



Pokerbots 2025

Lecture 3: Poker Strategy

Sponsors



hudson river trading



CITADEL | CITADEL Securities



Announcements

Engine Updates

- Someone pointed out that it may be GTO to fold instead of checking back for free
- Latest version at pkrbot/engine
- Important to always use most updated version of engine as it is what we use on the scrimmage server and in tournaments

Week 1 Deadlines

- First pokerbot submission due Friday 1/10,
11:59PM EST on scrimmage server
- Mini-tournament 1 will occur shortly after

Hackathon Next Week!

- Next Wednesday night (1/15)
- Show up and work on your pokerbot!
- Dinner provided, plan to go late into the night
- Snacks, fun, and games
- Prizes for challenges and those that stick around
- Location TBA

Giveaway Game: pkr.bot/LUPI



- Enter an integer between 1 and 100, inclusive
- You win if you submit the lowest integer that nobody else also submits
- Submissions will close in 5 minutes

Poker Strategy and Theory

Alex Zhang

Agenda

- Basic Poker Principles
- Hand Types
- Pot Odds and Outs
- Implied Odds
- Board Texture Considerations
- Ranges

Poker Principles

Strength Principle

- Raising with Strong Hands
- Checking with Middling Hands
- Folding/Bluffing Weak Hands

Playing Styles

- Tight vs Loose
- Aggressive vs Passive
- In general, be tight and aggressive

Purpose of Betting

- Value Betting → want weaker hands to call
- Bluffing → want stronger hands to fold
- Betting for Protection → want drawing hands to draw at unfavorable odds
- Sometimes bets can serve multiple purposes

Deception

- Easy to read = Exploitable
- Almost never want to do one action at 100% frequency
- Incorporate bluffs

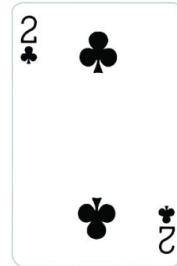
Hand Types

Starting Hand Types

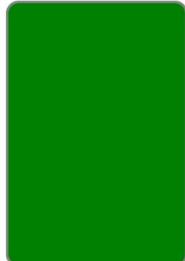
- Paired vs Unpaired
 - Suited vs Off-suit
 - Connected vs Not connected
 - High vs Low
 - Best starting hands?

Drawing Hand

Board Cards



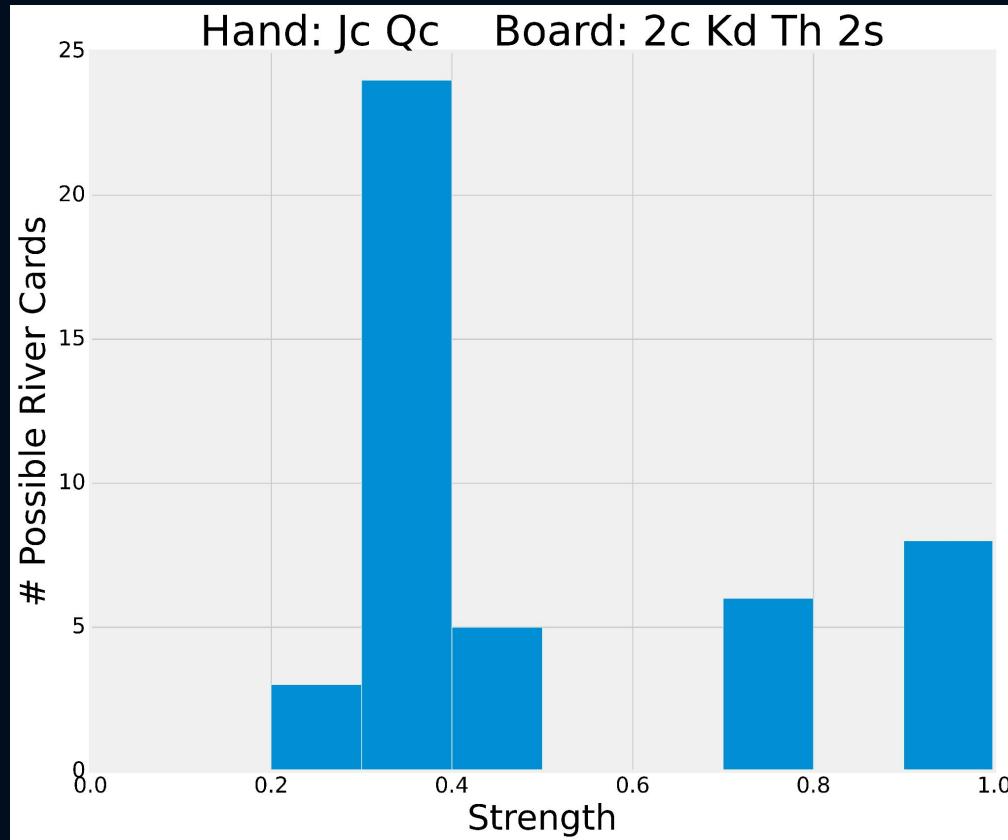
Opponent Cards



Your Cards

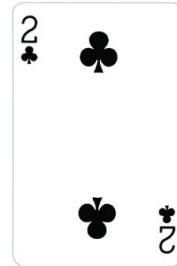


Drawing Hand



Low Pair

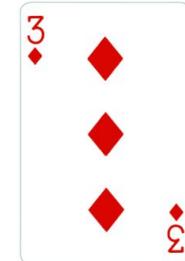
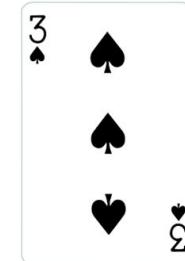
Board Cards



