How to win at Poker

Introduction

Since the first deck of cards was invented around 1100 years ago, and the first card games were played, players and mathematicians have always asked “How can I beat it?” With some games it’s simply impossible. For example, Snap, which requires reflexes and quick thinking more than anything else. However, it is a known fact that Poker has a mathematical element more than other games, to the extent that competitions are even held to create “Poker Bots”, in which competitors go head-to-head to build the best mathematical model to run on a computer to win the game as reliably as they can.

How to Play Poker

While many variants exist, the most common is Texas Hold ‘em. In this version, each player gets dealt a hand of 2 Cards that they can see and no one else, and 5 more cards are placed on the table face-down to begin. Players use combinations of the cards in their hand and the cards on the table to create the highest scoring set of 5 cards, ranked on things such as Pairs, Straights (cards in order) and Flushes (cards of the same suit). They take turns placing bets based on how confident they are in their ability to win, revealing more and more cards as they go. So where does the maths come in?

Bets can be strategically calculated based on what cards are known, the amount of chips available to you, and the amount of chips available to others.

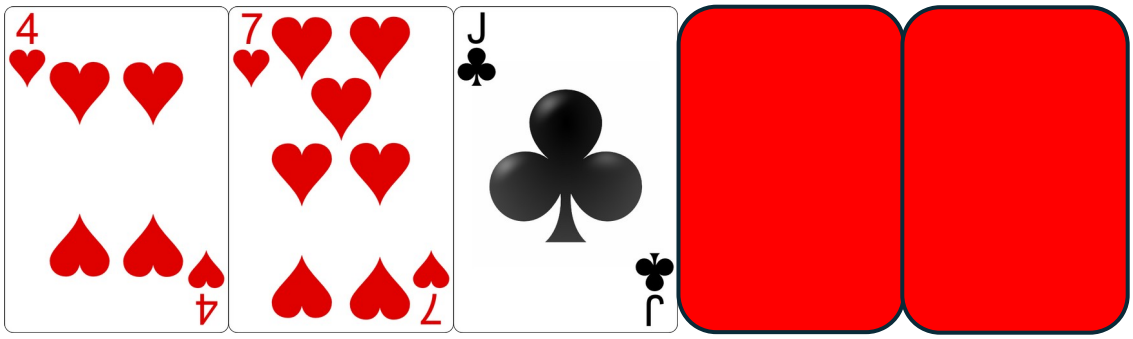
Pot Odds

Pot odds, based on ratios are typically used to make the decision to call (match the bet on the table) or fold (essentially quit this round and cut your losses). It calculates the odds of completing a hand in a flush or straight and compares it to the ratio of risk to reward, I.e. the ratio of the amount you need to call to the amount you would win.

Suppose a player is in a flush draw (they need one more card to complete a set of 5 of the same suit).

Hand:

Table:



This player needs 1 more card to be a heart in order to have a flush. Suppose he has 3 opponents each with 2 cards, this means that there are 47 cards that the two on the table could possibly be. There are 9 other hearts if no one else has a heart, and 38 of any other suit so we could say his odds are 38:9 or roughly 4.2:1. Now suppose the pot currently stands at £350 and his options are call £50 to make the pot £400 in total, or fold and be out of the round. We can say that his

risk is £50 to a reward of potentially £400, making a ratio of 400:50 or 8:1. These odds are clearly higher than his card odds, suggesting that he should take the risk.

Expected Value

We can use this theory and take it a step further to calculate the expected value of this flush draw. This measures over the long run, given that the probabilities of taking a card stay the same, how much you are expected to gain or lose each time. Expected value is typically found in finance, where it measures the value of a company over the long run from estimations of its cash flows, but here we can use this formula:

EV = (Reward Value * Chance of Win) + (Risk * Chance of Loss)

In this case, our reward could be £400, our risk is £50, and our chance of winning is roughly 1 in 5 (0.2) meaning our chance of losing is roughly 0.8. By calculating, we find:

EV = (400 * 0.2) + (-50 * 0.8) = 30

Meaning over the long run, on average this decision is consistently profitable as the reward outweighs the risk, shown by a positive expected value.

Combinatorics

Moving away from calculating bets, we can also use combinatorics to predict (to some extent) the likelihood of your opponent having a certain hand. For example, the best hand you can be dealt is two Aces (we will refer to this as AA), as it is the strongest pair, so before any other cards are revealed these are the two strongest cards. Suppose we start with an Ace and a King, which could very quickly turn into a great hand, and is often considered the second or third best starting hand. We want to figure out the chance that our opponent has something better (for example AA)

This chance can be calculated with this formula:

$N = {}^{A}C_{2}$ Where N is the number of ways this could occur, and A is the number of Cards available of that specific type. C here refers to Combinations, or this formula:

$$nCr = \frac{n!}{r!(n-r)!}$$

As we already have one Ace, there are only three available, so there are only ${}^{3}C_{2}$ ways our opponent could have out of a possible ${}^{52}C_{2}$ starting hands of poker (3 in 1326). If you can do this quickly, you can call a bluff with ease and get a rough estimate of how many hands you beat compared to how many hands you don’ t, and use this to make your decision.

Conclusion

Overall, these can be used all together to give someone a pretty good chance at winning the game, or at least stopping themself from losing everything. While there are so many variables to consider, such as bluffing, and (just the chance that no matter what cards you get dealt, your opponent could almost always have the same or better), the maths can take you to a certain point, and in the long run can help a lot.

Thanks for reading