Analyzing Swertress Lotto Bet Types: Probability and Profitability through Monte Carlo Simulation.

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Abstract—This simulation study examines the probabilities of winning and profitability of the straight bet and rambolito bet in Swertres Lotto. The results reveal that the rambolito bet consistently demonstrates higher probabilities of winning compared to the straight bet. However, both bet types ultimately result in losses, with the rambolito bet experiencing larger losses. The study highlights the importance of considering the financial risks associated with these betting options. This simulation study provides insights into the probabilities and profitability of straight and rambolito bets in Swertres Lotto. Future research should expand the study's scope and explore different lottery games to further advance our knowledge in this domain.

Keywords—Simulation, lotto, Monte, Carlo, Swertress, probability, profitability(key words)

I.   INTRODUCTION

Gambling has a long-standing tradition in the Philippines, deeply ingrained in its cultural fabric[1]. From informal betting activities to regulated gambling establishments, Filipinos have always had a penchant for games of chance[3]. One particular form of gambling that has gained immense popularity is the lottery. Lottery games offer an enticing opportunity for Filipinos to test their luck and potentially win substantial prizes. Among the numerous lottery games available, Swertress Lotto stands out as a widely recognized and widely played game. Swertress Lotto, operated by the Philippine Charity Sweepstakes Office (PCSO), captivates players with its simple yet enticing format[2]. In Swertress Lotto, players are tasked with selecting a three-digit number combination, choosing from a range of 000 to 999[4]. The objective is to match the winning three-digit number drawn during the official draw. Depending on their chosen bet type and wager, players can win various prizes, making Swertress Lotto an enticing game of chance for many. Understanding the probabilities and expected returns associated with different bet types in Swertress Lotto is crucial for players aiming to maximize their chances of winning. This study employs Monte Carlo Simulation, a powerful computational technique, to provide valuable insights into the probability of winning and expected returns for the two primary bet types in Swertres Lotto: the straight bet and rambolito. By leveraging Monte Carlo Simulation and utilizing the Python programming language, this research generates a large number of random trials to accurately estimate the likelihood of success and assess the potential financial gains for players. The simulation provides a robust framework for examining the probabilities and expected returns associated with each bet type, allowing players to make informed decisions when participating in Swertress Lotto.

A.   Swertress Lotto

PCSO Swertress Lotto, also known as Swertres Lotto or simply Swertres, is a popular lottery game in the Philippines operated by the Philippine Charity Sweepstakes Office (PCSO). It is a three-digit game where players choose a three-digit number combination from 000 to 999[4]. The draws take place three times a day, and players can participate in the morning, afternoon, or evening draws. The order of the numbers is critical, and players can choose between two types of bets: Straight and Rambolito. In a Straight bet, all numbers must be in exact order. On the other hand, Rambolito is derived from the word "rambol," meaning "to mix," and "ito," meaning "this" in English. Therefore, Rambolito means "mix this." Rambolito can be either Rambolito 3, where the numbers can be in any order with one repeating digit, or Rambolito 6, where the numbers can be in any order with no repeated digits. The winning numbers are determined through a mechanical ball machine draw, and the payouts vary depending on the type of play and the amount wagered. The odds of winning vary depending on the type of game played[4].

B.   Main Objective

The objective of this study is to analyze and compare the chances of winning in a swertres lotto, a popular lottery game in the Philippines using Monte Carlo Simulation. The aim is to gain insights into the differences in winning probabilities between two commonly used bet types in this game. Additionally, this research will examine the profitability of a specific bet type, providing valuable information regarding potential financial outcomes for participants. Understanding these elements can assist players in making more informed decisions and developing a deeper understanding of the dynamics of the game.

a.   Specific Objectives
i.   To analyze and compare the winning probabilities of the straight bet and rambolito in Swertress Lotto.
ii.   To evaluate the expected return or payout associated with each bet type.
iii.   To provide valuable insights to Swertress Lotto players regarding the odds of success and potential financial implications of their bet choices.

C.   Scopes and Limitations

The scope of this study encompasses the analysis and comparison of winning probabilities and profitability for the two primary bet types, the straight bet and rambolito, in Swertress Lotto. The study focuses specifically on the game operated by the Philippine Charity Sweepstakes Office (PCSO) and examines the probability and profitability from the perspective of an individual player. The analysis utilizes Monte Carlo Simulation to simulate the outcomes of multiple iterations for each bet type, providing insights into the likelihood of winning and the potential financial gains. These limitations should be considered when interpreting the findings and applying them to real-world situations.