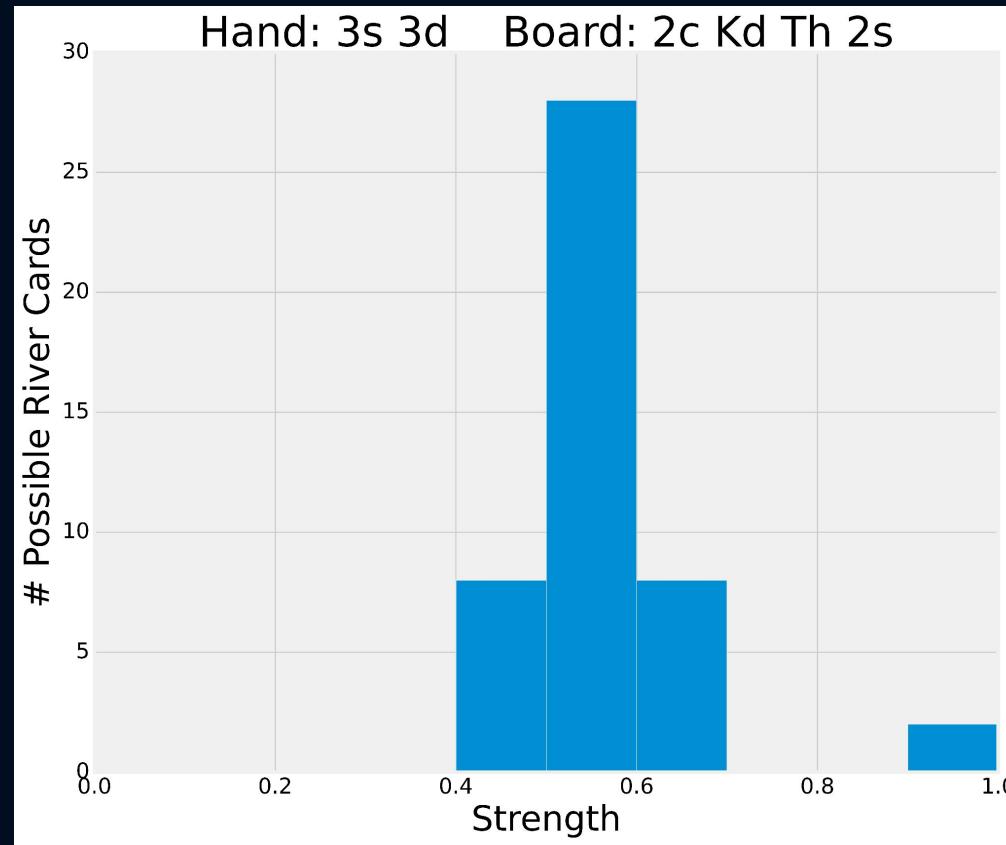
Opponent Cards



Your Cards

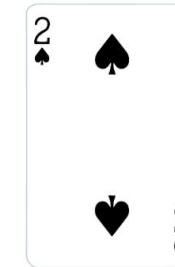


Low Pair

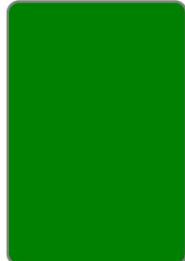


Top Pair

Board Cards



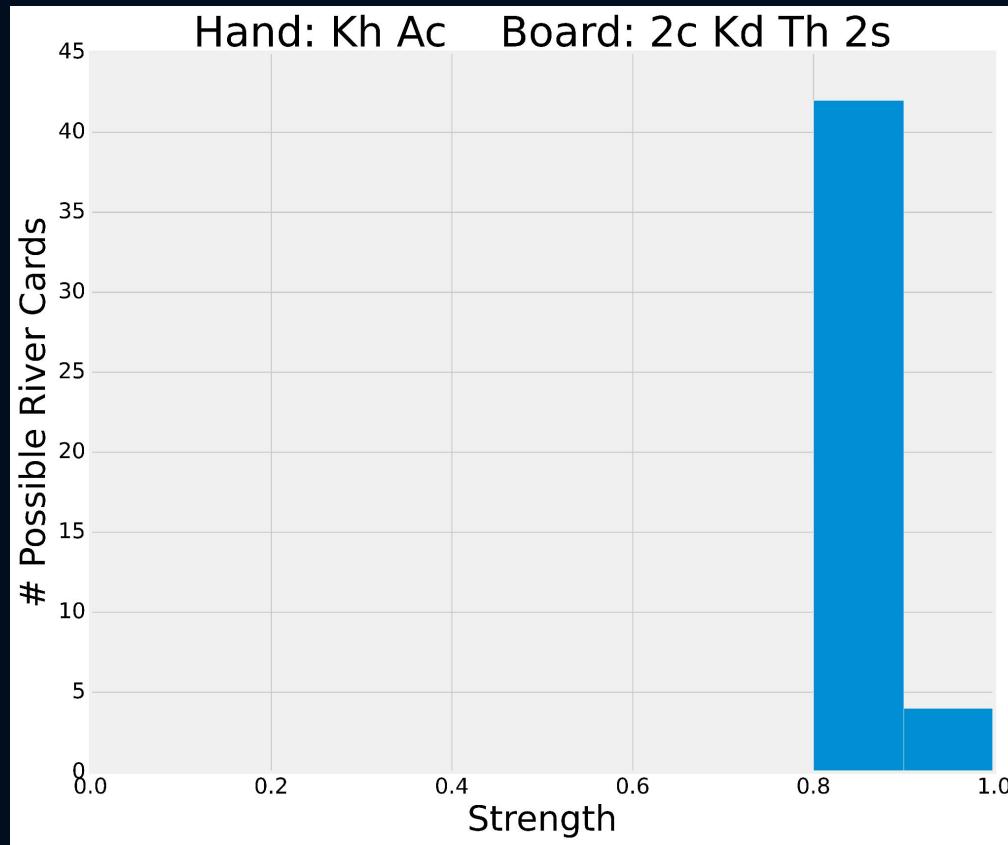
Opponent Cards



Your Cards

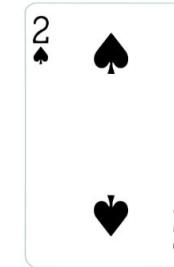
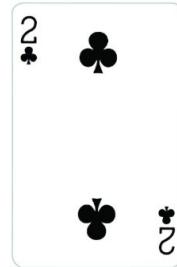


