



STA 7934

Spring 2022

Advanced topics in causal inference

Instructor: Joseph Antonelli

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Office hours: Wednesdays: 10:00am-11:00am, Thursdays: 1:45pm-2:45pm.

Zoom link (when necessary): <https://ufl.zoom.us/j/5347192919>

Course Website: [e-Learning](#)

Course Prerequisites: It is expected that you will have taken classes on probability, inference, and regression.

Course lectures: Attendance for lectures is strongly recommended and will take place every Tuesday from 11:45am to 1:40pm, and every Thursday from 12:50pm to 1:40pm in FLI 0113.

Course Notes/Material: Notes for the week will be posted at the beginning of each week on the course website. These should contain nearly all of the material that we cover in class, however, I will present some additional material in the lectures that is not posted on the course website.

Software: We will be using the R software language throughout. R is free and should be easy to download on your personal computer. I also highly recommend running R through RStudio, though it is not a requirement. If you have any problems downloading R or RStudio, feel free to talk to me. If you do not have access to a computer, please reach out to me via email.

Required Text: None

Course Description: Overview of the field of causal inference. We will begin with an introduction to causal inference and potential outcomes. We will then proceed through a range of topics in causal inference such as randomized trials, estimation and identification in observational studies, non-binary treatments, sensitivity analysis, mediation analysis, treatment effect heterogeneity, regression discontinuity designs, panel data methods, longitudinal treatments, and the applications of machine learning to causal inference. If time permits we will discuss other issues such as post-treatment confounding, interference, or semiparametric efficiency.

Course Objectives: The goal of this course is to develop an understanding for when and how we are able to infer causality from data. At the end of this course you should understand different designs and identification strategies, as well as how to subsequently estimate causal effects in these settings.

Homework

There will be a couple of homework assignments spread throughout the semester.

Presentations

We will be giving presentations as well in the second half of the semester. Students will be required to cover a paper that the entire class will read beforehand, and lead a discussion on different aspects of the manuscript.

Grade Distribution

Homework	60%
Presentation	40%

Letter Grade Assignment: Grades will be assigned as follows: 90-100, A; 87-89.9, A-; 84-86.9, B+; 80-83.9, B; 77-79.9, B-; 74-76.9, C+; 70-73.9, C; 67-69.9, C-; 64-66.9, D+; 60-63.9, D; 55-59.9, D-; 0-55, F

The numeric scores will be rounded to the nearest tenth.

Make up Policy: Requirements for class attendance and make-up exams, assignments, and other work in this course as well as policies regarding absences, religious holidays, illness and student athletes are consistent with [UF Attendance Policies](https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/) (<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>)

Dropping and Withdraw

For late course drops and course withdrawals please visit <https://catalog.ufl.edu/UGRD/academic-regulations/dropping-courses-withdrawals/>

Incomplete

An incomplete grade may be assigned at the discretion of the instructor as an interim grade for a course in which the student has completed a major portion of the course with a passing grade, been unable to complete course requirements before the end of the term because of extenuating circumstances, and obtained agreement from the instructor and arranged for resolution of the incomplete grade in the next term. Instructors are not required to assign incomplete grades. For complete details please visit [CLAS incomplete grade policies and forms](https://www.advising.ufl.edu/academicinfo/clas-policiesprocedures/incomplete-grades/).

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Accommodating Students with Disabilities

Students requesting accommodation for disabilities must first register with the Dean of Students Office. The Dean of Students will provide documentation to the students who must then provide this documentation to the instructor when requesting information. You must submit this documentation prior to submitting any assignments for which you are requesting accommodation.

Academic Misconduct: Students are held accountable to the [UF Honor Code](#).
(<https://sccr.dso.ufl.edu/process/student-conduct-code/>)

Evaluations: Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

Additional resources: Any additional resources including academic support or information technology can be found at <https://www.ufl.edu/about/offices-services/>

Weekly breakdown of the material:

Week 1 – Introduction

Week 2 – Randomized trials

Week 3 – Identification and estimation in observational studies. Regression and matching.

Week 4 – Identification and estimation in observational studies. Weighting and DR estimation.

Week 5 – Non-binary treatments

Week 6 – Sensitivity analysis

Week 7 – Mediation analysis

Week 8 – Treatment effect heterogeneity

Week 9 – Regression discontinuity design

Week 10 – Panel data methods

Week 11 – Longitudinal treatments

Week 12 – Machine learning and high-dimensional confounder spaces

Week 13 – Post treatment confounding

Week 14 – Semiparametric efficiency