

MIT Pokerbots 2015



Lecture 3

- Poker
 - Rules
 - Starting Hand Ranges
 - Expectation
 - Odds and Outs
 - Stack Sizes
 - Position



Pot Limit Texas Hold'em

- Blinds
 - Small
 - Big
- Position
 - Dealer Button
- Legal Actions
 - Check
 - Bet
 - Raise
 - Fold



Hand Rankings



ROYAL FLUSH



STRAIGHT FLUSH



FOUR OF A KIND



FULL HOUSE



FLUSH



STRAIGHT



THREE OF A KIND



TWO PAIRS



ONE PAIR



Play of the Hand

- Blinds Posted
- Cards Dealt
- Pre-flop Betting Round
 - Order: Dealer, SB, BB
- Post-flop (Flop, Turn River)
 - Order: SB, BB, Dealer
- Showdown



Starting Hands Ranking

- High pocket pairs
- Medium pocket pairs
- Low pocket pairs
- Broadway hands (AK – JT)
- Any Ace (AT – A2)
- Suited connectors
- Gap connectors
- Junk



High Pocket Pairs (AA-JJ)



High Pocket Pairs (AA-JJ)



87% vs



68% vs



81% vs



57% vs



87% vs



Medium & Small Pocket Pairs



Medium & Small Pocket Pairs



- Still very good in heads-up and short-handed tables
- 55% chance of winning against two overcards
- 20% chance of winning against a higher pocket pair



Broadway Hands

- Broadway hands (suited and offsuit)
combinations of:



Broadway Hands

- Broadway hands (suited and offsuit)
combinations of:



- Good heads-up starting hands
- Top pair good kicker
- Beware : domination



Dominated Hands

- Broadway hands (suited and offsuit)
- A dominant hand has a 70% chance of winning



Dominated



Ace-x Hands



- Good for short-handed tables
- Low chance of domination
- Suited aces can win **big** pots



Suited and Gap Connectors



Suited and Gap Connectors



- Drawing hands: Potential for straights and flushes
- Poor hand choice for short-handed and short stacked game
- Good “semi-bluffing” hand when all the players are deep stacked



The Rest



- “Junk” cards that are not usually worth playing for value
- May be used to bluff against opponents to steal their blinds or even win good sized pots



Play Style

- It is important to get a good range of starting hands for your bot
- Every bot will have a different starting range
- Don't have your bot perform the same actions for the same type of starting hands
- Vary your betting habits to be less exploitable



Expected Value (EV) and Equity

- ***Expected Value*** is the weighted average mean of a random variable given probabilities and payouts
- In poker, we refer to EV as “***equity***”
- ***Equity*** is the amount of the pot that you “own” given your odds of winning the pot at a particular point in the hand
- Can calculate equity by simulating possible results of hand and finding chance of winning



Pot Equity vs Pot Odds

- ***Pot Equity***
 - Amount of pot you “own”
 - Calculate chance of winning the pot and multiply by size of pot
- ***Pot Odds***
 - Size of the current pot to the cost of a contemplated call.
 - If pot odds are better than your pot equity, call or raise
 - If pot odds are worse, fold



Hand Example

- You have \$50, dealt:



- Opponent has \$50, dealt:



- There is \$100 in the pot

- The flop is:



- Your opponent bets \$50
- The pot is now \$150 and you have to call \$50 all-in to continue in the hand for a chance to hit your straight
- Should you call?