Top Pair

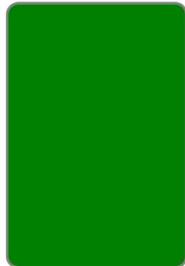


The Nuts

Board Cards



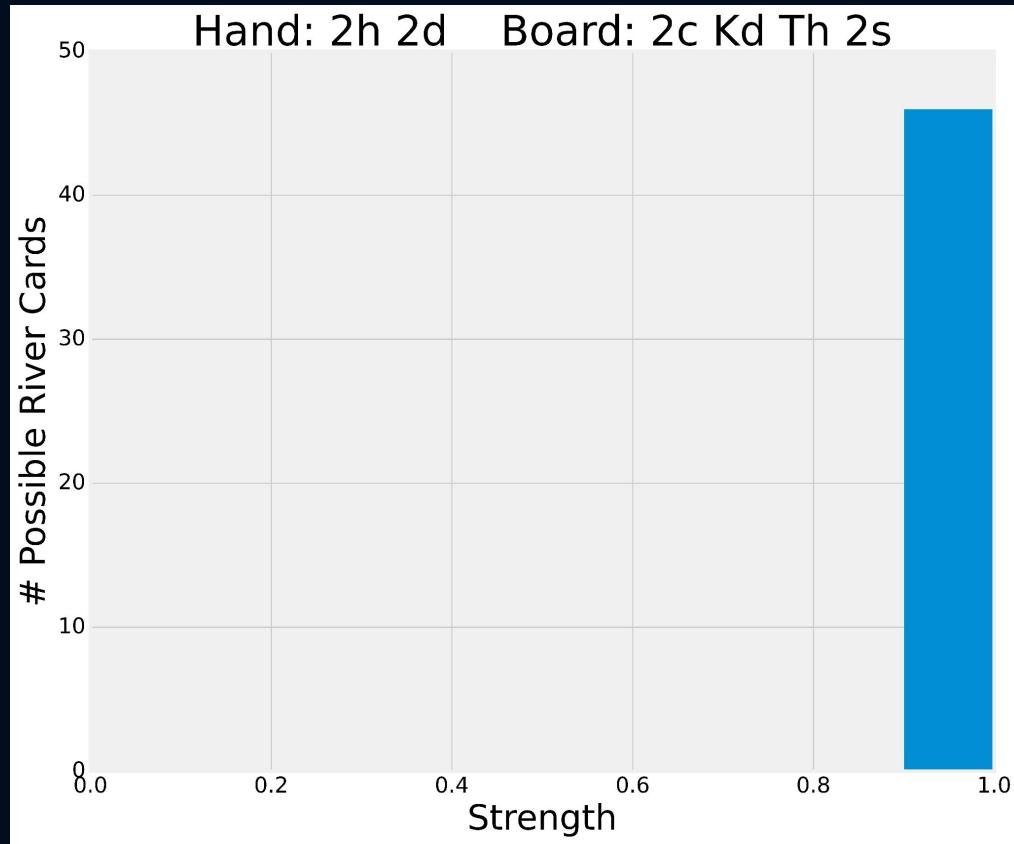
Opponent Cards



Your Cards



The Nuts

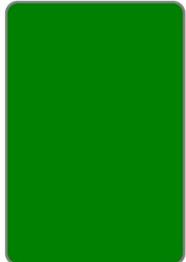


Total Air

Board Cards



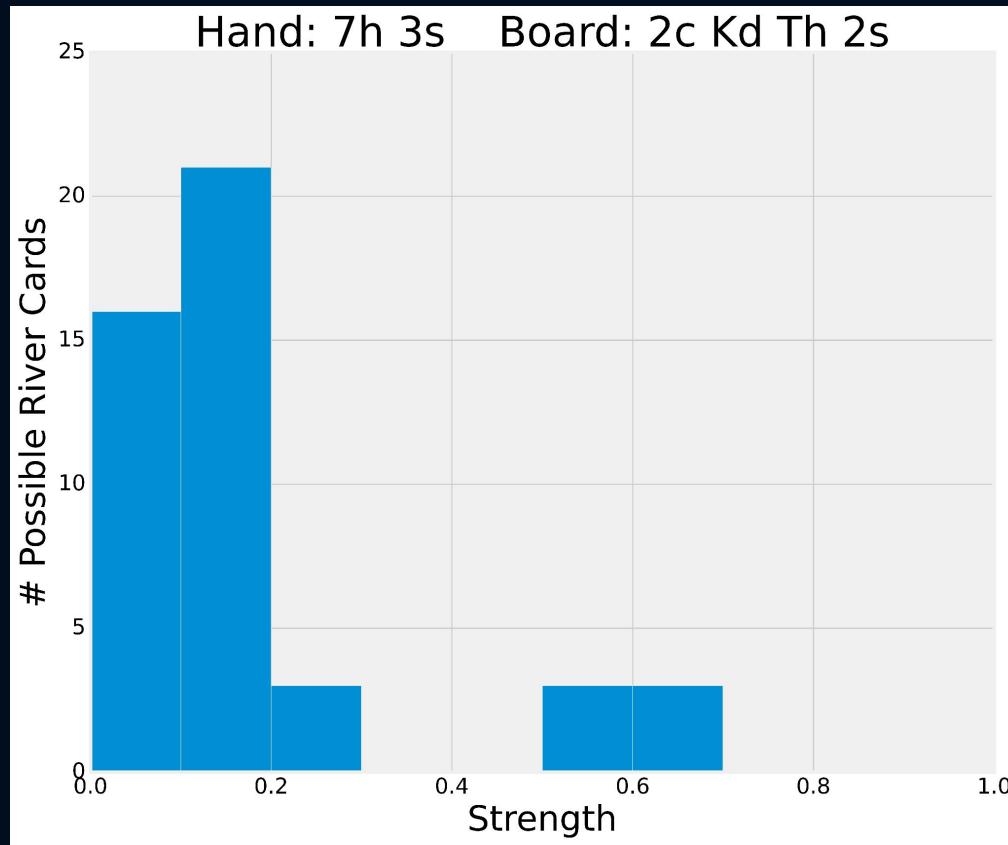
Opponent Cards



Your Cards



Total Air



Pot Odds and Outs

Defining P

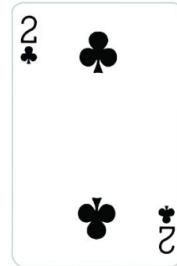
- At any point in the game there exists some fixed probability of winning (P)
 - Also called equity
- In reality P is often hard to explicitly calculate, but we can reasonably estimate

Expected Value

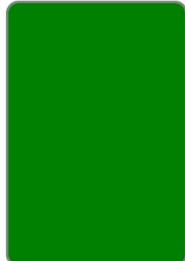
- Expected Value: how many chips we expect to win/lose on average
- EV of folding = $0 * \text{pot_total} - 0 * \text{continue_cost} = 0$
- EV of calling a bet = $P \cdot \text{pot_total} - (1 - P) \cdot \text{continue_cost}$
- $P \geq \text{continue_cost} / (\text{pot_total} + \text{continue_cost})$
- RHS is called the “pot odds”

Pot Odds Exercise

Board Cards



Opponent Cards



80

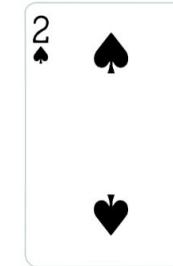


Your Cards

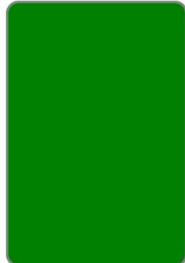


Pot Odds Exercise

Board Cards



Opponent Cards



80



10



Your Cards



C or F?

Pot Odds Exercise

- $\text{pot_total} = 90$
- $\text{continue_cost} = 10$
- $\text{pot odds} = 10 / (90 + 10) = 0.1$
- If $P \geq 0.1$, we should call!

How do we know what P is?

