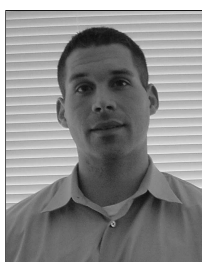


# Blackjack Betting Systems and Strategies: The Mathematics Behind the Game

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The game of Blackjack, also called Twenty-One, has changed significantly since Edward Thorp wrote his famous book *Beat the Dealer* in the 1960's. Prior to the publication of this book, Blackjack players gave a huge advantage to the casino. Thorp's book allowed even the casual gambler to employ a method which did not require advanced mathematical knowledge. This method, known as Basic Strategy, formalized a decision-making routine by which the house advantage was significantly reduced, if not turned to the player's advantage [1]. Ever since Blackjack has been offered at casinos, players have attempted to employ strategies to gain an advantage, but Thorp's system actually works because of its strong mathematical foundation. Thorp developed his method by running computer simulations and determining the optimal decision based on the current known information.

The goal of our honors thesis was to examine the expected payoff and risk of Thorp's Basic Strategy as well as more powerful card counting strategies and compare these against less scientific strategies. We developed a Blackjack simulation program to run tests on various strategies. The program allowed options to test what happens when multiple decks are used, when multiple players are at the table, and when players quit after attaining a certain amount of winnings. Results of the program seemed to fall in line with what Thorp discovered. Sticking to the Basic Strategy, assuming you are not counting cards, is an effective way to maximize your returns (or more likely minimize your losses).

The program also showed the anticipated effects of card counting. With card counting, the player keeps track of cards that have previously been dealt from the deck and uses this information to decide how to play the current hand, improving the expected results. There are many different card counting methods and some are extremely sophisticated. The method simulated in the program assigns a count of +1, 0, or -1, based on the value of the card, to every card dealt on the table (Hi-Lo count). The player keeps track of a running count and decides how much money to lay out for his initial bet according to the running count. The program showed that Hi-Lo card counting can give the player a slight advantage over the house. This is why casinos guard against card counting and have introduced multiple deck games with less favorable rules. Many casinos have now gone to continuous shuffling, which essentially means that dealers deal from a fresh deck for every round of Blackjack hands, making it extremely difficult to count cards.

The Martingale betting system is a highly risky system by which a player doubles his/her bet every time until a winning hand comes up. A big win after a string of smaller losses gives the player a positive payoff, but this strategy quickly gets very expensive and often fails because a player goes bust or hits the table max and cannot double the prior bet. The Martingale, like many other betting systems, just puts more money on the table and therefore increases a player's expected losses. As expected, the Martingale and other risky betting systems showed adverse results.

Players often deviate from their strategies, forfeiting a portion of their advantage back to the house. Whether it be overzealous betting, or ultra-conservative decision making, the player often gives away opportunities where he/she has an advantage. The computer program made the correct decision every time according to the strategy specified, but human players often get caught up in a winning streak or a losing streak and stray from their game plan. Players often bet loosely while up against the house and bet conservatively while down. Sticking to the strategy usually produces better results.

Finding the most beneficial rules to the player should be a priority for a serious Blackjack player. It is rare to find single-deck games anymore because fewer decks increases the odds for the player. Doubling down rules also have a large effect on a player's expected gain/loss. Casinos often offer loose rules to attract more players. The casino doesn't mind since it is still holding the overall advantage in the game against most players.

## References

- [1] E.O. Thorp, *Beat the Dealer*, Vintage Books (1966).