

MIT Pokerbots 2017



Administrivia

- OH will be MT next week from 3 PM - 5 PM.
- Final event on Feb 6th at 10-250
- Accounts should have been created with password “ilovepoker”. Let us know if you dont have an account.
- Important dates:
 - Mini Tournament: Tuesday, Jan. 25th, 11:59PM



Prize Structure

- Newbie Tournament
- Scrimmage Server Prizes
- Mini Tournament Prizes
- Final Tournament Prizes
- Strategy Report Prizes



Administrative Specs

- Zipped bot size: 3 GB
- Unzipped bot size: 10 GB
- Read access: The bot directory you submit
- Write access: None
- Libraries: poker-eval, boost, numpy, scipy, pbots_calc



Tournament Structure

- Bankroll instant runoff tournament structure
- Team with the lowest bankroll gets eliminated every round
- For every match, simulate SnG tournaments until hand limit has been reached
- Payout the cumulative winner one SnG worth of winnings



Mini Tournament Structure

- 1,000 hands until top 9
- 10,000 hands until top 3
- 25,000 hands until winner



Final Tournament Structure

- 1,000 hands until top 27
- 10,000 hands until top 9
- 25,000 hands until top 3
- 100,000 hands until winner



Using the Bot

- Using the engine:
 - You can find the updated engine and skeleton bot on mitpokerbots.com/code
 - Run with “java -jar engine.jar”
- Using the skeleton bot:
 - Run with “./pokerbot.sh [port number]”
- You can verify your bot at batman.mit.edu



Agenda

- Introduction to NLHE Poker
- NLHE Poker General Strategy Concepts
- NLHE With Discard Variation



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Heads Up NLHE Poker Rules

- Rules:
 - Each player starts with 2 cards randomly dealt.
 - Preflop: SB folds, calls or bets. If SB raises then BB can either call or 3-bet. If BB 3-bets then SB can call or 4-bet. This process continues.
 - Flop: Three cards are laid down randomly from the remaining deck and action starts with BB. The BB can either check or bet and if BB bets action continues.
 - Turn and River: In each street one more card is put down and at the end in the river the player if both players are still in the pot the player with the best 5 cards out of the total 7 wins.



Hand Rankings

Royal Flush



A straight from a ten to an ace with all five cards of the same suit. In poker all suits are ranked equally.

Straight Flush



Any straight with all five cards of the same suit.

Four of a Kind



Any four cards of the same rank. If two players share the same Four of a Kind (on the board), the bigger fifth card (the "kicker") decides who wins the pot.

Full House



Any three cards of the same rank together with any two cards of the same rank. Our example shows "Aces full of Kings" and it is a bigger full house than "Kings full of Aces."

Flush



Any five cards of the same suit (not consecutive). The highest card of the five determines the rank of the flush. Our example shows an Ace-high flush, which is the highest possible.

Straight



Any five consecutive cards of different suits. Aces can count as either a high or a low card. Our example shows a five-high straight, which is the lowest possible straight.

Three of a Kind



Any three cards of the same rank. Our example shows three-of-a-kind Aces, with a King and a Queen as side cards - the best possible three of a kind.

Two Pair



Any two cards of the same rank together with another two cards of the same rank. Our example shows the best possible two-pair, Aces and Kings. The highest pair of the two determines the rank of the two-pair.

One Pair



Any two cards of the same rank. Our example shows the best possible one-pair hand.

High Card



Any hand not in the above-mentioned hands. Our example shows the best possible high-card hand.



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Scenario

- Villain has only ever played past the preflop with JJ, QQ, AK, KK, AA in the past 400 hands.
- Blinds are 1/2 and you are SB with 27o.



