

Stat 156: Causal Inference (Fall 2024)

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- Units: 4
- Lectures: Tuesday and Thursday 11:00 am – 12:29
- Office hours
 - GSI: Mondays: 2-4 PM and Tuesdays: 9:00-11:00 AM, Evans 428
 - Instructor: Thursday 4-5 PM, Evans 427
- GSI lab sessions: Mondays 10 am – 12pm and 4-6 pm Evans 340
- GSI: Mingrui Zhang (PhD student in Biostatistics)
- Course website: <https://stat156.berkeley.edu/fall-2024/>

This course provides an introduction to causal inference using the potential outcomes framework and causal diagrams. We will cover topics such as randomized experiments, observational studies, instrumental variables, and mediation analysis. We will discuss applications of these methods to a variety of fields such as medicine and public policy.

The course emphasizes both theory and data analysis. Lectures present concepts and methods, and lab sections focus on applications, derivations, and worked problems often using the statistical language R.

Consult the [course website](#) for updates, homework assignments, reading assignments, and course-related announcements. We will use bCourses to release solutions for homework and the midterm. Grades will be released on Gradescope. We use Ed for discussion outside the classroom.

Students with disabilities please use the [DSP](#) to register any accommodations you may need for physical, mental or learning disabilities. The [Academic Accommodations Hub](#) provides many resources relevant to accommodations and supportive measures.

Textbooks

Course readings will be drawn primarily from the following textbooks:

- Ding, P. (2024). *A first course in causal inference*. CRC Press. Available for purchase in print [here](#). Add promotion code JSM24 for additional discount (good thru end of September). A slightly older version is available on [arXiv](#) for free.
- Robins, J., & Hernán, M. A. (2020). *Causal inference: what if*. CRC Press. Available online [here](#) for free.

Prerequisites

- Stat 135 (if you have taken an equivalent course and/or CS 189, ask me by email for permission to take the course)
- Stat 151A recommended
- Software R and LaTeX

Evaluation

Grades will be determined according to:

- Homework (30%): Assignments every other week on theory and data analysis. The GSI will provide details on submitting homework. We recommend working on the homework collaboratively with your classmates. Each student must hand in their own solutions. It is not acceptable to photocopy/reproduce someone else's answers. When the problem requires computer code, make sure you submit the code as part of your solution. Your lowest homework score will be excluded from the grade calculation.
- Midterm (15%): October 29, in class
- Scribe notes (5%). Students will be in charge of scribing lecture notes in LaTeX. Each student will sign up to scribe one lecture, along with 1-2 of their peers, in a shared Overleaf. Tuesday scribes must release the lecture notes by the following Friday and Thursday scribes must release the lecture notes by the following Monday.
- Group project with a presentation & final report (35% for final report; 15% for presentation). Project teams will be assigned randomly. The GSI will provide more information later in the semester. Presentations will occur in class during the last lectures of the semester (on 12/3 and 12/5) to allow students time to incorporate feedback into the final report. Presentations will be recorded by Course Capture. The recording will be available to the instructor and GSI only. The final report should be 15-20 pages. If your project involves analyzing data, make sure the data is publicly available.

The final report is due on 12/10/2024. Please note that this is during RRR and plan accordingly.

Late assignments will not be accepted. We will drop your lowest homework grade (as noted above).

Academic Integrity

Code of Student Conduct is available at <https://conduct.berkeley.edu/code-of-conduct/>.

It is not permissible to communicate with other students during an exam. All questions should be directed to the instructor or GSI.

Wellness

Wellness is important but can sometimes feel challenging during the demands of the semester. I encourage you to make mental wellbeing a priority. The university has resources for ensuring [basic needs](#). If you are in a crisis, call a counselor at [\(510\) 642-9494](tel:5106429494) (Monday - Friday, 8:00

AM - 5:00 PM) or [\(855\) 817-5667](tel:8558175667) (other hours). UHS offers many [resources](#) for maintaining mental health. You may find wellness resources on [recalibrate](#). I am also available to chat, listen and share my own wellbeing journey and practices.

Other policies

No laptops allowed in class (first lecture excluded). Laptops distract from the lecture. Lecture notes will be available later so just allow yourself to be present and fully attentive!

Please refer to me as Professor Coston or Dr. Coston in both emails and in-person interactions.

Course Outline

The planned topics for the course are

- Association and paradoxes (week 1)
- Potential outcomes framework (week 2)
- Randomized experiments (week 2, 3)
- Unconfounded observational studies (weeks 4, 5, 6)
- Instrumental variables (weeks 7,8)
- Sensitivity analysis (week 9)
- Negative controls (week 10)
- Principal stratification and mediation (week 11)
- Modern methods (week 12)