Introduction to the Theory & Practice of Poker

Lecture #2

Jan 14, 2020
Playing poker

• We have switched to PokerStars
  • See detailed email in BlackBoard on joining
  • Email me if you did not get that message and need instructions
• Start playing poker tonight!
• Calculating cash results
  • Self-reporting
  • Keep track of 15k add ons, Every 4 hours
  • Keep track of tourney buy-ins
• 7-11 pm are most encouraged hours
  • But tables will be available at all times
• We will do a dry run poker tourney either this weekend or Monday
  • Tournaments cost 20k in chips, make sure you have them for the satellites
    • You can buy 1M for $2.99, but you shouldn’t have to
Cash trophy

• To be eligible

• Start with 50,000 in chips
  • 35k + initial add on of 15k

• No more than 5 add-ons allowed
  • On the honor system, so keep track

• By noon on Thursday, Jan 23, update our google doc with
  • Your cash balance, adjusted for tournament subtractions

• You will need to supply screen shot
  • And proof of tourneys
<table>
<thead>
<tr>
<th>Club ID</th>
<th>Club Name</th>
<th>Members</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3195469</td>
<td>Club #3195469</td>
<td>4</td>
<td>Admin</td>
</tr>
<tr>
<td>#3198273</td>
<td>Club #3198273</td>
<td>91</td>
<td>Manager</td>
</tr>
<tr>
<td>#3198276</td>
<td>Club #3198276</td>
<td>91</td>
<td>Member</td>
</tr>
<tr>
<td>#3198278</td>
<td>Club #3198278</td>
<td>92</td>
<td>Member</td>
</tr>
<tr>
<td>#3198281</td>
<td>Club #3198281</td>
<td>89</td>
<td>Member</td>
</tr>
<tr>
<td>#3198282</td>
<td>Club #3198282</td>
<td>92</td>
<td>Member</td>
</tr>
</tbody>
</table>

### JHUPOKER TABLE 1

<table>
<thead>
<tr>
<th>Player</th>
<th>Location</th>
<th>Chips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tournaments

- Make for great TV
  - All the money on the table heads up
  - Lots of drama
  - WSOP Main Event on ESPN
- Greater element of luck than in cash games
  - We’ll look at the theory of why
- Anybody can win on any given day
- Chris Moneymaker changed the poker world
2003 Main Event

• $10,000 Entry fee
• 839 players entered (as opposed to 2019, with 6,140)
• Final 3 players:
  • Chris Moneymaker
  • Sam Farha
  • Dan Harrington
• 10th place: Phil Ivey

• Top 3 prizes
  • 1st place: $2.5M
  • 2nd place: $1.3M
  • 3rd place: $650,000
Introductory concepts

Fundamentals
Expected value

• Example: House flipping
  • Fixer upper for $300k
  • Contractor says for $80k can make it so it can sell for $500k
  • Realtor charges 6% to sell
  • What is your expected value?

\[
500,000 - (300,000 + 80,000 + 0.06 \times 500,000) \\
= 500,000 - 410,000 \\
= 90,000 \text{ profit}
\]

You should do it!!
Expected value

• In house flipping
  • Expected value is
    • Sale price MINUS cost of rehab and commissions

• In poker
  • Expected value in a hand is
    • How much you win when you win MINUS how much you lose when you lose
    • More accurate:
      How much you win times probability of winning MINUS how much you lose times probability of losing

• Key to poker is to push your positive expectations
  • And fold your negative expectations
Expected value in action

• Your hand: 

• After the turn, the board is: 

• Pot contains $50, and you have $20 left, you are heads up

• Tight, solid opponents bets $20
  • You know him, and he would only do this with 2 pair or better

• Should you call or fold?

(show of hands, Why call? Why fold?)
Example (cont.)

• If you fold, your expected value at this point is zero.
• What about calling?
  • You need a club to win
  • There are 13 clubs in a deck
  • You have 2 clubs, and 2 clubs are showing, so 9 clubs left
  • There are 46 unknown cards left: 9 clubs and 37 non-clubs
  • $9/46 = 0.196$, so there is approx. 20% of river being a club
  • You win 20% of the time; when you win, you win $70 (50 + 20)$
    $0.2 \times 70 = $14
  • You lose 80% of the time; when you lose, you lose $20$
    $0.8 \times -20 = -$16
  • So the expected value from the hand is $14 - 16 = -2$
  • On average, in this spot, you will lose $2$
• Don’t call!!!