II.   METHODOLOGY

A.   The Simulation Setup

The main program will be implemented in Python, specifically using Python 3.9. It will utilize the permutation function from the itertools module in the Python standard library to handle all possible permutations of the rambolito bet type. The simulation requires several input parameters: the number of *iterations* (indicating how many times the simulation will run), *bet_cost* (representing the cost of each combination), and *result_winnings* (denoting the maximum payout for the winning combination). In the initial program, the chosen 3-digit combinations for both straight and rambolito bets are generated randomly in every iteration. This means that these combinations will be different throughout the iterations. Although additional test cases were explored, fixed list, and random list combinations, this study will solely focus on the results obtained from the initial program.

The simulation will be executed in three iterations: 1000, 10,000, and 100,000 to ensure more accurate and reliable results. The *bet_cost* parameter will have a default value of 12 pesos per combination, while the *result_winnings* parameter will default to 4,500 pesos. As for the *rambolito_bet_combination* if the chosen 3 digit combination is rambolito 3 the payout will be *results_winning/3* and if the combination is rambolito 6 the payout will be *results_winning/6*. These default values were taken from the official PCSO online lotto results website[4]. The winning 3 digit combination will be different in every iteration.

B.   The Simulation Process

The simulation process aims to study the probability and outcomes of the Swertress Lotto game, with a particular focus on the Straight and Rambolito bet types. We may gain significant insights into the likelihood of winning and the potential returns on investment for each bet type by simulating several rounds of the game. This simulation enables us to evaluate the efficacy of various betting methods and comprehend the game's fundamental trends. We can obtain a better understanding of the Swertress Lotto by analyzing the simulation outcomes and providing helpful information to players and enthusiasts.

The simulation process begins by initializing the input variables, including the number of iterations, bet cost, result winnings. The simulation then runs for the specified number of iterations. In each iteration, a 3-digit winning number is generated randomly. The 3-digit combination for straight and rambolito bets is also generated randomly. The bet cost for both the straight and rambolito bets is calculated.

$$\text{Straight Bet Cost} = \text{bet\_cost} \tag{1}$$

$$\text{Rambolito Bet Cost} = \text{All Possible Permutation} \times \text{Bet Cost} \tag{2}$$

The program checks if the three-digit combination for the straight and rambolito bets matches the generated winning number. If not, it goes back to generating a new winning number. If there is a match for the straight bet, the counters are updated, and winnings are calculated. Similarly, if there is a match for the rambolito bet, the counters are updated, and winnings are calculated.

$$\text{straight\_wins} +\!= 1 \tag{3}$$

$$\text{straight\_winnings} = \text{result\_winnings} - \text{straight\_bet\_cost} \tag{4}$$

$$\text{straight\_total\_winnings} = \sum_{i=1}^{n} \text{straight\_winnings} \tag{5}$$

$$\text{rambolito\_wins} +\!= 1 \tag{6}$$

$$\text{rambolito\_winnings} = \begin{cases} \frac{\text{result\_winnings}}{3} - \text{rambolito\_bet\_cost} & \text{Permutations} = 3 \\ \frac{\text{result\_winnings}}{6} - \text{rambolito\_bet\_cost} & \text{Permutations} = 6 \end{cases} \tag{7}$$

$$\text{rambolito\_total\_winnings} = \sum_{i=1}^{n} \text{rambolito\_winnings} \tag{8}$$

The total bet cost and total winnings are calculated, followed by the calculation of probabilities and return on investment.

$$\text{Straight Total Bet Cost} = \sum_{i=1}^{n} \text{Straight Bet Cost} \tag{9}$$

$$\text{Rambolito Total Bet Cost} = \sum_{i=1}^{n} \text{Rambolito Bet Cost} \tag{10}$$

$$\text{straight\_prob} = \frac{\text{straight\_wins}}{\text{iterations}} \times 100 \tag{11}$$

$$\text{rambolito\_prob} = \frac{\text{rambolito\_wins}}{\text{iterations}} \times 100 \tag{12}$$

$$\text{straight\_roi} = \left(\frac{\text{straight\_total\_winnings} - \text{straight\_total\_bet\_cost}}{\text{straight\_total\_bet\_cost}} \right) \times 100 \tag{13}$$

$$\text{rambolito\_roi} = \left(\frac{\text{rambolito\_total\_winnings} - \text{rambolito\_total\_bet\_cost}}{\text{rambolito\_total\_bet\_cost}} \right) \times 100 \tag{14}$$