Estimating P by Counting Outs

Out = A card that would complete our hand or make us significantly stronger

Idea: If we count our outs, we can estimate the probability of finding cards we need
We can use this to estimate our probability of winning P

Strategy:

- Count the number of cards that complete our hand (outs)
- Multiply this number by 2 (1/52 cards gives ~2% chance of getting a specific card)
- If we have two cards left to see (turn and river), multiply by 2
- This number is our probability estimate! (as a percent)

Counting Outs Exercise



Counting Outs

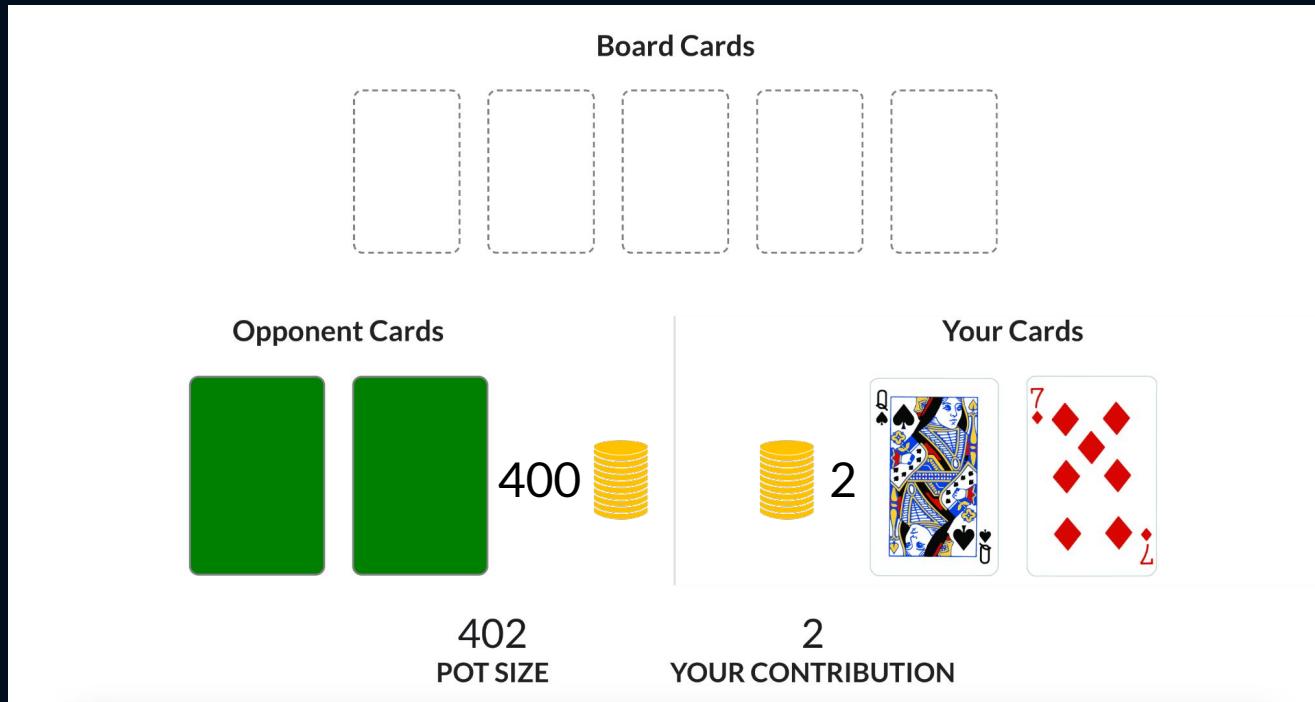
- How can we hit a straight?
 - Any Ace or Nine (8 outs)
 - Only 1 card left to come, so $1 * 8 * 2\% = 16\%$
- How can we hit second pair?
 - Any Jack or Queen (6 outs)
 - Only 1 card left to come, so $1 * 6 * 2\% = 12\%$
- P, assuming opponent does not have top pair or better: 28%
- $P > 0.1$, so we call!

Reverse Pot Odds

- If we overbet relative to the size of the pot, then we give our opponent the opportunity to exploit pot odds
- If they have a bad hand, we win a little
- If they have “the nuts,” we lose a lot

Example: All-in Bot

- Scenario: Opponent goes all-in before the flop every hand



Example: All-in Bot

- Scenario: Opponent goes all-in before the flop every hand
- What P do we need to call profitably as the big blind?
- `pot_total = 402`
- `continue_cost = 398`
- $\text{pot odds} = 398 / (402 + 398) = 0.4975$
- If $P \geq 0.4975$, we should call!
- Fun fact: Q5o tends to beat 50% of starting hands

Questions?

Implied Odds

Implied Odds

- The amount of money you expect to win on later streets if you hit one of your outs
- Enables us to call when we don't have the right pot odds
- Important to consider when we have a drawing hand

Updated P

- Pot odds cutoff: we should stay in the game if
 $P \geq \text{continue_cost} / (\text{pot_total} + \text{continue_cost})$
- Implied odds cutoff: we should stay in the game if
 $P \geq \text{continue_cost} / (\text{pot_total} + \text{continue_cost} + \text{future_win_amount})$

Pot Odds Exercise (again)



Pot Odds Exercise (again)

- pot_total = 250
- continue_cost = 50
- pot odds = $50 / (250 + 50) = 0.1667$
- P , assuming you need to beat King pair = $1 * 8 * 2\% = 0.16$
- $0.16 < 0.1667$, so we should fold!

Implied Odds

- Assumption, our opponent has three of a kind of Twos or pair of Kings and will call if we bet 100 more on the river no matter what card comes
- `pot_total = 250`
- `continue_cost = 50`
- `future_win_amount = 100`
- $\text{pot odds} = 50 / (250 + 50 + 100) = 0.125$
- $P, \text{assuming you need to beat King pair} = 1 * 8 * 2\% = 0.16$
- $0.16 > 0.125$, so we should call!

