SIMULATING EARLY-GAME STRATEGIES IN BALATRO: A COMPREHENSIVE ANALYSIS OF POPULAR STRATEGIES

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Abstract

Balatro is a poker-inspired roguelike card game that challenges players to maximize their scores through strategic card play, resource management, and deck optimization [1]. This paper presents a simulation-based analysis of various strategies, focusing on the early-game phase, where players often play without special cards and upgrades. Several gameplay strategies were programmed and tested using a Python-based simulation model. The simulation environment was intentionally simplified to capture the features of the early rounds, where special cards and upgrades have yet to affect the gameplay. Moreover, most skilled players intentionally skip upgrade purchases during initial rounds to build interest and have a better economy for the mid and endgame, making this simplified simulation highly relevant to actual play patterns [2]. Performance metrics were collected across numerous simulation iterations, and rigorous statistical tests studied the effectiveness of each strategy. Results reveal clear performance differences between strategies, offering insight into optimal game planning. This study contributes to the broader understanding of simulating probabilistic strategy games and provides a foundational core for the future, more developed modeling of *Balatro*'s complex systems.

1 Introduction

1.1 Overview

Balatro is a modern twist on traditional poker-based card games, combining elements of deckbuilding, roguelike progression, and score maximization. Players build hands, discard cards, and strategically optimize their deck over time to reach increasingly higher scores across a series of rounds and chapters. The game has gained notable popularity among all levels of players, from casual players to enthusiasts, for its blend of randomness, strategic depth, and infamously addictive nature [3].

This paper aims to explore and evaluate different strategic approaches to playing *Balatro* through simulation. After several hours of personal gameplay and engagement with online player communities, I observed various strategies, ranging from risk-heavy, combo-focused styles to more consistent, low-variance approaches [4] [5]. This observation inspired the development of a simplified simulation model to test and compare strategic outcomes in a controlled environment.

This project aims to implement community-sourced and personally developed strategies into a Python-based simulation environment and statistically analyze their performance using metrics such as average score and consistency across multiple runs. By removing human decision-making and simulating standardized play conditions, this analysis aims to uncover general trends in strategy effectiveness.

1.2 Scope of the Study

Due to the complexity of *Balatro*'s full mechanics, including jokers, tarot and planet cards, deck upgrades, and other modifiers, this simulation focuses solely on a restricted version of the game. The model includes only the fundamental poker cards and excludes advanced game elements. This simplification is partially due to time and resource constraints, but it also intentionally aligns with how many skilled players approach the game's early stages. Players often avoid spending money on upgrades in the first few rounds, deciding to conserve resources and build interest for future rounds instead. In *Balatro*, the saved money returns passive interest after each round—$1 interest per $5 saved, typically capped at $5 interest per round without upgrades—-making early financial restraint a strategic investment [1]. As a result, strategic card play, without the influence of power-ups, is especially important in these early stages. By modeling this specific game phase, the simulation still captures a meaningful and widely applicable aspect of *Balatro* gameplay, providing insights relevant to new and experienced players.

2 Background

2.1 Gameplay Mechanics

During a game, a player passes through "Antes," with each Ante containing three progressively difficult "Blinds" (Small, Big, and Boss Blind) [1]. For each Blind, the player must reach a target score, which can be achieved by playing hands with up to five cards in specific combinations. For each round, a player gets a fixed number of plays and discards. The player can either play or discard up to 5 cards at a time until they can no longer. The game ends if the player uses up all plays and does not reach the target score. The core gameplay loop per round involves:

1. Drawing a hand of cards from a deck.
2. A player can choose either:
    (a) Choose up to 5 cards to play. Earns a score according to the type of hand played. The remaining number of plays is decremented by 1.
    (b) Choose up to 5 cards to discard. Draws the same number of new cards from the deck. The remaining number of discards is decremented by 1.
3. The round ends when either:
    (a) The player has reached the target score. The player is awarded the base reward and interest from the saved money. If a player has won with remaining plays, the player gets an additional $1 per unused play.
    (b) The player used all plays and did not reach the target score. The player is defeated, and the run ends.
4. After finishing a round, the player can spend money in shops to purchase jokers, upgrades, or booster packs (although this study focuses on runs without these elements).

