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

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 1/9/23: Introduction to Pokerbots	♠ Introduce rules of poker variant for Pokerbots 2023 ♠ Game engine overview ♠ Upload to scrimmage server ♡ Prepare students to start working by the end of class
Wednesday 1/11/23: Poker Strategy	♠ Understand hand types w/ example driven approach ♠ Learn betting strategy ♡ Pot odds ♡ Position ♡ Playstyle ♠ Live coding demo implementing strategy concepts - code available for download
Friday 1/13/23: Game Theory	♠ Normal- and extensive-form games ♠ Imperfect information ♠ Nash equilibria ♡ Deviating from Nash ♠ Adverse selection
Wednesday 1/18/23: Guest Lecture: Noam Brown	♠ Renowned computational poker researcher ♠ Creator of the Libratus and Pluribus poker algorithms ♠ Facebook AI researcher
Friday 1/20/23: Engineering & Performance	♠ Computational Complexity ♠ Algorithms and Data Structures ♠ Systems and Memory ♠ Code Optimizations
Monday 1/23/23: Advanced Topics	♠ Reinforcement learning ♡ Q-learning ♡ Counterfactual regret minimization ♠ Recent successes in algorithmic poker playing ♠ Neural Network and Deep Learning Techniques

Sponsors

Platinum

HAP Capital's market-making utilizes proprietary applications to make pricing decisions in a consistent, rational, and disciplined manner. We compete for the right to transact with other market participants on the basis of superior price and speed of execution. Acting as a liquidity and efficiency provider to the marketplace, we identify the demand for specific equity and index options and proactively demonstrate our willingness to buy or sell to satisfy that demand. HAP Capital's individual portfolio managers speed the market price discovery process while extracting expected value in an environment constructed to enable, promote and reward proven alpha and well thought out risk-taking. With over a decade of consistent successes, HAP Capital extracts value and provides efficiency to the markets through our market-making and portfolio managers. HAP Capital differentiates itself from most other firms in the space in its internally developed quantitative approach to its trading strategy and business model.

Hudson River Trading's scientific approach to trading financial products has been massively successful, and we're growing! We have built one of the world's most sophisticated computing environments for research and development. A community of self-starters, we are motivated by the excitement of being at the cutting edge of automation in every part of our organization – from trading, to business operations, to recruiting and beyond. At HRT, we're friends and colleagues – whether we're sharing a meal, playing the latest board game, or writing elegant code. We embrace a culture of togetherness that extends far beyond the walls of our office.

Feel like you belong at HRT? Our goal is to find the best people and bring them together to do exceptional work in a place where everyone is valued. HRT is an equal opportunity employer; so whoever you are we'd love to get to know you.

Gold

SIG is a global quantitative trading firm founded with a growth mindset and an analytical approach to decision making.

As one of the largest proprietary trading firms in the world, SIG benefits the financial markets by providing liquidity and ensuring competitive prices for buyers and sellers. SIG brings together the brightest minds, the best technology, and an expansive library of data to design and implement quantitative trading strategies that make us leaders in the financial markets. SIG hires students into internship and full time roles in quantitative trading, technology, buy side research, quantitative research, sales and trading, growth equity and more.

At Seven Eight Capital, the scientific method is the foundation of our success. We use a disciplined approach in applying mathematics and statistics to the markets where data and proprietary machine learning methods validate hypotheses and produce alpha, and efficient risk management enables us to handle a variety of market conditions. Our technology, including unique data management and visualization tools and distributed computing, is integral to distilling complexity and bringing scale to our work. Tying it all together, our transparent and collegial atmosphere enables everyone to perform both as individuals and together as a team.

Gold (continued)

Jane Street is a quantitative trading firm with offices worldwide. We hire smart, humble people who love to solve problems, build systems, and test theories. You'll learn something new every day in our office—whether it's connecting with a colleague to share perspectives, or participating in a talk, class, or game night. Our success is driven by our people and we never stop improving.

