Course Code: CSCI-404 Artificial Intelligence
Semester Year: Spring 2025
Credit Hours: 3 Credit Hours
Sections & Meeting Times:

- 9:30AM – 10:45AM Tuesday and Thursday **(404A; Can)**
- 11:00AM – 12:15PM Tuesday and Thursday **(404B, 571; Corah)**

Class Location: Hill Hall 202

Instructors:
Micah Corah
Email: micah.corah@mines.edu
Office Phone: 303-384-2787 **Office Location:** Brown 280M
Office Hours: Mondays 3:00-4:00PM or by appointment

Tolga Can
Email: tolgacan@mines.edu
Office Phone: 303-384-2060 **Office Location:** CTLM 246K
Office Hours (in person): 1:30-2:30PM Tuesdays and Thursdays or by appointment

Teaching Assistants:
Sharfi Rahman (Lead TA): sharfirahman@mines.edu

- **Office Hours:** <fill in details>

Blake Adauto: badouto@mines.edu

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- **Office Hours:** <fill in details>

Commented [MC1]: Update details for office hours

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Pre-requisites:

- CSCI220 (Data Structures and Algorithms or equivalent)
- MATH201/334 Introduction to Statistics (or Probability)
- CSCI358 Discrete Mathematics *(recommended but not required)*

In general, students should have a good math and programming background and should be familiar with basic analysis of algorithms such as to identify the time complexity of an algorithm or to distinguish between polynomial and exponential time algorithms.

Course Description:

This course gives an introduction to the philosophies and techniques of Artificial Intelligence. AI techniques have become an essential element in modern computer software and are thus essential for a successful career and advanced studies in computer science. Students successfully completing this course will be able to apply a variety of techniques for the design of efficient algorithms for complex problems. Topics covered in this course include search algorithms (such as breadth-first, depth-first, A*), game-playing algorithms (such as Minimax), knowledge and logic reasoning, probabilistic reasoning, and machine learning.

In this course, we cover the following topics in Artificial Intelligence:

1. Search algorithms
    a. Uninformed search
    b. Informed search
2. Constrained satisfaction problems
3. Games and multi-agent search
    a. Minimax search
    b. Introduction to game theory
4. Logics
    a. Propositional logics
    b. Proof by resolution-refutation
    c. First-order logics
5. Probabilities
    a. Basics of probabilities and inference under uncertainty
    b. Bayesian networks
6. Markov Processes
    a. Markov Models & Hidden Markov Models
    b. Mark Decision Processes
7. Selected topics related to AI applications

Learning Outcomes:

Students completing this course will have an in-depth understanding of the core areas of AI and the connections among them. They should be able to:

1. Identify problems where artificial intelligence techniques are applicable,
2. Apply selected basic AI techniques; judge applicability of more advanced

Commented [MC2]: Can I update this to better reflect needs of engineering and other non-cs students?

Commented [TC3R2]: I think adding good math and programming background should be sufficient for non-cs students. It is an alternative for listing CSCI 220, MATH 210/334, and CSCI 358.

Commented [MC4R2]: A decent number of students last year struggled with basic combinatorial stuff (asymptotic growth, being able to calculate the size of the search space), and we spend a lot of time with probability so I think it's worth calling out those courses, even if we don't require them strictly.

I get the impression that the algorithms & discrete math side of the content we cover is pretty foreign to some engineering students (I had a few Mech-E students who came to office hours regularly and needed extra support.

Commented [MC5R2]: The other side to the convo is also what knowledge we want to assume in teaching and how well we can address gaps

Commented [TC6R2]: Got it. Listing the courses is a good idea.

Commented [MC7]: Update to reflect any change to the schedule

techniques,

3. Participate in the design of systems that act intelligently and learn from experience.

Recommended Texts and Resources:

- Required textbook:
  - Artificial Intelligence: A Modern Approach, Fourth Edition, by S. Russell and P. Norvig.
- Reference textbooks:
  - Reinforcement Learning: An Introduction, by Richard Sutton and Andrew G. Barto
  - Artificial Intelligence in the 21st Century, by Stephen Lucci, Danny Kopec.
  - Artificial Intelligence: A Systems Approach, by M. Tim Jones.

Resources for locating your textbooks and reference materials include the Mines Official Bookstore and Arthur Lakes Library.

Assessments:

The assessments for this course include the following:

1. **Homework sets (40%):** 5 homework sets
2. **Participation (404: 30%; 571: 15%):** Approximately 10 quizzes will be given throughout the semester
3. **Projects (30%):** Small programming projects will be assigned throughout the semester. This is a new component to the course, and we will provide more detail later on.
4. **571 GRADUATE ONLY: Paper reading and presentation (15%):** Students are expected to form reading groups, and each group can have up to 2 students. Through a discussion assignment on Canvas, each group is expected to present one paper in the last few weeks of the semester and lead the discussion on the paper.
   Note: The presentation will be classified as part of the participation grade on Canvas

Coursework Return Policy

- Quizzes will be graded within one week from the due dates.
- Written homework sets will be graded and returned within two weeks from the due dates.

