



MIT 15.S50 LECTURE 3

Monday, January 23rd, 2012

STARTER: DO YOU CALL?



DO THE MATH

- Need to call 2BB to win 5.5BB already in the pot
- $2/7.5 = 27\%$ equity needed
- Assume he's raising top 25 percent of hands (see right)

- Your equity with 72o is 28%

Player 1	$\frac{R}{D}$	66+, A2s+, K6s+, Q8s+, J8s+, T8s+, A7o+	71.989%
Player 2	$\frac{R}{D}$	72o	28.011%

- Enough to call!
- “Escape Rule”

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

[illegible]

INTRODUCING REVERSE IMPLIED ODDS

- In the first situation, we called because we were all-in and the equity calculation (which assumes that players are all-in) said we could call with 5.5-to-2 odds.
- In this situation, even though pot odds tell us to call, the correct play is clearly to **fold**.
- The reason is because, the hand is not over the moment you call. You still have to play the flop, turn, and river. With a hand like 72o, it is going to be extremely difficult to play postflop. You are often going to fold the best hand, or put in more chips with the worse hand, which makes your 28% equity less relevant.
- We say that in this situation your actual odds are worse than 5.5-to-2 due to **reverse implied odds**.



SAY YOU HAD A2o...



REVERSE IMPLIED ODDS ARE VERY IMPORTANT!

- I would still fold in this situation! Even though your equity against his range is 43%, and you only need 27% equity to all-in profitably.
- You will often lose a lot of money when he has a stronger ace and an ace comes.
- You will often get bluffed off a pair of deuces, when there are 4 higher cards on the board.
- To make things worse, you are out of position the entire hand. You have to act first on the flop, turn, and river, which causes you to make even more postflop mistakes.



HERE, WE ONLY HAVE 37% EQUITY
INSTEAD OF 43%, BUT I WOULD CALL.



REVERSE IMPLIED ODDS DON'T WORK AGAINST YOU HERE

- Even though your equity is worse than with A2o, I could call instead of fold, because you will be able to make much better decisions with your remaining 60,000 chips.
- You can hit a straight, and get him to put in lots of money with a good pair.
- You can hit a flush, and get him to put in lots of money with a good pair.
- When you hit a 9 or a 8, it's harder to bluff you off the hand than if you had a pair of deuces, because there will be fewer cards on the board higher than 9 or 8.
- Yes, you are still out of position, but whatever.



IMPLIED ODDS

- Sometimes, reverse implied odds can work in your favor! In this situation, we say that you have **implied odds**.
- This can happen when you have a hand that plays well postflop (suited connectors, pairs), and you are in position.



[illegible]

ANALYSIS

- You need to put in 3BB, with 5.5BB already in.
- You need $3/8.5 = 35\%$ equity.
- However, you only have 34% equity:
- I would **definitely still Call**:

Player 1	$\frac{R}{D}$	88+, AJs+, KQs, AQo+	65.689%
Player 2	$\frac{R}{D}$	22	34.311%

- You are in position.
- You can win a huge pot vs. AA on a 752 flop.
- You can win a huge pot vs. AK on a A62 flop.
- Even though you will lose the pot most of the time, you will rarely lose a big pot.
- You will flop a deuce (flop a “set”) 1/8 of the time.
- We say that you are “set mining”.



ANOTHER HAND





A screenshot of a Texas Hold'em poker game interface. The game is in progress on a green felt table. The community cards are the Ace of Diamonds (A♦), 5 of Spades (5♠), and 2 of Diamonds (2♦). The pot contains \$6,100, represented by 5k, 1k, and 400 chip icons. The players and their stacks are:

- UTG+1: \$55,878
- UTG: \$79,900
- BB: \$61,600
- SB: \$4,036
- BTN: \$77,900 (holding J♦ 10♦)
- CO: \$27,150
- HJ: \$48,654 (with a 25 chip icon and a stack of cards next to them)
- HJ-1: \$16,155
- HJ-2: \$6,685

Buttons at the top right include "LEAVE TABLE" and "VIEW LOBBY". At the bottom left are tabs for "Chat", "Notes", "Stats", and "Info". A "Last Action" log at the bottom right shows "CO bets 2750\$".



