Causal Inference (36-731/732)

Fall 2026

Schedule: Monday/Wednesday, 12:30-1:50pm
Tepper 2400

Instructor: Edward Kennedy (edward@stat.cmu.edu)
Instructor Office Hours: 2:00-3:00 Mondays at Baker 132J

Teaching Assistant: Elsa Palumbo (epalumbo@andrew.cmu.edu)
TA Office Hours: 11:00-12:00 Thursdays at TBA

Objectives

Upon completing this course, you should be able to define counterfactual parameters, state and assess the assumptions necessary for identification, and describe and implement various tools for estimation, across the variety of causal settings discussed over the semester.

Textbooks

Rather than following a single textbook, we will use course notes and readings from the literature. However, useful textbooks are:

- Hernan & Robins: "Causal inference" (available here)
- Wager: "Causal Inference - A Statistical Learning Approach" (available here)

Other introductions can be found in:

- Ding: "A First Course in Causal Inference" (available here)
- Imbens & Rubin: "Causal inference for statistics, social, & biomedical sciences"
- Morgan & Winship: "Counterfactuals and causal inference"
- Pearl: "Causality: models, reasoning, and inference"
- Rosenbaum: "Observational studies"
- van der Laan & Rose: "Targeted learning"

and for more advanced treatments consider:

- Tsiatis: "Semiparametric theory and missing data"
- van der Laan & Robins: "Unified methods for censored longitudinal data and causality"

Course Outline

Planned topics for the course include:

- randomized experiments
- unconfounded observational studies
- matching, weighting, & regression
- nonparametric efficiency theory
- instrumental variables
- time-varying treatments
- continuous treatment effects
- marginal structural models
- dynamic & stochastic interventions
- mediation
- heterogeneous effects
- bounds & sensitivity analysis
- interference

Grading

Grades will be weighted as follows:

Homework	60%
Course Project	30%
Class Attendance & Participation	10%

Homework

Problem sets will be assigned approximately once every 3 weeks, and should be downloaded and submitted via Gradescope (link). Clear writing and presentation are important and will be weighted highly along with correct solutions. Late homeworks will not be accepted, apart from exceptional circumstances where prior permission is given.

Final Project / Exam

There will be a final project at the end of Mini 2. This will be a review of a topic or paper(s) of interest, or a draft of a new contribution; this could be on a generalization/extension of something we covered in class, or a new topic altogether. There may also be a smaller project or take-home exam at the end of Mini 1.

Participation

Attendance and in-class participation is an important part of learning. You will get the entire 10% if during at least 50% of lectures you ask substantive non-trivial questions. Office hours discussions can also play a role, but it is particularly important for us to have discussions during lectures. Remember: if you have doubts about something we are discussing in class, it is likely that someone else does as well; further, actively engaging with material (as opposed to passively listening and not clarifying questions you have) will improve learning outcomes.