

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: Tuesdays & Thursdays, **1005 – 1125** (CB 3400)

Office Hours: Thursdays, **1430 – 1530** (HP 5411 in the Data Science wing)

You may book additional appointments (including Zoom meetings) via email. Emails and Discord messages during this hour will be replied to promptly.

Required Tools: Python, and Discord

Last Revised:

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

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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 in-person classes every week**. You are expected to attend as lectures **will not be recorded**. If you miss a lecture, it will be your responsibility to catch up on missed materials.

The assessments in the course will be based on a combination of individual assignments and a final project. The final project will be 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 the class at the end of the term. Graduate students will complete the project solo, while undergraduates enrolled in the COMP 4900 section will work in groups of 2.

Health

If you feel ill or exhibit COVID-19 symptoms, please do not come to class. While Carleton has paused the COVID-19 Mask policy, students are encouraged to wear a mask in the classroom in order to protect the vulnerable and each other. Presentation speakers (including the instructor) can feel free to eschew masking for clarity of speech. This is a trade-off between health precautions and quality of the education experience. This section may be updated according to new health recommendations. See the Special Information section for additional details.

Inquiries

If you have a question (ex: clarification on readings, discussion about something said during class, questions about assignments), you should **post them online** 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.

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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 within 24 hours** of the due date.

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

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 | Fair division of resources |
| 8 | Teams and coalitions |
| 9 | Multiagent learning |
| 10 | 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 are 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.

Writing and Academic Integrity

This course includes significant written and oral evaluation components. This may be the first time you have written long form prose in some time. Nonetheless, clear and concise written communication is a valuable skill for computer scientists. All written and oral communications should be **in your own words** (with several clearly marked and referenced quotations).

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 grader. 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

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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

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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.

Special Information

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are number of actions you can take to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

Feeling sick? Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's symptom reporting protocols.

Masks: Carleton has paused the COVID-19 Mask policy, but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

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Vaccines: While proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in cuScreen as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 website and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.

Doctor's note or medical certificate: in effect for Fall 2022 term. In place of a doctor's note or medical certificate, students are advised to complete the [self-declaration form](#) available on the Registrar's Office website to request academic accommodation for missed course work including exams and assignments. Students should also discuss with the course instructor the required accommodations arising from the COVID-19 situation.

Acknowledgements

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