CS 4820/5820: Syllabus

Artificial Intelligence

Tue / Thr 12:15 PM - 1:30 PM, Centennial Hall 106

Instructor:	Adham Atyabi
Office:	Engineering 243
Email:	aatyabi@uccs.edu
Office Hours:	M @ 9 AM - 2 PM with appointment in advance.
Teaching Assistant:	Ali Al Shami (aalshami@uccs.edu)

Objective: Acquire an excellent understanding of the fundamental principles as well as practice of Artificial Intelligence. While there are many definitions of Artificial Intelligence, I look at it as a branch of knowledge that attempts to understand and build systems that are good at tasks that most humans, sometimes gifted ones, usually excel. The general topics covered are solving problems using search, solving problems using logic, machine learning, and application areas such as natural language processing.

Textbooks: The recommended textbook is *Artificial Intelligence, A Modern Approach, Third Edition, by Russell and Norvig (RN3)*. I have not order the book through the bookstore this semester since you can download the second edition of the book from the Web for free but you can also buy it from any source you like. I put an order for this book in bookstore in previous semesters so it is likely that they still have it and you might be able to get it from them as well. The book is quite voluminous with about 1,125 pages of dense material. We will cover 350-400 of it at most. Please note that will cover almost everything we intend to cover in this class.

There are three other excellent books which I have found on the Web for free download. The first two books are *Artificial Intelligence by Rich and Knight, 3rd edition (RK3)*, and *Artificial Intelligence by Winston, 3rd edition (W3)*. I will require you to read chosen chapters from these books as necessary. The last book is *Machine Learning by Mitchell (M)*. Please download these three books as well.

The tentative list of topics that will be covered in our class is provided Table 1 (see page 6). Depending on how slow or fast we proceed in our lectures, I will adjuse our lecture pace and as a result, will have to make adjustments to the topics covered.

Grading Scheme

Grading for the class will be based on a class project, 4 home work assignments, and class participation. Students will complete a substantial class project during the semester. I prefer individual projects, but because the class is so big, I would like the undergraduates to work in groups of two.

The expectation from graduate students is much higher in this class. The graduate students are expected to work in groups of 2 and 4 (preferably 2) on a set of predefined projects. The expectation from each student is to take charge in developing one method, implement, evaluate and present results. Students from the same or different teams who are working on the same project (especially Graduate students) are prohibited from using the same method in their project. That is, for example, if two graduate teams, each having 2 students in the team, are working on the same project, project A, the expectation is to see 4 different methods presented by them.

Together, with the help of the TA (Mr. Ali Al Shami), it is expected that the final product and documentations (report) of the Graduate students' projects to be in an status appropriate for AAAI 2024 conference submission.

This is a substantial work and the students are advised to choose their teammates very carefully. Grading for a team will be based on the assumption that team members work well together and work equitably.

Class participation will be evaluated in terms of physical presence in the class, reading the required material and participating in discussions in a manner that reflects the knowledge acquired from reading. The details of these three phases and points dedicated to homework assignments and class participation are as follows:

The grade for the **Class Project** will be assessed in three phases of *Proposal*, *Mid-term Exam*, & *Final Exam*

- *Proposal:* A 2-page class project proposal is due at the end of the fourth week of classes. You will talk to the class for about 7-10 minutes regarding what you want to accomplish in the class project. The proposal write-up and talk are worth **7.5% of the class grade**.
  - The proposal must be written in AAAI format (see below) and must be "dense" with background research, references, and definite ideas for work to be pursued.
  - Each student should present minimum of 3 references related to the topic of his/her project.
  - **Only peer reviewed conference and journal articles are acceptable in this course. Students are advised to consider following journals and publishers as their main source of reading material for their projects: Nature, Scientific Reports, IEEE Transactions, Elsevier, Springer**.
  - You will lose points for not strictly following the requested AAAI format in your 2 page write up report.
  - Students in the same team can/should provide a single report containing the works of every member of the team. For a team of 2 students, this report is expected to have minimum of 6 references and to be minimum of 4 pages long.
  - I want the presentations and reports to be uploaded to Canvas. The presentations must move quickly so we can finish on time. We will have two or maximum of three classes dedicated for the presentations, depending to the size of the class. The presentation order and schedule will be released a week before the proposal presentation session.

- *Mid-term Exam*: The mid-term exam will be worth **12.5% of the class grade**.
  - The mid-term exam will be comprised of a presentation, a write-up and a demo of your class project accomplishments so far.
  - You will do a 10-15 minute presentation in the class where you discuss 3 new references, the problem statement, the approach you are taking to address the problem and your progress.
  - The write-up will be 3-4 pages (one or two new pages to be added to proposal document), once again in AAAI format with sufficient preliminary content.
  - The expectation from project reports in midterm stage is to compliment the report you put in your proposal stage.
  - Students in the same team can/should provide a single report containing the works of every member of the team. For a team of 2 students, this report is expected to have minimum of 6 new references (total of 12 with the references in proposal stage) and to be minimum of 6-8 pages.
  - You Should also have a live or prerecorded of your demo presented in this session as part of your midterm presentation.
  - You *must* make visible progress by the mid-term date to get full credit.
- *Final Exam*: The final exam will be held during the last two weeks of classes, and the day of the scheduled final exam. It is worth **25% of the class grade**.
  - The final exam will be comprised of a 10-15 minute presentation, a write-up and a demo of your class project.
  - The write-up will be 5-6 pages long (two to three new pages to be added to mid-term report). Write it as if you are submitting it to the Annual Conference of the Association for the Advancement of Artificial Intelligence (AAAI)[1].
  - Students in the same team can/should provide a single report containing the works of every member of the team. For a team of 2 students, this report is expected to have minimum of length of 10-12 pages.
  - The final report of each student is expected to contain minimum of 9 references. Therefore, final reports produced by teams of 2 and 4 graduate students are expected to have minimum of 18 and 36 references respectively.
  - The expectation from project reports in final stage is to compliment the report you put in your proposal and midterm stages. This effort is intended to give students the experience of writing a scientific conference paper.
  - Your final report is to contain following 10 sections/components: Project Title, Authors, Abstract, Introduction, Background & Related Work, Problem statement, Methodology, Results, Discussion & Conclusion and References.

