

**CGSC 3601 Artificial Intelligence and Cognitive Science**

**Prerequisites:** third-year standing and CGSC 2002 and either CGSC 1005 or COMP 1005.

Restricted to students enrolled in B.Cog.Sc. Honours.

**Lecture Time:** 8:35 a.m. to 11:25 p.m. on Fridays

**Lecture URL:** <https://carleton-ca.zoom.us/j/93565172655>

**Passcode:** 3601

**Tutorial B1:** 4:05 p.m. to 5:25 p.m. on Monday

**Tutorial URL:** T.B.A.

**Tutorial B2:** 2:35 p.m. to 3:55 p.m. on Tuesday

**Tutorial URL:** T.B.A.

**Instructor:** M. Alex Kelly, Ph.D. (they/them; [alex.kelly@carleton.ca](mailto:alex.kelly@carleton.ca))

**Prof. Kelly's Office URL:** <https://carleton-ca.zoom.us/j/97622879308>

**Prof. Kelly's Office Hours:** Tuesdays 1pm to 2pm; Thursdays 1pm to 2pm

**Teaching Assistants:** T.B.A.

**T.A. Office Hours:** By appointment.

- I. **Course description:** An overview of Artificial Intelligence (AI) techniques, such as problem solving by search, machine learning, probabilistic reasoning, neural networks, and natural language processing. By the end, you will be able to:
  - a. Describe various AI algorithms, including rationale for their design
  - b. Explain how to evaluate AI algorithms
  - c. Compare and contrast various AI approaches
  - d. Apply AI algorithms and techniques to solve problems and synthesize results

- II. **Brightspace:** Zoom URLs, lectures, exams, and assignments will be posted here:

<https://brightspace.carleton.ca/d2l/home/56454>

- III. **Textbook:** There is no textbook required for the course. Readings will be provided through the course web site. If you require a resource beyond the course materials, the following artificial intelligence textbook is freely available online:

<http://artint.info/2e/html/ArtInt2e.html>

If you are interested in neural networks, or want a resource to help you through the neural network material in the course, I recommend Tariq Rashid's *Make Your Own Neural Network* which can be purchased here in either ebook (Kindle) or paperback formats: <https://www.amazon.com/Make-Your-Own-Neural-Network-ebook/dp/B01EER4Z4G>

**IV. Software:** All students taking CGSC 3601 are required to either own or have daily access to a computer (either Mac or PC; desktop or laptop) that they can both work on and install software on. This software includes but is not limited to the programming language Python and a number of Java applets. Netbooks, Chromebooks, and Smartphones are not suitable. The computer must be running either Windows or a Mac operating system. Wifi functionality on this computer is required; we also recommend at least 8GB of RAM and sufficient hard drive space.

**V. Evaluation:** The coursework consists of an online midterm and final exam, three quizzes on readings, three assignments, and work done in the labs/tutorials.

<i>Evaluation</i>	<i>Value</i>	<i>Date</i>
Reading quizzes	6% (2% each)	Feb. 4, Feb. 18, March 18, April 1
Midterm	28%	March 4
Assignments	18% (6% each)	March 4, March 25, April 12
Tutorials	10% (1% each)	Once per week on Monday or Tuesday.
Final	38%	During final exam period.

- **Grading System:**

Letter grades assigned in this course have the following percentage equivalents:

A+ = 90-100    B = 73-76    C- = 60-62

A = 85-89    B- = 70-72    D+ = 57-59

A- = 80-84    C+ = 67-69    D = 53-56

B+ = 77-79    C = 63-66    D- = 50-52

F Failure. No academic credit.

ABS Absent from the final examination.

DEF Official deferral.

FND Failed, no deferral.

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

- **Midterm and final exam:**

The midterm will cover content from the first portion of the course (up to and including week 5). The final exam will focus on the part of the class not covered by the midterm (week 6 onwards) but will also include some selected topics prior to the midterm – details will be provided in class.

The midterm and the final will be based on:

- (1) the course slides, which will be made available on Brightspace,
- (2) selected tutorial topics,
- (3) any additional content provided during the class and/or readings as specified before the test/exam.

Class attendance is strongly encouraged because information will be provided during class beyond that in the slides or readings, including explanations of course themes, perspectives that are not in the slides, hints for tests, etc. Thus, if you miss a class, please watch the recorded lecture and/or obtain notes from another student.