2.2 Hand Scoring

Each hand is scored based on traditional poker rankings but with unique scoring multipliers and base chip values specific to *Balatro*. Without any enhancements or upgrades—such as Jokers, special cards or decks, planet cards, etc.—the score for a poker hand is calculated as per Equation 1 [1].

$$Score = (Base\ Chips + Card\ Chips) \times Multiplier \tag{1}$$

The base chips and multipliers vary for each hand type and are introduced in Table 1 [1]. For each played card, the chip value of the card is added to the base chip. Each card has its chip value corresponding to the rank, except for Aces and the face cards. The face cards have the same chip values of 10, and the Ace alone has a chip value of 11. Therefore, playing cards with a higher chip value is often necessary to maximize the score and increase the money earned per round.

Hand Type	Base Chips	Multiplier
High Card	5	1
Pair	10	2
Two Pair	20	2
Three of a Kind	30	3
Straight	30	4
Flush	35	4
Full House	40	4
Four of a Kind	60	7
Straight Flush	100	8

Table 1: Poker Hands Base Chips and Multipliers

2.3 Common Strategy

Most players minimize the money spent early in the run to quickly save $25 and base their economic foundation towards the maximum interest of $5 per round as soon as possible [2]. To achieve this goal, the players often skip all Jokers and upgrades in early Shops unless they are overpowered—have potential to carry to the endgame—or help with the economics—often increases the base reward or the interest cap. This common strategy results in more difficult early rounds, and the players need to play higher-tier poker hands—such as Straight, Flush, and Full House—which are more challenging than lower-tier poker hands, to reach target scores and minimize the number of hands played to gain additional rewards.

3 Simulation Design

3.1 Simulation Goal

There had been attempts to simulate *Balatro*, but they were limited to only one hand [6] or were able to calculate the result of a single hand played [7]. However, this simulation aims to simulate the whole round to find the most reliable and effective strategy to pass the early rounds before Jokers and upgrades start to engage. Three strategies will be tested, each one prioritizing one of the poker hands below:

- Straight (5 consecutive ranks in hand, such as 7, 8, 9, 10, Jack)
- Flush (5 same suits in hand, such as 5 Hearts)
- Full House (a Three of a Kind and a Pair, such as 3 Sixes and 2 Queens)

Each strategy gets 4 plays and 4 discards during the simulation run, following the predefined play/discard logic to achieve the maximum score possible. While the strategies are prioritized to make the hands assigned, they are not limited explicitly from playing the hands of other strategies or better hands—such as Four of a Kind and Straight Flush—when given such hands by chance.

3.2 Simulation Structure

Due to the nature of this game, it was very tough, if not impossible, to use conventional simulation software to simulate. Instead, the simulation was written in Python from the most basic components of the game. Although most of the concepts and structure have been manually developed, some detailed implementation has been done using several Generative AI agents and AI auto-completion. The program is comprised of 3 main parts:

- Card, Deck, and Player: The most basic component of the game. A card is assigned a unique set of suits and ranks and contains its chip information. A deck contains 52 unique cards, and they are randomly shuffled when initialized. A player gets a deck and draws 8 cards during initialization. The player is capable of checking the score of the played Hand, playing Cards, and discarding cards. The history of played hands and scores is tracked along the progress. This simulation can be played with manual operations of selecting the indices of cards to play/discard.
- Strategy: Contains strategies to select cards to play or discard based on the specific strategy. The detailed strategies will be discussed in detail in the coming section.
- Strategic Player: A strategic player inherits all basic features and functions from the player. It automatically plays games according to the strategy as-

signed and saves the results for further analysis. Figure 1 [8] describes the detailed decisions and actions for the strategic gameplay.