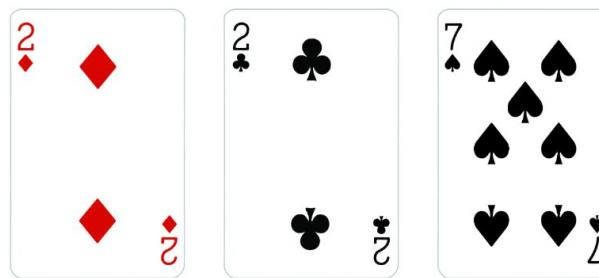
Board Texture

Board Texture

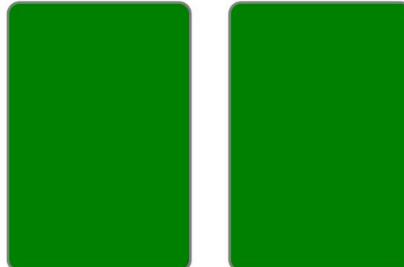
- How connected the board is
- Dry → hands are not likely to improve as more cards come
- Wet → hands are likely to improve as more cards come

Dry Board

Board Cards



Opponent Cards



Your Cards

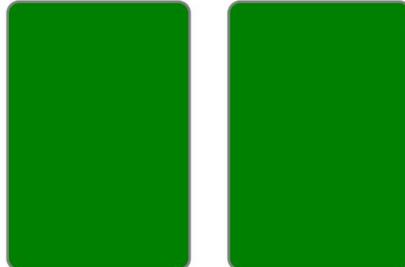


Wet Board

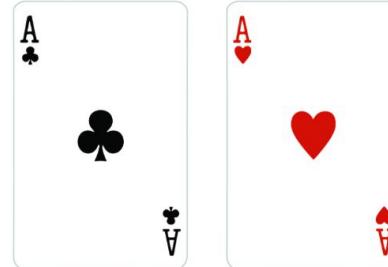
Board Cards



Opponent Cards

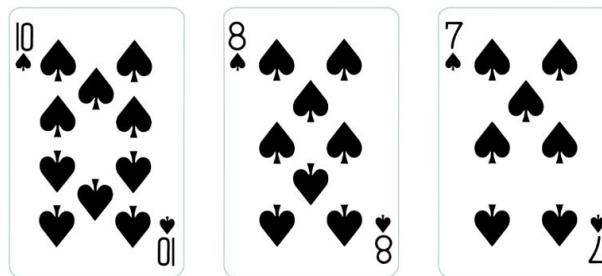


Your Cards

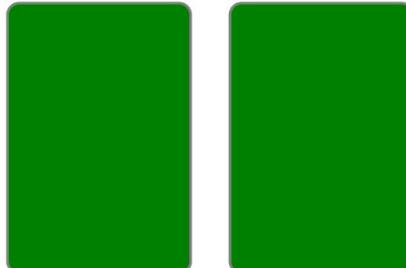


Very Wet Board

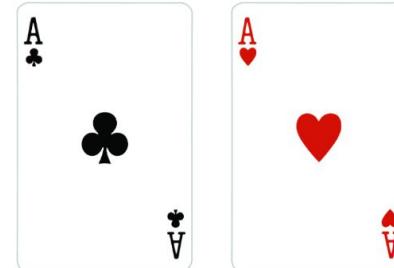
Board Cards



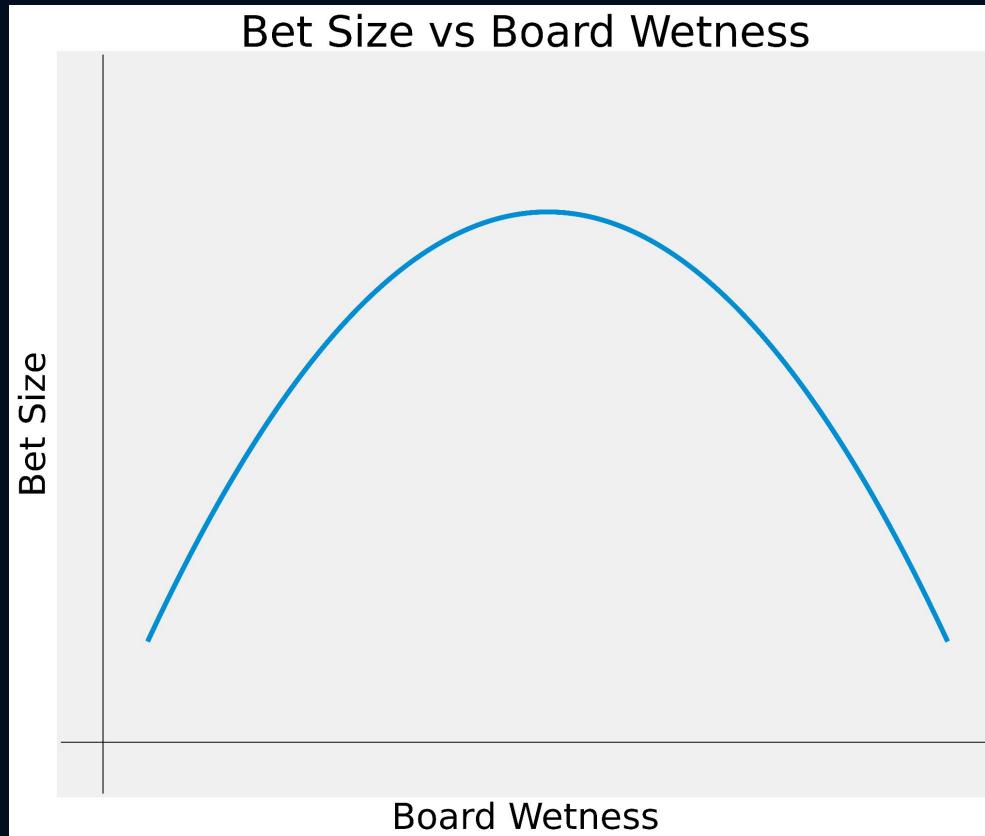
Opponent Cards



Your Cards



Flop Bet Size



Board Texture Exercise

Board Cards

Opponent Cards

Your Cards

350
POT SIZE

175
YOUR CONTRIBUTION

Choose an action
The cost is listed in parentheses

CHECK RAISE (75) RAISE (225)

Board Texture Exercise

- Two flush draws
- Several straight draws: 9T, TJ, AJ
- Board is wet, we don't want opponents to complete their draws cheaply
- Go all-in!

Ranges

Ranges

- We know the pot odds when faced with any bet
- If we can estimate P better than our opponent, then we will make money on average
- What affects P ?

Factors of win probability

- Bluffing
- Betting style
- Board and Hole cards
- *Ranges*

Our opponent's *range*
is the distribution of
hands we expect
them to hold

Which ranges are good?

- Tight-aggressive
- Fold early and often to mitigate losses
- Bet and win when you have a good hand!

Example range

- Six players, first to act