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- Villain has only ever played past the preflop with JJ, QQ, AK, KK, AA in the past 400 hands.
- Blinds are 1/2 and you are SB with 27o.
- Conclusion: Villain is a very tight player. We have a bad hand but we can exploit him.
- **Raise!** → (amount can depend) **Raise to 5**



Hand Ranges

Hold'em Distribution [Player 1]

Cards Preflop

AA	AKs	AQs	AJs	ATs	A9s	A8s	A7s	A6s	A5s	A4s	A3s	A2s
AKo	KK	KQs	KJs	KTs	K9s	K8s	K7s	K6s	K5s	K4s	K3s	K2s
AQo	KQo	QQ	QJs	QTs	Q9s	Q8s	Q7s	Q6s	Q5s	Q4s	Q3s	Q2s
AJo	KJo	QJo	JJ	JTs	J9s	J8s	J7s	J6s	J5s	J4s	J3s	J2s
ATo	KTo	QTo	JTo	TT	T9s	T8s	T7s	T6s	T5s	T4s	T3s	T2s
A9o	K9o	Q9o	J9o	T9o	99	98s	97s	96s	95s	94s	93s	92s
A8o	K8o	Q8o	J8o	T8o	98o	88	87s	86s	85s	84s	83s	82s
A7o	K7o	Q7o	J7o	T7o	97o	87o	77	76s	75s	74s	73s	72s
A6o	K6o	Q6o	J6o	T6o	96o	86o	76o	66	65s	64s	63s	62s
A5o	K5o	Q5o	J5o	T5o	95o	85o	75o	65o	55	54s	53s	52s
A4o	K4o	Q4o	J4o	T4o	94o	84o	74o	64o	54o	44	43s	42s
A3o	K3o	Q3o	J3o	T3o	93o	83o	73o	63o	53o	43o	33	32s
A2o	K2o	Q2o	J2o	T2o	92o	82o	72o	62o	52o	42o	32o	22

SHIFT, CTRL, ALT
modify selection

All
Any Suited
Any Broadway
Any Pair
Clear

Selected

22+, A2s+, K2s+, Q2s+, J2s+, T2s+, 9

75.0%

OK Annuleren Toepassen



Betting Characteristics

- 3-Betting in the preflop is when you raise a bet in the preflop. Raising a 3-bet is called a 4-bet and raising a 4-bet is called a 5-bet.
- Raising higher amounts can do two things: add more money into the pot which can help you when you have a winning hand. Or it can convince the other player that your weak hand is stronger than it actually is which will induce folds.



Hand Range Practice

- By the river Obst has narrowed his opponent's range down to 8c9c, some QQ or JJ, or a bluff some small portion of the time. and he folds his full house. Try to dissect each street and looking at the range chart see if you can figure out why that makes sense.
- https://www.youtube.com/watch?v=SlvYj_uwV7o



Balance Your Range

- You can choose to only 3-bet with TT+,AK,AQ but then you're only 3-betting with ~7 percent of your range and you become easily exploitable.
- You can balance your range by adding in ~6 percent bluffs. Now opponents cannot pinpoint how strong your hand is. This is one reason why professional poker players often 3 bet with hands like 89s.



Preflop Stats

- Possible stats to look at:
 - Limp - Not important for heads up. In general means what portion of the time the player doesn't raise and just calls the BB.
 - PFR - Preflop Raise (percentage of time a player raises in preflop).
 - 3-bet% - Percentage of time the player 3-bets.
 - Fold to 3-bet% - Percentage of time a player folds to a 3-bet.
 - 4-bet % - Percentage of time the player 4-bets.
 - VPIP - Voluntarily Put (money) Into Pot. This just shows how often you call or raise.



Flop Statistics

- Continuation Bet %
- Fold to Continuation Bet %
- Check-raise %
- 3-Bet %



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NLHE With Discards

- In the flop before betting occurs the BB has the option to check or discard and replace one of his two cards with another from the remaining cards in the deck. Then the SB faces the same situation. The flop then continues as expected.
- In the turn the same situation occurs as before.



Strategy Change

- Different ranges. Generally a hand like A6o is considered very weak. While the Ace is strong the 6 is very weak and there is little implied odds because of no straight combinations and little chance for a flush. But now with the discard option this hand has a higher value because with some probability the 6 can be replaced for a higher card.



