

CGSC 3601-A Artificial Intelligence and Cognitive Science

Prerequisites: third-year standing and CGSC 2002 and (CGSC 1005 or COMP 1005). Restricted to students enrolled in B.Cog.Sc. Honours.

Lecture Time: 2:35 p.m. to 3:55 p.m. on Mondays and Wednesdays

Lecture Room: 406 Southam Hall

Tutorial A1: 4:05 p.m. to 5:25 p.m. on Thursday

Tutorial A2: 4:05 p.m. to 5:25 p.m. on Tuesday

Tutorial Room: 509 Southam Hall

Instructor: M. Alex Kelly, Ph.D. (they/she; alex.kelly@carleton.ca)

Prof. Kelly's Office: 2209 Dunton Tower; <https://carleton-ca.zoom.us/j/97622879308>

Prof. Kelly's Office Hours: By appointment.

Teaching Assistants:

Eilene Tomkins-Flanagan (she/her; eilenetomkinsflanaga@cmail.carleton.ca)

Maria Vorobeve (she/they; MariaVorobeve@cmail.carleton.ca)

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:** Slides, recorded lectures, quizzes, exams, and assignments are posted here:
Home page: <https://brightspace.carleton.ca/d2l/home/56454>
Labs will be posted on and submitted to the lab Brightspace pages:
A1 (Thursdays): <https://brightspace.carleton.ca/d2l/home/143428>
A2 (Tuesdays): <https://brightspace.carleton.ca/d2l/home/143429>
- III. **Textbook:** No textbook is required for the course. Readings, slides, and recorded lectures will be provided through the course web site. If you require a resource beyond the course materials, the following artificial intelligence textbook is free: <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 in 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, review/reflection questions to be completed after each lecture, three online quizzes on readings, three assignments, and labs/tutorials. All course materials will be available through Brightspace.

<i>Evaluation</i>	<i>Value</i>	<i>Date</i>
Reading quizzes	12% (4% ea.)	Sept. 21-Oct. 5, Oct. 5-19, Nov. 7-16
Midterm	28%	Oct. 31-Nov. 3
Assignments	18% (6% ea.)	Oct. 31, Nov. 23, Dec. 8
Tutorials	9% (1% ea.)	Once per week on Tuesday or Thursday.
Lecture questions	5% (0.2% ea.)	Available after each lecture, due in 1 week.
Final	28%	During final exam period.

VI. **Grading System:**

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

A+ = 90-100	B = 73-76	C- = 60-62	F Failure. No academic credit.
A = 85-89	B- = 70-72	D+ = 57-59	ABS Absent from the final examination.
A- = 80-84	C+ = 67-69	D = 53-56	DEF Official deferral.
B+ = 77-79	C = 63-66	D- = 50-52	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.

VII. **Lectures:** In the interest of accommodating sick, immunocompromised students, or COVID-cautious students, all lectures will be recorded and made available on Brightspace. In-person attendance is neither taken nor required.

VIII. **Lecture questions:** Each lecture will have corresponding review or reflection question(s) worth, collectively, 6% of your final grade, due to be completed on Brightspace one week from the lecture at 11:59pm.

IX. **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. The midterm and the final will be based on:

- (1) slides and recorded lectures, which will be made available on Brightspace,
- (2) tutorial / lab topics.

Exams are **open book**: you may consult course materials while taking the exams.

X. **Tutorials / Labs**

The tutorials are designed to provide hands on practice with concepts discussed in class. Tutorials are intended to be completable during the tutorial time allotted, but you have **until the start of the next tutorial at 4:05 pm** to submit your worksheet to your tutorial section's Brightspace page. Some tutorials provide assignment time. Attendance is **not** taken and **not** mandatory.

XI. **Exam Deferral Policy**

Both the midterm and final exam will be online, open on the Brightspace page for a period of several days with a time limit of 3 hours once started.

If you expect to miss the **midterm** exam (which will be available to be completed any time from 10:00 am on Oct. 31st to 11:59 pm on Nov. 3rd), you must notify me as soon as possible.

Deferral of the **final** exam is only possible if the registrar office is notified and their protocol is followed.

XII. **Assignments**

There are three written assignments that involve the application of AI techniques . **All assignments are due by 11:59pm** 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 Stack Exchange, *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”).

XIII. 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 4%. If you write all 4 quizzes, that grade will be added to the quiz total (if you obtain over 12%, that additional score up to 4% 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.

XIV. **Email:** We, the professor and TAs, will try to respond to e-mails within 48 hours (excluding weekends and holidays).

