Instructor: Grant Schoenebeck
Lecture: Tuesday and Thursday; 10am-11:30am Location Zoom: https://umich.zoom.us/j/92395119986
Email: schoeneb@umich.edu
Office Hours: Tuesday 1-2pm (public) https://umich.zoom.us/j/98442586030
      Tuesday 2-3pm (private by appointment) https://umich.zoom.us/j/99488958193

Introduction

As the internet draws together strategic actors, it becomes increasingly important to understand how people interact with computational artifacts. In this course we will study this interaction, focusing on reasoning about incentives and strategy. We will use game theory, which models and reasons about interactions between strategic agents, and mechanism design which studies how to design systems that take agent strategies into account.

On-line auction sites (including search word auctions), cyber currencies, and crowd-sourcing are all obvious applications. However, even more exist such as designing non-monetary award systems (reputation systems, badges, leader-boards, Facebook “likes”), recommendation systems, and data-analysis.

Because of the way these systems interact with people, they must be designed to take into account the fact that agents may act strategically (e.g. report false information), in addition to the traditional focus on computational tractability. Moreover, agent incentives can interact in complicated ways with other goals such as fairness and privacy.

Format: This course will be nearly entirely be remote. In particular, the main lectures and office hours will be held via zoom. I am optimistic that those interested can meet up in person near the beginning of the term. The class periods will be (interactive) lecture style on classic materials supplemented with modern research papers. If the course is small enough to allow it, students will lead presentations on additional topics in pairs. A key part of the course will be a final project.

Text Book: We will use the Parkes and Seuken text “Algorithmic Economics: A Design Approach” as a foundation. Electronic access will be provided on the nb site. You can sign up here: link TBD. Please do not share access to this with people outside the class.

Prerequisites: I encourage students from a variety of diverse disciplines to consider this course. No previous knowledge of game theory or algorithms will be assumed, but familiarity with mathematical reasoning and basic probability theory will be essential to getting the most out of this course. If you are interested in the course but aren’t sure if you have the necessary training, please contact the instructor and ask!
Learning Goals:

**Mastery:** Solve for equilibrium of games; modeling real-world systems with game theory; understanding different equilibrium types and when they apply.

**Competence:** ability to read and explain a modern algorithmic game theory research paper, identifying key features of mechanism design problems, being able to explain incentive structures of computational systems (e.g. auctions, reputation systems, prediction markets, and crypto-currencies) in terms of game theory concepts.

**Exposure:** social choice theory, revenue maximizing auctions, computational aspects of mechanism design.

Tentative Schedule

This is likely to change. Readings will be posted in the class Perusall site; email the course staff if you do not have access!

- (1) Introduction: Motivating examples, high level terrain of course of study. Reading: Parkes and Seueken Chapter 1
- (2) Simultaneous Move Games. Reading: Parkes and Seueken Chapter 2 (skip §2.5, 2.6), also Bayesian Nash Equilibria.
- (1) Finding Equilibrium. Reading: Parkes and Seueken Chapter 3 (skip/skim §3.3, §3.4, and §3.5).
- (2) Social Choice. Reading: Parkes and Seueken Chapter 15. Choose how to choose additional topics.
- (2) Extensive Form Games. Reading: Parkes and Seueken Chapter 4
- (1) Peer-to-peer Systems. Reading: Parkes and Seueken Chapter 5
- (1) Auction Design. Reading: Parkes and Seueken Chapter 6 (skip §6.3 and §6.4)
- (2) Mechanism Design. Reading: Parkes and Seueken Chapter 7 (skip §7.3, and §7.4, skim §7.5 )
- (1) Midterm
- (10) Additional topics will be chosen and presented by students in the course. The following list gives possible topics (but others could be suggested). We will use the procedure designed by the class to choose the topics.
  - Social Computing and Human Computation (Parkes and Seueken Chapter 13)
  - Behavioral Economics (Parkes and Seueken Chapter 28)
  - Information Elicitation (Parkes and Seueken Chapter 17)
  - Prediction Markets (Parkes and Seueken Chapter 18)
  - Blockchains and Digital Currency (Parkes and Seueken Chapter 22)
  - Reputation Systems (Parkes and Seueken Chapter 20)
  - Recommendation Systems (Parkes and Seueken Chapter 19)
  - Privacy (Parkes and Seueken Chapter 29)
  - Revenue Optimal Auctions (Parkes and Seueken Chapter 6 and 8)
  - Price of Anarchy (Parkes and Seueken Chapter 26)
  - Online Ad Markets (Parkes and Seueken Chapter 10)
  - Combinatorial Auctions (Parkes and Seueken Chapter 11)
  - Matching Markets (Parkes and Seueken Chapter 12)
  - Online Platforms with Network Effects (Parkes and Seueken Chapter 27)
  - Algorithmic Mechanism Design (Parkes and Seueken Chapter 8)
  - Networks (Parkes and Seueken Chapter 23)
  - Network Formation Games (Parkes and Seueken Chapter 24)
  - Networks, Cascades, and Influence (Parkes and Seueken Chapter 25)
  - Kidney Exchange
  - Security Games
  - Fairness and Incentives
  - Cloud Computing
– Adversarial Machine Learning
• (2) Information Elicitation or other topics (no reading)
• (1) Final Project Presentations

