

PHP 2580 Statistical Inference II

Spring Semester 2024

General Information

Canvas: <https://canvas.brown.edu/courses/1094217>

Class time and location: 121 South Main Street 331, Mondays and Wednesdays 10:30 – 11:50am

Instructor: Youjin Lee (youjin_lee@brown.edu)

Office Hours: Thursdays 9-10am at SPH 704

Course Summary

This course provides theoretical and methodological knowledges on how to do statistical inference with data. The course is focused on asymptotic behaviors of different estimators and test statistics, statistical decision theory, M-estimation, and statistical learning.

Goals and Expectations

The course mainly consists of three parts: lectures, assignments, and exams, all of which are closely connected with each other. First, students are expected to come to class on time, ready to study each week's topics. To do so, students are highly encouraged to read the textbooks assigned at each lecture. Assignments are mostly to solve problem sets covered during the lecture.

Credit hours and time expectations

Over 13 weeks, students are expected to spend 3 hours in class, 4 hours on reading the textbooks, and 3 hours on Problem Sets per week (130 hours total). Students are expected to spend up to 40 hours reviewing the course materials and taking part in office hours for the exam preparation. The (in-class and oral) midterm and final exam will take about 5 hours and 3 hours, respectively (180 hours total).

Pre-requisites

Statistical Inference I and a solid foundation in calculus and real analysis.

Assessment:

- 25% Problem sets
- 20% Midterm Exam (in-class)
- 25% Oral Exam (by appointment)
- 30% Final Exam (in-class)

Problem sets

Students will complete a total of eight problem sets throughout the semester. Problem sets will primarily cover the topics from the lectures for the most recent week (as of the due date). Each problem set will equally affect the course grade. Problem sets will be assigned on Wednesdays and will be due on the following Friday by 11:59pm. While students are encouraged to discuss homework problems together, the actual document that is turned in must be each student's own work.

*Midterm Exam (in-class only, **March 6 Monday**, 60 minutes)*

The format of the Midterm Exam will be similar to that of Problem Sets. It will encompass the subjects up until Asymptotic Theory. The exam will be conducted under closed-book conditions. A double-sided one-page A4 size cheat sheet will be allowed.

Oral Exam (by appointment, between 3/5 and 3/20, 30 minutes)

The instructor and each student set a 30-minute appointment after March 4th and the student will be asked about the concepts covered in the lectures and to derive the answers for one or two problems. Please contact the instructor via an e-mail between 2/12-2/25.

Final Exam (in-class only, **May 6 Monday**, 90 minutes)

The format of the Final Exam will be similar to that of the Midterm exam. It will cover the subjects up until the last lecture.

Late or missed assignments

Problem sets must be turned in online at or before the posted due date. Every one-day (24 hours) of delay will result in a ten-point (out of 100) downgrade.

Letter grades are based on the following cut-offs:

A = 90% of higher

B = 80-89%

C = 70-79%

F = less than 70%

Course materials

B&S Boos, D. D., & Stefanski, L. A. (2013). Essential statistical inference: theory and methods (Vol. 591). New York: Springer.

There are two textbooks of which some sections are used during the class. The online version is available at Brown Library.

Berger Berger, James O. Statistical Decision Theory and Bayesian Analysis. 2nd ed. New York, N.Y: Springer, 1985. Print.

TR&J Hastie, T., Tibshirani, R., Friedman, J. H., & Friedman, J. H. (2009). The elements of statistical learning: data mining, inference, and prediction (Vol. 2, pp. 1-758). New York: springer.

Course outline

Dates	Lecture	Reading
1/24	Course overview and review of preliminaries	B&S 1
1/29, 1/31	Likelihood representation	B&S 2.1-2.3
2/5, 2/7, 2/12	Likelihood-based estimation	B&S 2.5-2.7, B&S 6.5
2/14, 2/21	Likelihood-based tests	B&S 3
2/26, 2/28, 3/4, 3/13	Asymptotic theory and review	B&S 6
3/6	In-class midterm	
3/18, 3/20, 4/1, 4/3	Statistical decision theory	Berger 1,2,3,4
4/8, 4/10, 4/15, 4/17	M-estimation	B&S 7
4/22, 4/24	Monte Carlo methods and resampling procedures	B&S 9, 10, 11
4/29, 5/1	Overview of statistical learning and review	TR&J
5/6	In-class final exam	

*No class on 3/11 due to the conflict with the ENAR conference

Books, Supplies, and Materials

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 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.

Accessibility and Accommodations

Brown University is committed to full inclusion of all students. Please inform me early in the term if you may require accommodations or modification of any of course procedures. You may speak with me after class, during office hours, or by appointment. If you need accommodations around online learning or in classroom accommodations, please be sure to reach out to Student Accessibility Services (SAS) for their assistance (seas@brown.edu, 401-863-9588). Students in need of short-term academic advice or support can contact one of the academic deans in the College.

COVID-19 Plans and Protocols

We will follow University requirements and guidance.

Class Recording and Distribution of Materials

Lectures delivered in-person will not be recorded. The Canvas site can only be accessed by students enrolled in the class. Lectures and other course materials are copyrighted. Students are prohibited from reproducing, making copies, publicly displaying, selling, or otherwise distributing the recordings or transcripts of the materials. The only exception is that students with disabilities may have the right to record for their private use if that method is determined to be a reasonable accommodation by Student Accessibility Services. Disregard of the University’s copyright policy and federal copyright law is a Student Code of Conduct violation.

Use of Technology to Support Your Learning in This Course

This course will use Canvas and Zoom. The instructor is committed to ensuring access to online course resources by students. If you have any concerns or questions about access or the privacy of any of these platforms, please reach out to the instructor. The IT Service Center (<https://it.brown.edu/get-help>) provides many IT Services including remote assistance, phones, tickets, and chat. Please also see the Online and Hybrid Learning Student Guide.

Students with Special Needs

Brown University is committed to full inclusion of all students. Students who, by nature of a documented disability, require academic accommodations should contact the professor during office hours. Students may also speak with Student and Employee Accessibility Services at 401-863-9588 to discuss the process for requesting accommodations.

Diversity Statement

This course is designed to support an inclusive learning environment where diverse perspectives are recognized, respected, and seen as a source of strength. It is our intent to provide materials and activities that are respectful of various levels of diversity: mathematical background, previous computing skills, gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

English Language Learners

Brown University welcomes students from around the world, and the unique perspectives international students bring enrich the campus community. To empower students whose first language is not English, an array of ELL support is available on campus including language and culture workshops and individual appointments. For more information about English Language Learning at Brown, contact the ELL Specialists at ellwriting@brown.edu.

Guidance on the use of AI tools for assignments

The instructor acknowledges the utility of AI tools (e.g., ChatGPT) for educational purposes. However, it should be used with cautions, particularly when students may not have the ability to determine whether the AI-generated responses are correct or not. The primary purpose of assignments is to support students in learning and receiving timely feedback from both the instructor, rather than evaluation. These assignments are also important for the instructor to learn how or whether students understand the materials so that she can adjust the level of exams. In that sense, it is highly encouraged for students to initially tackle the assignments unaided by AI so that they could identify parts that require additional time to understand.