Schonfeld Strategic Advisors is a global multi-manager platform investing capital with Internal and Partner portfolio managers, primarily on an exclusive or semi-exclusive basis, across quantitative, fundamental equity, tactical, and discretionary macro & fixed income trading strategies.

We have created a unique structure to provide global portfolio managers with autonomy, flexibility and support to best enable them to maximize the value of their businesses.

Citadel is a global investment firm built around world-class talent, sound risk management, and innovative leading-edge technology. For thirty years, Citadel's hedge funds have delivered meaningful and measurable results to top-tier investors around the world, including sovereign wealth funds, public institutions, corporate pensions, endowments and foundations.

Citadel Securities is an award-winning global market maker that helps meet the liquidity needs of asset managers, banks, broker-dealers, hedge funds, government agencies, and public pension programs. We offer a broad array of fixed income and equity products, utilizing a unique set of capabilities and tools designed to drive down the cost of transactions. We strive to provide the most efficient execution and highest caliber of client services, making markets more fair and accessible for all.

Gold (continued)

Jump Trading is a leading algorithmic trading firm that combines sophisticated quantitative research, cutting-edge technology, and an entrepreneurial trading culture. Founded in 1999, Jump has over 1,000 employees across offices in Chicago, New York, London, Paris, Singapore, Shanghai, Sydney, Hong Kong, and more.

Jump is still privately owned and funded, fostering a culture of intellectual curiosity and learning. We have a 20-year history of investing in superior infrastructure, including custom hardware, software, wireless networks, and a world-class supercomputer. We leverage our proprietary technology to analyze massive data sets and identify trends in global markets across asset classes.

Campus hiring has been the backbone of growing Jump, and we have internships and full-time opportunities for students across a variety of roles, listed on our website

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DRW is a diversified trading firm with over 3 decades of experience bringing sophisticated technology and exceptional people together to operate in markets around the world. We value autonomy and the ability to quickly pivot to capture opportunities, so we operate using our own capital and trading at our own risk.

Headquartered in Chicago with offices throughout the U.S., Canada, Europe, and Asia, we trade a variety of asset classes including Fixed Income, ETFs, Equities, FX, Commodities and Energy across all major global markets. We have also leveraged our expertise and technology to expand into three non-traditional strategies: real estate, venture capital and cryptoassets.

We operate with respect, curiosity and open minds. The people who thrive here share our belief that it’s not just what we do that matters–it's how we do it. DRW is a place of high expectations, integrity, innovation and a willingness to challenge consensus.

Silver

The Chicago Trading Company believes in healthy financial markets. Each day, we help the world price and manage risk by deploying our deep expertise to make markets fairer, transparent, and more efficient. We actively trade in a broad spectrum of asset classes on derivatives exchanges around the world. Our culture is highly collaborative – our cross-discipline teams work together to solve the toughest problems our markets have to offer.

We pride ourselves on our strong values, our entrepreneurial spirit, and our commitment to doing the right thing. We aim to cultivate a workplace that celebrates diversity where each person feels included, engaged, and empowered. We also strive to make a positive impact on our industry, the lives of our employees, and the communities to which we belong.

For three decades IMC has provided liquidity to the financial markets globally. Specializing in algorithmic trading and advanced technology, we set the pace for the evolution of market making.

At IMC we approach our work with an entrepreneurial spirit putting an emphasis on collaboration, continuous improvement and innovation. Our employees are our greatest asset so we give them lots of responsibility early on to make an impact.

Two Sigma is a financial sciences company. We combine rigorous inquiry, data analysis, and invention to solve hard problems across financial services.

We're looking for people who see beauty in data and the possibilities it reveals. Researchers who see connections and patterns in unexpected places. Engineers who build tools that channel massive amounts of data into insights. And experts across business disciplines to help solve the toughest challenges in investment management, insurance, market-making, private equity, and venture capital.