Late Submission Policy

- The submission time will be specified on the course website on Canvas.
- Students are strongly encouraged to submit all assignments on time. However, students will be permitted to submit **two assignments** up to **two days late** with no questions asked
  (two total assignments, projects, or quizzes; NOT TWO PER CATEGORY)
- Please submit assignments early to allow adequate time for any possible computer or network trouble.

- Exceptions will only be made for documented emergencies, in strict adherence to CSM policy.

Grading Policy

A curve may be applied, but final grades will be no worse than the following thresholds:
A: ≥ 90
B: ≥ 80
C: ≥ 70
D: ≥ 60
F: < 60

Oredigger Promise: We Climb Together

Orediggers climb together. Orediggers look out for each other.
We made it through the 2020-21 school year together, on campus and in person, and we can do it again this year. But just as global data trends show us the pandemic isn't over, we also know it will take a shared commitment from us all to safely navigate the year ahead. As our understanding of the virus increases and variants take center stage, our commitment to protecting our community needs to evolve. This year's Oredigger Promise reflects this evolution as well as our continued need to climb together and protect our classmates and colleagues, our families and neighbors. I WILL:

- MONITOR MY HEALTH DAILY AND CHECK FOR COVID-19 SYMPTOMS. I will stay home if I am experiencing symptoms of COVID-19 – even if I feel well enough to come to campus and even if I'm vaccinated. I will get tested for COVID-19 before returning to campus life. I will report symptoms of or exposure to COVID-19 to Mines.
- ISOLATE AND QUARANTINE AS DIRECTED. Isolation is for those who test positive for COVID-19 and quarantine is for those who have had close-contact exposure to someone with COVID-19.
- WEAR AN APPROPRIATE FACE COVERING over my mouth and nose when inside classrooms, teaching labs, computer labs and other campus locations designated at entrances. I will also be supportive if others choose to wear face masks in other spaces around campus.
- WASH MY HANDS FREQUENTLY using soap and water or hand sanitizer.
- PARTICIPATE IN CONTACT TRACING AND TESTING to preserve the wellness of the community.
- BE GRACIOUS AND ATTENTIVE when others provide safety reminders and when I notice a fellow Oredigger who may be struggling.

Expectations of online etiquette or netiquette:

Here are few do's and don'ts about communicating in your course through emails or in online discussion forums:

- **Do**…

- Ask questions and engage in conversations as often as possible—feel free to contact the instructor via the discussion forum for questions or via email or other communication.
- Be patient and respectful of others and their ideas and opinions they post online.
- Remember to be thoughtful and use professional language. Keep in mind that things often come across differently in written text, so review your writing before posting.
- Be prepared for some delays in response time, as "virtual" communication tends to be slower than "face-to-face" communication.
- Contact the instructor if you feel that inappropriate content or behavior has occurred as part of the course.
- Check the syllabus and course policies stated by your instructor to know what to expect about your instructor's turnaround time for responding.

- **Do NOT**…
  - Use inappropriate language—this includes, but is not limited to, the use of curse words, swearing, or language that is derogatory.
  - Post inappropriate materials—for example, accidentally posting/showing a picture that is not appropriate for the course content.
  - Post in ALL CAPS, as this is perceived as shouting and avoid abbreviations and informal language ("I'll C U L8R").
  - Send heated messages even if you are provoked. Likewise, if you should happen to receive a heated message, do not respond to it.
  - Send an email or post to the entire class, unless you feel that everyone must read it.

Diversity and Inclusion:

At Colorado School of Mines, we understand that a diverse and inclusive learning environment inspires creativity and innovation, which are essential to the engineering process. We also know that in order to address current and emerging national and global challenges, it is important to learn with and from people who have different backgrounds, thoughts, and experiences.

Our students represent every state in the nation and more than 90 countries around the world, and we continue to make progress in the areas of diversity and inclusion by providing Diversity and Inclusion programs and services to support these efforts.

Disability Support Services:

The Colorado School of Mines is committed to ensuring the full participation of all students in its programs, including students with disabilities. If you anticipate or experience any barriers to learning in this course, please feel welcome to discuss your concerns with me. Students with disabilities may also wish to contact Disability Support Services (DSS) to discuss options to removing barriers in this course, including how to register and request official accommodations. Please visit their website at disabilities.mines.edu for contact and additional information. If you have already been

approved for accommodations through DSS, please meet with me at your earliest convenience so we can discuss your needs in this course.