Pot Equity Calculation

- Hand Calculator
 - [Ts 9s] has 34.242% equity against [Ac Ad] on a board of [8h 7c 2d]
 - **about 2 : 1 odds**
- Counting Outs
 - You have 8 outs: [Jd Jc Jh Js 8d 8c 8h 8s]
 - Rule of 4 says you have $8 * 4 = 32\%$ equity
 - **about 2 : 1 odds**
- You must get at least 2-to-1 pot odds to make a profitable call



Pot Odds Calculation

- Your opponent has bet \$50 into a pot of \$100
 - The new pot size is \$150 and you must call \$50
 - Your pot odds are \$150 : \$50, or **exactly 3 : 1**
 - You must hit your hand at least 1 / 4 times to make a profitable call
-
- If pot odds are better than your pot equity, call or raise
 - If pot odds are worse, fold
 - ***3 : 1 is better than 2 : 1 → CALL***
 - ***You hit your hand 1 / 3 times but only have to pay for hitting it 1 / 4 times → CALL***



Edge Collection

- Regardless of the outcome, you have made a +EV call and 'collected edge'
- How much edge?
 - You win \$150 when you win 34.242% of the time
 - You lose \$50 when you lose (100% – 34.242) of the time
 - Your expected payout is
$$(\$150 * .34242) + (-\$50 * (1 - .34242)) = \$18.484$$
 - You've just made \$18.484 in EV!
- If you play this game indefinitely, your profits will converge to \$18.484/game



Implied Odds

- Pot odds only take into account how much money is in the pot **now**
- You must also consider ***implied odds***, the future amount of money you can expect to win if you make your hand
- ***Implied odds*** is the ratio between the potential future pot size to the current bet size



Stack Sizes

- Stack sizes play a huge role in calculating implied odds
- The *effective stack size* is the size of the smallest stack when two players are in a pot
- This represents the maximum amount of future winnings you can make
- As effective stack size gets larger, drawing hands become more profitable



Hand Example

- You have \$500, dealt:
- Opponent has \$500, dealt:



- There is \$100 in the pot

- The board is:



- Your opponent bets \$100
- Should you call?



Hand Analysis

- 8 outs gives 4.75:1 pot equity
- Pot odds is \$200:\$100 = 2:1
- Without implied odds, folding is the best option
- If we assume that the opponent will risk his whole stack on the river, the pot odds is \$600:\$100 = 6:1
- This gives you the edge to call

Outs	Flop to Turn		Turn to River		Turn and River	
	%	Odds	%	Odds	%	Odds
20	42.6%	1.35-1	43.5%	1.30-1	67.5%	0.48-1
19	40.4%	1.47-1	41.3%	1.42-1	65.0%	0.54-1
18	38.3%	1.61-1	39.1%	1.56-1	62.4%	0.60-1
17	36.2%	1.77-1	37.0%	1.71-1	59.8%	0.67-1
16	34.0%	1.94-1	34.8%	1.88-1	57.0%	0.75-1
15	31.9%	2.13-1	32.6%	2.07-1	54.1%	0.85-1
14	29.8%	2.36-1	30.4%	2.29-1	51.2%	0.95-1
13	27.7%	2.62-1	28.3%	2.54-1	48.1%	1.08-1
12	25.5%	2.92-1	26.1%	2.83-1	45.0%	1.22-1
11	23.4%	3.27-1	23.9%	3.18-1	41.7%	1.40-1
10	21.3%	3.70-1	21.7%	3.60-1	38.4%	1.60-1
9	19.1%	4.22-1	19.6%	4.11-1	35.0%	1.86-1
8	17.0%	4.88-1	17.4%	4.75-1	31.5%	2.17-1
7	14.9%	5.71-1	15.2%	5.57-1	27.8%	2.60-1
6	12.8%	6.83-1	13.0%	6.67-1	24.1%	3.15-1
5	10.6%	8.40-1	10.9%	8.20-1	20.3%	3.93-1
4	8.5%	10.75-1	8.7%	10.50-1	16.5%	5.06-1
3	6.4%	14.67-1	6.5%	14.33-1	12.5%	7.00-1
2	4.3%	22.50-1	4.3%	22.00-1	8.4%	10.90-1
1	2.1%	46.00-1	2.2%	45.00-1	4.3%	22.26-1