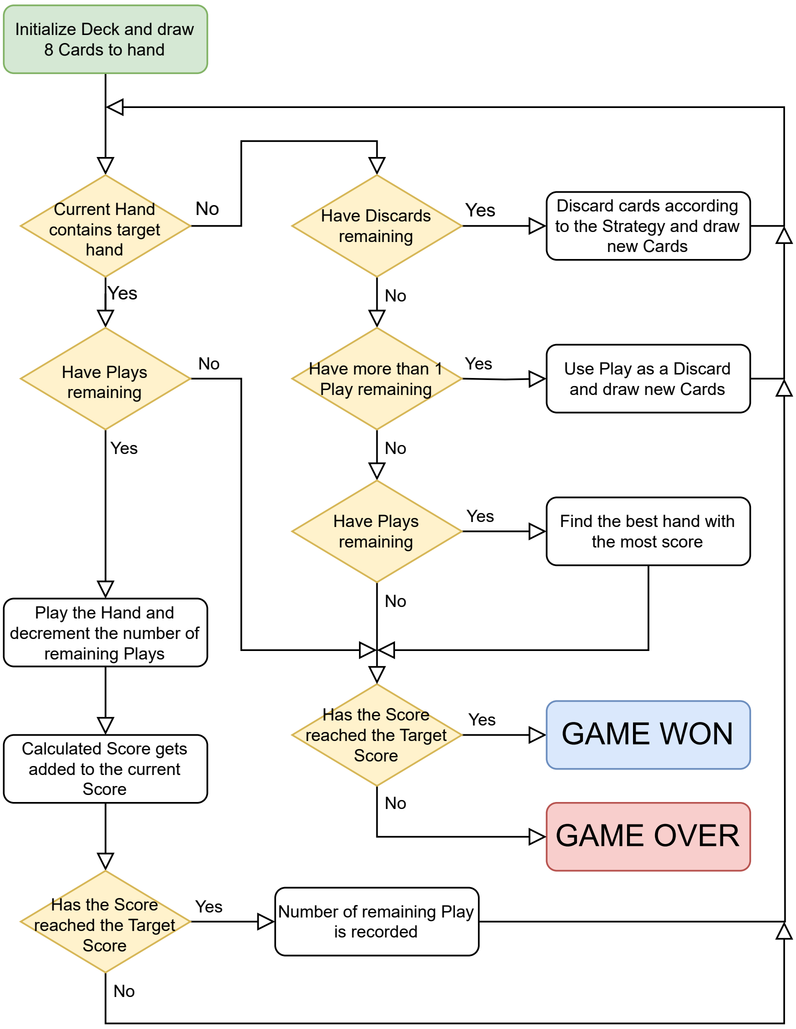

Figure 1: Strategic Player Decision Flowchart

Each run lasts until all plays have been used, and the program collects the final score, the number of plays remaining when reaching the target score, and the history of played hands for each run for each strategy. The target score is set to be 600 for this study [1]. Because 600 is the target score of the Boss Blind of the first Ante, it effectively represents the early stage goal as mentioned in this report as the primary scope.

3.3 Strategy Design

The following subsections describe the main principles for each strategy to decide which cards to play or discard. The strategies developed combine common sense, online forum advice, and insights from personal gameplay. For every strategy, selecting the cards to play follows the same principle: checking every combination of cards in hand and finding the hand with the highest score that is in the target hand list. This way, the strategies behave more rationally and do not miss a good or better hand that could have been discarded to find the assigned hand when given such hands by chance.