- Orange: Raise
- Blue: Fold

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

Heads-Up Range

AA	AKs	AQs	AJs	ATs	A9s	A8s	A7s	A6s	A5s	A4s	A3s	A2s
9.95	3.96	2.9	2.32	1.97	1.53	1.35	1.23	1.06	1.16	1.05	0.95	0.85
AKo	KK	KQs	KJs	KTs	K9s	K8s	K7s	K6s	K5s	K4s	K3s	K2s
3.19	8.17	2.07	1.73	1.52	1.14	0.91	0.81	0.71	0.6	0.52	0.45	0.39
AQo	KQo	QQ	QJs	QTs	Q9s	Q8s	Q7s	Q6s	Q5s	Q4s	Q3s	Q2s
2.06	1.29	6.58	1.53	1.38	1.05	0.78	0.53	0.46	0.39	0.34	0.27	0.22
AJo	KJo	QJo	JJ	JTs	J9s	J8s	J7s	J6s	J5s	J4s	J3s	J2s
1.49	0.94	0.8	5.21	1.34	1.02	0.79	0.51	0.29	0.25	0.21	0.19	0.16
ATo	KTo	QTo	JTo	TT	T9s	T8s	T7s	T6s	T5s	T4s	T3s	T2s
1.13	0.73	0.63	0.63	4.08	1.03	0.85	0.58	0.33	0.2	0.18	0.16	0.13
A9o	K9o	Q9o	J9o	T9o	99	98s	97s	96s	95s	94s	93s	92s
0.7	0.37	0.33	0.33	0.36	3.15	0.89	0.68	0.44	0.19	0.13	0.11	0.08
A8o	K8o	Q8o	J8o	T8o	98o	88	87s	86s	85s	84s	83s	82s
0.53	0.27	0.22	0.22	0.25	0.26	2.43	0.77	0.59	0.32	0.14	0.07	0.05
A7o	K7o	Q7o	J7o	T7o	97o	87o	77	76s	75s	74s	73s	72s
0.41	0.22	0.13	0.13	0.16	0.18	0.19	1.86	0.66	0.43	0.2	0.09	0.01
A6o	K6o	Q6o	J6o	T6o	96o	86o	76o	66	65s	64s	63s	62s
0.33	0.16	0.08	0.04	0.07	0.09	0.11	0.14	1.49	0.57	0.37	0.13	0.03
A5o	K5o	Q5o	J5o	T5o	95o	85o	75o	65o	55	54s	53s	52s
0.33	0.12	0.05	0.02	0	0.01	0.03	0.07	0.09	1.19	0.53	0.32	0.08
A4o	K4o	Q4o	J4o	T4o	94o	84o	74o	64o	54o	44	43s	42s
0.28	0.08	0.03	0	0	0	0	0	0.03	0.06	0.97	0.23	0.06
A3o	K3o	Q3o	J3o	T3o	93o	83o	73o	63o	53o	43o	33	32s
0.25	0.05	0	0	0	0	0	0	0	0	0.73	0.22	0.02
A2o	K2o	Q2o	J2o	T2o	92o	82o	72o	62o	52o	42o	32o	22
0.2	0.02	0	0	0	0	0	0	0	0	0	0.61	

