/01/2026 (Monday), the course ends on 08/07/2026 (Friday).

Course Week: from Sunday to Saturday (except the first week: Monday to Saturday).

Course Description

This course is designed for students with introductory statistics background who would like to learn to do statistical computing in R and who would like to further their understanding of inferential statistics and statistical modeling.

R is the platform for this course. It will be introduced in a way that helps make the connection between data preparation and

manipulation, data generation (simulation), data presentation (descriptively and graphically), statistical concepts, and statistical modeling. Additionally, through R programming, students will learn to document the analytic process for reproducibility of research work.

Topics of statistical computing include methods of describing data, numerical summary and graphical presentation of data, computing of probability, density, and quantiles based on given distributions (e.g., Gaussian distribution, t-distribution, F-distribution, Chi-square distribution, and binomial distribution), simulation and data generation, and writing functions for custom statistics. While the main theme of this course is on statistical computing with R, we will emphasize the applied aspect through using data from empirical studies.

Learning Goals

Students who successfully complete Psyc148A will be able to:

- Document the working process (e.g. statistical analyses that have been done) using R.
- Understand R environment and data types in R.
- Read data in different formats into R and manipulate data as desired.
- Export data from R to desired formats.

- Write scripts to generate numerical summary of data.
- Write scripts to present data graphically (and professionally).
- Compute probability or quantiles based on a given distribution.
- Generate (random) data based on a given distribution or hypothesized statistical model.
- Write functions to do customized analyses or generate non-standard statistics (e.g. a function to compute adjusted-correlation coefficient based upon sample size), and
- Implement general linear model (e.g. regression model and ANOVA model).

Learning strategies

In this course, we will follow the principle of “learning by doing”. Statistical concepts and theories will be introduced through applied examples. Students are expected to review and reinforce the key concepts through re-doing all the examples presented in course readings and through completing weekly assignment.

Prerequisites

No prior R experience is required. Some introductory statistics

experience will be helpful.

Credit Hours

This is a four-credit course. Success in this four-credit hour course is based on the expectation that students will spend on average 18 hours per week in this course.

Major Assessments

Tasks	Descriptions
Weekly assignment 70%	Students will complete nine weekly assignments by the designated deadline. Each assignment will cover the learning objectives specified in each week and earlier. The points of each assignment may

Tasks	Descriptions
	be different depending upon the problems asked, but each will be converted into a 100- scale when computing the final course grade. Each assignment will take the form of a single R Markdown file and a related HTML file. Details of grading criteria for each assignment will be given below.
Weekly Discussion forum 10%	Students are expected to actively participate in online discussion forum and activities (through posting your thoughts on and solutions to discussion questions, offering comments on the posts from other students, and asking or answering questions from other students). Details of grading criteria for discussion forum will be given below
Individual meeting 5%	Each student is epected to schedule

Tasks	Descriptions
	and have a 10-15 minutes zoom meeting with me (beginning week 5), to discuss their progress in this course and the topic/data for their final project
Final project presention 5%	The final project will help assess overall to what extent students achieve the learning goals. Students are expected to record a final project presentation and share the recording with the class. Details of the presentation will be given during the course
Final project paper 10%	Students are expected to submit an R markdow (Rmd) file and a related HTML or PDF file (based on the Rmd file) as their final project report. Details of grading criteria for the final project will be given in the instructions of the final project. The

Tasks	Descriptions
	final project will be due on 8/7/2026.

Grading criteria for weekly assignment

When doing a homework assignment, students shall NOT use any functions or packages not yet introduced in the then course materials (unless otherwise noted OR students already have knowledge of such functions or packages before seeing the assignment problems, in which case, students should include a note and appropriate citation in their work.)

Points_allocation	Descriptions
HTML file 5%	In week one, no HTML file. In all the other weeks, an HTML file will be submitted. The HTML file should include your name, additional references if relevant, and without

Points_allocation	Descriptions
	error message
R markdown file/script file 5%	In week one, you will submit an R script file. In all the other weeks, you will submit an Rmd file which should be knitted successfully into the HTML file you submited.
R script styles 10%	Good script styles: Easy to read and follow up; Appropriate and detailed comments; Appropriate indentation; Appropriate use of functions; Reasonable object names; Appropriate use of inline code chunks; and No extra or unnecessary scripts. With the exception of first two assignments, 15% deduction if failure on at least 2 criteria; 50% deduction for failure on 3 or more of the criteria.

Points_allocation	Descriptions
Completeness and Correctness 80%	Deductions will be made based upon points assigned to each problem and whether the scripts and answers are correct.
Late submission	Each assignment is due by 23:50, Saturday of the week (Boston local time). Your assignment will be automatically time-stamped when you submit your work through course website. Late submission will get zero points (unless with pre-arrangement or documented emergency, in which case, students should submit whatever they have done as soon as possible and may submit a finished version at a later time with permission from the instructor).