CALL. WE DON'T HAVE MORE THAN 50% EQUITY TO WANT TO RAISE, AND RAISING GIVES HIM THE OPPORTUNITY TO RE-RAISE ALL-IN.



CO BETS AGAIN, AND BIG, ON THE TURN.



ANALYSIS

- Let's assume that CO has at least a pair of Aces when he bets again, and bets this big. Let's assume that we win if and only if we hit a diamond on the river.
- We need to call 8000 to win 20000 already in the pot.
- $8/28 = 29\%$ equity is what we need
- # of diamonds left = 9. # of total cards left = 46.
- $9/46 = 20\%$ equity is what we have – not enough!
- However, I would definitely still **call**. Because when you hit your flush, you actually win more than 20000: you win 20000 + the money to go in on the river, which could be up to another 20000.
- So we say that you call because of **implied odds**.



THE SAME SCENARIO WITH DIFFERENT CARDS...



HERE, YOU DON'T REALLY HAVE IMPLIED ODDS TO CALL

- When you do hit the 4th diamond, the board will have 4 diamonds on it, and it will be sort of “obvious” that you have a flush when you bet. He will only call with a decent diamond (Td, 9d), which he is not that likely to have. So your “implied odds” are a lot worse.
- You're not even drawing to the best hand. When the board has 3 diamonds and you have a J-high flush, you're only beaten by the Qd or Kd **with another diamond**. Here, you're beaten by the naked Qd or Kd.
- Also remember, on paired boards, flushes can be beaten by full houses! (Whereas on non-paired boards, flushes are unbeatable.)



BLUFFING WITH DRAWS

- So far, we've played all of our draws passively – that is, we either fold if we don't have the implied odds, or call if we have the implied odds and try to hit our flush.
- However, draws are very potent when you play them aggressively. In fact, “bluffing” is equivalent to “raising aggressively with a draw”. You should **VERY RARELY** be bluffing (before the river) without a draw.



EXAMPLE



LEAVE TABLE
VIEW LOBBY

UTG+1
\$5878

UTG
\$7554

UTG
\$7554

Call

SB
\$6036

BTN
\$12400

CO
\$2443

HJ
\$8654

HJ-1
\$16155

HJ-2
\$6685

\$4500

\$500

10
9

Chat
Notes
Stats
Info

Last Action
BB calls 800\$



A screenshot of a Texas Hold'em poker game interface. The central green felt area shows three community cards: Jack of Clubs (J♣), 8 of Hearts (8♥), and 5 of Hearts (5♥). A pot of \$4500 is indicated by chip icons (one red \$1k chip and one purple \$500 chip) in the center. Around the table are seven player positions, each with a yellow circular avatar placeholder and a black box showing their position and stack size:

- UTG+1: \$5878
- HJ-2: \$6685
- HJ-1: \$16155
- HJ: \$8654
- CO: \$2443
- BTN: \$12400
- SB: \$6036

The UTG+1 player has two hole cards visible: the 10 of Diamonds (10♦) and the 9 of Hearts (9♥). Below their cards is a black button labeled "Check". At the top right, there are two orange buttons: "LEAVE TABLE" and "VIEW LOBBY". At the bottom left, there is a navigation bar with four tabs: "Chat", "Notes", "Stats", and "Info". Below the "Chat" tab is a large white rectangular chat window.



HE CONTINUATION BETS.



HI-YA!



WHY DID WE DO THIS INSTEAD OF CALLING AND TRYING TO HIT OUR STRAIGHT?

