# **Poker Combination Probability Given 2 Cards**

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# **Introduction**

Poker is a game where people gamble large amounts of money in order to win more money. The way poker is won is by having a stronger set of cards than your opponents. In poker, you normally create a combination of 5 cards. The probabilities of each winning combination happening can easily be found on wikipedia. To differentiate our project from the one we can find in wikipedia, we will instead find the probabilities of getting a winning combination given the first 2 cards we were dealt with. This is important as in Texas holdem, a variation of poker, 2 cards are given to the player and 3 cards are to be revealed later. We will calculate the probabilities of getting a royal straight flush, straight, 4 of a kind, 3 of a kind, and full house given our first 2 cards. The first 2 cards will be chosen from a dropdown menu. There will be 4 dropdown menus containing the values of the 2 cards. Of course we will have the face and the number. We will create buttons which the player will click on and these buttons will correspond to the different winning combinations. The probabilities of winning the chosen combination will be given in percentage form.

# **Objectives**

Create a program that accepts the face and suit of 2 cards and calculates the probability of having a winning combination.

# **Related Work**

The wiki has a very comprehensive guide on calculating the probabilities of the different combinations found in poker. However, it is the probability that did not take into consideration that 2 cards are already given. It uses the nCr function which calculates the number of combinations are possible. The total combinations of 5 cards that can be obtained from the deck of 52 is 52C5 or 2598960. Since we are only considering the probabilities based on the given first 2 cards, we can say that we only have 50 cards left in the deck and are looking for the number of combinations of 3. This gives us 50C3

# **Methodology**

We use a similar logic with the guide from the wiki, instead using 50C3 ways and taking note of the first 2 cards

**Royal Straight Flush:**

If the 2 cards are the same face and either A K Q J 10 the probability is given by this formula:

1 way over 50C3 ways

Else:

0

**Straight Flush (same face and straight in a row):**

If the 2 cards are the same face and have no cards between them the probability is given by this formula:

1 card in between

2 cards in between

3 cards in between

Note: If the cards are both A K Q J 10 subtract by (subtract P of RSF)

Else (more than 3)

0

**4 of a kind:**

Different cards:

Same cards:

**Full House:**

Different cards:

Same cards:

**Flush:**

Same suit:

Different suit:

0

Note: If the cards are close in proximity, subtract by the P of the Straight Flush. When subtracting it, subtract it by the raw Straight flush that didn't get subtracted yet by the royal straight flush.

**Straight:**

If the 2 cards have no cards between them the probability is given by this formula:

1 card in between

2 card in between

3 card in between

Note: If the cards are both the same suit, subtract by the P of the Straight Flush. When subtracting it, subtract it by the raw Straight flush that didn't get subtracted yet by the royal straight flush.

Else:

0

**3 of a kind:**

Different cards:

Same cards:

1. **Results and Discussion**

<https://www.youtube.com/watch?v=0nJeI0A6qjI>

Here is the sample video of the app that the group was able to make. It has a dropdown of the different cards you can choose and it will give out a failure remark if it is given 2 of the exact same cards. Here you can see the difference of having 2 cards that are not the same suit or 2 cards that are very far away. This will have an obvious impact on the probabilities of winning a straight or a flush. Similarly, we can also see that having 2 cards with the same face dramatically increases the probabilities of winning 3-of an kind, 4 of a kind, and a full house.

1. **Conclusion and Future Work**

People in the future can make better models that will give out the probabilities of certain combinations happening given 3 and 4 cards as the game in poker progresses and every round, there is 1 extra card that is given.

1. **Contributions**

Santiago De Larrazabal - Contributed in the creation of the demo as well as the calculation of the different combination probabilities. Also contributed to testing the app.

Emmanuel Jose Navarro - Created the majority of the code.

Francesca Chantal Nacino - Bug testing as well as checking the calculations of the probabilities.