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

Sept. 7	Lecture	Introduction
Sept. 12	Lecture	Problem solving as search
Sept. 14	Lecture	Symbolic systems
Sept. 13/15	<i>Tutorial</i>	<i>Problem solving as search</i>
Sept. 19	Lecture	Robotics
Sept. 21	Lecture	Bayesian probability; Reading quiz 1 opens
Sept. 20/22	<i>Tutorial</i>	<i>ACT-R</i>
Sept. 26	Lecture	Bayesian networks
Sept. 28	Lecture	Dynamic bayesian networks
Sept. 27/29	<i>Tutorial</i>	<i>Bayesian networks</i>
Oct. 3	Lecture	Decision networks and naive Bayes; Assignment 1 posted
Oct. 5	Lecture	Supervised machine learning; quiz 1 closes; quiz 2 opens
Oct. 4/6	<i>Tutorial</i>	<i>Assignment 1 time</i>
Oct. 10	Thanksgiving	No lecture.
Oct. 12	Lecture	Supervised machine learning
Oct. 11/13	<i>Tutorial</i>	<i>Weka</i>
Oct. 17	Lecture	Decision Trees
Oct. 19	Lecture	Midterm review & ID3; quiz 2 closes; Assn 2 posted
Oct. 18/20	<i>Tutorial</i>	<i>Decision Trees</i>
Oct. 24-28	Fall break	No tutorial. No lecture.
Oct. 31	Midterm	No lecture; Assignment 1 due; Online midterm opens
Nov. 2	Lecture	Perceptrons
Nov. 1/3	<i>Tutorial</i>	<i>Assignment 2 time; online midterm closes on the 3rd</i>
Nov. 7	Lecture	Perceptrons; Reading quiz 3 opens
Nov. 9	Lecture	Single-layer neural networks
Nov. 8/10	<i>Tutorial</i>	<i>Perceptrons</i>
Nov. 14	Lecture	Multi-layer neural networks

Nov. 15		Last day for academic withdrawal
Nov. 16	Lecture	Designing neural networks; Reading quiz 3 closes
Nov. 15/17	<i>Tutorial</i>	<i>Neural networks</i>
Nov. 21	Lecture	Structural natural language processing; quiz 4 opens
Nov. 23	Lecture	Statistical NLP; Assn 2 due; Assn 3 posted
Nov. 22/24	<i>Tutorial</i>	<i>Assignment 3 time</i>
Nov. 28	Lecture	Unsupervised machine learning
Nov. 30	Lecture	Unsupervised machine learning; quiz 4 closes
Nov. 29 / Dec. 1	<i>Tutorial</i>	<i>Natural language processing</i>
Dec. 5	Lecture	Reinforcement learning
Dec. 7	Lecture	Q-learning and Deep Reinforcement Learning
Dec. 6/8	<i>Tutorial</i>	<i>Clustering; Assn 3 due on the 8th</i>
Dec. 9	Last Day	No lecture for CGSC 3601. Monday schedule followed for other courses.
Dec. 10-22	Exam Period	Final Exam scheduled

XVI. 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).

XVII. 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.

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, artworks, 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.

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Statement on Student Mental Health

As a University student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. Here is a list that may be helpful:

Emergency Resources (on and off campus): <https://carleton.ca/health/emergencies-and-crisis/emergency-numbers/>

Carleton Resources:

- Mental Health and Wellbeing: <https://carleton.ca/wellness/>
- Health & Counselling Services: <https://carleton.ca/health/>
- Paul Menton Centre: <https://carleton.ca/pmc/>
- Academic Advising Centre (AAC): <https://carleton.ca/academicadvising/>
- Centre for Student Academic Support (CSAS): <https://carleton.ca/csas/>
- Equity & Inclusivity Communities: <https://carleton.ca/equity/>

Off Campus Resources:

- Distress Centre of Ottawa and Region: (613) 238-3311 or TEXT: 343-306-5550, <https://www.dcottawa.on.ca/>
- Mental Health Crisis Service: (613) 722-6914, 1-866-996-0991, <http://www.crisisline.ca/>
- Empower Me: 1-844-741-6389, <https://students.carleton.ca/services/empower-me-counselling-services/>
- Good2Talk: 1-866-925-5454, <https://good2talk.ca/>
- The Walk-In Counselling Clinic: <https://walkincounselling.com>

Statement on Pandemic Measures

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 [a 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 should follow Carleton's [symptom reporting protocols](#).

Masks: Masks are no longer mandatory in university buildings and facilities. However, we continue to recommend masking when indoors, particularly if physical distancing cannot be maintained. We are aware that personal preferences regarding optional mask use will vary greatly, and we ask that we all show consideration and care for each other during this transition.

Vaccines: While proof of vaccination is no longer required to access campus or participate in in-person Carleton activities, 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 response and health and safety requirements please see the [University's COVID-19 website](#) and review the [Frequently Asked Questions \(FAQs\)](#). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.

Requests for Academic Accommodations

ACADEMIC ACCOMMODATION

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

Pregnancy obligation: write to me 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 accommodation regarding a formally-scheduled final exam, you must complete the Pregnancy Accommodation Form ([click here](#)).

Religious obligation: write to me 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 [click here](#).

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and 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 me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

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: <https://carleton.ca/equity/sexual-assault-support-services>

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 will be provided to students who compete or perform at the national or international level. Write to me 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. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

Important Information

- Students must always retain a hard copy of all work that is submitted.
 - All final grades are subject to the Dean's approval.
 - For us to respond to your emails, we need to see your full name, CU ID, and the email must be written from your valid CARLETON address. Therefore, in order to respond to your inquiries, please send all email from your Carleton CMail account. If you do not have or have yet to activate this account, you may wish to do so by visiting <http://carleton.ca/ccs/students/>
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For a list of dates and deadlines, including holidays and exam dates, please visit:

<https://calendar.carleton.ca/academicyear/>