Grading criteria for discussion forum

The discussion forum in course website takes the place of discussions that would occur in a traditional classroom. Keep in mind that postings to the forums will be as rich as you make them. They are required so that you can reflect on the course materials and share your knowledge and ideas while gaining from the insights of your peers as well. The instructor will not lead these discussions but may facilitate through probing questions or comments to which you will be expected to respond.

The discussions are an extension of your academic work, so they will require a formal style of writing. They are not the equivalent to discussion postings that you may find in online media sites or in social media (See detailed grading criteria below).

For each week (except week 1), you should post and response to the discussion forum on at least 2 different days of the course week (and no later than Thursday if it's your initial post or no later than Saturday if it's your response to other student's post).

Post	Descriptions	Max_points
Thoughtful post with supporting evidence (if relevant)	Your post should reflect your effort and careful thoughts, including references or citations	5

Post	Descriptions	Max_points
	to weekly readings or other external references.	
Detailed response completeness	Answers all the question(s) completely.	3
Mechanics	Complete sentence, little to no spelling or grammatical errors.	2
Total points for post		10

Response	Descriptions	Max_points
Substantive	Follow-on points from your personal insights and/or from the readings, meet minimum requirement specified in each	4

Response	Descriptions	Max_points
	discussion.	
Mechanics	Complete sentence, little to no spelling or grammatical errors.	2
Total points for response		6

Late post and response: each week, your initial post should be no later than Thursday. Initial post 1 day late will get 4 points deduction; Initial post 2 days or more late will get 8 points deduction. Your response should be no later than Saturday. Response 1 day late will get 3 points deduction; and no response points if it is after Sunday.

Guideline for course letter grade

course.points	letter.grade
95 & above	A

course.points	letter.grade
90 to <95	A-
85 to <90	B+
80 to <85	B
75 to <80	B-
70 to <75	C+
65 to <70	C
60 to <65	C-
<60	no credit

Students who have already enrolled in a graduate program and would like to get graduate credit for this course will need to do extra problems given in some assignments and/or in the final project.

Note: B- is the minimum letter grade for graduate credits.

Accommodations

Brandeis seeks to create a learning environment that is welcoming and inclusive of all students, and I want to support you in your learning. If you think you may require disability accommodations, you will need to work with Student Accessibility Support (SAS). You can contact them at 781-736-3470, email them at access@brandeis.edu, or visit the Student Accessibility Support

home page. You can find helpful student FAQs and other resources on the SAS website, including guidance on how to know whether you might be eligible for support from SAS. If you already have an accommodation letter from SAS, please provide me with a copy as soon as you can so that I can ensure effective implementation of accommodations for this class. In order to coordinate exam accommodations, ideally you should provide the accommodation letter at least 48 hours before an exam.

Course Materials

There are no required textbooks. Students don't need to purchase any course material.

All required readings will be posted on the course website at least one week earlier before the topic will be discussed. All the course materials will be posted completely online, available at https://moodle.brandesi.edu. The site contains the course syllabus, assigned reading materials, links/resources to other course-related materials, discussion forum, practices and assignments, and due dates.

Here are a few references if you would like some additional readings:

Michael W. Trosset (2023). An Introduction to Statistical Inference and Its Applications with R. ISBN 9781032477725, CRC Press.

Pace, L.(2012). Beginning R – an introduction to statistical programming. New York: Apress. (online version may be available through Brandeis library)

Crawley, M. J. (2013). The R Book. Hoboken, N.J.: John Wiley & Sons Inc. (online version may be available through Brandeis library)

Temple, M. (2016). Simulation for Data Science with R. Packt publishing (advanced reading, devoted to simulation in R, online version may be available through Brandeis library)

Apps or Tools/Equipment

R (https://www.r-project.org) will be the statistical platform for this course. We will also use Rstudio (https://rstudio.com/products/rstudio/) for most of our course work. R is free, Rstudio has free version.

Details of getting R and RStudio will be given in first week.

Students will need a computer or similar equipment for this course.

Student Equipment/Course Supply Needs and Available Support

For those who experience financial challenge to secure the minimal set of hardware, software, and/or course related supplies that are needed to be successful in this course, undergraduate students from Brandeis School of Arts and Sciences should contact Student Financial Services to discuss options available to purchase equipment and other technology and supply needs. Graduate School of Arts and Sciences students should contact Financial Aid in GSAS. Students from other school should contact their corresponding school main office. The library has short-term laptop loan program if needed.

