To find the playing strategies to win Blackjack card game

Background

Blackjack, also known as twenty-one, is the most widely played casino banking game in the world.

It' s precursor was twenty one. The origin of which is not known. One of the first references is found in a book 'Don Quixote' written by the Spanish author Miguel de Cervantes around 1601. So it was played since the beginning of the 17th Century or earlier.

When twenty-one was introduced in the United States, gambling houses offered bonus payouts to stimulate players' interest. One such bonus was a ten to one payout if the player's hand consisted of the ace of spades and a black jack (either the jack of clubs or the jack of spades). This hand was called a "blackjack" and the name stuck to the game, even though the ten to one bonus was soon withdrawn. In the modern game, a blackjack refers to any hand of an ace plus a ten or face card, regardless of suits or colors

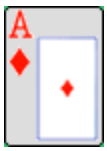
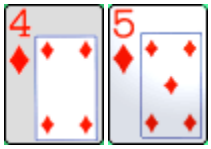
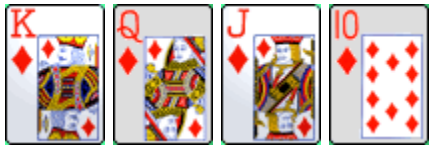
Statement of task

The objective of this investigation is to determine the strategies to win Blackjack card game. The aim of Casino Blackjack is for a player to come as close to 21 without going over, while still having a higher number than the dealer.

Blackjack basic rules

Blackjack is a comparing card game between a player and dealer and played with one or more decks of 52 cards. The player or players are dealt an initial two card hand and add the total of their cards. Face cards (Kings, Queens, and Jacks) are counted as ten points. The player and dealer can count their own Ace as 1 point or 11 points. All other cards are counted as the numeric value shown on the card.

Blackjack Card Values:

ACE	VALUE
	1 or 11
CARDS	**VALUE**
	Card value
High Cards	**VALUE**
	10

If the total value of the player's cards is closer to 21 than the dealer, the player wins as much as he wagered. If the player has Blackjack, he wins 3 to 2, as long as the dealer does not also have Blackjack.

If the total of the player's cards exceeds 21, he "busts" and loses his wager. If his cards total the same number as the dealer (from 17 to 21), no one wins and the player receives his wager back. This is considered a "push." Keep in mind that "Blackjack" beats a score of 21 consisting of 3 or more cards. Blackjack is achieved when your first two cards total 21.

If the player has a hand that consists of a 6 and an Ace, he may either consider it at 17 or drop its value to 7. The Ace may count as 1 or 11. You may change the value of the Ace as the hand progresses.

The Dealer is not allowed to hit on a soft 17 (at most casinos but this may vary from casino to casino depending of the casinos blackjack rules).

All hands which contain an ace valued at 11 are considered "soft" hands (i.e. A6 is a soft 17). Hands containing an ace valued at 1 are considered "hard" hands (A, 6, K is a hard 17).

Prior to receiving any cards, the player must place a wager. Once the wager is made, the player is dealt two cards face up. The dealer is also dealt two cards, one facing up and one facing down. The dealer's card will remain face down until the player has completed his hand.

The dealer then turns over his card. The dealer continues to draw cards until his total is greater than 16. At most casinos the dealer must not draw another card if his hand is a soft 17. The player wins if the dealer goes over 21 ("Busts").

Terms used in the game

Deal

Clicking on the deal button after placing a bet starts a new game.

Hit/Stand

Clicking on the hit button will deal the player an additional card. Clicking on the stand button will keep the player's hand at its current value.

Split

If the player's first two cards are of the same value (i.e. 7, 7, or Q, K) he may split them into 2 separate hands, placing a second wager of equal value. The player then proceeds to draw cards as usual, at some casinos with these exceptions:

If a player splits two aces, he receives only one additional card for each hand. A hand totaling 21 after splitting aces is considered 21, not Blackjack.

Double

When a player has been dealt two cards and believes that a third card will give him a position to beat the dealer's hand, he can "double." His wager is doubled, and he is allowed to hit and receive just one additional card.

Insurance

Insurance gives the player a chance to protect himself when he believes the dealer might have Blackjack. If the dealer's first card is an ace, he is considered to have a fair chance of getting Blackjack. If the player believes the dealer's hole card (face down) value is 10, the player may purchase insurance against dealer Blackjack at the price of half their initial bet. If the dealer does have Blackjack, the insurance pays 2 to 1, which corresponds to the amount of the initial bet. If the player has bought insurance and the dealer does not have Blackjack, the player loses his insurance. The player's initial bet is then settled by comparing his cards with the dealer's. If the dealer and the player both have Blackjack the game results in a push.