3.3.1 Straight Strategy

For the Straight strategy, discarding cards is determined by calculating the probability of making a Straight when a certain set of cards has been held and not discarded. It only considers when more than three cards are discarded because if five cards are to be held, it already has a Straight. For each hold, it loops over all possible Straight combinations—from [A, 2, 3, 4, 5] to [10, J, Q, K, A]—and calculates the probability that the cards needed to finish the combination are to be drawn, and combines the probabilities to gain the overall potential for each hold. The probability of drawing the cards with specific ranks from the deck—there may be multiple copies—is calculated by the multivariate hypergeometric distribution [9] [10].

$$P(\text{success}) = \frac{\prod_{i=1}^{m} \binom{K_i}{k_i}}{\binom{N}{n}} \tag{2}$$

$$\begin{aligned}
K_i &: \text{Number of cards of rank } i \text{ in the deck} \\
k_i &: \text{Number of cards of rank } i \text{ to draw (1 in default)} \\
N &: \text{Total number of cards in the deck} \\
n &: \text{Total number of discards (to draw)} \\
m &: \text{Number of different ranks to draw}
\end{aligned}$$

Equation 2 was used to calculate each hold for each window, and the results were aggregated per hold. Noticeably, k_i defaults to 1 since no more than 1 copy is required for each rank. The hold with the maximum probability is the final hand to keep, and the rest are discarded for new cards to be drawn from the deck. Listing 1 shows how each hand is being calculated for each window for the possibility of making a Straight according to the remaining cards in the deck. The result implies that the hand with [8, 9, 10, J] has about 20% chance of making a Straight, which is reasonable since they are already four consecutive numbers.

```
calculating probability of Straight with hand: ♣8, ♣9, ♦Jack, ♥10

window: [1, 2, 3, 4, 5]
this window is impossible to make a Straight with the current hand and deck

window: [2, 3, 4, 5, 6]
this window is impossible to make a Straight with the current hand and deck

window: [3, 4, 5, 6, 7]
this window is impossible to make a Straight with the current hand and deck

window: [4, 5, 6, 7, 8]
this window is impossible to make a Straight with the current hand and deck

window: [5, 6, 7, 8, 9]
this window is impossible to make a Straight with the current hand and deck

window: [6, 7, 8, 9, 10]
this window is impossible to make a Straight with the current hand and deck

window: [7, 8, 9, 10, 11]
probability of Straight with window: [7, 8, 9, 10, 11] is: 0.09935

window: [8, 9, 10, 11, 12]
probability of Straight with window: [8, 9, 10, 11, 12] is: 0.09935

window: [9, 10, 11, 12, 13]
probability of Straight with window: [9, 10, 11, 12, 13] is: 0.00523

window: [10, 11, 12, 13, 1]
probability of Straight with window: [10, 11, 12, 13, 1] is: 0.00055

total probability of Straight: 0.20448
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Listing 1: Straight Probability Calculation Example

3.3.2 Flush Strategy

For the Flush strategy, cards are selected for discard based on concentrating the hand toward a single suit. The strategy first identifies which suit has the most cards in the player's hand. In the case of ties—multiple suits with the same count—it references the deck composition to determine which tied suit has the most remaining cards, choosing the suit with greater drawing probability.

