COMP 4900B/5900G for Fall 2021

Multiagent Systems

Course Outline

Course Information

Instructor: Alan Tsang (https://people.scs.carleton.ca/~alantsang/)
Contact: Alan.Tsang@carleton.ca
Course Website: https://brightspace.carleton.ca
Lectures: Mondays & Wednesdays, **1005 – 1125** (on Zoom) ****changed**
Office Hours: Mondays & Wednesdays, **1125 – 1225** (on Zoom and Discord) ****changed**
Required Tools: Python, Zoom, and Discord

> *Office hours will take place on Zoom after Tuesday classes. If the Zoom link is not live, contact the instructor by email or Discord. Emails and Discord messages during this hour will be replied to promptly.*

Last Revised: 2021-09-02

Teaching Assistants

Contact info for your TA will be posted once the course starts.

Course Calendar Description

Multiagent systems is a branch of artificial intelligence that explores the interactions between multiple rational entities, where each may have access to different information and possibly conflicting priorities. This course takes an approach founded on economic game theory. We will examine how coordination and cooperation can emerge, and how to design systems to achieve global goals despite a lack of cooperation from individual entities. Students should be comfortable with rigorous mathematics and formal proofs. Assignments will also require basic Python programming skills

Format: Blended

Course Objectives

This course surveys a number of topics in the area of multiagent systems. Students will gain a robust understanding of algorithmic game theory, which can be used as stylized models of scenarios in the real world. Using game theory, they will be able to capture a scenario's decision points (strategies), represent agents and their desires (preferences) mathematically,

and compute plausible outcomes to those scenarios (equilibria). Students will then examine several types of well studied scenarios in detail, including voting (social choice theory, auctions (auction theory), and the fair division of resources (mechanism design).

Textbooks (Optional):

Primary Textbook

- Y. Shoham, K. Leyton-Brown, Multiagent Systems: Algorithmic Game-Theoretic, and Logical Foundations, Cambridge University Press, 2009.

Other Useful References

- N. Nisan, T. Roughgarden, E. Tardos, and V. Vazirani (Eds.), Algorithmic Game Theory, Cambridge University Press, 2007.
- M. Osborne and A. Rubinstein, A Course in Game Theory, MIT Press, 1994.

Course Format and Assessments

The course has **two synchronous sessions every week** over Zoom. Links will be posted on Brightspace. Attendance in all sessions is recommended but not mandatory.

The assessments in the course will be based on a combination of individual assignments and a final project. The final project will the form of a conference paper, which may survey existing works or contain original research. Students will also present their paper (or their work-in-progress) to class at the end of the term. Graduate students must complete the project solo, while undergraduates enrolled in the COMP 4900 section may work in groups of 2.

Inquiries

If you have a question (ex: clarification on readings, discussion about something said during class, questions about assignments), you should **post them to Discord** so your classmates can benefit from the discussion. If the question is about your assessments or situation, you may email the instructor or leave a message on Discord.

Please **add COMP 5900G or 4900B in your email subjects** to ensure they are prioritized. Do not post code or assignment answers in the open or in course discussions. Questions about assessments **will not be answered with 24 hours** of the due date.

You may also schedule an appointment by emailing the instructor or assigned TA.

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Topics Covered

1	Game Theory and Game Forms
2	Computation of game theoretic solution concepts
3	Bounded rationality
4	Social choice
5	Mechanism design
6	Auctions (single item, combinatorial, sponsored search)
7	Teams and coalitions
8	Multiagent learning
9	Applications of multiagent systems

Other important dates and deadlines can be found here.

There will be a week-long experiential learning activity toward the end of November where students will form teams that compete and cooperate with each other. While the primary interactions will be asynchronous, one member from each team must be available for scheduled synchronous activities. More information will be released as we approach November.

Assessment Scheme

40%*	Final Project (due during Exam Period)
15%*	Presentation
45%	Assignments

* Undergrads in COMP 4900 have the option to complete the project in groups of 2

Late Policy

All assignments and the final project may be submitted up to 48 hours late, with **no late penalty**. Presentations must be done in the designated timeslot.

This policy accommodates unexpected circumstances such as technical and personal issues; therefore, no additional extensions will be granted (excepting accommodations provided by university policy). Submissions are handled electronically via Brightspace and items submitted after the extended deadline (by even one minute) will not be accepted.

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Writing and Academic Integrity

This course includes significant written evaluation components. This may be the first time you have written long form prose in a while. Nonetheless, clear and concise written communication is a valuable skill for computer scientists. Marks will be deducted for grammar, spelling, and punctuation errors, and other mangled misuse of language. You are expected to follow academic integrity guidelines, particularly the section on plagiarism. Plagiarism is often *very obvious* to the marker. Don't do it!

Other academic boilerplate:
If you are unsure of the expectations regarding academic integrity (how to use and cite references, how much collaboration with lab- or classmates is appropriate), ASK your instructor. Sharing assignment or quiz specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is considered academic misconduct. You are never permitted to post, share, or upload course materials without explicit permission from your instructor. Academic integrity offences are reported to the office of the Dean of Science. Penalties for such offences can be found on the ODS webpage: https://science.carleton.ca/academic-integrity/.

Undergraduate Academic Advisor

The Undergraduate Advisor for the School of Computer Science is available in Room 5302C HP; by telephone at 520-2600, ext. 4364; or by email at undergraduate_advisor@scs.carleton.ca. The undergraduate advisor can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisor will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

SCS Computer Laboratory

SCS students can access one of the designated labs for your course. The lab schedule can be found at: https://carleton.ca/scs/tech-support/computer-laboratories/. All SCS computer lab and technical support information can be found at: https://carleton.ca/scs/technical-support/. Technical support is available in room HP5161 Monday to Friday from 9:00 until 17:00 or by emailing support@scs.carleton.ca.

University Policies

For information about Carleton's academic year, including registration and withdrawal dates, see Carleton's Academic Calendar.

Pregnancy Obligation. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit Equity Services.

Religious Obligation. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit Equity Services.

Academic Accommodations for Students with Disabilities If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton Centre website.

Survivors of Sexual Violence. As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities. Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the policy.

Student Academic Integrity Policy. Every student should be familiar with the Carleton University student academic integrity policy. A student found in violation of academic integrity standards may be awarded penalties which range from a reprimand to receiving a grade of *F* in the course or even being expelled from the program or University. Examples of punishable

offences include: plagiarism and unauthorized co-operation or collaboration. Information on this policy may be found here.

Plagiarism. As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own". Such reported offences will be reviewed by the office of the Dean of Science. Standard penalty guidelines can be found here.

Unauthorized Co-operation or Collaboration. Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis". Please refer to the course outline statement or the instructor concerning this issue.

Acknowledgements

This course uses course materials devised by Professor Kate Larson and Professor Yair Zick.