CS 4700/5700: Foundations of Artificial Intelligence

Enrollment Questions

Most questions about enrollment are not specific to this course and you'll find the answers at:

- Enrollment information for CS classes
- Waitlist FAQs.
- Information specifically for 4000- and 5000-level courses.

If, after reading the above resources, you still have a question about getting into the course, please file a help ticket at https://tdx.cornell.edu/TDClient/193/Portal/Home/. Thank you!

Course Staff:

- Instructor:
  - Prof. Kevin Ellis, Gates 442B
- Course Administrator:
  - Lacy Jordaens, lsl92@cornell.edu
- Graduate TAs:
  - Vivian Nguyen
  - Top Piriyakjulkj
  - Jinyan Su
- Office Hours can be found at https://calendar.google.com/calendar/u/0?cid=ZWU2ZGNjOTRlZTZmNjk5NDA2MjFiZjE2NmY2Mjg3YTQyODlmMTI1MTJlMzRkODM5OGExNDJjYWE3NmI

Course email

- **Please always put "CS4700" in the Subject field of any course email.**
- All course-specific administrative matters: lsl92@cornell.edu (Lacy Jordaens) - such as, for example, exam logistics and special accommodations letters, including those arising from COVID.
- All course content matters: If you have any questions about course content - such as about homework solutions or things like that - please contact the instructors via Ed Discussion

CS 4700/5700 online

- Canvas: The Canvas website for the course will be used as the entry point to all online material for the course, and will include links to the other online resources for the course.
- Ed Discussion: Online course discussions will take place on Ed Discussion, and is accessible via the course's Canvas page. You will be automatically enrolled in it. You are required to read it - it will be the primary place where we send information to students.
- Gradescope: Assignments should be submitted via Gradescope. Navigate to Gradescope via Canvas. **Please use your Net ID as your student ID number to ensure that your grades are recorded correctly.**

Prerequisites:

Officially this course lists CS2110/ENGRD2110 and CS2800 as prerequisites. What follows is the more specific list of topics that the course will assume you know. If you don't know them yet, don't take the course hoping you'll pick them up along the way. There is ample evidence that students who do so struggle in the course. **If you know the following, regardless of the courses taken, then that's all**

we care about. This is a senior/master's-level CS course, and we will expect that level of background from students.

- Trees and graphs and algorithms on them. You should come into the course capable of, for example, giving a pseudo-code algorithm for depth-first search or Dijkstra's shortest path algoritm.
- Basic probability. For example, if asked to compute P(A|B) and you know P(B|A), P(A), and P(B), you should recognize that this is when you pull out Bayes Rule (and, obviously, then correctly compute P(A|B)).
- Propositional and first-order logic. Coverage of this topic in 2800 can be somewhat variable, so this is the one prerequisite we spend some time reviewing and not just assuming.
- Programming. This is a 4000-level CS course for undergraduates and a 5000-level CS course for master's students. You should know how to program. The course will therefore also assume you are comfortable programming and some homework assignments will involve programming. **If you don't feel comfortable programming do not take this course.**
    - All programming assignments will require Python. If you do not know it yet, the course assumes you will be able to pick it up. (Moreover, if you don't know it, it's something you really should have picked up by the time you leave Cornell.) Much of the infrastructure for your programming assignments will be given to you, so if you don't know Python a lot of this will be more about looking up the syntax for things you already know.

Textbook:

- *Artificial Intelligence: A Modern Approach, 4th Edition* by Stuart Russell and Peter Norvig
  The textbook is also being made available via Instant Access within Canvas. **You will be charged until you opt out of the textbook.**
- Exercises: Most textbooks have helpful exercises at the end of each chapter. This textbook, however, has moved all exercises to github: Exercises for *Artificial Intelligence: A Modern Approach*

Grading:

Grade components: Your final grade percentage will be computed from the following course elements in the percentages listed:

- **Prelim: 35%:**The prelim for the course will take place on **Thursday, March 14, 7:30pm**. It will cover the material up through the lecture on Wednesday, March 13. All exam conflicts should be reported using a conflict form that will be announced on Ed. Please include details on the other exam or course causing the conflict.
- **Final: 40%:**While the final exam may include material from the entire semester, it will be primarily focused on testing material not covered on the prelim.
- **Homework: 25%:** There will be homeworks approximately every two weeks. Some will involve programming. Each will be worth an equal proportion of your homework grade unless specified otherwise.
    - Deadlines: Penalty of 3% per day (rounded up to the nearest day). Example: You get 90% on the homework (raw score), but you submit it 1.4 days late, which rounds up to 2, giving a total of penalty 3%/day * 2 days = 6%. Your adjusted score becomes: (1 - 3%/day * 2 days) * 90% = 94% * 90% = 84.6%. **If you have extenuating circumstances**, please send email to the course administrator, Lacy Jordaens, lsl92@cornell.edu. We will provide extensions when applicable for injuries, family emergencies, etc., on a case-by-case basis. Getting confused about the time an assignment is due, or being bogged down by work in other classes, is not an extenuating circumstance. **There are no dropped homeworks.**
    - Submissions: Read homework assignments carefully. You have not submitted the assignment on time if you have not submitted it on the proper platform (Gradescope or otherwise) on time.
    - Format: **Nonprogramming homeworks must be typeset**, such as via Microsoft Word or LaTeX. Regardless of the tool you use, use common sense: Is it legible? We are harsh. If we