Additional topics will be added according time and student interest.

Grade Components:

Reading Responses: You are required to read materials before each class. You must upload reading worksheet responses the day before class. Problems testing technical understanding on these are to help with understanding the reading, and will be graded on effort not correctness. Your response will be marked highly if it is clear that you have read and thought about the readings and questions. It is okay to have typos as long as your response is easily understood. We will drop the lowest two marks of the term.

Final Project: A main component of this course will be a final project. The goal of this project is to gain a deeper understanding of some specific topic related to algorithmic game theory, and to use that understanding to perform independent research. Students should work in small groups of 2-3 in order to complete this project. Members of the group should equally contribute to the project. The final project must be approved, but, in general, students are free to pick any topic related to the course. We will have a poster sessions where final projects are presented (likely virtual, around the last day of class). Additionally, students should turn in a write up of their final projects due the final day of class (December 8). The project should be written up in 10 pages (max) but may include appendices for completeness. A project proposal is due November 12 before class (2 pages max), but students are encouraged to get an earlier start.

Midterm Exam: A midterm exam will be administered. The exam will be closed book, but students will be allowed one sheet of paper (8.5” x 11”), front and back, for any notes. While the focus of the class will be on projects, this exam will ensure that students keep up with foundational material of the course. A practice exam will be available help students study (and to indicate what the exam will focus on). Technical problems will ape those on the problem sets. Conceptual problems will be added. October 20, 2020.

Problem Sets: There will be several problem sets, concentrated during the first half of the course, due the evening before a class. Late assignments will receive a 10% grade deduction per day up to 3 days late after which they will not be accepted. Student may collaborate, but should state with whom they collaborated.

In-class Participation: Students are expected to actively contribute comments to class discussion. Quality is much more important than quantity. Both thoughtful questions and thoughtful answers are valued. Because the course will be virtual, students should have their video on and not be working on other things (e.g. email, Facebook, other coursework) during the course. Please contact the instructor if you need an exception made. I will have a pledge available.

Course Leading: Students will be put in small groups (likely pairs) and assigned a day to present. The presenters should prepare a worksheet for the other students to fill out to help them understand important themes of the readings. The leaders should prepare to lead a section of class that includes an engaging activity, lecture, and discussion. Worksheets should be provided to the instructor two weeks ahead of the class presentation.

Research Paper Presentation: Students will choose a recently published paper or theme to present on. The student will give a 20-30 minute oral presentation on the work. During the presentation students will be asked about its main contribution and relation to material in the course. This will be done outside of class at a mutually agreed upon time. Feel free to schedule it at any time. If not done by Thanksgiving, scheduling may become more restrictive.
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<tr>
<th>Grade Component</th>
<th>Percentage</th>
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<tr>
<td>Reading Responses and Participation</td>
<td>15%</td>
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<tr>
<td>Final Project Proposal</td>
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<td>Final Project</td>
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<td>Midterm Exam</td>
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<td>Problem Sets</td>
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<td>Course Leading</td>
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<tr>
<td>Research Paper Presentation</td>
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Grades will be aggregated according to the standard scale, A+: 100-97, A: 96-93, A-, 92-90, etc. Individual grades will be rescaled. For example, a 75% on the midterm need not correspond to a “C”, since the midterm may be written to be harder than the typical grading curve.

Key Dates:

September 1, 2020  First Class. Also Instructor’s Birthday ;)

Oct 20  Midterm

Nov 2  Proposal for Final Project Due

Dec 8  Final

Dec ?  Final Project Poster Session

Participation:

I will expect students to be present and have their video turned on for class. This serves several purposes. First, it allows me to see if students are following. Second, it gives the class a more community feel. Third, it applies a very small amount of peer pressure to pay attention (at least to say seated and tuned in). I understand this may not be possible for everyone. Please let me know in advance if you cannot attend a particular class or if you have a reason for not turning on your video.