- When we just call, we can put our money in when we hit, and not put our money in when we miss...why did we raise all-in instead with ten high!???
- The thing is, it doesn't matter that we have ten-high. He is never calling our all-in with a naked Queen high or King high or Ace high. What's important, is we have **8 outs** (or more) against hands he calls with, ie. hands with Jacks (or better). We have 8 outs even if he has JJ!
- Compare this to say 65 on this flop. Even though we have a pair, we actually have fewer outs (**5 outs**) against a pair of jacks, and have close to 0% equity vs. JJ.



A BLUFFING EPIPHANY

- It doesn't matter how “good” our hand is. It only matters how many “outs” we have against the hands he calls our raise with.
- This is why bluffing with draws is so good! Because draws are hands that suck (ten-high), but have many outs against the good hands in his range.
- On the other hand, a hand like 77 is better to call with instead of raise, since it beats most hands in his range, but loses badly to the ones that call our raise.



EPIPHANY CONTINUED...

- The next time you make a bluff, instead of thinking “how good is my hand”, count “how many outs do I have against the good hands he could have”?
- How you do vs. his bad hands doesn't matter, because he's folding all of them. That's why bluffing with draws is so good. Draws do relatively well vs. his monster hands (vs. his best possible hand, you still have 8 outs), and relatively poorly vs. his “bad” hands (even vs. Q3, you are losing).





LEAVE TABLE
VIEW LOBBY

UTG+1
\$3000

HJ-2
\$3000

UTG
\$3000

HJ-1
\$3000

BB
\$2910

SB
\$2985

CO
\$2910

HJ
\$3000

BTN
\$3000

Chat Notes Stats Info

Last Action
BB calls 60\$



CHECK TO PREFLOP RAISER...



HE “CONTINUATION BETS”, AS EXPECTED



WE CHECK-RAISE FOR NO REASON HERE?



HE CALLS...



WE BET THE TURN WITH ABSOLUTELY NOTHING



HE CALLS



A screenshot of a Texas Hold'em poker game in progress. The game is set on a green felt table with a wooden border. The community cards are the Ace of Hearts, 8 of Hearts, 2 of Clubs, Jack of Diamonds, and 3 of Clubs. The pot is \$2215, with chips of 25, 100, and 500 visible. The blinds are \$1900 (BB) and \$2985 (SB). The button (BTN) is at the bottom with a stack of \$3000. The stack sizes for the other players are: UTG+1 (\$3000), UTG (\$3000), HJ-2 (\$3000), HJ-1 (\$3000), HJ (\$3000), CO (\$1900), and SB (\$2985). The BB is currently all-in. The player's hand is 7 of Diamonds and 6 of Diamonds. The interface includes a chat window at the bottom left, tabs for Chat, Notes, Stats, and Info, and buttons for 'Last Action' and 'BB is All-in' at the bottom right.

Position	Stack Size
UTG+1	\$3000
UTG	\$3000
HJ-2	\$3000
HJ-1	\$3000
HJ	\$3000
CO	\$1900
SB	\$2985
BTN	\$3000
BB	\$0

Community Cards: A♥, 8♥, 2♣, J♦, 3♣

Pot: \$2215

Player Hand: 7♦, 6♦

Blinds: \$1900 (BB), \$2985 (SB)

Buttons: 25, 100, 500

Chat: [Empty]

Notes: [Empty]

Stats: [Empty]

Info: [Empty]

Last Action: BB is All-in



THIS IS “OPENING YOUR WALLET AND GIVING YOUR MONEY TO YOUR OPPONENT”

- You should never be bluffing because “you feel like it”. All big bluffs start with a draw.
- Bluffing is much better when a scary card just came. When the flop is Jack-high, a turned Ace can scare a player off the Jack they called with. When the flop is Ace-high, it’s harder to turn a card that scares them off the Ace they called with.
- The “safe” 3c on the river isn’t a great card to bluff. In general, big cards are scarier than small cards (since players are more likely to play big cards preflop).



...THIS IS BLUFFING!



SAME



[illegible]

SAME



SAME



[illegible]

WHAT DO YOU SAY?

