Introduction to Multiagent Systems

Lecture 1

Lecture Overview

Course Description

This course examines the mathematical and computational foundations of modern multiagent systems, 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 Multiagent Systems 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.

Academic Honesty

Plagiarism is a serious offence 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) 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 offence 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 about 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

The course will include weekly assignments, given out at the second class of the week (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. Assignments will not be weighted equally: weighting will be proportional to the total number of available points. Students will be given five late days for use on the assignments; at most two can be used for any one assignment. These are intended to help avoid scheduling conflicts with other courses, personal commitments, and emergencies. Therefore, no additional late days will be granted except under truly exceptional circumstances. Once late days are used up, late assignments will be penalized at 20% per day. No assignment will ever be accepted after 1:00 PM on the second class of the week it was due.

Grading Scheme

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

Presentations

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

Presentations should be about 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. Each presentation should include at least one interactive activity or puzzle for students to solve.

Presentations will be peer evaluated. 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).

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 a Multiagent Systems 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

http://www.cs.ubc.ca/~kevinlb/teaching/cs532l-2013-14/index.html#Schedule

Lecture Overview

Pictures and Introductions

Please:

- Write your name on a piece of paper
- Introduce yourself by saying what country you're from, where you did your undergrad, and your favourite band, book, flavour of ice cream, or anything else you'd like...
- Pose for a photo, holding your piece of paper!

Lecture Overview

Cooperative vs. Competitive MAS

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

Lecture Overview

Fun games

- Let's buy and sell some money...