Participation Pledge  This course is a lot of fun when the students are engaged. Even in a classroom setting, this is difficult for many students. With remote instruction, there will be many temptations. In order to aid students (and keep the class exciting), I am offering a participation pledge. During the first week of class, you will be able to sign the pledge if you choose. The pledge will be to fully participate in each class period. This means no looking at your phone, no email, no doing other class assignments, no Facebook, no listening to music, etc. You should behave as if you are actually sitting in a classroom and paying attention. I know this is hard. It’s hard for the instructor! However, I believe that if you take this seriously, you will get a much better experience from the class. Both by learning more, and by having more fun.

You need not sign the pledge, and can still receive full marks in the class. As a small sweetener, I will allow anyone that signs the pledge 2 free late days (total) on the problem sets.

Platforms and Technology:

Even offline, this class relies on software. Here is a summary of the different software platforms we will use. **Canvas** Assignments will be posted and turned in on Canvas. Also announcements made (though you should receive email versions of these).

**Zoom**  Class will be held on Zoom. Also, virtual office hours.

?  On-line whiteboard for class presentations

**Perusall**  Use this to access readings and comment on, and ask/answer questions about readings. Accessible through Canvas.
MobLab  Use this to play (virtual) games against classmates. Also, may be able to design games for your week presenting.

Information Elicitation Platform  Polling software (with a twist). More details to be announced.

email  Direct contact with instructor.

Disconnection  If I become disconnected during class: I will try to communicate with the class via email. If I am unable to communicate via email/canvas, please wait 15 minutes (chat amongst yourselves, do other work, etc) before disconnecting. If you become disconnected during class, please email the instructor. Unfortunately, there is likely little that I can do.

Other

Accommodation for students with disabilities:  If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way we teach may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (SSD) to help us determine appropriate accommodations. SSD (734-763-3000; ssd.umich.edu/) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. I will treat any information that you provide in as confidential a manner as possible.

Academic integrity:  Unless otherwise specified in an assignment all submitted work must be your own, original work. Any excerpts, statements, or phrases from the work of others must be clearly identified as a quotation, and a proper citation provided. Any violation of the School’s policy on Academic and Professional Integrity (stated in the Master's and Doctoral Student Handbooks) will result in serious penalties, which might range from failing an assignment, to failing a course, to being expelled from the program. Violations of academic and professional integrity will be reported to UMSI Student Affairs. Consequences impacting assignment or course grades are determined by the faculty instructor; additional sanctions may be imposed by the assistant dean for academic and student affairs. I encourage students to work together (except on the actual midterm)! You may discuss any problem, project, etc. There is a concrete standard for what is permissible and what is not: your write-up should be your own. You should not look at someone else’s assignment or allow them to look at yours. There should not be any similarities between the writing on different students’ assignments (e.g. the solution was collaboratively written on a whiteboard, and two students copied it down).

Mental Health:  The University of Michigan is committed to advancing the mental health and wellbeing of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, contact Counseling and Psychological Services (CAPS) at (734) 764-8312 and https://caps.umich.edu/ during and after hours, on weekends and holidays, or through its counselors physically located in schools on both North and Central Campus. You may also consult University Health Service (UHS) at (734) 764-8320 and https://www.uhs.umich.edu/mentalhealthsvcsc, or for alcohol or drug concerns, see www.uhs.umich.edu/aodresources. For a listing of other mental health resources available on and off campus, visit: http://umich.edu/ mhealth/

COVID  For the safety of all students, faculty, and staff on campus, it is important for each of us to be mindful of safety measures that have been put in place for our protection. By returning to campus, you have acknowledged your responsibility for protecting the collective health of our community. Your participation in this course on an in-person basis is conditional upon your adherence to all safety measures mandated by the State of Michigan and the University, including maintaining physical distancing of six feet from others, and properly wearing a face covering in class. Other applicable safety measures may be described in the Wolverine Culture of Care and the University’s Face Covering Policy for COVID-19. Your ability to participate in this course in-person as well as your grade may be impacted by failure to comply
with campus safety measures. Individuals seeking to request an accommodation related to the face covering requirement under the Americans with Disabilities Act should contact the Office for Institutional Equity. If you are unable or unwilling to adhere to these safety measures while in a face-to-face class setting, you will be required to participate on a remote basis (if available) or to disenroll from the class. I also encourage you to review the Statement of Students Rights and Responsibilities, which includes a COVID-related Statement Addendum.