- My heart is feeling strong.



WE TURN A 15-OUT DRAW



SAME



SOME NOTES

- If CO shoved, we would have odds to call his all-in (we have 15 outs in 46 cards; just barely have enough odds).
- Note that by check-raising flop, betting turn, we give ourselves the chance to put all our money in on the river without ever having to bet absurdly big. So we give ourselves a chance to double up without having to do weird bet sizing.
- Betting more than pot is unconventional just because you are committing more than necessary at one time.
- You should usually play draws this way because this is how you would play your good hands (say 22) on this board.



RIVER IS KC INSTEAD OF 3C, A LOT SCARIER
AND MORE LIKELY FOR HIM TO FOLD!



GIVING UP A BLUFF:



[illegible]



CO BETS



A screenshot of a Texas Hold'em poker game interface. The game is in progress with the following details:

- Players and Stacks:**
 - UTG: \$3000
 - UTG+1: \$3000
 - HJ-2: \$3000
 - HJ-1: \$2910
 - HJ: \$3000
 - CO: \$2760
 - BTN: \$3000
 - SB: \$2985
 - BB: \$2535
- Community Cards:** 10 of Clubs, 7 of Diamonds, 2 of Hearts.
- Player Hands:** BB has J♥ 9♥.
- Chips:** Various chip denominations are visible on the table, including 100, 25, and 5.
- Buttons:** "LEAVE TABLE" and "VIEW LOBBY" are in the top right. "Chat", "Notes", "Stats", and "Info" are in the bottom left.
- Last Action:** BB raises to 375\$.



ANALYSIS

- We have 4 outs to hit the nuts (8's), 3 outs to hit a higher pair than the 10, 3 outs to hit a lower pair than the 10
- Furthermore, we have lots of back-door draws...
- If we turn a heart, now we have a flush draw
- If we turn a Queen, we have an 8-out straight draw. If we turn a King, we ALSO have an 8-out straight draw (“double-gutter”)!
- Notice that we can hit combinations of these cards. Eg. Qh. This is what makes back-door draws so relevant.



HJ-1 GETS OUT OF THE WAY



Community Cards: 10♣, 7♦, 2♥

Position	Name	Stack (\$)	Action
UTG+1		\$3000	
HJ-2		\$3000	
HJ-1		\$2910	
HJ		\$3000	
Call			Call
BTN		\$3000	Calling
SB		\$2985	
BB		\$2535	
UTG		\$3000	

Pot: \$285

Last Action: CO calls 225\$



TURN IS THE WORST POSSIBLE CARD...



ANALYSIS

- This card does not help us at all.
- Furthermore, this card is very “safe”. It doesn’t really put his pair of Tens, or pair of Queens, or whatever, in jeopardy. If he called with a 7 on the flop, he now improved to 3-of-a-kind.
- A huge issue – we cannot have a 7 here! With a 7, we’d just call the flop, by my heuristic before of “call medium hands, raise strong hands and draws, fold everything else”.
- We stop our bluff here. He’s not going to fold much if he knows we can’t have a 7.



CHECK...



AND FOLD.



BLUFFING EPIPHANY 2

- Other than counting how many outs we have, it's important to analyze **what we are representing**.
- When a 7 comes and we cannot represent a 7 by our flop play, this is a bad spot to bluff.
- An Ace-turn would be better to bluff because it scary, also we can represent AJcc, A8dd, etc.
- A 6-turn would be alright to bluff too because we can represent 98.
- When you were bluffing (with a draw) and a **different draw completes**, this is usually a good opportunity to bluff.



SWITCHING GEARS TO SOME GENERAL POKER IDEAS...

- There have been some complaints of this form: “If I follow the strategy on the slides, then everyone knows my strategy...”
- Why should I listen to this crazy Will Ma guy?



LET'S TAKE THE EXAMPLE FROM BEFORE...



