

## Massachusetts Institute of Technology

### 6.9630 Pokerbots Competition

IAP 2023

1/9, 1/11, 1/13, 1/18, 1/20, 1/23

10:00–11:30 a.m. EST

Zoom Link: <https://pkr.bot/class>

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#### Links

Homepage:

<https://pokerbots.org>

Live Zoom Lecture:

<https://pkr.bot/class>

Zoom Office Hours:

<https://pkr.bot/oh>

Scrimmage Server:

<https://pkr.bot/scrimmage>

Canvas page:

<https://pkr.bot/canvas>

Piazza:

<https://pkr.bot/piazza>

Resources:

<https://pkr.bot/resources>

Instagram:

<https://pkr.bot/instagram>

## Introduction

This course is an annual month-long programming competition in which students create an autonomous poker-playing algorithm, called a “pokerbot,” in teams of one to four members. It emphasizes building computer science, game theory, and data analytics skills through the open-ended pokerbot design project over the course of IAP.

Students will learn how to think about developing their pokerbots by attending six lectures and will have the chance to test their skills in competition against their peers. During the two weeks of lecture, students will learn poker strategy and game theory as well as algorithm design and software architecture. A scrimmage server allowing teams to challenge each other will be run for the first three weeks of IAP with a mini tournament held at the end of each week. In the fourth

week, teams may continue to work on their pokerbots separately. During the final competition, teams' finished pokerbots are put to the test in a tournament for larger prizes.

Poker is a complex yet highly accessible challenge: it's easy to learn, but difficult to be competitive in. Building a pokerbot is similar, as anyone can make an elementary bot, but building a competitive bot requires a deep understanding of the strategies adopted by other teams and how to contest them. At the heart of the Pokerbots competition is the challenge of applying the algorithmic and strategic thinking taught in theoretical courses.

## Evaluation

To receive a passing grade in 6.9630, students are expected to fulfill both of two requirements: participation on the scrimmage server, and completion of a final strategy report.

### Participation

Pokerbots is designed to encourage exploration. Students who put more effort into trying new ideas to design a winning pokerbot will have greater learning opportunities and a better chance to win prizes. To earn 6 units of credit for participation in 6.9630, students are expected to put sustained effort into developing their pokerbots. This will be judged by three weekly scrimmage server check-ins during which each team's pokerbot will be evaluated for improved performance relative to their previous week's submission and against a bot that implements a random strategy.

### Make-up

If a team fails to improve their pokerbot from one week to the next, that team is expected to submit a half-page double-spaced make-up report describing the unsuccessful attempted improvements for the week. This is intended to avoid penalizing students who explore avenues that do not end up resulting in successful strategies. Make-up reports (if necessary) are due the Tuesday following each mini tournament.

### Final Report

Each team is expected to submit a three to five page double-spaced strategy report outlining the techniques they used in developing their final pokerbot, due near the end of IAP. These reports are meant to catalog the effectiveness of strategies explored throughout the class, as well as describe the distribution of work. Diagrams are optional, but *highly* recommended. The report should highlight the strategic and/or architectural insights that went into your team's pokerbot.

### Grading

All teams who meet the above requirements in good faith will receive a passing grade.

## Structure

Over the course of IAP, students have five main touchpoints with the course: the lectures, the scrimmage server, Canvas, Piazza, and the final event.

## Lectures

We will be giving six lectures in person (6-120), each which will be directly applicable to developing a successful pokerbot. These lectures will also be available on Zoom and recorded. Virtual office hours will be held daily over the first three weeks of IAP. We'll also be holding giveaways during each of the lectures!

## Scrimmage Server

The scrimmage server is how you will gauge the performance of your pokerbot relative to reference bots and other teams. On the scrimmage server, you can challenge your opponents and keep track of useful bot statistics. Furthermore, all pokerbot submissions are done via the scrimmage server. We'll be giving out prizes based on your performance on the server as well!

## Canvas

Throughout this course we will be posting materials, announcements, and additional resources to Canvas. We will be providing detailed notes (along with slides) and a recording after every lecture as well. Materials will also be posted publicly on Github for the duration of the course.

## Piazza

Piazza is an online forum we will be using to answer questions. You can post (publicly or privately to classmates) and a member of the Pokerbots team will respond as soon as possible. You are also encouraged to answer other students' questions, and we will be rewarding students who contribute the most in this manner over the month.

