EECS 547: Electronic Commerce (Algorithmic Game Theory)

(Tentative Syllabus)

Time: Tuesday and Thursday 10:30am-Noon

Location: 1690 BBB

Instructor: Grant Schoenebeck
Email: Schoenebeck@eecs.umich.edu
Office Hours: Wednesday 3pm and by appointment; 3636 BBBB

Graduate Student Instructor: Biaoshuai Tao
Email: bstao@umich.edu
Office Hours: 4-5pm Friday in Learning Center (between BBB and Dow in basement)

Introduction:

As the internet draws together strategic actors, it becomes increasingly important to understand how strategic agents interact with computational artifacts. Algorithmic game theory studies both how to models strategic agents (game theory) and how to design systems that take agent strategies into account (mechanism design). 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 when strategic agents are involved.

In this particular course, we will especially focus on information elicitation mechanisms (crowd-sourcing).

Description:

Modeling and analysis for strategic decision environments, combining computational and economic perspectives. Essential elements of game theory, including solution concepts and equilibrium computation. Design of mechanisms for resource allocation and social choice, for example as motivated by problems in electronic commerce and social computing.

Format:

The two weeks will be background lectures.

The next half of the class will be seminar style and will focus on crowd-sourcing, and especially information elicitation mechanisms. Each class period, the class will read a paper (or set of papers), and a pair of students will briefly present the papers and lead a class discussion. Students are expected to contribute to the in-class discussion, present one or more papers, and to execute a final paper. A brief work sheet/response paper about the day's reading will be required before each lecture to help facilitate discussion. The seminar style portion of this course will focus on crowd-sourcing, and

especially information elicitation mechanisms. Students will execute a final project which contains some portion of original research.

The last portion of the course will be lectures on classical algorithmic game theory results. To the extent that these are necessary for understanding the papers we read, they will be interspersed with the seminar style classes.

Goals:

This course has several goals. First, students should gain a basic grasp of classical algorithmic game theory results. Second, students acquire an understanding of information elicitation mechanisms that enables them to read and understand cutting edge research. Third, students should learn how to read a research paper and analyze its strengths and weaknesses. They should see how research progresses both by reading and by producing original research.

Prerequisites:

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. Students should expect to learn additional mathematics on their own as necessary. Parts of this course will rely on basic ideas from economics (like Nash equilibrium and related notions), so experience with these ideas will also be helpful, but not assumed. I encourage students from a variety of diverse disciplines to consider this course. If you are interested in the course but aren't sure if you have the necessary training, please contact me and ask!

Additionally, you can try to read some of the technical papers listed below to get a sense for what we will be doing. However, note that the first part of the course will survey some background material designed to help you read these papers.

Grade Components:

Course Leading:

Students will be put in pairs and assigned a day to present. The presenters should prepares a worksheet for the other students to fill out to help them understand important themes of the paper. The leaders should prepare to lead a section of class that includes about 1/3 engaging activing, 1/3 lecture, and 1/3 discussion. This presentation should highlight the main contributions of the works and also provide some context.

Final Project:

A main component of this course will be a final project. The goal of this project is to gain a deep understanding of some specific topic related to algorithmic game theory, and to use that understanding to work on an open research problem. 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 algorithmic game theory.

We will have a poster sessions where final projects are presented. Additionally, students should turn in a write up of their final projects due **December 12**. The project should be written up in 10 pages (max) but may include appendices for completeness. A project proposal is due **November 9** in class (2 pages max), but students are encouraged to get an earlier start.

Problem Sets:

There will be problem sets covering both the initial lecture material, and the lectures at the end of class (none will be given on the information elicitation readings). Each will be 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.

Final Exam:

A final exam will be administered on December 19th. While the focus of the class will be on projects, this exam will ensure that students keep up with the boarder material of the course.

Reading Responses:

You are required to read papers and other listed reading materials before each class. (Materials listed under additional readings in the schedule are optional.) You must upload reading worksheet responses by midnight before class. Your comments should include answers to posted reading questions (if any) and general comments. For research papers, things to think about for general comments include (you don't need to hit all of these...):

- What is the main contribution of this paper? Why is this interesting?
- What was the main insight?
- What are you still confused about?
- Is anything missing?
- Where does this paper fit?
- What are conceptual contributions?
- What are technical contributions?
- What are technical hurdles?
- What are strengths of the paper?
- What are weaknesses?
- What are ideas for future work?
- What is a good idea for a final project relating to this paper?

