**Introduction**

In any casino in the world, Blackjack is one of the most popular games. It involves a player or players playing with a dealer where the goal is to ensure that the value of one's hand comes close to 21 but does not go over the dealer's. A player is normally given two cards to begin with and then is at liberty to decide whether to "hit" (get dealt a new card) or "stand" (not get dealt more cards). Face cards: 10 points Aces: 1 or 11 points Other numbered cards: worth their face value for the point

Our study used an initial bet of $100 per hand. Furthermore, we assumed that the blackjack game offered by the casino uses 6 decks of cards. In addition, in major casinos, dealer’s hand must reach 17 to qualify for a play. We also added this rule in our simulation setup. These configurations are all intended to model the closest real-world situation of a blackjack table at a casino.

I am always aware that the casino is statistically favored, so I am very worried about any increased bet size. But when I look at videos of professional players playing blackjack, they frequently double up and split. Humans, in general, tend to be risk-averse. Doubling down and splitting increase the sunk cost per each hand, a little running against that stance of abhorring risk. This paper shall establish how these advanced strategies affect the total profit and total wins vis-à-vis the basic strategy that most non-professional players can easily memorize and utilize.

**Basic Strategy**

While not the focus of our research, basic strategy is to be familiarized as it serves as the foundation for the more advanced methods. This strategy is well-documented and widely available online. Non-professional players can memorize this strategy to improve their odds of winning without needing to delve into more complex decision-making processes. The basic strategy does not typically involve decisions about doubling down or splitting. The basic strategy includes a set of rules indicating when one should hit, stand. These rules are intended to bring the house edge down as much as possible and increase the player's chances of winning.

**When to Hit**:

* Hit when the total of your hand is low and the risk of busting is minimal. For example, always hit if your total is 8 or less.
* Hit if you have a soft hand (a hand containing an Ace counted as 11) and your total is less than 18. For example, hit on a soft 17 (Ace + 6).

**When to Stand**:

* Stand when you have a high chance of busting if you hit. For example, stand if your total is 17 or higher.
* Stand if you have a hand that is likely to beat the dealer's hand. For example, stand on a hard 12 to 16 if the dealer's upcard is 2 to 6 (the dealer is more likely to bust with these upcards).

**Why These Decisions Are Made**:

* **Minimizing Risk**: Hitting on low totals minimizes the risk of busting, as drawing a card is unlikely to exceed 21.
* **Maximizing Potential**: Standing on high totals avoids the high risk of busting and leverages the likelihood that the dealer will bust instead.
* **Dealer's Upcard Influence**: The dealer's upcard significantly influences the player's decision. A low dealer upcard (2-6) increases the chance that the dealer will bust, so players are advised to stand on lower totals.

These decisions are based on probabilities and the known rules of the game, ensuring players make the statistically optimal choice.

**Advanced Strategies**

Advanced strategies include doubling down and splitting, which can dramatically turn the tide of the game. These strategies thus have the effect of increasing the sunk cost per hand. That has a player put more resources at stake with the hopes of getting higher payoffs. It's all about the same basic principles; it's just that, on certain hands, the player doubles down and, for hands that player is dealt with the same two cards (except for 10s, only fools split 10s), splits.

**Simulation Results**

Two simulations were conducted to compare the basic and advanced strategies:

1. **Total Profit**:
   * **Basic Strategy (Sim 1)**: The total profit ranged from -3,600 to 2,800, with a mean of -738. The mode was -600, and the median was -700.
   * **Advanced Strategy (Sim 2)**: The total profit ranged from -3,100 to 4,700, with a mean of 979.40. The mode was 900, and the median was 1,000.
2. **Total Wins**:
   * **Basic Strategy (Sim 1)**: The total wins ranged from 29 to 62, with a mean of 43.639. The mode was 43, and the median was 44.
   * **Advanced Strategy (Sim 2)**: The total wins ranged from 30 to 67, with a mean of 48.176. The mode was 47, and the median was 48.

**Major Findings**

**Risk and Reward:** The advanced strategy presented a more positive potential return compared to the basic strategy. Average profit for the advanced strategy was much better than the basic strategy. But the advanced strategy also spread far regarding outcomes, so it is riskier and more volatile.

**Average Wins:** The improved strategy's average total wins were better, leading to that it being riskier, although most frequent wins are gained with the improved strategy.

**Volatility:** The standard deviation for the simulation in the profits of the advanced strategy was high. That would generally mean increased risk because of doubling down and splitting.

**Mode and Median:** The mode and median value of profits and wins were higher in the advanced strategy, signifying additional proof that advanced strategies could lead to better performance for players willing to take on more risks.

**Recommendations**

From our research, there is one main recommendation that can be made to a player about how to raise their profit while playing Blackjack.

**Double Down and Split Strategically:** The advanced strategy showed more of the wins being higher potential profits. A player should strategize such that he or she can double down and split only when the probability is decisively on their side. For example, players ought to double down in case of 11 in total and if the dealer happens to have a small card (2 to 6). Or even by splitting a pair of Aces and 8s. They can do so strategically while taking up higher profits higher, albeit with an enhanced risk.

**Conclusion**

This research indicates that whereas the basic strategy serves as a less risky and more or less assured way of playing Blackjack, the advanced strategy serves the purpose of making bigger profits and winning games on a relatively large basis. However, this is risky and has many variations in outcomes. It calls for individuals to evaluate their risk-taking level against playing an advanced strategy like doubling down and splitting.

It is important to remember that these results only show a statistical finding. Gambling is always risky, and there is no guaranteed way to win consistently. Players should always gamble responsibly, manage their bankrolls wisely and avoid gambling addiction. All in all, the advanced strategy would be more beneficial to someone who has chosen to accept the inherent risks. While averse to risk, some players might find it more comfortable to go with the basic strategy and sustain less of a loss than stick with an unpredictable game experience. Using double down and split features prudently will hopefully increase the player's take while still getting enjoyment from playing Blackjack.