AA	AKs	AQs	AJs	ATs	A9s	A8s	A7s	A6s	A5s	A4s	A3s	A2s
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3.19	8.17	2.07	1.73	1.52	1.14	0.91	0.81	0.71	0.6	0.52	0.45	0.39
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A9o	K9o	Q9o	J9o	T9o	99	98s	97s	96s	95s	94s	93s	92s
0.7	0.37	0.33	0.33	0.36	3.15	0.89	0.68	0.44	0.19	0.13	0.11	0.08
A8o	K8o	Q8o	J8o	T8o	98o	88	87s	86s	85s	84s	83s	82s
0.53	0.27	0.22	0.22	0.25	0.26	2.43	0.77	0.59	0.32	0.14	0.07	0.05
A7o	K7o	Q7o	J7o	T7o	97o	87o	77	76s	75s	74s	73s	72s
0.41	0.22	0.13	0.13	0.16	0.18	0.19	1.86	0.66	0.43	0.2	0.09	0.01
A6o	K6o	Q6o	J6o	T6o	96o	86o	76o	66	65s	64s	63s	62s
0.33	0.16	0.08	0.04	0.07	0.09	0.11	0.14	1.49	0.57	0.37	0.13	0.03
A5o	K5o	Q5o	J5o	T5o	95o	85o	75o	65o	55	54s	53s	52s
0.33	0.12	0.05	0.02	0	0.01	0.03	0.07	0.09	1.19	0.53	0.32	0.08
A4o	K4o	Q4o	J4o	T4o	94o	84o	74o	64o	54o	44	43s	42s
0.28	0.08	0.03	0	0	0	0	0	0.03	0.06	0.97	0.23	0.06
A3o	K3o	Q3o	J3o	T3o	93o	83o	73o	63o	53o	43o	33	32s
0.25	0.05	0	0	0	0	0	0	0	0	0.73	0.22	0.02
A2o	K2o	Q2o	J2o	T2o	92o	82o	72o	62o	52o	42o	32o	22

Variant Specific Considerations

Bounty Pot Odds

Board Cards

Opponent Cards

200

C or F?

Your Cards

600

POT SIZE

J

YOUR BOUNTY RANK

200

YOUR CONTRIBUTION

Choose an action

The cost is listed in parentheses

CALL (200)

FOLD (0)

Bounty Pot Odds

- EV of folding = $0 * \text{pot_total} - 0 * \text{continue_cost} = 0$
- EV of calling a bet = $P \cdot (\text{pot_total} + \text{opponent_contribution} * 0.5 + 10) - (1 - P) \cdot \text{continue_cost}$
- $P \geq \text{continue_cost} / (\text{pot_total} + \text{opponent_contribution} * 0.5 + 10 + \text{continue_cost})$
- Without bounty: $P \geq 200 / (600 + 200) = 0.25$
- With bounty: $P \geq 200 / (600 + 400 * 0.5 + 10 + 200) = 0.198$
- How many outs do we have?
- 9 hearts left in the deck + 3 non-heart Ts to give us the nuts: $1 * 2\% * 12 = 24\%$
- $0.24 > 0.198$, so we should call!

Questions?

Lunch



Leave any type of feedback at [pkr.bot/feedback!](https://pkr.bot/feedback)



Live Coding Session

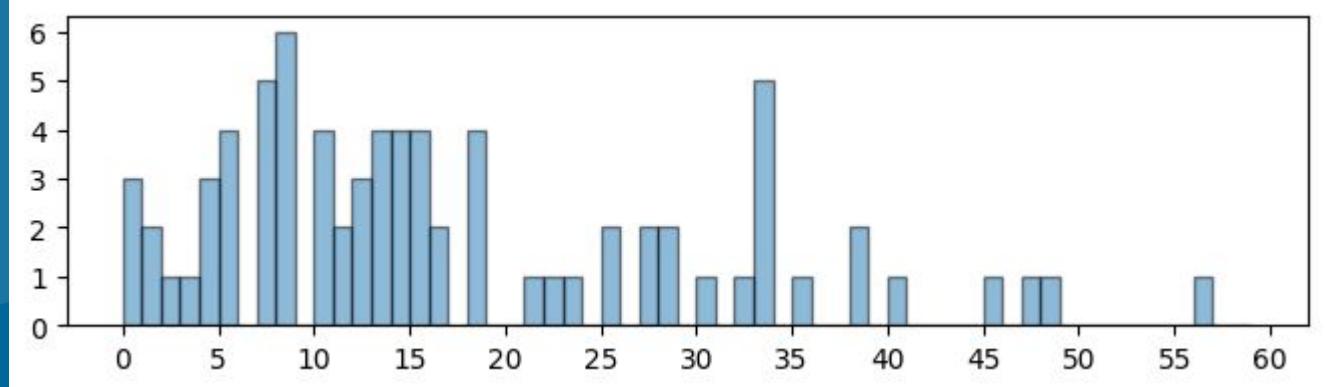
All code from today can be found at:

github.com/mitpokerbots/reference-3-2025

Giveaway Winners

LUPI Winner: kerb “yangj216”

Lowest Unique Positive Integer was 3



Thanks for watching!

Slides/notes will be posted on [pkr.bot/resources](#)

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