can't read it you get a zero. If you submit something handwritten, you get a zero. Really.
    - Collaboration Policy: Doing a homework problem typically involves three steps: (1) understanding a question, (2) figuring out a solution and (3) writing it up coherently. For the first step we encourage discussion with classmates. For the second, discussion with classmates is also ok, but it is important that it conclude with you understanding how to solve the question, not just copying someone else's solution. You are also allowed to refer to online resources that you might find that might help you understand the question and understand any required background knowledge, but not to figure out the solution. Always, the third step, writing it up, must be your own work.
        - You are not allowed to share digital or written notes or images of your work in any form with each other.
        - Your work must include acknowledgements of all students with whom you collaborated at the top of your first page.
        - The solutions that you write up must be entirely your own work.

Additional grading information:

- **Regrade Requests:** Regrade requests must be submitted within **seven days** of grades/solutions being released. They should not be "Why is this wrong?" - that is something you can ask in office hours or via a post on Ed Discussion. Regrade requests should be made because you believe a specific error was made in the grading. Sometimes a student *does* discover either an error in the expected solution or a valid solution that had not been considered. Determine this first in office hours or via an online post, and submit a regrade request if it is verified there. We reserve the right to lower points on other questions if you submit a regrade request. (And, to be truthful, that last sentence is to give us options to respond to students who abuse the regrade request process or who submit requests using anything but language respectful of their fellow students who are responsible for grading.)
- **Extra credit:** Participation on Ed Discussion, particularly answering questions and writing helpful posts, is strongly encouraged, and those who participate energetically in this online venue for the course will receive extra credit at the end of the semester. Asking questions that have already been answered on Ed Discussion or on this very page will counteract extra credit.
- **Conversion to letter grades:** We do not have predetermined letter-grade cutoffs, and will determine those based on the final distribution of overall grade percentage. However, we commit to using letter-grade cutoffs which are **at least** as generous as the following: 90%+ will be some kind of A, 80%+ will be **at least** some kind of B, 70%+ will be **at least** some kind of C. Any adjustment of letter-grade boundaries will only be to lift up grades relative to these cutoffs, and never to shift grades below what they would be using these cutoffs. In other words, you are guaranteed at least whatever letter grade you would have received given typical highschool grade cutoffs, and you might hypothetically, for example, receive an A with an 80% final average if the class average skews low enough.

Class Policies

- **Auditing**: There is no auditing option for this course. **Do not sign up to audit this course.**
- **Technology:** Numerous research studies have found adverse learning (and grade) impacts from the use of technology (laptops, cellphones, etc.) in classrooms, both directly for the students who are using the technology but also for other students in the class. This is true even for those students who think they are good multi-taskers or otherwise think they are able to learn better with the use of technology in class - studies show that those who do the most multitasking on their computer are the ones with the weakest ability to multitask. It also impacts the instructor when students are sufficiently engaged in their technology than it impacts the subtle body language that informs a teacher about how well their material is being received.
  Our strong advice is to not use technology in the classroom. However, some students will want to do things like use a tablet to take notes on the PDFs of slides. As a result the policy for this course is as follows:

> *You can use technology only if you are seated in the back rows of either side section of the lecture hall. If you use technology otherwise you will be asked to turn it off.*

(For completeness, should the instructor ask you to do use technology - such as to answer an online poll - you are of course allowed to use it. When completed the technology must be put away.)
If you believe you have special circmstances that aren't covered by this policy please contact the instructor.

