Statistics 265  Causal Inference --- Spring 2018

Instructor:  Professor Hal Stern  
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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 ¾ 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/Jewll)

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


Other texts:  
*Data Analysis Using Regression and Multilevel/Hierarchical Models* (Ch. 9-10) – A. Gelman and J. Hill; Cambridge University Press, 2007.  
*Observational Studies* – P.R. Rosenbaum; Springer-Verlag, 1995.  

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