

# COMP 5900G (cross COMP 4900G) for Term Winter 2024 (Preliminary Outline)

## Special Topics in CS: Multiagent Aspects of Deep (Reinforcement) Learning

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### Course Information

Instructor: Zinovi Rabinovich

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Classroom: Please see Carleton Central and/or Brightspace.

Lectures: Monday, 14:35-17:25 (in person)

Course Website: <https://brightspace.carleton.ca/d2l/home/258838>

### Graduate courses only:

- Brightspace access for University of Ottawa Students; please see information here: <https://gradstudents.carleton.ca/faculty-of-graduate-and-postdoctoral-affairs-access-to-brightspace/>
- University of Ottawa Students who need access to SCS IT resources such as openstack and nextcloud must submit a request to SCS Tech Support [SCS.Tech.Support@cunet.carleton.ca](mailto:SCS.Tech.Support@cunet.carleton.ca). The request must be sent from their @cmail.carleton.ca email address and the email should say which resource is required and for which course (including section).

For information about Carleton's academic year, including registration and withdrawal dates, see [Carleton's Academic Calendar](#).

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### Course Calendar Description

Deep (Reinforcement) Learning has been successfully applied in a variety of domains, but the presence of multiple learners (potentially with distinct purposes/optimality criteria) engenders critical non-stationarity in the system. We will study a variety of approaches that deal with, acknowledge and exploit this effect: cooperative learning and its federated point of view, learning to communicate, and behaviour/strategy manipulation. The course will have the format of a reading seminar with a mini-project (we'll aim for publication potential).

Prerequisites: For undergraduate students: COMP 3105 or COMP 3106.

Lectures three hours a week, seminar presentations and project work.

### Required Textbook(s) and Other Resources

Stefano V. Albrecht, Filippos Christianos, and Lukas Schäfer. Multi-Agent Reinforcement Learning: Foundations and Modern Approaches. MIT Press, 2024. [MARL Book](#).

Further reading and online resources will be published on the course website.

### SCS Laptop Requirement (only applies to on-campus courses)

Every student that has been enrolled in a 1000-level (i.e., first year) course offered by the School of Computer Science after the 2020/2021 school year is required to have a laptop. This includes COMP1001, COMP1005, and COMP1006. For more information, please visit <https://carleton.ca/scs/scs-laptop-requirement/> and then review the requirements at <https://carleton.ca/scs/scs-laptop-requirement/laptop-specs/>.

## Topics Covered and Learning Outcomes

The course will largely divide into three portions.

First portion is introductory: we will review some basic and up-to-date multi-agent learning algorithms, striking at the issues of cooperative learning, learning to communicate, constrained-cooperative (such as federated) learning, learning in games, and manipulation of learning processes.

Second portion is participatory (seminar-style): students of the course will be provided with a choice of recent papers on the above topics and tasked to present them in class. It will be necessary to expand the reading beyond the papers themselves, as the presentation will have to contain the necessary background for the paper.

Third portion is applied (project): students will be asked to organise into groups of up-to 3 people, choose among a set of suggested subjects (or introduce one of their own accord, as long as it aligns with the course topics) and implement it. It is suggested that the graduate students of the course should aim at a publishable result.

The idea behind this course structure is to provide students both with information on recent advances in MultiAgent (Reinforcement) Learning, and foster soft and specific research skills, including (but not limited to) project design, literature review, presentation skills and practical experience in coding and training multi-agent algorithms. Notably, however, the course will not teach coding, but rather give an opportunity to further the skill.

Exact scheduling will depend on the number of students signed up for the course. However, there will be in any case the following periods:

- Overview and introductory lectures
- First batch of seminar talks
- Project Design Presentations and Defence
- Second batch of seminar talks
- Project Outcome Presentations and Defence

We will also endeavour to invite guest speakers, though it depends on their and time-slot availability.

General university calendar dates and deadlines can be found here:

- <https://carleton.ca/registrar/registration/dates/academic-dates/>, including class suspension for fall, winter breaks, and statutory holidays.

