

Statistics 265 Causal Inference --- Spring 2018

Instructor: Professor Hal Stern
Department of Statistics
2216 Bren Hall
ph: 824-1568
email: sternh@uci.edu
course web: www.ics.uci.edu/~sternh/courses/265/
office hour: Tu 2:00-3:00pm

When: Tu Th 12:30-1:50pm

Where: Donald Bren Hall 1422

Course goals: The course will consider various approaches to causal inference, including the potential outcomes framework (Rubin causal model) and the structural causal / graphical model framework. Topics include randomized experiments, observational studies, treatment assignment mechanisms, matching, linear models and instrumental variables, and sensitivity analysis.

Prerequisites: Statistics 200ABC (graduate level statistical theory), Statistics 210 (linear models). Statistics 211 and 212 wouldn't hurt but they are not listed as prerequisites in the catalogue!

Grading and Course Requirements:

- (1) There will be approximately 3 homework assignments during the quarter.
- (2) There will be a single exam about $\frac{3}{4}$ of the way through the course, May 17, 2018;
- (3) Students will be expected to do a project (solo or in groups of size 2 or 3). The projects will be presented in short papers and in 20 minute talks during the last week of class and finals week (June 5-7, 12-14). Details to come. Grades will be determined by performance on this work as follows: homework (25%), project (30-40%), exam (35-45%).

Software: Assignments may require computation; if so any software can be used but I will focus on R.

Topical Outline/Reading for Lectures (IR=Imbens/Rubin; PGJ=Pearl/Glymour/Jewell)

Week(s)	Topics	Reading
1	Introduction to causal modeling and counterfactuals; Treatment assignment mechanisms; Missing data	IR: 1-3
2-3	Causal inference in randomized experiments	IR: 4-9
3-4	Mathematics of Causation	PGJ: 1.4-1.5, 2, 3.1-3.6, 4.1-4.3
5-6	Causal inference in observational studies – design (propensity scores, matching)	IR: 12-16
6-8	Causal inference in observational studies – analysis (approaches, estimates, variances)	IR: 17-20
8-9	Special topics (unconfoundedness, noncompliance in experiments, causes of effects)	IR: 20-23
10	Project presentations	

References:

Text: *Causal Inference for Statistics, Social, and Biomedical Sciences* – G.W. Imbens and D.B. Rubin; Cambridge University Press, 2015.

Secondary text: *Causal Inference in Statistics: A Primer* – J. Pearl, M. Glymour, N.P. Jewell; Wiley, 2016.

Other texts:

Mostly Harmless Econometrics – J. Angrist and J.-S. Pischke; Princeton University Press, 2008.

Data Analysis Using Regression and Multilevel/Hierarchical Models (Ch. 9-10) – A. Gelman and J. Hill; Cambridge University Press, 2007.

Counterfactuals and Causal Inference – S.L. Morgan and C. Winship; Cambridge University Press, 2007.

Causality: Models, Reasoning and Inference – J. Pearl; Cambridge University Press, 2009 (2nd edition).

Elements of Causal Inference – J. Peters, D. Janzing, and B. Scholkopf; MIT Press, 2017.

Design of Observational Studies - P.R. Rosenbaum; Springer, 2010.

Observational Studies – P.R. Rosenbaum; Springer-Verlag, 1995.

Matched Sampling for Causal Effects – D.B. Rubin; Cambridge University Press, 2006.

We will also read selected papers. This will generally be provided as PDFs as we go.