- **Academic Integrity**: From Cornell's code of academic integrity:

> *Absolute integrity is expected of every Cornell student in all academic undertakings. Integrity entails a firm adherence to a set of values, and the values most essential to an academic community are grounded on the concept of honesty with respect to the intellectual efforts of oneself and others. Academic integrity is expected not only in formal coursework situations, but in all University relationships and interactions connected to the educational process, including the use of University resources. ... A Cornell student's submission of work for academic credit indicates that the work is the student's own. All outside assistance should be acknowledged, and the student's academic position truthfully reported at all times. In addition, Cornell students have a right to expect academic integrity from each of their peers.*

  Any distribution or dissemination of course assignment information (such as copies of exams, solutions, etc.) to students not taking the course - whether to students in a subsequent offering of the course, via a website, or any other circmstance - is a violation of the academic intregity policy for this course. **We will pursue strong negative consequences for academic integrity violations.**
- **Accommodations** There are various non-academic reasons students can face difficulties in successfully completing a course of study. Some can be short-term, some chronic. If there are any special accommodations that we must be aware of to help you be a successful student in this course it will typically be documented in a letter from the appropriate Cornell office, most typically Student Disability Services. Please email such letters to the course administrator, Lacy Jordaens, at lsl92@cornell.edu. While it is our responsibility to be mindful of relevant Cornell policies governing such matters, it is your responsibility to notify us of the relevance of these policies to you. **Please submit the necessary documentation during the first two weeks of the semester**, so that we can ensure that the necessary arrangements can be made as quickly as possible.
- **Respect:** Everyone - the instructor, TAs, and students - must be respectful of everyone else in this class. All communication, in class and online, will be held to a high standard for thoughtfulness and inclusiveness: it may never target individuals or groups for harassment, and it may not exclude specific groups. Sometimes such acts occur without hurtful intent, but nonetheless create hurtful experiences for others. One very common example of this is humor when it targets particular individuals or groups. The label on this section is "Respect" because the surest way to be thoughtful about such matters is to always interact with others in respectful ways. Humor that targets particular individuals or groups is not respectful. If any of the communications or interactions in this class doesn't meet these standards - whether with a fellow student or with course staff - please contact the instructor; if for whatever reason you don't feel comfortable discussing something directly with the instructor you may also choose to raise it with your advising office or the department chair.

Course Schedule

Starting Monday January 22, lectures will take place Mondays and Wednesdays 2:55pm - 4:10pm in Hollister Hall B14. The schedule of lectures and homeworks is as follows. (We may tweak this schedule as the semester progresses.) Slides for each lecture will be posted on Canvas just before the relevant lecture under Files > Slides.

Date	Title	Readings	Homework
1/22	Overview		
1/24	Uninformed Search	Russell & Norvig Ch. 3.1-4	HW 1 out, due 2/5
1/29	Informed Search	Russell & Norvig Ch. 3.5-6	
1/31	Local search	Russell & Norvig Ch. 4.1-2	
2/5	Game Trees: Minimax	Russell & Norvig Ch. 5.1-3	HW 1 due HW 2 out, due 2/14
2/7	Game Trees: Expectimax, Utilities	Russell & Norvig Ch. 5.5, 16.1-16.3	
2/12	Markov Decision Processes 1	Russell & Norvig Ch. 17.1-3	
2/14	Markov Decision Processes 2	Russell & Norvig Ch. 17.1-3	HW 2 due HW 3 out, due 3/4
2/19	Reinforcement Learning 1	Russell & Norvig Ch. 21	
2/21	Reinforcement Learning 2	Russell & Norvig Ch. 21	
2/24-2/27	February Break		
2/28	Bandits, Monte Carlo Tree Search		
3/4	Probability	Russell & Norvig Ch. 12.1-6	HW 3 due
3/6	Bayes Nets	Russell & Norvig Ch. 13.1-2	HW 4 out, due 4/10 Masters (5700) HW out, due 3/25
3/11	Independence	Russell & Norvig Ch. 13.1-2	
3/13	Bayesian Inference and Prediction		
3/14	Prelim Exam	7:30pm, location TBD	
3/18	Exact Inference	Russell & Norvig Ch. 13.3	
3/20	Sampling Methods	Russell & Norvig Ch. 13.4	
3/25	Hidden Markov Models 1	Russell & Norvig Ch. 14.1-	Masters (5700) HW due

		3	
3/27	Hidden Markov Models 2	Russell & Norvig Ch. 14.1-3	
3/30-4/8	Spring Break, Eclipse		
4/10	Decision Networks / VPI	Russell & Norvig Ch. 16.5-6	HW 4 due
4/15	Propositional Logic 1	Russell & Norvig Ch. 7.1-4	HW 5 out, due 4/29
4/17	Propositional Logic 2	Russell & Norvig Ch. 7.5 - 7.7	
4/22	First-Order Logic	Russell & Norvig Ch. 9.1-5	
4/24	Planning 1	Russell & Norvig Ch. 11.1-3	HW 6 out, due 5/6
4/29	Planning 2	Russell & Norvig Ch. 26.5	HW 5 due
5/1	Special Topics in AI		
5/6	Special Topics in AI		HW 6 due
TBD, 5/13-5/20	Final Exam		