[1]Look at https://aaai.org/aaai-conference/ for the 2024 conference; download the 2024 AAAI Author Kit. Also, look at published papers at AAAI Conferences for full paper formats.

  - You will demo the final accomplishments for the project to me during your final presentation session.

  Students are advised to take advantage of office hours to work on their final project with me. You need to make an appointment in advance.

- *Homework Assignments*: The four home work assignments will be worth **50%** of the class grade.
- **5%** of the grade will be based on your regular attendance and participation in class discussion.

Please note that:

- **No late submission for homework assignments, proposal, midterm, or final project presentation and reports will be accepted.**
- An overall grade of 92.5% or above is guaranteed a grade of A, 90% - 92.5% A-.
- Every drop of grade by 10% is expected to roughly correspond to a letter grade drop.
- B+: 87.5% - 90% ; B: 87.5% - 82.5% ; B-: 80% - 82.5%,
- C+: 77.5% - 80% ; C: 77.5% - 72.5% ; C-: 70% - 72.5%.
- **Any grade bllow 70% (C-) will recieve F and it will be considered as a Fail.**

Formats

Use AAAI 2024 conference author style for all your reports. Each report must have academic-type references from reputed conferences and journals. Use Powerpoint or PDF for presentations. You will be penalized for not following the requested formats. The write-ups should look like as if they are ready to submit to AAAI 2024! The presentations should look professional.

Presentations Needed on Given Dates: If you have special reasons for not being able to hand in an assignment on time, please make prior arrangements with me. If you can't come to the class on the day of your presentation for unavoidable reasons, you must make the presentation through MS Teams, Zoom or some other means. You may also be able to upload a video of you giving your presentation with the slides somewhere. The presentations must be finished on schedule, no matter what (unless school is closed for snow day!).

Honesty: *You must do every assignment on your own*. You must not discuss solutions to specific problems given in the assignments with anyone. *Discussing specific problems from assignments with others will be considered cheating.* However, it is perfectly acceptable and actually encouraged that you discuss general topics and problems not given in the assignment, with others in the class. In fact, it is one of the best ways to learn. *You must not also look at each others' codes in any form—soft or hard*. *You must not copy solution to a problem or code from the Internet or*

any other source. Researching on the Internet or anywhere else is OK; you can read any material from any source, but you cannot copy material from any source.

If I find out that you have been dishonest on one or more specific problems on an assignment or exam, I will give you a zero for the whole assignment or exam. For egregious cases, the punishment may be severe, as determined by university policy; I will report you to people above me in such a situation and they will make the decision.

Important Dates

Please note that these dates are to be considered as place holders and they are to be adjusted depending on the overall progress of the class:

Project Proposal Report and Presentation:	09/23/2025 & 09/25/2025
Midterm Exam Report and Presentation:	11/06/2025, 11/11/2025 & 11/13/2025
Final: Presentation, Demo & Report:	12/09/2025, 12/11/2025, 12/16/2025

Topics	**Primary Material**	**Secondary Material**
Introduction	RN3:1.1 & 1.4, same in RN2	
Solving Problems by Searching	RN3:3.1-3.4, RN2:3	RK:2
Heuristic Search	RN3:3.5-3.6, RN2:4	RK:3
Beyond Classical Search	RN3:4.1 , RN2:4.4, discussion in RN3 is more extensive	
Proposal Presentations		
Evolutionary Optimization Algorithms	RK:23	RN3:4.1.4, RN2:20.8, W3:21
First Order Logic	RN3:8, RN2:7	W3:13
Inference in First Order Logic	RN3:9, RN2:9	W3:13
Midterm Presentations		
Machine Learning: Introduction	RN3:18.1-18.2, RN2:18.1	
Decision Tree Learning	M:3	RN3:18.3, W3:21
Neural Networks	RN3:18.7, RN2:19.1-19.5	RK:18, M:9
Reinforcement Learning	M:13	RN3:21, RN2:20
Natural Language Processing	RN3:22 & 23, same in RN2	RK:15, W3:28 & 29
Applications of AI		
Project Discussions		
Final Presentations		

Table 1: Potential topics to be covered and Lecture Schedule: RN3–Russell & Norvig, Edition 3; RN2–Russell & Norvig Edition 2; W3–Winston, Edition 3; RK3–Rich & Knight, Edition 3; M–Mitchell. The primary reading materials are from RN3 or RN2, except for three topics.