ISyE 4232 Advanced Stochastic Systems
Spring 2027

LECTURES:
TBA. Location: TBA.

INSTRUCTOR:
Debankur Mukherjee (debankur.mukherjee@isye.gatech.edu),
Office hour: TBA.

TEACHING ASSISTANTS: TBA.

Course Overview

This course covers Markov Decision Processes (MDPs) and selected introductory Reinforcement Learning (RL) algorithms. We begin with a brief refresher on Markov chains, followed by MDP fundamentals, including finite- and infinite-horizon dynamic programming, value iteration, and policy iteration. We also discuss average-cost MDPs and the curse of dimensionality.

The latter part of the course introduces the RL problem formulation, along with a brief discussion of Monte Carlo methods, temporal-difference (TD) learning, and Q-learning. Throughout the course, concepts are illustrated using applications drawn from areas such as inventory, production, and service systems.

The course emphasizes analytical modeling, mathematical reasoning, and algorithmic problem-solving for sequential decision-making under uncertainty.

COURSE LEARNING OUTCOMES

By the end of this course, students will be able to model and analyze stochastic systems using Markov chains and Markov Decision Processes. Students will develop the ability to formulate and solve sequential decision-making problems using dynamic programming and selected reinforcement learning methods. The course emphasizes applying these tools to engineering systems such as inventory, production, and service systems.

REFERENCES

There is no required textbook for this course. Lecture notes will be shared regularly via Canvas. The following references may be useful:

1. Richard Feldman and Ciriaco Valdez-Flores, Applied Probability and Stochastic Processes.
2. Martin L. Puterman, Markov Decision Processes: Discrete Stochastic Dynamic Programming.
3. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction.

GRADING COMPOSITION

There will be approximately four homework assignments and one mini-project during the semester. The final grade will be determined as follows:

- Class Participation: 5%
- Homework Assignments and Mini-Project: 30%
- Quick Tests: 20%
  - Quick Test 1 (TBA): 10%
  - Quick Test 2 (TBA): 10%
- Midterm Exam (TBA): 20%
- Final Exam (scheduled by the Registrar's Office): 25%

Late submissions for homework assignments will not be accepted. Each take-home component of the course will be assigned with a sufficiently long submission window to accommodate students' schedules. Students are encouraged to discuss homework assignments and mini-projects at a high level with classmates. However, each student is expected to independently develop, write, and submit their own solutions.

The use of generative AI tools (such as ChatGPT) is strictly prohibited during all in-class assessments, including quick tests and exams. For homework assignments and the mini-project, limited use of such tools is permitted only as a learning aid to help understand advanced concepts and to polish write-ups when needed. Students are expected to rely primarily on their own understanding, reasoning, and creativity when producing submitted work.

SPECIAL NEEDS

Any student with special needs should bring this to the attention of the instructor as soon as possible, but not later than the second week of class.

CLASS PARTICIPATION

Class participation consists of regular attendance and active engagement during lectures. Any absence due to health reasons or other circumstances must be communicated to the TA before the class. Please do not expect a response to such notifications; receipt of your message will be assumed.

CAMPUS RESOURCES AND HONOR CODE

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