

# ASEN 6519: Advanced Survey of Sequential Decision Making

Zachary Sunberg

Fall 2023

## Prerequisites

ASEN 5264 Decision Making under Uncertainty, research experience in robotics or artificial intelligence, or permission from the instructor.

## Learning Objectives

1. Obtain a broad understanding of models and algorithms for sequential decision making
2. Understand theoretical tools for analyzing sequential decision making
3. Communicate about recent research in sequential decision making
4. Become familiar with and investigate open research questions in sequential decision making

## List of Topics

1. Applications of sequential decision-making algorithms in fields such as aerospace, robotics, medicine, and ecology.
2. Survey of popular reinforcement learning algorithms
3. Theoretical tools for characterizing sequential decision-making algorithms
4. Important properties of select algorithms
5. Advanced online and offline algorithms for solving POMDPs and Games
6. Guest Lectures related to model learning, game theory, and deep learning reliability

## Assignments and Grading

**50% Presentations.** Each student will read and prepare presentations for three papers that will be assigned after the first week. For each paper there will be three requirements:

- Draft presentation: Must be uploaded several days before the date of the presentation - see ed for details.
- In-class presentation and discussion: You will deliver a 20-25 minute presentation summarizing the paper and lead a 10-15 minute discussion.
- Two practice exercises to help fellow students prepare for the midterms and form the basis for quiz questions.

**10% Quizzes.** There will be three quizzes that will test your understanding of the previous block of presentations.

**35% Final Project.** A final project chosen by the student that ideally connects to their research. Deliverables will be a 15 minute presentation and a 4-8 page report. The project may be completed in teams of up to 2.

**5% Participation.** Students are expected to attend all lectures except for approved reasons such as travel, illness, or religious observances. You will also be expected to ask questions and participate in discussions during the semester.

# Learning Technology

Ed ([edstem.org/us/courses/45361](https://edstem.org/us/courses/45361)) will be the main hub for the course. A detailed schedule will be posted there. Gradescope ([gradescope.com](https://gradescope.com)) will host assignments.

## Instructor Contact

Professor Zachary Sunberg

AERO 263 [zachary.sunberg@colorado.edu](mailto:zachary.sunberg@colorado.edu)

**Office Hours** By request: please create a calendar invitation for a time not marked busy on my calendar at <https://zachary.sunberg.net/contact#calendar> and indicate whether you would like to meet in my office or provide a videoconference link.

## Meetings

Tuesdays and Thursdays 1-2:15 pm

AERO 114

## University Policies

### Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part of adhering to the Honor Code.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: [Student-Conduct@colorado.edu](mailto:Student-Conduct@colorado.edu). Students found responsible for violating the Honor Code will be assigned resolution outcomes from Student Conduct & Conflict Resolution and will be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

### Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or [DSinfo@colorado.edu](mailto:DSinfo@colorado.edu) for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.

If you have a temporary illness, injury or required medical isolation for which you require adjustment, **[Faculty: insert your procedure here for students to alert you about absence due to illness, injury or medical isolation. Because of FERPA student privacy laws, do not require students to state the nature of their illness when alerting you. Do not require "doctor's notes" for classes missed due to illness; campus health services no longer provide "doctor's notes" or appointment verifications.]**

### Accommodation for Religious Obligations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please communicate

the need for a religious accommodation in a timely manner. In this class, **[Faculty: insert your procedure here for students to alert you about the need for a religious accommodation. Please note that it violates CU Boulder policy if you penalize students for missing class or an exam for religious obligations. Therefore, if you have a class attendance policy, classes missed due to religious obligations should not be counted as an absence. If you allow your students the opportunity to skip an exam or drop their lowest-scored exam, an exam missed because of religious obligations should not be counted toward that opportunity.]** See the campus policy regarding religious observances for full details.

## Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information does not always align with how they identify. If you wish to have your preferred name (rather than your legal name) and/or your preferred pronouns appear on your instructors' class rosters and in Canvas, visit the Registrar's website for instructions on how to change your personal information in university systems.

## Classroom Behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, marital status, political affiliation, or political philosophy.

### Additional classroom behavior information

- Student Classroom and Course-Related Behavior Policy.
- Student Code of Conduct.
- Office of Institutional Equity and Compliance.
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## Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email [OIEC@colorado.edu](mailto:OIEC@colorado.edu). Information about university policies, reporting options, and OIEC support resources including confidential services can be found on the OIEC website.

Please know that faculty and graduate instructors are required to inform OIEC when they are made aware of incidents related to these concerns regardless of when or where something occurred. This is to ensure the person impacted receives outreach from OIEC about resolution options and support resources. To learn more about reporting and support a variety of concerns, visit the [Don't Ignore It](#) page.

## Mental Health and Wellness

*[Faculty: The following is a recommended syllabus statement but not required]*

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS), located in C4C, or call (303) 492-2277, 24/7.

## Acceptable Use of AI in This Class

*[Faculty: Creating a syllabus statement is strongly recommended but not required]*

**[Faculty:** CU Boulder does not have a policy on how generative AI may be used in student work and thus does not have a single required syllabus statement on AI. As a matter of academic freedom, faculty may allow AI to be used in a range of different ways, including not allowing it at all. In order for your students to understand what uses of AI are allowable in your course vs. what uses will be regarded as academic dishonesty, it is strongly recommended that you include in your syllabus a statement about the permissible use of AI in your class. The Boulder Faculty Assembly & Center for Teaching & Learning (CTL) have posted AI syllabus statement guidance.]