After the target suit has been determined, the strategy keeps all cards of the target suit. It discards other cards, prioritizing to remove the lowest-value cards when a number of cards to discard exceeds the maximum number of cards that can be discarded at a time (5). This strategy maximizes the probability of completing a Flush while retaining higher-value cards when possible. The selection logic follows the following steps:

1. Identify the suit with the highest representation in the hand
2. Resolve ties by examining the deck for the suit with the most remaining cards
3. Keep all cards of the chosen suit
4. Discard cards of other suits, prioritizing the removal of the lowest-value cards first

3.3.3 Full House Strategy

The Full House strategy prioritizes forming either a Full House (Three of a Kind plus a Pair) or Four of a Kind due to the non-trivial chance of getting a fourth card. The discarding decision-making process follows a hierarchical approach based on the current hand composition and the remaining deck to maximize the potential to have made hands with the least amount of discards.

Case 1: When a Three of a Kind is present

1. Keep the Three of a Kind
2. Among the remaining ranks, identify which has the most copies in the deck
3. Keep one card of that rank to form a potential Pair; use one with a higher rank if ties
4. Discard all other cards

Case 2: When two or more Pairs are present

1. Sort Pairs by the number of remaining copies in the deck
2. Keep the two Pairs with the highest potential (most copies in the deck); use one with a higher rank if ties

3. Discard all other cards

Case 3: When only one Pair is present

1. Keep the Pair
2. Among the remaining ranks, identify which has the most copies in the deck
3. Keep one card of that rank; use one with a higher rank if ties
4. Discard all other cards

Case 4: When no Pairs or Three of a Kind is present

1. For each rank, count how many copies remain in the deck
2. Keep the two ranks with the highest remaining counts; use ones with higher ranks if ties [11]
3. Discard all other cards

4 Results

4.1 Data Collection

After completing the game, the player returns three items. Each item refers to different aspects of a "good strategy."

1. Score: The final score when the game is finished. It has to exceed 600 to win the game. A higher score means the strategy successfully played/discarded cards to play target hands as much as possible. Furthermore, a very high score implies that the strategy could play very high hands, such as Four of a Kind and Straight Flush.
2. Remaining Plays: Number of unused plays when the score exceeds 600. The simulation continues after reaching 600 regardless of its winning. Higher remaining plays mean that the strategy could efficiently discard cards and play target hands to win the game, as the player did not have to use up the play as a discard to make the target hands.
3. History: History of played hands. This will be evaluated to save the ratio of $\frac{\textit{target hand}}{\textit{total hand}}$ to find how reliably the strategy could make the target hand.

