

# ISyE 4601 Online Learning and Decision Making

Fall, 2026

## Day and Time

Tuesdays and Thursdays 9:30 – 10:45 AM

## Instructor and email

Vidya Muthukumar (vmuthukumar8@gatech.edu)

## Prerequisite

ISYE 3133

## Course Description

At the heart of most machine learning applications today – like advertisement placement, movie recommendation, and node prediction in evolving networks – is an optimization engine trying to provide the best decision with the information observed thus far in time, i.e. the problem of online learning. To solve these problems, one must make online (meaning dynamic/real-time in machine learning lingo) decisions and continuously improve the performance with the arrival of data and feedback from previous decisions. The course aims to provide a foundation for the development of such online methods and for their analysis. We will discuss fundamental principles for learning from an unknown environment, limited feedback, and learning with dynamic, long-term consequences. Time permitting, the course will also discuss ethical and legal issues that arise due to unintended consequences of decision-making, and mathematical tools to formalize as well as mitigate such issues.

## Course Learning Outcomes

At the end of this course, the students will be able to:

1. Understand where online learning is applicable in many real-world scenarios,
2. Develop algorithms that combine partial information as best as possible to make online decisions,
3. Understand how exploration of decision space and exploitation from historic data must be prioritized to be able to reach optimal decisions,

4. Understand the consequences of automated decisions on different population groups and how to mitigate harm caused by online machine learning.

## Required Course Materials

None other than materials that will be posted on Canvas.

## Grading Policy

Homeworks: 50%

In-class midterms: 30%

Final exam: 20%

## Description of Graded Components

There will be 4 homeworks in total. There is an optional Homework 0 that counts as 2% bonus towards the overall grade.

There are 2 in-class midterms in total.

The final exam will be held during the regular schedule (see the Final Exam Matrix for Fall 2026 for details).

## USG required Course Policies

### Attendance and/or Participation

You are encouraged to join the class during class if you are in a similar time zone and join the discussion.

### Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Please review [Georgia Tech's Honor Code](#), the student [Code of Conduct](#).

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

## Core IMPACTS

Not applicable

## Additional Georgia Tech Required Policies

### Accommodation for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the [Office of Disability Services](#) (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

### Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The [Student-Faculty Expectations](#) articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

### Collaborations, Group Work

You are allowed to work in groups on assignments, but any submission must be written in your own work. The assignments are for learning so that you can demonstrate your understanding on the test without these assistances. class tests and exams will be closed book and notes, but I will provide an equation sheet.

### Use of Generative AI

Limited Generative AI Use Permitted: Use of Generative AI (such as ChatGPT, Gemini, Claude, Microsoft Copilot, etc) for homework/course project is permitted in this course, but strictly within instructor-approved boundaries. For this course, you can use Generative AI to assist with English writing in your solutions (e.g. grammar refinement) and coding assistance (e.g. checking correctness of already written code, or improving documentation of existing code). You *cannot* use generative AI to generate math solutions, or code from scratch, in this course.

Any use of Generative AI must be transparent and documented in a required AI Usage Statement with each submission. The statement must include:

- Tool used and date of access
- The input (prompt) you provided
- A copy of the output
- A description of how you used or edited the AI-generated content

Failure to follow these guidelines – including using Generative AI when it is not permitted or failing to disclose its use – may be considered a violation of Georgia Tech’s academic integrity policies. When in doubt, always consult the instructor before using Generative AI.