STA7934 **Modern Methods for Causal Inference** **Fall 2023**

Instructor: Bikram Karmakar (bkarmakar@ufl.edu).

Class hours: Tuesday | Period 7 (1:55 pm–2:45 pm), Thursday | Period 7-8 (1:55 pm–3:50 pm).

Classroom location: Griffin-Floyd Hall (FLO) 230.

Course website: Canvas page. Please check regularly.

Instructor's office: 226 Griffin-Floyd Hall (FLO). (Phone. 352-273-2994)

Instructor Office Hours: Fridays 3:00 pm–5:00 pm, or by appointment.

Note: Tentatively, lectures on Sep 12 and Oct 24 will be delivered over Zoom.

Objectives:

To train graduate students in methods of causal inference, with a focus on inference from large cross-sectional, panel and complex-longitudinal studies. The course will emphasize methodological development to draw causal inference, which will include understanding assumptions, establishing identification results, estimation method and inference strategy.

Since the focus will be on methods, in some cases, the materials will point to more technical results for additional reading.

Topics:

- Potential outcomes model; the role of the ignorablity and overlap assumptions (1 week)
- Methods for cross-sectional data (2.5 weeks)
  - Matching methods
  - Propensity score weighting
  - Weighting methods – Balancing and stabilizing weights
- Instrumental variables method (2 weeks)
- Methods for panel data
  - Difference-in-differences (2 weeks)
    - Parallel trends assumption
    - Use of multiple time periods
    - Instrumented difference-in-differences
  - Two-way fixed effects model – classical approach and modern interpretation (1 week)
  - Synthetic controls method (1.5 weeks)
- Clustered data (aggregated vs fine-grained data) (1 week; if time permits)
- Complex longitudinal studies (1 week)
  - Static and dynamic treatment regime
  - g-formula for causal inference

Course materials

Lecture notes: Lecture notes/overheads will be posted on Canvas. They are not meant to be substitutes for the lectures. You are responsible for learning all the material presented during the lecture. The lecture notes may not reproduce everything covered in the lectures. On occasions, there may be additional information in the lecture notes.

Computing: We will use the free statistical computing language R. You should download it from `https://www.r-project.org`. You may wish to also download Rstudio from https://www.rstudio.com (go to `https://www.rstudio.com/products/rstudio/` download to get the free Open Source License).

Course structure

Homework assignments: There will be approximately 4 short homework assignments.

Take-home mid-term exam: The mid-term will be a take-home exam. You'll have 2 days to complete the exam.

Presentations: The final evaluation will be based on a 15-20 min individual presentation. The presentation may be on a relevant topic based on a few research papers or on your own work that uses methods covered in this course.

Attendance: Classroom lecture attendance and participation is expected.

Grading: Grading will be based on a composite score: 5% class participation + 25% homework assignments + 30% from take-home mid-term exam + 40% final presentation.

Final letter grades will be assigned based on the University's grading scale that includes minus-grades (this may change depending on any changes in policies). You can familiarize yourself with the University's grading policy here: `https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx`.

Tentatively, we will follow the following percent to letter grading scale: $A = 95$–100 or above, $A- = 90$–94, $B+ = 85$–89, $B = 80$–84, $B- = 75$–79, $C+ = 70$–74, $C = 60$–69, $C- = 50$–59, and so on. The lower limits on this grading scale may be lowered. The calculation of your final composite score will be done outside of Canvas using the details provided above. Please note that the formula used by Canvas will not necessarily produce the final average according to the course grading scheme.

Course Policies

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, `dso.ufl.edu/drc`) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: `catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/`

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Relevant links: gatorevals.aa.ufl.edu/students/; ufl.bluera.com/ufl/; gatorevals.aa.ufl.edu/public-results/.

https://policy.ufl.edu/policy/masking-and-physical-distancing/

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.