Table 2 shows a sample result for 1 iteration for each strategy of how the results will be saved in *Pandas Dataframe* format. In this format, it is very efficient to store and analyze the data recorded from the runs of the simulation.

Strategy	Won	Score	Remaining_plays	Target_hand_ratio
Straight	1	688	1	0.75
Flush	0	488	0	0.25
Full House	1	1378	3	1

Table 2: Sample Dataframe of Strategy Outcomes

To effectively find the differences between each strategy, having a large number of iterations is very important. However, too many iterations will result in inefficiencies in simulation time and storage. Therefore, a small study was conducted to find the sample mean and variance for the optimal sample size for statistically significant ($p < 0.05$) analysis results. Moreover, each iteration will initialize the deck and hand of the strategies with the same seed to reduce the variance by having paired samples. 50 iterations have been simulated to use the Central Limit Theorem (CLT), and the result is recorded in Table 3 [12].

Strategy	Winrate	Score	Remaining_plays	Target_hand_ratio
Straight	0.88, 0.33	889.00, 201.18	0.92, 0.70	0.74, 0.19
Flush	1, 0	1051.60, 255.18	1.22, 0.74	0.81, 0.16
Full House	0.78, 0.42	886.38, 318.88	0.98, 0.87	0.63, 0.28

Table 3: Study with 50 Iterations (Mean, Standard Deviation) Format

From the results collected from Table 3, paired t-tests have been conducted to find the difference in mean and the corresponding p-values. The paired t-test results are presented in Table 4. It can be seen that for comparison with Flush—both Flush to Straight and Flush to Full House—most results are statistically significant with $p < 0.05$. However, between Straight and Full House, the results indicate insufficient evidence to reject the null hypothesis (H_0) that one of them is a better strategy than the other.

Strategy	Winrate		Score		Remaining_plays		Target_hand_ratio	
	diff.	p-value	diff.	p-value	diff.	p-value	diff.	p-value
S - F	-0.12	0.0128	-162.6	0.0008	-0.30	0.0419	-0.070	0.0334
F - FH	0.22	0.0005	185.2	0.0001	0.24	0.0766	0.185	0.0000
FH - S	-0.10	0.1678	-22.6	0.6752	0.06	0.6953	-0.115	0.0143

Table 4: Paired T-Test Results from 50 Iterations

Four comparisons were not quite statistically significant. Below Table 5 shows the Power analysis results for comparisons between Full House and Straight based on the values in Table 4 and decides the sample size for further analysis [13]. The results imply that about 2500 samples would be needed for a statistically significant comparison between Full House and Straight. Although the difference for the remaining plays is minimal, as shown in Table 5, the difference in Score is worth further study. Therefore, strategy comparison will be conducted with 2500 samples each, since, due to the very efficient nature of this simulation program, it only takes about a minute to finish.

Winrate			Score			Remaining_plays		
p-value	Cohen's d	n_req	p-value	Cohen's d	n_req	p-value	Cohen's d	n_req
0.1678	-0.1980	203	0.6752	-0.0596	2211	0.6953	0.0557	2531

Table 5: Power Analysis for Full House vs. Straight with 80% Power and $\alpha = 0.05$

4.2 Strategy Comparison