What if there had been $180 in the pot instead of $50?
Example ($180 in the pot)

• If you fold, your expected value at this point is zero.
• What about calling?
  • You need a club to win
  • There are 13 clubs in a deck
  • You have 2 clubs, and 2 clubs are showing, so 9 clubs left
  • There are 46 unknown cards left: 9 clubs and 37 non-clubs
  • $9/46 = 0.196$, so there is approx. 20% of river being a club
  • You win 20% of the time; when you win, you win $200 (180 + 20)$
    $0.2 \times 200 = $40
  • You lose 80% of the time; when you lose, you lose $20$
    $0.8 \times -20 = -$16
  • So the expected value from the hand is $40 - 16 = 24$
  • On average, in this spot, you will win $24$

• Call!!!
Pot Odds

- An easier way to calculate previous example
- Ratio of amount in the pot to the amount of the bet to call
- $70 in the pot (after opponent bets $20)
- $20 to call the bet
- $20 to win $70 is 70 to 20 pot odds, or 3.5-to-1
- 37 non-clubs in the deck; 9 clubs
- Odds against hitting are 37-to-9 or just over 4-to-1

- **Whenever odds against are worse than pot odds, don’t call!**
- **Whenever pot odds are better than odds against, call!**

If pot had $180 before opponent’s $20 bet, what are the pot odds when it’s your turn?
Pot Odds
Example: Pot odds

- You hold:  

- Board after the turn is:  

- Pot: $150

- You have $50; one opponent has $200; another opponent has $100

- Player with $200 goes all in; second player calls

- Should you call or fold?
Call or fold?

• Safe to assume both players have a club in their hand
• Will cost you $50 to call (rest goes into side pot)
• Pot odds:
  • 250-to-50 (why?), which is 5-to-1
• How many “outs” do you have?
  • 1 ace; 3 Jacks; 3 eights; 3 fours = 10 cards to make full house or quads
  • 46 unknown cards in the deck; 36 of them don’t help
  • Odds against are 36 to 10, or 3.6-to-1
• Pot odds are better than odds against, so you should call!
• Extra credit: Odds against are actually 3.4-to-1, why?
Exercise: Pot Odds

• Volunteer student come up and solve on the board
• You have: 
  ![Cards](image1.png)
• Board is: 
  ![Cards](image2.png)
• There is 180 in the pot; opponent goes All In for $50. You have him covered.
• Opponent accidentally shows you his hand: 
  ![Cards](image3.png)
• Should you call or fold?
• Step 1: Calculate pot odds
• Step 2: Calculate odds against (how many outs?)
• Step 3: Make decision
• What if opponent goes All In for $10?
Exercise 2: Pot Odds

- Work with a partner in the class
- You have: ♠A♣Q
- Board is:

![Board Cards]

- There is $200 in the pot; opponent goes All In for $100. You have him covered.
- Opponent accidentally shows you his hand: ♠3♥3♥
- Should you call or fold?
- Step 1: Calculate pot odds
- Step 2: Calculate odds against (how many outs?)
- Step 3: Make decision

- What if your opponent held Ah3h instead of 33?
Exercise 3: Pot Odds

• On the turn
  • You have top pair, top kicker
  • You believe your opponent has a flush draw (9 outs)
• There is $100 in the pot
• What is the minimum you should bet so that it is a mistake for him to call?

Answer:

Odds against 37-9 which is 4.1 to 1
Pot odds 4 to 1 so \( \frac{100 + x}{x} = 4 \) for a toss up

\[
\begin{align*}
100/x + 1 &= 4 \\
100/x &= 3 \\
x &= 100/3 = 33
\end{align*}
\]

Anything greater than 33 will give wrong odds to call
Exercise 3: Pot Odds

• You can do the same exercise for any number of outs
  • Don’t just bet – have a **purpose** for your bets

• When making a bet ask yourself
  • Is this bet amount giving him correct odds to call?
  • If he is no a draw, can I get him to call incorrectly?

• Always consider opponent’s hand
  • Try to force them into a mistake
Don’t give your opponent pot odds to call

• As you can see in the last exercise
  • Betting 1/3 of the pot gives a flush draw odds to call
  • Betting more than 1/3 of the pot does not give them odds to call
    • Would be a mistake for them to call ½ pot or ¾ pot

• Your goal is to cause opponent to make a mistake
  • You are the house
  • You want every edge
    • Calling without the right odds is a losing proposition

• Don’t call when getting the wrong odds
• Don’t offer a drawing opponent the odds to correctly call
Pot Odds – some limitations

• Imperfect information – you don’t really know what opponent has
  • You can often deduce a range of hands
  • Harder if they are tricky

• Not every decision is an All In situation

• Pot odds calculated on the flop
  • There are still 2 cards to come

And yet, Pot Odds is perhaps the #1 most important concept in NLHE.
Phil Helmuth

- Winningest tournament player
- 15 WSOP bracelets
- 5 WPT final tables
- Over $14M career earnings at WSOP
- Fifth all time money ranking
- Nickname: “Poker Brat”
  - Lots of antics at the table
  - Sore loser, ungracious winner
- Arguably the GOAT in tournaments (he’ll tell you himself)
Phil Helmuth discusses “Outs”