Accessibility within Canvas:

Read the Accessibility Statement from Canvas to see how the learning management system at the Colorado School of Mines is committed to providing a system that is usable by everyone. The Canvas platform was built using the most modern HTML and CSS technologies, and is committed to W3C's Web Accessibility Initiative and Section 508 guidelines.

The Writing Center:

The writing center is a free academic support service available to all members of the campus community including undergraduate and graduate students. We can assist you at any stage of the writing process, from brainstorming to final revisions. You do not need a complete draft to make an appointment. Our consultants are experts in a variety of composition and communication fields, providing support as you work on projects such as lab reports, essays, collaborative papers, scholarly publications, thesis chapters, and oral presentations. Whether you are focusing on organization or sentence structure, the Writing Center can evaluate your individual needs and tailor each appointment so that you become a more effective and efficient communicator. The Writing Center is open Sunday-Friday for in-person and online appointments. To learn more about our services and to make an appointment, please visit writing.mines.edu For questions, please e-mail writing@mines.edu

Office of Institutional Equity & Title IX:

All learning opportunities at Mines, including this course, require an environment that allows each student to be able to learn without fear of discrimination or harassment based on any protected class. Discrimination and harassment of any type, including sexual harassment, sexual assault, dating violence, domestic violence, and stalking, are prohibited under the Policy Prohibiting Unlawful Discrimination and the Policy Prohibiting Sexual Harassment, Sexual Assault, and Interpersonal Violence. To report discrimination and harassment, please utilize one of the following options:

- **Katie Schmalzel (Title IX Coordinator and Director):** 303.273.3260; titleix@mines.edu
- **Any of the other confidential and non-confidential reporting options listed:** https://www.mines.edu/institutional-equity-title-ix/reporting/
- **Online Reporting Form (option to be anonymous):** https://www.mines.edu/institutional-equity-title-ix/submit-report/

Please note: Course rosters are provided to the instructor with the student's legal name. I will honor your request to address you by a preferred name and I will use your identified pronouns. Please advise me of any adjustments early in the semester so I may make appropriate changes to my records.

CARE @ Mines:

If you feel overwhelmed, anxious, depressed, distressed, mentally or physically

unhealthy, or concerned about your wellbeing overall, there are resources both on- and off-campus available to you. If you need assistance, please ask for help form a trusted faculty or staff member, fellow student, or any of the resources below. As a community of care, we can help one another get through difficult times. If you need help, reach out. If you are concerned for another student, offer assistance and/or ask for help on their behalf. Students seeking resources for themselves or others should visit care.mines.edu.

Additional suggestions for referrals for support, depending on comfort level and needs include:

- CARE at Mines: care.mines.edu for various resources and options, or to submit an online "CARE report" about someone you're concerned about, or email care@mines.edu
- CASA - https://www.mines.edu/casa/ for academic advising, tutoring, academic support, and academic workshops
- Counseling Center – https://www.mines.edu/counseling-center/ or students may call 303-273-3377 to make an appointment. There are also online resources for students on the website. Located in the Wellness Center 2nd floor. Located at 1770 Elm St.
- Health Center - https://www.mines.edu/student-health/ or students may call 303-273-3381 for appointment. Located in Wellness Center 1st floor.
- Colorado Crisis Services - For crisis support 24 hrs/7 days, either by phone, text, or in person, Colorado Crisis Services is a great confidential resource, available to anyone. http://coloradocrisisservices.org , 1-844-493-8255, or text "TALK" to 38255. Walk-in location addresses are posted on the website.
- Food and/or Housing - Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify your professor if you are comfortable in doing so. This will enable your professor to provide resources that may be available.

All of these options are available for free for students. The Counseling Center, Health Center, and Colorado Crisis Services are confidential resources. The Counseling Center will also make referrals to off-campus counselors, if preferred.

In an emergency, you should call 911, and they will dispatch a Mines or Golden PD officer to assist.

Absence Policy:

The Student Absences webpage outlines CSM's policy regarding student absences. It contains information and documents to obtain excused absences.

Note: All absences that are not documented as excused absences are considered unexcused absences. Faculty members may deny a student the opportunity to make up some or all of the work missed due to unexcused absence(s). However, the faculty members do have the discretion to grant a student permission to make up any missed

academic work for an unexcused absence. The faculty member may consider the student's class performance, as well as their attendance, in the decision.

In the case of an absence, the student is responsible for determining what work was missed and for putting forth a good faith effort to review the material on their own.

If you (student) are sick and can't come to class, need to isolate due to exposure, or care for a sick family member, you should notify the instructor and the Dean of Student Office as early as possible so arrangements can be made for remote accommodations and/or to make up missed coursework, assignments, or exams as needed.

Policy on Academic Integrity/Misconduct:

The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining an fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every student's academic achievements, and giving credence to the university's educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times.

Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.

The complete policy can be found in the Mines' Policy Library.