Figure 2 and Table 6 show the result after 2500 simulation iterations. Flush generally shows the highest values with the lowest *mean/standard deviation* ratio from the result.

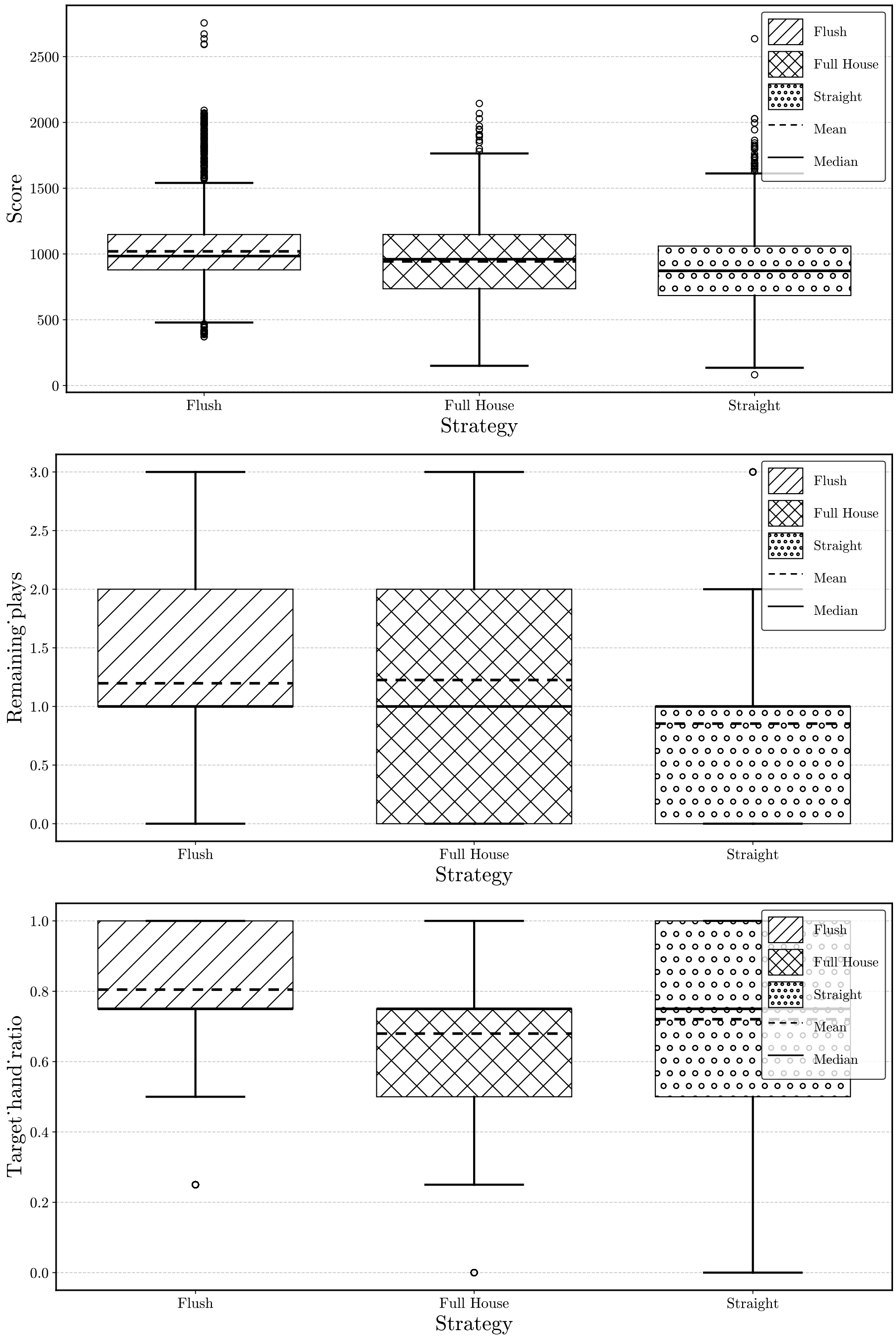

Figure 2: Boxplot Charts for Strategy Comparison

Strategy	Winrate	Score	Remaining_plays	Target_hand_ratio
Straight	0.87, 0.34	871.40, 248.53	0.85, 0.73	0.72, 0.22
Flush	0.98, 0.14	1019.92, 270.71	1.20, 0.71	0.80, 0.19
Full House	0.88, 0.32	943.53, 290.11	1.23, 0.86	0.68, 0.24

Table 6: Study with 2500 Iterations (Mean, Standard Deviation) Format

Although the Flush strategy has shown apparent dominance over other strategies, its superiority cannot be determined until it is considered statistically significant. Table 7 records the paired t-test results between strategies after 2500 iterations.

Strategy	Winrate		Score		Remaining_plays		Target_hand_ratio	
	diff.	p-value	diff.	p-value	diff.	p-value	diff.	p-value
S - F	-0.111	0.000	-148.52	0.000	-0.344	0.000	-0.084	0.000
F - FH	0.096	0.000	76.38	0.000	-0.028	0.176	0.125	0.000
FH - S	0.016	0.091	72.13	0.000	0.372	0.000	-0.041	0.000

Table 7: Paired T-Test Results from 2500 Iterations

The following insights can be derived from Table 7.

- Straight vs. Flush: The Flush strategy demonstrates significant dominance over the Straight strategy. The Flush strategy wins 11.1% more, scores 148.52 more points, plays 0.344 fewer hands to win (which means $0.344 extra per round), and plays made hands 8.4% more than Straight Strategy.
- Flush vs. Full House: The Flush strategy again shows significant dominance over the Full House strategy, except for the remaining plays. Flush strategy wins 9.6% more, scores 76.38 more points, and plays made hands 12.5% more than the Full House Strategy. For the remaining plays, due to the difference being too small and statistically insignificant, it can not be determined that the Flush strategy outperforms the Full House strategy by playing fewer hands to win.
- Full House vs. Straight: Results show mixed dominance between the strategies. However, due to the very small difference in win rate and target hand ratio, it is not practical to claim that one strategy outperforms the other by these measures. For other measures, the Full House strategy scores 72.13 points more and plays 0.372 fewer hands to win than the Straight strategy.

Combining all observations, it can be reasonably derived that the Flush strategy is superior, followed by Full House, then Straight.

5 Conclusion

This simulation study has successfully created an early-game environment of *Balatro* in Python and examined three strategic approaches, focusing on the making of Straight, Flush, and Full House, with strategic play/discard decisions made regarding available cards in hand and in deck. The results demonstrate a clear statistical advantage for the Flush strategy across multiple performance metrics. With a 98% win rate, the highest average score of 1019.92, and the highest target hand completion ratio of 80%, the Flush strategy consistently outperformed alternative approaches in almost all measured categories.