Table of Outs

Type of Draw	Hand	The Flop	Specific Outs	# Outs
Pocket Pair to Set	2♦ 2♣	Q♦ 4♥ 9♣	2♥ 2♠	2
One Overcard	A♠ 8♦	J♣ 5♣ 2♦	A♣ A♦ A♥	3
Inside Straight Draw	J♥ 9♣	Q♣ 8♦ 4♣	10♠ 10♥ 10♣ 10♦	4
Two Pair to Full House	K♥ Q♣	K♣ Q♦ 5♣	K♠ K♦ Q♥ Q♠	4
One Pair to Two Pair or Set	A♣ Q♦	A♦ 10♣ 3♣	A♥ A♠ Q♥ Q♠ Q♣	5
No Pair to Pair	9♣ 7♦	2♠ 3♦ J♣	9♠ 9♥ 9♦ 7♠ 7♥ 7♣	6
Two Overcards to Over Pair	A♦ J♥	10♣ 8♦ 2♣	A♠ A♣ A♥ J♠ J♦ J♣	6
Set to Full House / Four of a Kind	6♣ 6♦	6♠ 7♥ J♣	6♥ 7♠ 7♦ 7♣ J♦ J♠ J♥	7
Open Ended Straight Draw	9♣ 8♦	7♣ 10♥ 3♣	J♦ J♠ J♥ J♣ 6♠ 6♦ 6♥ 6♣	8
Flush Draw	K♠ J♠	A♠ 6♠ 8♦	2♠-5♠ 7♠-10♠ Q♠	9
Inside Straight & Two Overcards	A♣ K♦	Q♥ 10♠ 2♣	J X A♦ A♥ A♠ K♥ K♠ K♣	10
Inside Straight Draw & Flush	A♦ K♦	J♦ Q♠ 3♦	10 X 2♦ 4♦-9♦ Q♦	12
Open Straight and Flush Draw	K♥ Q♥	10♥ J♠ 4♥	9 X A X 2♥-3♥ 5♥-8♥ J♥	15



Pot-Limit vs. No-Limit

- In Pot-Limit, the smallest odds you can force your opponent to call your bet is 2:1
- In No-Limit, the smallest odds is nearly 1:1
- Implied odds is factored more in NL because it takes just one bet to get the whole stack into the pot
- In PL, it is harder to build up the pot unless both players commit early or re-raise each other
- Early small bets are key to building up the pot in the future



Pot Control

- Even though pot odds caps at 2:1, the pot size may vary in size
- Keep the pot small for medium strength hands that won't improve much
- Try to create a big pot for strong hands
- Semi-bluff: A bet or a raise on a drawing hand
- Relies on fold equity, but builds a large pot if called, giving better implied odds



Position

- Position is **very** important in poker
- The button has the last action in postflop play and gets to act based on the opponent's action
- If the opponent hits on the flop and bets, he risks losing value on the hand if the button folds
- If the opponent misses on the flop and checks, he shows weakness and may induce a bet from the button
- Opponent may have to use deception, ultimately reducing the EV of the hand as opposed to the button



Pre-flop Bet Sizing

- If your pre-flop raising size is too big, then you lose a lot when people behind re-raise you with good hands. You are risking an unnecessary amount to steal the blinds.
- If your pre-flop raise size is too small (or if you just call pre-flop), then the big blind has extremely good odds to play any two cards profitably against you.
- A good sweet spot is raising around 2.5x the big blind. Namely, you should rarely just call (limp) if you are the first one to enter the pot.



Announcements

- Wednesday's lecture will feature guest lecturer **Doug Hull**, a dual programmer/poker author
- Lecture will be focused on advanced poker strategy
- Casino starts tonight! Upload your bot by 12am midnight to scrimmage
- Please upload your resume on our website by this Wednesday



Helpful sites

- [http://en.wikipedia.org/wiki/Poker_probability_\(Texas_hold_%27em\)](http://en.wikipedia.org/wiki/Poker_probability_(Texas_hold_%27em))
- <http://www.pokerlistings.com/online-poker-odds-calculator>
- <http://www.texasholdem-poker.com/calculator>