Library

“The Brandeis Library collections and staff offer resources and services to support Brandeis students, faculty and staff. These include workshops, consultations, collaboration, materials and instruction on emerging trends in technologies such as machine learning, emerging trends in research such as data visualization, and emerging trends in scholarship such as open access. Librarians at the Circulation Desk, Research Help Desk, Archives & Special Collections, Sound & Image Media Studios, MakerLab, AutomationLab, and Digital Scholarship Lab are available to help

you.”

Academic Integrity

“Every member of the University community is expected to maintain the highest standards of academic integrity. A student shall not submit work that is falsified or is not the result of the student’s own effort. Infringement of academic honesty by a student subjects that student to serious penalties, which may include failure on the assignment, failure in the course, suspension from the University, or other sanctions (see Section 20). A student who is in doubt regarding standards of academic honesty as they apply to a specific course or assignment should consult the faculty member responsible for that course or assignment before submitting the work. Students may not drop or withdraw from a course while an allegation of academic dishonesty is pending.” (from the 2025-2026 edition of Rights and Responsibilities).

Please consult Brandeis University Rights and Responsibilities for all policies and procedures related to academic integrity. When you submit your work through course website, your submitted work may be checked by software or programs to verify originality. Allegations of alleged academic dishonesty will be forwarded to the Department of Student Rights and Community Standards. Citation and research assistance can be found at Brandeis Library Guides - Citing

Sources.

Policy on the use of generative AI tools

All work students submit for this course will be their own. In instances when collaborative work is assigned, the assignment should list all team members who participated. Students may use generative artificial intelligence (AI) tools in this class, if they find that such tool may help their learning and understanding of the course materials. When such AI tools is used while you work on the course assignment and report, appropriate citations and references (e.g. the key words or phrases you used as input for the AI tools) have to be included in your work. Violations of this policy will be considered academic misconduct.

Learning how to use AI tools ethically and responsibly is quite important these days. However, be aware of their limitations and the need to properly cite them in your work. To do so:

- assume that any AI output is the product of its imagination (no matter how convincing it may seem) and fact-check each argument. Errors and omissions are your responsibility.

To fully acknowledge the use of AI, you shall make sure to:

- first, cite it appropriately. For example, text generated with the help of ChatGPT should be credited using the following format:

> ChatGPT (YYYY, Month DD of query). Text of your query. Generated using OpenAI. https://chat.openai.com/.

Content generated using other AI tools should follow a similar citation format.

> next, include a paragraph explaining how you used AI, including the full list of your prompts and, if possible and relevant, the AI-generated responses. This can be submitted as a separate document.

In this course, the use of any AI tools without appropriate acknowledgement is a violation of academic integrity. You may be asked to show the proof of your work for any course assignment where it is appropriate.

We draw your attention to the fact that different classes at Brandeis could implement different AI policies, and it is the student's responsibility to conform to expectations for each course. In the situation where this policy is in conflict with Brandeis University adopted/required policy, we will follow the university policy.

Course Plan

The weekly schedule here is subject to change/adjust by the

instructor.

- Week 01 (6/1-6/6):
    - Course expectations
    - R & RStudio installation and interfaces
    - R Console, R script/document

- Week 02 (6/7-6/13):
    - R markdown
    - R working directory
    - data structure (1): basic data type, vector

- Week 03 (6/14-6/20):
    - R data structure (2): matrix, data frame & list
    - R built-in function
    - functions related to vector, matrix, data frame & list
    - functions related to descriptive statistics (mean, sd, quantiles)

- Week 04 (6/21 - 6/27):
    - R data structure (3): factor, Conditional processing, and loop
    - Functions and statistics helping get to know the data
    - User defined function

- Week 05 (6/28-7/4):
    - Discrete random variable (e.g. binomial distribution), probability mass function
    - Continuous random variable (e.g. normal distribution), probability density function
    - R functions related to distributions
    - Simulation (of data with given distributional property)

- Week 06 (7/5-7/11):
    - Data import/export in R
    - Data manipulation, data merging and concatenation
    - Data transformation
    - Sample statistic as random variable
    - Sampling distribution through simulation
    - Central limit theorem and the law of large numbers through simulation

- Week 07 (7/12 & 7/18):
    - The idea of Monte Carlo Simulation
    - Review of hypothesis testing, hypothesis testing through simulation
    - Statistical analyses for two-group or multi-group design in R

- Week 08 (7/19 & 7/25):

    - package ggplot2
    - Graphical presentation of relations between continuous variables
    - Functions related to correlation and simple regression

- Week 09 (7/26 & 8/1):
    - General linear modeling in R

- Week 10 (8/2 & 8/7):
    - Review and final project presentation and report