## Final Tournament + Event

Pokerbots culminates in a virtual final event on February 3rd, 2023. This is where we will announce the winners of the final pokerbots tournament, as well as give out many additional prizes. There will be fun and games, as well as a chance to meet our sponsors directly! More details about the final tournament and event will be posted on the course Piazza as the date approaches.

## Timeline

Date	Day	Class	Deadline
Jan 9	Mon	Lecture 1: Intro to Pokerbots	
Jan 11	Wed	Lecture 2: Poker Theory	
Jan 11	Wed	<b>Poker Afternoon Study Break</b> (with prizes!)	
Jan 13	Fri	Lecture 3: Game Theory	11:59 PM, Upload and select week 1 bot
<b>Jan 14</b>	<b>Sat</b>	<b>Mini Tournament #1</b>	
Jan 16	Mon	No Class: Martin Luther King Day	
Jan 18	Wed	Lecture 4: Guest Lecture: Noam Brown	
TBA	TBA	<b>Poker Afternoon Study Break</b> (with prizes!)	
Jan 20	Fri	Lecture 5: Engineering & Performance	11:59 PM, Upload and select week 2 bot
<b>Jan 21</b>	<b>Sat</b>	<b>Mini Tournament #2</b>	
Jan 23	Mon	Lecture 6: Advanced Topics	
Jan 27	Fri	No class	11:59 PM, Upload and select week 3 bot
<b>Jan 28</b>	<b>Sat</b>	<b>Mini Tournament #3</b>	
Jan 31	Tue	No class	11:59 PM, Strategy report due
Feb 1	Wed		11:59 PM, Upload and select final bot
<b>Feb 3</b>	<b>Fri</b>	<b>Pokerbots Final Event</b>	

## Prizes

The prize pool for Pokerbots 2023 is over **\$40,000**. Here's the breakdown:

Final Tournament Prizes	
First place	\$7,500
Second place	\$5,000
Third place	\$3,500
Fourth place	\$2,000
Fifth place	\$1,000
First place in language (Python, Java, or C++)	\$500 x 3
Second place in language (Python, Java, or C++)	\$250 x 3
Third place in language (Python, Java, or C++)	\$125 x 3
Best freshman-majority (>51%) team	\$2,000

Scrimmage Server Prizes	
Weekly tournament winner	\$1,000 x 3
Weekly tournament biggest upset	\$500 x 3
Weekly tournament most improved	\$750 x 2
Most time at the top of the scrimmage server	\$1,000

Miscellaneous Prizes	
Most helpful Piazza students	\$250 x 3
Surprise prizes, lightning tournaments, and raffles	\$10,000

We'll be holding raffles during each of the classes and events for great tech prizes!

## Class Objectives

Monday 1/9/22: Introduction to Pokerbots	<ul style="list-style-type: none"><li>♠ Introduce rules of poker variant for Pokerbots 2022</li><li>♠ Game engine overview</li><li>♠ Upload to scrimmage server<ul style="list-style-type: none"><li>♡ Prepare students to start working by the end of class</li></ul></li></ul>
Wednesday 1/11/22: Poker Strategy	<ul style="list-style-type: none"><li>♠ Understand hand types w/ example driven approach</li><li>♠ Learn betting strategy<ul style="list-style-type: none"><li>♡ Pot odds</li><li>♡ Position</li><li>♡ Playstyle</li></ul></li><li>♠ Live coding demo implementing strategy concepts - code available for download</li></ul>
Friday 1/13/22: Game Theory	<ul style="list-style-type: none"><li>♠ Normal- and extensive-form games</li><li>♠ Imperfect information</li><li>♠ Nash equilibria<ul style="list-style-type: none"><li>♡ Deviating from Nash</li></ul></li><li>♠ Adverse selection</li></ul>
Wednesday 1/18/22: Guest Lecture: Noam Brown	<ul style="list-style-type: none"><li>♠ Renowned computational poker researcher</li><li>♠ Creator of the Libratus and Pluribus poker algorithms</li><li>♠ Facebook AI researcher</li></ul>
Friday 1/20/22: Engineering & Performance	<ul style="list-style-type: none"><li>♠ Computational Complexity</li><li>♠ Algorithms and Data Structures</li><li>♠ Systems and Memory</li><li>♠ Code Optimizations</li></ul>
Monday 1/23/22: Advanced Topics	<ul style="list-style-type: none"><li>♠ Reinforcement learning<ul style="list-style-type: none"><li>♡ Q-learning</li><li>♡ Counterfactual regret minimization</li></ul></li><li>♠ Recent successes in algorithmic poker playing</li><li>♠ Neural Network and Deep Learning Techniques</li></ul>