Calculating Probabilities

To formulate a successful strategy, we need the probabilities for different cases. Here are the probabilities that dealer wins for different dealer cards:

Dealers card value : 2
17 probability : 0.120256
18 probability : 0.121656
19 probability : 0.121411
20 probability : 0.113309
21 probability : 0.110076
Busting probability : 0.413293
Sum of Probabilities = 1.000000

Dealers card value : 3
17 probability : 0.113172
18 probability : 0.121046
19 probability : 0.113611
20 probability : 0.113051
21 probability : 0.105439
Busting probability : 0.433680
Sum of Probabilities = 1.000000

Dealers card value : 4
17 probability : 0.113438
18 probability : 0.104452
19 probability : 0.111976
20 probability : 0.106502
21 probability : 0.105174
Busting probability : 0.458458
Sum of Probabilities = 1.000000

and so on
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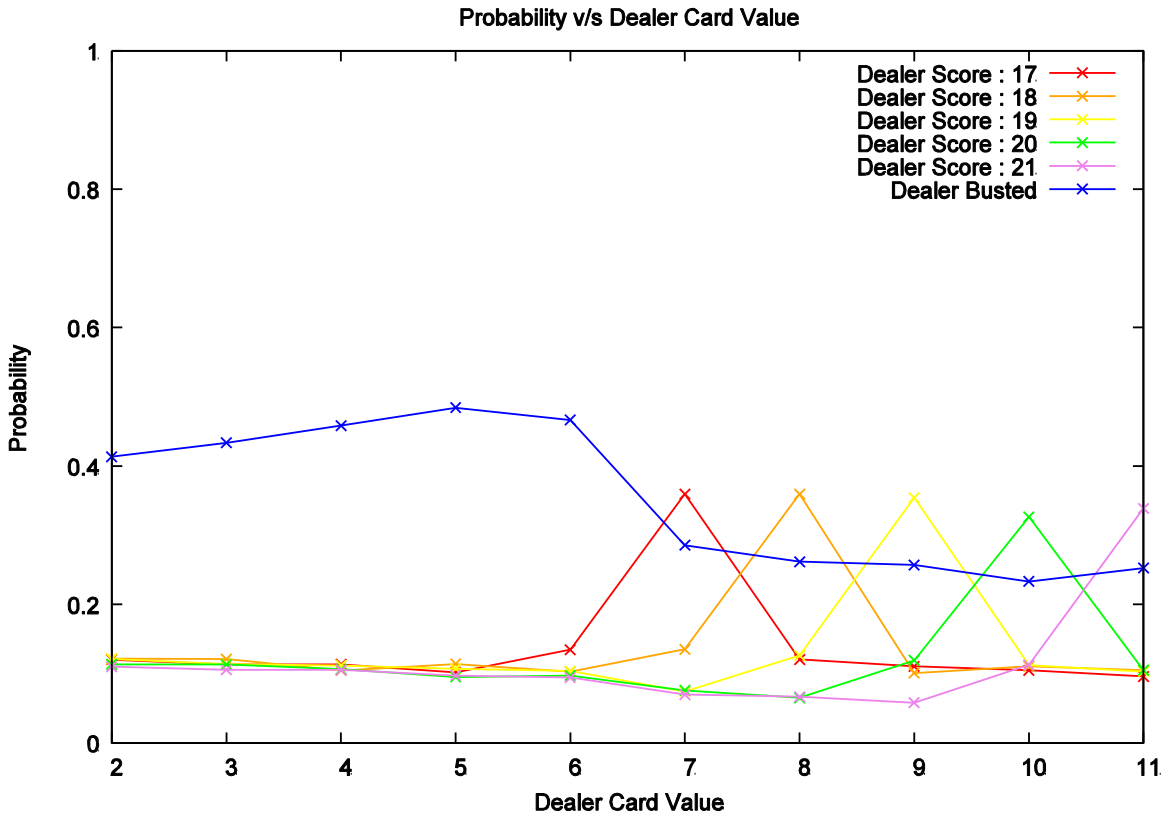
(i have NOT included all data)

Based on the data above I plotted a graph , given below:



I went a step further and and wanted to calculate the odds of both player odds and dealer odds. In order to do so, I calculated the probabilities for different sums of player card , and dealer card, for six cases:

1. Player Stands
2. Player hits exactly one time
3. Player hits exactly two times
4. Player hits exactly three times
5. Player hits exactly four times
6. Player hits exactly five times

Sum:4 , Dealer Card:2

Stand:	Player win = 0.415428	Dealer win = 0.584572
Hit 1:	Player win = 0.415428	Dealer win = 0.584572
Hit 2:	Player win = 0.429575	Dealer win = 0.516242
Hit 3:	Player win = 0.179790	Dealer win = 0.794626
Hit 4:	Player win = 0.037888	Dealer win = 0.956525
Hit 5:	Player win = 0.004784	Dealer win = 0.994508

Sum:4 , Dealer Card:3

Stand:	Player win = 0.432866	Dealer win = 0.567134
Hit 1:	Player win = 0.432866	Dealer win = 0.567134
Hit 2:	Player win = 0.440017	Dealer win = 0.508953
Hit 3:	Player win = 0.185617	Dealer win = 0.789228

Hit 4: Player win = 0.040644 Dealer win = 0.953648
Hit 5: Player win = 0.005417 Dealer win = 0.993817

Sum:4 , Dealer Card:4
Stand: Player win = 0.458816 Dealer win = 0.541184
Hit 1: Player win = 0.458816 Dealer win = 0.541184
Hit 2: Player win = 0.452628 Dealer win = 0.499088
Hit 3: Player win = 0.191960 Dealer win = 0.783643
Hit 4: Player win = 0.043163 Dealer win = 0.951098
Hit 5: Player win = 0.005950 Dealer win = 0.993247

and so on
.....
.....
.....
(i have NOT included all data)

I also plotted graphs for this. (but have not included here).

I also intend to explain as to how these complicated probabilities were calculated. (but have not included here).

Summary

Based on the calculated probabilities, we can sure find a solid strategy to increase the odds at all those fancy casinos.