

# COMP 4900C

## Introduction to Reinforcement Learning

### Course Outline

Instructor: Junfeng Wen (junfeng.wen [AT] carleton.ca)

Fall 2023  
School of Computer Science  
Carleton University

## Course Information

**Instructor:** Junfeng Wen

**Contact:** junfeng.wen [AT] carleton.ca

**Classroom:** Room location is posted on the [public class schedule](#)

**Lectures:** Mondays & Wednesdays 8:35 am - 9:55 am

**Office Hours:** By appointment

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

## Course Description

This is an introductory course for reinforcement learning (RL), where a learning agent interacts with a complicated environment in order to perform certain task. This course will cover the fundamentals of reinforcement learning. Students will understand, design and program an RL agent to make sequential decisions.

## Recommended Textbooks

- [Reinforcement Learning: An Introduction](#) (2nd edition), Sutton Barto
- [Algorithms for Reinforcement Learning](#), Szepesvari
- *Markov Decision Processes: Discrete Stochastic Dynamic Programming*, Puterman

## Prerequisites

COMP 2402, COMP 2404, STAT 2507 and (MATH 1104 or MATH 1107). Students are expected to be familiar with linear algebra, calculus, basic statistics and Python programming.

## Topics Covered and Learning Outcomes

This course will cover the following (tentative) topics

- Multi-armed bandit
- Markov decision process

- Dynamic programming methods
- Monte-Carlo methods
- Temporal difference learning
- Planning and learning
- Prediction and control with function approximation
- Policy gradient and actor-critic methods
- Deep reinforcement learning methods

Upon completion, students should be able to

- Develop a solid understanding of the fundamental concepts and principles in reinforcement learning
- Understand a wide range of reinforcement learning algorithms, their applicability, strengths and weaknesses
- Design and implement reinforcement learning algorithms for real-world problems, and evaluate their performance

## Evaluation

Three assignments 60% (20% each)

- Done individually
- For assignments, you have three excused days **throughout the term** (rounded up to the nearest day) to account for any unforeseeable difficulties. After that no late submission will be accepted
- Submissions are handled electronically (i.e., through Brightspace). Technical problems do not exempt you from late policy, so if you wait until the last minute and then have issues with your connection, it will still count as a late submission. Consequently, you are advised to
  1. Periodically upload you progress
  2. Attempt to submit your final submission early (e.g., at least one hour in advance of the due date and time) and
  3. Download the submitted files to make sure they are correct

Group project 40%

- In-class demo (10%)
- Final report (30%)

## Intellectual Property

All materials created for this course (including, but not limited to, lecture notes, in-class examples, tutorial exercises, assignments, examinations, and posted solutions) remain the intellectual property of the instructor. These materials are intended for the personal and non-transferable use of students registered in the current offering of the course. Reposting, reproducing, or redistributing any course materials, in part or in whole, without the written consent of the instructor, is strictly prohibited.

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](#).

## 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.

## SCS Computer Laboratory

Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found [here](#). All SCS computer lab and technical support information can be found [here](#). Technical support staff may be contacted in-person or virtually, see [this page](#) for details.

## University Policies

**Academic Accommodations.** Carleton is committed to providing academic accessibility for all individuals. Please review the academic accommodation available to students [here](#).

**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 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”.