- **Tutorials.**

The tutorials are designed to provide hands on practice with concepts discussed in class—please see schedule below for exact dates. Attendance is mandatory, and the TA will give you a mark for the tutorial at the end of the session: 0 means you did nothing or did not show up, 0.5 is partial credit (e.g., did some work on the tutorial but arrived late or left early; spent part of the tutorial session on other work), and 1 is full credit. Some of the tutorials provide assignment time. If you finish the corresponding assignment before the tutorial and submit the final version before the tutorial start time, you don't have to attend the tutorial and you will get credit – but you must let your TA know before the tutorial starts.

- **Midterm Exam and Tutorial Deferral Policy**

If you expect to miss any of the tutorials or the midterm, you must notify the instructor as soon as possible, before the date of the tutorial, unless extraordinary circumstances prevent doing so. A deferred tutorial or exam will be permitted under only two conditions: illness or bereavement. Documentation is required in order to schedule a deferral. If no documentation is provided, you will receive a grade of zero for that tutorial or exam. Deferral of the final exam is only possible if the registrar office is notified and their protocol is followed.

- **Assignments**

There are three written assignments that involve the application of AI techniques . **All assignments are due by 11:59m** on the specified date. Please avoid putting the assignment off until the last minute – this does not work well with AI assignments as they require exploration of the concepts, use of AI software, etc.

**Late policy:** Assignments will be accepted late if an extension has been requested **before** the deadline for submitting the assignment. If an extension has been

granted, the assignment must be handed in before the assignments are graded and returned, otherwise the assignment will be graded as a zero.

**Collaboration policy:** You may collaborate on the assignments with **one other person**—if you do, you must clearly indicate the name of the person you worked with on the assignment you pass in (and in that case, your assignments can be the same). Group collaboration on the assignments with more than 2 people is not permitted—this will be strictly enforced.

**Citation policy:** If you use any external sources, like papers or stackexchange, *please cite these sources*. In general, if you are not sure, please check with us. Please see the notice on academic integrity towards the end of the syllabus (e.g., “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”).

- **Reading quizzes**

There will be 4 brief online quizzes on the assigned readings which will be research papers illustrating the application of AI techniques – you are **only** required to write any **3** of the **4** scheduled quizzes and each is worth 2%. If you write all 4 quizzes, that grade will be added to the quiz total (if you obtain over 6%, that additional score up to 2% will count as bonus points to the course total).

**All quizzes are due by 11:59pm** on the specified date.

**What happens if I miss a quiz?** Make-up quizzes will not be available—if you miss a quiz because of a documented reason, you will either be provided with an extension or its weight will be added to the final.

**VI. Course Schedule***This schedule is to be regarded as tentative.*

Jan. 14	Lecture	Introduction. Problem solving as search.
Jan. 17/18	<i>Tutorial</i>	<i>Problem solving as search</i>
Jan. 21	Lecture	Symbolic approaches.
Jan. 24/25	<i>Tutorial</i>	<i>Expert systems</i>
Jan. 28	Lecture	Bayesian networks; Reading quiz 1 opens
Jan. 31/Feb. 1	<i>Tutorial</i>	<i>Bayesian networks</i>
Feb. 4	Lecture	Bayesian networks; Assignment 1 posted; quiz 1 closes
Feb. 7/8	<i>Tutorial</i>	<i>Assignment 1 time</i>
Feb. 11	Lecture	Supervised machine learning; quiz 2 opens
Feb. 14/15	<i>Tutorial</i>	<i>Weka</i>
Feb. 18	Lecture	Supervised machine learning; quiz 2 closes; Assn 2 posted
Feb. 21-25	<b>Winter break</b>	<b>No tutorial. No class.</b>
Feb. 28/March 1	<i>Tutorial</i>	<i>Decision Trees</i>
March 4	Lecture	<b>Midterm Exam</b> ; Assignment 1 due
March 7/8	<i>Tutorial</i>	<i>Assignment 2 time</i>
March 11	Lecture	Neural networks; Reading quiz 3 opens
March 14/15	<i>Tutorial</i>	<i>Perceptrons</i>
March 18	Lecture	Neural networks; Reading quiz 3 closes
March 21/22	<i>Tutorial</i>	<i>Neural networks</i>
March 25	Lecture	Language processing; Assn 2 due; quiz 4 opens; Assn 3 posted
March 28/29	<i>Tutorial</i>	<i>Assignment 3 time</i>
April 1	Lecture	Unsupervised machine learning; quiz 4 closes
April 4/5	<i>Tutorial</i>	<i>Natural language processing</i>
April 8	Lecture	Reinforcement learning
April 11/12	<i>Tutorial</i>	<i>Clustering; Assn 3 due</i>
April 14-28	<b>Exam Period</b>	<b>Final Exam scheduled</b>

**VII. E-mail**

We, the professor and TAs, will try to respond to e-mails within 48 hours (excluding weekends and holidays). E-mail is best reserved for simple questions. If you have questions that require more than a yes/no type answer, the best time for answering them is during class, tutorials, or office hours.