Example: 2

**HERO:** ♠A, ♠K

**OPPONENT:** ♠7, ♦7

**FLOP:** ♠7, ♦3, ♣9

OUTS = 8

Ace or King won’t help...

will give him a full house
How many outs for Mark?
Calculating Outs

• Involves some calculation and some guess work
• What does your opponent have?
  • Could your supposed outs actually give him a better hand?
  • For example, you hit a straight, but he makes a flush?
• Say in middle position, you hold: 

• You raise, and opponent behind you in position calls
• Flop: 

• You check, and opponent bets. How many outs do you have?
Outs example

- Opponent has:
  - A big hand – 2 pair or better
    - You need a K or a 9 for a straight, 8 outs
    - Backdoor Flush draw, 10/47 on turn and 9/46 on River: call it 2 outs
    - But, even if we hit, he could hit a full house, so subtract 2 outs
    - Let’s assign it 8 outs
  - He has an A in his hand
    - Unlikely he’ll beat a straight or flush, so 10 outs
  - He has a J in his hand
    - Now, 3 more outs for the Q, so 13 outs
  - He has a lower pair
    - 16 outs, with the three 10s in the deck

- We actually have no idea what he has, so going with 10 outs is probably best in this scenario.
### Handy Outs table

<table>
<thead>
<tr>
<th>Number of outs</th>
<th>Drawing Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2 pair, needing a full house; or inside straight draw</td>
</tr>
<tr>
<td>6</td>
<td>2 overcards needing to make a pair</td>
</tr>
<tr>
<td>8</td>
<td>Open-ended straight draw</td>
</tr>
<tr>
<td>9</td>
<td>Flush draw</td>
</tr>
<tr>
<td>11</td>
<td>Flush draw plus a pair needing to improve to trips</td>
</tr>
<tr>
<td>12</td>
<td>Flush draw plus inside straight draw</td>
</tr>
<tr>
<td>15</td>
<td>Flush draw plus open-ended straight draw</td>
</tr>
</tbody>
</table>

Rule of thumb: 14 outs makes you even money against a better hand
And you will always be getting better than even pot odds from any bet.
Express odds vs. implied odds

• Pot odds when all in
  • Express odds. It is what it is. Easy decisions. Simple math.

• Pot odds with chips behind
  • How much will you win if you hit your draw?
  • Some draws are obvious, e.g. flush draws
  • Some are hidden, e.g. straight draws

• Implied odds
  • What are the pot odds, taking into account future betting?
Example – implied odds

- Your hand: 

- The board after the turn: 

- You are heads up in position

- Pot $180

- You have $500 in your stack, and so does your opponent

- Opponent bets $100
  - Most likely he has an A, but regardless, you assume you are behind

- Should call, fold, or raise?
Example – implied odds

• Your hand: 🃏キング♦️, 🃏ジャック♦️
• The board after the turn: 🃏スペードAce, 🃏ハート7, 🃏ハート4, 🃏スペード4, 🃏スペード8
• Pot $180
• You have $500 in your stack, and so does your opponent
• Calculate pot odds:
  • 100 to win 280, so 2.8-to-1
• Calculate odds against:
  • 46 unseen cards, 37 bad and 9 good (flush), so 37-to-9, just over 4-to-1
• Do not have express odds to call
• So fold??
  • Not so fast
Implied odds example

• If we call, on the river, the pot is $380
  • And we each have $400 left

• If we miss our draw, we are not putting more in the pot
  • And we will probably lose

• Scenarios if we hit our draw
  • He might bet, and we raise, and either way win more
  • Hi might check, we bet $100 into $380, and he’ll probably call getting 4.8-to-1
  • He might check, we bet $200, giving him 2.9-to-1, so maybe he’ll call
  • He might check, we go all in for $400, possible he’ll call
Implied odds example

• Let’s reexamine Turn decision
  • If we win extra $100 on the River
    • Implied pot odds are really 3.8-to-1, still not good enough to call
  • If we win extra $150 on the River
    • Implied pot odds are really 4.3-to-1, totally adequate to call

• Factors to consider
  • How likely would this opponent be to call $200 bet on River if a spade comes?
  • How likely is he to realize I’m drawing to a spade?
  • Any chance he’ll put me on a bluff and call All In bet on River if spade comes?
    • Also, if he’s on spade draw too, my implied odds are huge, and I’m probably ahead anyway.
  • More advanced: If I miss my draw and bluff, can I get him to fold?

• My decision
  • In this Turn spot, folding is ok, but I like to call the turn bet and then bet $200 on the River if a spade comes and he checks.