Course Overview

Models of Strategic Behaviour
CPSC 532L, Term 2, Session 201, 2022–23

Lecture Overview

Syllabus

Why This Course?

Course Description

This course examines core economic and algorithmic models of strategic behavior and their applications, with a focus on game theoretic analysis of systems in which agents cannot be guaranteed to behave cooperatively. It will use a “flipped classroom” model in which lectures will be delivered online. Classes will emphasize student participation. The first class of a week will focus on reinforcing and applying material covered in the videos. The second class of a week will consist of student presentations on enrichment topics, which will be peer evaluated and discussed afterwards.

Course Topics

Overall, problems at the interface of economic theory and computer science. (No prior experience in economics is assumed.) Specific topic include: Games: normal-form; extensive-form; repeated; stochastic; coalitional; Bayesian. Computation of game-theoretic solution concepts. Mechanism design: key positive and negative results. Single- and multi-good auctions.

Prerequisites

There are no formal prerequisites, and it is assumed that most students in the class will be unfamiliar with game theory, mechanism design, auction theory, and the literature on multiagent systems.

Since some of the material to be covered is quite formal mathematically, students do need to be able to construct and follow formal proofs. Relevant mathematical/CS background includes introductory knowledge of probability theory, computational complexity and combinatorial optimization.

Much of the work associated with the course will revolve around reading papers from the literature and presenting findings to the class. As a result, students who have trouble reading, speaking or writing comfortably in English will find themselves at a disadvantage.

Wait List

Right now we have 10 students registered for the course and 13 on the wait list.

We have a hard cap of 20 in the course. (2 presentations/week over 10 weeks).

If you're on the waitlist, please write me a short paragraph (250 words max) explaining your background, why you're interested in this course, and reasons (if any) why it's important to your degree. I'll do my best to choose fairly.

Academic Honesty

Plagiarism is a serious offense and will be dealt with harshly. I consider plagiarism to be the unattributed use of an external source (e.g., another student, a web site, a book, a large language model) in work for which a student takes credit, or the inappropriate use of an external source whether or not attribution is made. The seriousness of the offense depends on the extent to which the student relied upon the external source. Assignments and midterms will include an "honour code" statement which you will be required to sign, specifying forms of collaboration and reference to non-course materials that are acceptable. For presentations, you must cite all external sources that you use, and the vast majority of the slides must be written in your own words. Any text that you take verbatim from another source must be in quotation marks and followed by a citation.

A Flipped Classroom Course

Before week's first class: Watch the week's videos. Hand in the previous week's assignment electronically.

Week's first class: We'll begin with a quiz on the material covered in videos. We'll swap quizzes and peer-grade, discussing concepts as we go. We'll have an opportunity for open discussion of the lecture material. Then I'll cover related material and we'll have a chance to apply what we've learned with challenge problems and games.

Week's second class: Student presentations on enrichment topics. Each student has 20 minutes to present, followed by discussion of both the material and the presentation itself. Remaining time will be devoted to discussion of the previous week's assignment and help with/group work on the current week's assignment.

This begins now!

Before next Tuesday's class, watch the first week of videos:

https://www.youtube.com/user/gametheoryonline

https://www.coursera.org/course/gametheory

Assignments

Weekly assignments will be given out at each week's second class (e.g., Thursday) and due an hour before the following week's first class (e.g., Tuesday). Assignments must be prepared using LaTeX and submitted electronically. They will include questions drawing on the week's lecture and also student-created questions based on the week's presentations.

Assignments will not be weighted equally: weighting will be proportional to the total number of available points. Late assignments will be penalized at 20% per day. Assignments will receive a grade of zero after 1:00 PM on the second class after the due date. At the end of the term, we will drop your 2 worst assignments, to account for brief illness, scheduling conflicts with other courses, personal commitments, and other emergencies. No additional accommodations will be granted except under truly exceptional circumstances.

Presentations

Each student will give a presentation on a topic that goes beyond a given week's core material. In the second class of the term, we'll have an auction to assign students to topics from the first two weeks; we'll assign the rest of the topics after the drop date.

Three quarters (15%) of the presentation grade will come from the presentation itself. Presentations should be 20 minutes long. Topics must be chosen from the assigned list or negotiated with me. The goal is to give you the chance to research and dig deeper into a topic that interests you. You're encouraged to include at least one interactive activity or puzzle for students to solve during your presentation.

After each presentation is complete, we'll have a discussion about the presentation itself (what worked, what didn't) and the subject matter it covered (clarifications, elaborations).