## Assessment Scheme

There will be **3 (three) components** to the scheme:

- **Participation: 15%** of the final grade
  - As the course includes a presentation component, it is important to learn how to ask questions, as well as how to answer them. During presentations students are expected to challenge the presenter, and send in additional questions off-line. Course discussion forums will facilitate this process.
- **Seminar presentation: 35%** of the final grade
  - Rubrics for seminar presentations will be published and discussed in advance.
- **Course project: 50%** of the final grade
  - Rubrics for projects are designed so that even if the final goal is not achieved, the project group may still gain full marks on the project.
  - Rubrics include team-work and communication, among other measures.
  - In particular, 15% of the final grade will depend on the two project-based presentations as such, while other rubrics will address the remaining 35%

### **A few notes on plagiarism**

*"If you are unsure of the expectations regarding academic integrity (how to use and cite references, if unauthorized collaboration with lab- or classmates is permitted (and, if so, to what degree), then you must ASK your instructor. Sharing assignment or quiz specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is ALWAYS 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. Information, process and penalties for such offences can be found on the ODS webpage: <https://science.carleton.ca/students/academic-integrity/>."*

"Many of the assessed activities in this course were designed to be completed by an individual working alone or by a specific group of persons working as a team of contributors. Unless it is explicitly stated otherwise, the use of any AI Tools will be considered academic misconduct. This includes, but is not limited to, chatbots (e.g., ChatGPT, Google Bard, Bing Chart), research assistants (e.g., Elicit), and image generators (e.g., Stable Diffusion, Dall-E), etc."

"An exception to the above rule is made for automated grammar and punctuation checking tools (such as Grammarly)."

"References to any material you use but did not originate must use the IEEE/APA/MLA citation style. Failure to reference materials correctly can result in severe penalties, and the use of manufactured (i.e., falsified) or misleading references will be treated as evidence of plagiarism and considered academic misconduct. "

"Everything you submit for evaluation (i.e., assignments, quizzes, tutorials, examinations, etc.) must be the result of your own work and only your own work. If you use more than five consecutive words from a single source without providing a valid reference, then that is considered plagiarism and an example of academic misconduct."

## Important Considerations

As our projects aim at a paper-level research, their schedule will echo the same process. In particular, all relevant materials will have to be delivered as per schedule without delays. As with real papers, technical problems do not exempt you from timeliness, so if you wait until the last minute and then have issues with your connection, you will still receive a mark of zero.

Consequently, you are advised to:

- periodically upload/commit you progress (e.g. upload your progress at least daily)
- attempt to submit your final submission at least one hour in advance of the due date and time

You will be submitting your project source-code, and it will have to be appropriately documented and packaged.

You are expected to demonstrate good programming practices at all times, as experiment reproducibility is a key feature of modern research.

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## Undergraduate Academic Advisors

The Undergraduate Advisors for the School of Computer Science are available in Room 5302HP; or by email at [scs.ug.advisor@cunet.carleton.ca](mailto:scs.ug.advisor@cunet.carleton.ca). The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

## Graduate Academic Advisors

The Graduate Advisors for the School of Computer Science are available in Room 5302 HP; or by email at [grad.scs@carleton.ca](mailto:grad.scs@carleton.ca). The graduate advisors can assist with understanding your academic audit and the remaining courses required to meet graduation requirements.

## SCS Computer Laboratory

Students taking a COMP course can access the SCS computer labs. The lab schedule and location 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/tech-support/>. Technical support staff may be contacted in-person or virtually, see this page for details: <https://carleton.ca/scs/tech-support/contact-it-support/>.

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## University Policies:

- **Academic Accommodations**

Carleton is committed to providing academic accessibility for all individuals. Please review the academic accommodation available to students here: <https://students.carleton.ca/course-outline/>.

- **Academic Integrity**

**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 sanctioned with penalties which range from a reprimand to receiving a grade of F in the course, or even being suspended or expelled from the University. Examples of punishable offences include plagiarism and unauthorized collaboration. Any such reported offences will be reviewed by the office of the Dean of Science. More information on this policy may be found on the ODS Academic Integrity page: <https://carleton.ca/registrar/academic-integrity/>.

**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. More information and standard sanction guidelines can be found here: <https://science.carleton.ca/students/academic-integrity/>.

**Unauthorized 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".