POTENTIAL THOUGHT

- “If I didn’t listen to Will Ma and bluffed this turn, my opponent would **NEVER** expect it and **fold everything**. Since he assumes I’m listening and won’t ever bluff this turn.”
- All in all, you would be better off if you just called your 7’s on the flop and rarely bluffed this turn, instead of check-raising 7’s on the flop, and/or sometimes bluffing this turn.
- What I’m suggesting are “fundamentally logical plays”. They are also somewhat “balanced”, close to “Nash Equilibrium”...
- Also, see the contradicting logic...



POTENTIAL THOUGHT 2

- “If I didn’t listen to Will Ma and check-raised the flop with a 7, then my opponent would NEVER expect me to have a 7 here, and he would **put in all his money!**”
- This is conflicting logic...do you expect him to call or fold??



THE “ESCAPING RULE”, PREFLOP RAISING RULES

- “If I follow these rules, my opponent knows my strategy!”
- Once again, this doesn’t matter, because these rules are there to allow you to make mathematically sound decisions.
- The only thing your opponent learns from you following these rules is “you like money, and will make decisions that maximize your expectation”.



BACK TO OPENING RANGES...



“HE KNOWS EXACTLY WHAT CARDS I MAY HAVE”

- You still have both value-bets and bluffs on all boards. The weaker hands in your range (AJ, 88 instead of AA) will usually end up being the **bluffs** (definition: bet to try to get them to fold a better hand).
- AA will usually end up being **bet for value** (definition: bet to try to get them to call a weaker hand).
- It doesn't matter if the flop comes 222 and you can NEVER have a 2, because AA is the monster hand you could potentially have on this flop!
- Your range is theoretically balanced as long as you have both value-bets and bluffs.



CAN I OPEN MORE HANDS, OR LESS HANDS?

- This is an empirically tested range that is neither too small (you get eaten up by the blinds) or too big (you put money in too often with bad cards).
- That being said, you can **adjust to your opponents**.



ADJUSTING

- If your opponents are particularly tight (folding too much), you can open more than I suggested, because you'll successfully steal the blinds more frequently. But be careful to fold a lot and rarely put more money in the pot if you don't get the blinds, since their cards must be so good if they didn't fold.
- If your opponents are particularly crazy, I would still rarely open FEWER hands than what I suggested, but be prepared to put all your money in with a greater % of the hands you open.



MORE ADVANCED ADJUSTMENTS

- At higher levels, you can make more advanced reads to what you adjust based on your opponent, like “my opponent likes to check-raise flush draws and play straight draws passively”.



YOU DON'T ADJUST BY LOOKING AT THEIR “POKER FACE”

- A good poker face is extremely important.
FALSE. No one actually possesses the ability to "look into your eyes and tell exactly what you're thinking". Only the most extreme beginners will "give away their cards with the look on their face". At any reasonable level, poker is 100% a mathematical game. Therefore, online poker is the exact same as live poker.



LUCK IN POKER

- It takes a much longer time than most people expect, for your actual results to converge to your expected results.
- I.e. There is a lot of “luck” in poker.
- The most novice player still has some chance of beating the best player in the world.
- Everyone overestimates their own skill at poker.
- This is what makes poker a “gambling” game, and why so many bad players are willing to “gamble” away their money in poker.



DECISIONS VS. RESULTS

- As students at MIT, everyone is probably very good at “inductive learning”, learning from your results.
- Eg. I ate this type of mushroom and got poisoned, so I won't eat it again.
- However, this type of logic will not work in poker. “I called here and last time I did this I won the pot by the river, so I'll do it again.” There is a difference between **decisions** and **results**!
- This is why it's so difficult to learn poker, despite the total knowledge required not being that high.
 - A lot of “sources” for learning poker are wrong.
 - 99% of people who could have learned poker well walk away from frustration too early.



NEXT CLASS

- All pre-flop play! Knowing pre-flop equities, when to shove, which hands are better to shove in which spots, when to call / re-shove as a bluff, lots of examples!