Assignment Questions Based On Presentations

The remaining quarter (5%) of the presentation grade will come from an assignment question submitted by the presenter and forming part of the week's assignment. Each question should be similar in difficulty and structure to that of the other assignment questions (you'll see at least two before you have to make your own) and should be graded out of 10 points.

Presenters will peer grade the responses to their own questions, which will be spot checked by the course TA; if this isn't done reliably, the student will forfeit the assignment question quarter of their participation grade. Otherwise, this portion of your grade will come 50% from an instructor assessment and 50% from a peer assessment.

Participation

We'll use a home-grown participation app to track your frequency of participation and ensure a diversity of voices is heard. Details to come. You'll need an internet-connected device (phone, tablet, laptop) to participate in class.

Grading Scheme

Item	Amount
Quizzes (weekly; we'll keep your 9 best grades)	10 %
Assignments (weekly; we'll keep your 9 best grades)	20 %
Midterm	15 % (or 7 %)
Final	20 % (or 28 %, if better and final $\geq$ 80 %)
Presentation	20 (10% instructor; 10% peer)%
Peer Review of Other Students' Presentations	5 %
Participation in Discussions; Attendance	10 %

Curving Grades and Peer Review

Final grades may be curved to give the overall distribution of grades a desired mean and standard deviation. Peer review is an important component of the class, and will be taken into account when evaluating presentations. Since this is an Algorithmic Game Theory course, a grading scheme has been constructed that does not provide students with any ability to influence their own grades by reviewing other students strategically. The curve for a given student x will be calculated disregarding x's presentation reviews of other students.

Textbook

We will be using the textbook Y. Shoham and K. Leyton-Brown, *Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations*, Cambridge University Press, 2009. It is available from the bookstore, and for free on-screen use at `http://www.masfoundations.org`.

Supplemental texts are listed on the course web page.

Schedule

Week	Dates	Topic (click for videos)	Presentations
0	Jan 10, 12	Course overview	Giving effective presentations
1	Jan 17, 19	Normal-form games	Congestion games (tex)
2	Jan 24, 26	Mixed Nash equilibrium	
3	Jan 31, Feb 2	Alternate solution concepts	
4	Feb 7, 9	Extensive-form games	
5	Feb 14, 16	Repeated games	
	Feb 28	***Midterm***	
6	Mar 2, 7	Coalitional games	
7	Mar 9, 14	Social choice	
8	Mar 16, 21	Bayesian games	
9	Mar 23, 28	Mechanism design	
10	Mar 30, Apr 4	Efficient mechanisms	
11	Apr 6, 11	Auctions	
12	Apr 13	TBA	

Allocating Presentations?

We'll use a descending-price Japanese auction to procure 4 presenters for the first four classes, starting from 50% bonus credit and descending; all 4 selected presenters will get the amount of bonus credit the 5th-highest student was willing to accept. If we reach 0% with more than 4 presenters we'll randomize among the set of students who remain. Once the 4 presenters are chosen, we'll see if they can come to an agreement on who presents in which week, and otherwise will randomize.

For the subsequent weeks, after the add-drop deadline we'll draw names from a hat in sequential order of week; at any point students whose names remain in the hat will be permitted to claim the week currently being decided instead of continuing to remain in the lottery. Within a given week, topics will be set on a first-come, first-served basis (two students cannot both present on the same topic.) After assignments are finalized, students are free to swap weeks with each other at any time if both agree.

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Why This Course?

Economics and Computer Science

Problems in economics can benefit from computational approach:

- modeling bounded rationality
- dealing with combinatorial outcome spaces in social choice problems, auctions
- solving huge games like poker
- computational bounding methods

Problems in computer science can benefit from economic lens:

- incentives in distributed systems
- belief aggregation
- multiagent artificial intelligence

Cooperative vs. Competitive Multiagent Systems

Cooperative MAS:

- same desires: the strategic/non-strategic distinction is not very significant
- example: multirobot control, uncertain environment
- issues:
  - coordination
  - bandwidth, computational limits
- optimality well-defined

Competitive MAS:

- potentially different utility function (but may be the same)
- example: P2P file-sharing system on the internet

Resource Allocation in MAS

- easy in cooperative settings
  - optimality is well-defined
  - everyone wants the same thing
- difficult in competitive settings, because people can lie
  - mechanism design
  - maximizing payoff
  - design of agents
  - auctions: why important