**VIII. Copyright**

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copyright protected and remain the intellectual property of their respective author(s). All course materials, including presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).

Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

**IX. Resources**

<i>Service</i>	<i>Helps with ...</i>	<i>Contact</i>
Cognitive Science Undergraduate Office	Course selection, meeting program requirements, questions about the program	613-520-2600 x 2522 2201 Dunton Tower <a href="https://carleton.ca/cognitivescience/">https://carleton.ca/cognitivescience/</a>
Centre for Student Support (CSAS)	Academic rules, finding a tutor, develop writing skills, study skills, and more.	613-520-3822 4th Floor, MacOdrum <a href="https://carleton.ca/csas/">https://carleton.ca/csas/</a>
Paul Menton Centre (PMC)	Learning disabilities accommodations and tools	613-520-6608 501 University Centre <a href="https://carleton.ca/pmc">https://carleton.ca/pmc</a>
International Student Services Office	Information and help with English for international students	128 University Centre 613-520-6600 <a href="https://carleton.ca/isso">https://carleton.ca/isso</a>
Reference Services Desk at MacOdrum Library	Library research help, learning support, IT support	613-505-4245 MacOdrum Library <a href="https://library.carleton.ca/services/research-help">https://library.carleton.ca/services/research-help</a>
Health and Counselling Services	Physical and mental health issues; stress.	613-520-6674 2600 Carleton Technology & Training Centre <a href="https://carleton.ca/health">https://carleton.ca/health</a>

## **X. Plagiarism**

The University Academic Integrity Policy defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This includes reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

Examples of plagiarism include, but are not limited to:

- any submission prepared in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one’s own; and
- failing to acknowledge sources through the use of proper citations when using another’s work and/or failing to use quotations marks.

Plagiarism is a serious offence that cannot be resolved directly by the course’s instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of “F” for the course or even suspension or expulsion from the University.

## **XI. Addressing Human Rights Concerns**

The University and all members of the University community share responsibility for ensuring that the University’s educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at [equity@carleton.ca](mailto:equity@carleton.ca).

## **XII. Requests for Academic Accommodations**

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

### **a. 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, please review the Student Guide to Academic Accommodation:

<https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

### **b. 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, please review the Student Guide to Academic Accommodation:

<https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

### **c. 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](mailto: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: <http://carleton.ca/pmc>

### **d. 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 where 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 the Equity and Inclusive Communities website:

<https://carleton.ca/equity/focus/sexual-violence-prevention-survivor-support/>

**e. 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 Senate Policy on Accommodation for Student Activities:

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

### **XIII. COVID-19**

All members of the Carleton community are required to follow COVID-19 prevention measures and all mandatory public health requirements (e.g. wearing a mask, physical distancing, hand hygiene, respiratory and cough etiquette) and [mandatory self-screening](#) prior to coming to campus daily.

If you feel ill or exhibit COVID-19 symptoms while on campus or in class, please leave campus immediately, self-isolate, and complete the mandatory [symptom reporting tool](#). For purposes of contact tracing, attendance will be recorded in all classes and labs. Participants can check in using posted QR codes through cuScreen platform where provided. Students who do not have a smartphone will be required to complete a paper process as indicated on the [COVID-19 website](#).

All members of the Carleton community are required to follow guidelines regarding safe movement and seating on campus (e.g. directional arrows, designated entrances and exits, designated seats that maintain physical distancing). In order to avoid congestion, allow all previous occupants to fully vacate a classroom before entering. No food or drinks are permitted in any classrooms or labs.

For the most recent information about Carleton's COVID-19 response and required measures, please see the [University's COVID-19 webpage](#) and review the [Frequently Asked Questions \(FAQs\)](#). Should you have additional questions, please contact [covidinfo@carleton.ca](mailto:covidinfo@carleton.ca)

Please note that failure to comply with University policies and mandatory public health requirements, and endangering the safety of others are considered misconduct under the [Student Rights and Responsibilities Policy](#). Failure to comply with Carleton's COVID-19 procedures may lead to supplementary action involving Campus Safety and/or Student Affairs.