This study provides statistical support for the popular strategy of playing Flushes with higher priority. Furthermore, the findings have set practical standards for a "good" strategy for *Balatro* players, particularly during the early game phases where resources are limited and players are focused on establishing economic foundations. By prioritizing cards of the same suit and pursuing Flush hands, players can maximize their chances of clearing early rounds efficiently while preserving plays for additional rewards. The insights discussed not only contribute to *Balatro* strategy discussions but also demonstrate the value of simulation methods in analyzing complex, probability-based games.

References

[1] B. W. Contributors. (2025) Balatro wiki. Accessed: Apr. 21, 2025. [Online]. Available: https://balatrogame.fandom.com/wiki/Balatro_Wiki

[2] A. Chiu. (2024) How to get a 100% win rate in balatro. Accessed: Apr. 21, 2025. [Online]. Available: https://www.youtube.com/watch?v=cN6BcGCRAVk

[3] P. Tassi. (2024) What is 'balatro' and why is everyone addicted to it? Accessed: Apr. 21, 2025. [Online]. Available: https://www.forbes.com/sites/paultassi/2024/11/22/what-is-balatro-and-why-is-everyone-addicted-to-it/

[4] DrBoomMD. (2024) How to win chips and influence mult (a thorough guide to beating balatro). Accessed: Apr. 21, 2025. [Online]. Available: https://www.reddit.com/r/balatro/comments/1bbh75a/how_to_win_chips_and_influence_mult_a_thorough/

[5] janedoe4815. (2024) What's your go-to strategy? Accessed: Apr. 21, 2025. [Online]. Available: https://www.reddit.com/r/balatro/comments/1bvkd7w/whats_your_goto_strategy/

[6] mangoboss42. (2024) I've made a python simulation! i present to you, the impact of hand size and starting deck! (see comments). Accessed: Apr. 21, 2025. [Online]. Available: https://www.reddit.com/r/balatro/comments/1b40a3d/ive_made_a_python_simulation_i_present_to_you_the/#lightbox

[7] DivvyCr. (2025) Divvy's preview for balatro. Accessed: Apr. 21, 2025. [Online]. Available: https://github.com/DivvyCr/Balatro-Preview

[8] Stefandreus. (2025) Better to save discards or discard with hands? Accessed: Apr. 21, 2025. [Online]. Available: https://steamcommunity.com/app/2379780/discussions/0/596265364943286364/

[9] K. Siegrist, *Probability, Mathematical Statistics, and Stochastic Processes.* LibreTexts, 2025, accessed: Apr. 21, 2025. [Online]. Available: https://stats.libretexts.org/Bookshelves/Probability_Theory/Probability_Mathematical_Statistics_and_Stochastic_Processes_(Siegrist)/12:_Finite_Sampling_Models/12.03:_The_Multivariate_Hypergeometric_Distribution

[10] J. Delaney. (2013) Discrete probability - texas hold'em flush example of hypergeometric distribution. Accessed: Apr. 21, 2025. [Online]. Available: https://www.youtube.com/watch?v=jHcyXmg7fS0

[11] zuzip_tr. (2024) Optimal discarding for pairs? Accessed: Apr. 21, 2025. [Online]. Available: https://www.reddit.com/r/balatro/comments/1dwbre7/optimal_discarding_for_pairs/

[12] A. Ganti. (2024) Central limit theorem (clt): Definition and key characteristics. Accessed: Apr. 21, 2025. [Online]. Available: https://www.investopedia.com/terms/c/central_limit_theorem.asp

[13] J. Cohen, "Approximate power and sample size determination for common one-sample and two-sample hypothesis tests," *Educational and Psychological Measurement*, vol. 30, no. 4, pp. 811–831, 1970.