Walking Through a Hand

- Villain (BB) _ _
- Hero (SB) AhTh (Good hand, see hand ranges chart)

Actions

- SB raises to 5
- BB raises to 15



Flop w/ Option to Discard

- Flop: 8s, 8h, 7c
- We have AhTh. Should we discard the Th? Let's look at the probability of improving our hand and the probability of not improving our hand.
- With an ~4 percent chance the next two cards will be hearts and we can get a flush.
- There are 3 A's and 3 T's in the deck and the other player's cards. The probability that the next card is an A or a T is $\sim 6/45$ (if we were certain the other played didn't have A,T).



Pot Odds

- Pot size is 20 chips right now. We need to put in 10 more to call. Rough estimate dictates we need to be put in 10 to win 20 additional chips total. So we either lose 10 chips or gain 20 chips. If we lose 10 chips twice as many times as we win the 20 then we are indifferent towards folding and playing onward.
- So we need to be winning $1/3$ of time or be ahead of at least $1/3$ of his range.



Dissecting BB's 3-Bet

- With historical preflop stats we can get a good idea of how the BB plays.
- Scenario 1: BB 3-bets a lot. Then we know we might be better than him. Now we figure out what percentage of the time we call and what percentage of the time we 4-bet based on BB's 4-bet statistics.
- Scenario 2: BB rarely 3-bets. This means he must likely be 3-betting with very good hands and some bluffs. Based on pot odds and what we calculate to be in his range we choose to proceed. Most of the time calling should be fine here because AhTh is a good hand.



Improving Hand

- Cards that will Improve:
- 8c, 8d
- 7s, 7h, 7d
- Ac, Ad, As
- Kh, Qh, Jh
- Maybe some other different suit K,Q,J.
- ~11 better cards + other K,Q,J.



Should we discard?

- ~11/45 chance of us getting a card that improves our hand.
- Another factor to look at is how many hands will not improve our hand we will be “okay” with receiving. In this case there’s no such cards that are like that. For example, any different suit T will be worse for us.



We choose not to discard.

- Flop: 8s, 8h, 7c
- Villain: Bets 15 chips (previous pot was 30 now its 45)
- Hero: Decision → put in 15 to win 45. We should count how many cards improve our hands (any heart, any T any A, any 7). 7 improves our hand if the opponent doesn't have a 7.
- What should we do here?
- Exploiting: Although depending on the other player we can choose to fold/raise based on our beliefs about his post-flop play.



Complication with Discards

- In NLHE we can simply create a hand range for Villain preflop and based on his bet on the flop narrow that range down. But because of the discard option we now have to weight the probability of the opponent hitting the flop higher.



Questions

- What hands will the Villain have that he 3-bets with in the preflop?
- What portion of those hands will he exercise the discard option?
- Of the hands where he discards when does he improve?
- How often does the Villain C-bet on the flop? Is the 50 percent bet size standard?



How to Exploit Bots?

- Create a historian class that automatically tallies important statistics on other bots
- If a statistic deviates from a standard average, have the bot adapt and perform different actions in order to exploit this vulnerability



Preflop Stats

- From the Button:
 - Limp
 - PFR
 - 4-bet %
 - VPIP
- From the SB/BB:
 - Raise limp %
 - 3-bet %
 - Fold to 4-bet %
 - VPIP



Exploitation Tactics

- 3-Bet % Too high? Tighten raising range
- 3-Bet % Too low? Raise any 2 cards from the button.
- Fold-to-4-Bet % too high relative to 3-Bet %? 4-bet bluff a lot.
- Button PFR too high? Call and 3-bet more often



Flop Statistics

- Continuation Bet %
- Fold to Continuation Bet %
- Check-raise %
- 3-Bet %



Exploitation Tactics

- Continuation Bet % too high? Check-raise him a lot.
- Fold to Continuation Bet % very high? Continuation Bet the flop a large %.
- Check-raise % high? Always Cbet with good hands, never slowplay. Check back often when you don't have a good hand.



Next Lecture

- More on exploitation.
- More on creating a historian along with sample code that we'll walk through.
- More general bot creation strategies.