You will be able to see other's feedback once you get yours in. Professor Michael Mitzenmacher has a blog post on a how to read a paper that you may find helpful if you do not have much experience reading research papers http://mybiasedcoin.blogspot.com/2010/03/reading-research-paper.html

You response will be marked highly if it clear that you have read and thought about the paper. It is okay to have typos as long as your response is easily understood.

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.

Grading:

Participation and Comments	15%
Problem Sets	15%
In Class Presentation(s)	20%
Final Project	35%
Final	15%

Rubrics will be posted for different assignments. Scores will be aggregated according to the above formula. Students will be ordered according to their final grades. Grade will be "curved" and assigned subjectively so that:

A+	Demonstrates a strong and in-depth understanding of the material. Will be able to see new applications of tools in the future and apply the material to it. Can expertly combine tools in innovative ways.
A	Demonstrated a strong and in-depth understanding of the material. Will be able to see new applications of tools in the future and apply the material to it.
A -	Demonstrated a solid understanding of the material. Will be able to see some new applications of tools in the future and apply the material to it.
B+	Demonstrated a good grasp of most of the material. Will be able to apply most tools in the future, but typically, the applications must be pointed out.
B	Demonstrated a good grasp of some of the material and a fair understanding of most. Will be able to apply some tools in the future, but typically, the applications must be pointed out.
B-	Demonstrated a fair understanding of most of the material. Can only apply tools in very straightforward manners even after applications are pointed out.
< C+	Failed to demonstrate understanding of most material. Failed to demonstrate the ability to even straight-forwardly apply tools.

Tentative Schedule

Background

September 5: Overview, Class Policies, Game

September 7: Intro to Game Theory I

- AGT: Ch 1

September 12: Intro to Game Theory II

- AGT: Ch 1

September 12: Course Background

- Background Handout

Information Elicitation

September 19: 3 Foundational Results

- Miller, Resnick, Zechhauser. "Eliciting informative feedback: The peer-prediction method." Management Science, 2005. http://pubsonline.informs.org/doi/pdf/10.1287/mnsc.1050.0379
- Prelec. "Baysian Truth Serum for subjective data." https://www.researchgate.net/profile/Drazen_Prelec/publication/8231017_A_Bayesian_Truth_Serum_for_Subjective_Data/links/0deec51bb0d8741001000000/A-Bayesian-Truth-Serum-for-Subjective-Data.pdf
- Dasgupta, Ghosh. "Crowdsourced judgement elicitation with endogenous proficiency." https://arxiv.org/pdf/1303.0799.pdf

September 21: Information Theory Interpretation

- Kong, Schoenebeck. "A Framework For Designing Information Elicitation Mechanisms That Reward Truth-telling." https://arxiv.org/abs/1605.01021 (new version available soon!)

September 26: Cheap Signals

- Gao, Wright, Leyton-Brown. "Incentivizing Evaluation via Limited Access to Ground Truth: Peer-Prediction Makes Things Worse." https://arxiv.org/abs/1606.07042
- Kong, Schoenebeck. "Eliciting Expertise without Verification." Available soon.

September 28: Heterogeneous Agents

- Agarwal, Mandal, Parkes. "Peer Prediction with Heterogeneous Users." http://www.cs.toronto.edu/~nisarg/papers/het-pp.pdf

October 3: Other Peer-Prediction TBA

- TBA

October 5: Property Elicitation

- TBA

October 10: Peer Grading

- TBA

October 12: Aggregation Functions

- TBA

October 17: <Fall break>

October 19: Eliciting Functions

- TBA

October 24: Learning in a Difficult Space

- TBA

October 26: Assigning Players Questions

- TBA

October 31: Empirical / Behavioral

- TBA

November 2: Prediction Markets I

- TBA

November 7: Prediction Markets I

- TBA

Classical Results

November 9: Reputation systems

November 14: Tournaments

November 16: Bit Coin I

November 21: Bit Coin II

November 23: <Thanks giving>

November 28: Myerson I

November 30: Myerson II

December 5: All Pay Auctions

December 7: Big Data

December 12: Fairness in Machine Learning

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; **http://www.umich.edu/~sswd/**) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. I will treat any information you provide as private and confidential.

Academic integrity

All submitted work must be your own, original work unless you clearly mark it as being otherwise. If you are directly quoting, or building on others' writing, provide a citation. See **the Rackham Graduate policy on Academic and Professional Integrity** for the definition of plagiarism, and associated consequences.

Laptops

Students are welcome to use Laptops in class for the purposes of the class: taking notes, referring to papers, referring to student responses. Laptops should not be used for email, Facebook, Youtube etc. This will affect class discussion and distract your neighbor.