The program checks if it has reached the final iteration. If not, it continues to run for the specified number of iterations. Once the final iteration is reached, the simulation process ends.
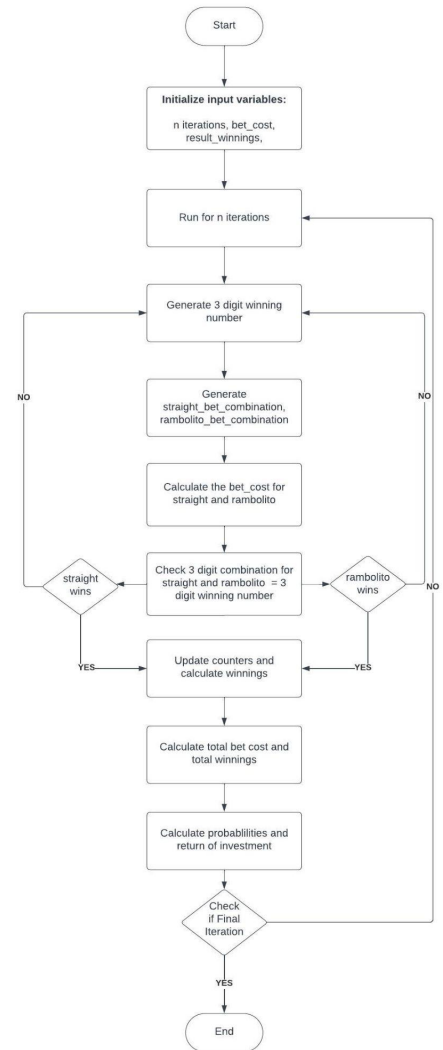

Figure 1. Simulation Process Flow Chart

C. *Data Analysis*

The simulation was performed in three iterations (1000, 10000, and 100000) to collect data for analysis. Each iteration was run once to generate the required results.The collected data was then organized and presented in both tabular and graphical formats for clear visualization and analysis purposes.

In the tabular format, the collected data was structured into three comprehensive table that provides a systematic overview of the simulation results. The first table includes relevant variables, such as the number of iterations, number of straight bet wins, number of rambolito bet wins, the probability of straight wins and the probability of rambolito wins. The second and third tables represents the total winnings and return of investment of each bet type in n number of iterations. This tabular presentation allows for easy comparison and analysis of the results.

In addition to the table, a line graph was created to visually represent the data. The line graph illustrates the trend of key variables, such as the probability of winning and the ROI, across different iterations or options. This graphical representation enhances the understanding of the trends and patterns in the simulation results, providing a visual depiction of the relationships between variables. By presenting the collected data in both tabular and graphical formats, this study aims to provide a comprehensive and accessible analysis of the simulation outcomes. The combination of tabular and graphical representations allows for a detailed examination of the numerical values and a visual interpretation of the trends and patterns observed in the data. This presentation approach facilitates a comprehensive understanding of the simulation results and enables readers to draw meaningful conclusions from the analysis.

III. RESULTS AND DISCUSSION

The objective of this study was to analyze the winning probabilities and profitability of the straight bet and rambolito bet types in Swertress Lotto using Monte Carlo Simulation. The simulation was conducted over three iterations, including 1,000, 10,000, and 100,000 trials. Each iteration involved generating random winning numbers and comparing them with the corresponding randomly generated combinations for each bet type.

In addition to the initial program, various test cases were explored, such as fixed combinations chosen by the player, fixed lists with multiple combinations, and random lists with varying lengths (1-10) for each bet type. The simulation results were used to calculate the probabilities of winning and the expected returns or payouts for each bet type. By considering multiple iterations and various combination scenarios, this study aimed to provide a comprehensive analysis of the Swertress Lotto game and offer insights into the potential outcomes and financial implications associated with different bet types.

A. *Probability Results*

The initial program results obtained from the Monte Carlo Simulation provide a basis for evaluating the winning probabilities of the straight bet and rambolito bet types in Swertress Lotto. The simulation was run for three iterations: 1,000, 10,000, and 100,000, and the results were analyzed accordingly.

The results of the Monte Carlo Simulation for the winning probabilities of the straight bet and rambolito bet types in Swertress Lotto are presented in the following table:

Table 1: Probability Results

Iterations	Straight Wins	Rambolito Wins	Straight Probability	Rambolito Probability
1,000	1	6	0.10%	0.60%
10,000	9	57	0.09%	0.57%
100,000	103	511	0.10%	0.50%

In the simulation with 1,000 iterations, there was 1 successful straight bet out of the total trials, resulting in a straight probability of 0.10%. On the other hand, there were 6 successful rambolito bets, yielding a rambolito probability of 0.60%. With 10,000 iterations, the number of straight wins increased to 9, leading to a straight probability of 0.09%. The rambolito wins also increased to 57, resulting in a rambolito probability of 0.57%. In the simulation with 100,000 iterations, the number of straight wins further increased to 103, corresponding to a straight probability of 0.10%. The rambolito wins totaled 511, resulting in a rambolito probability of 0.50%.
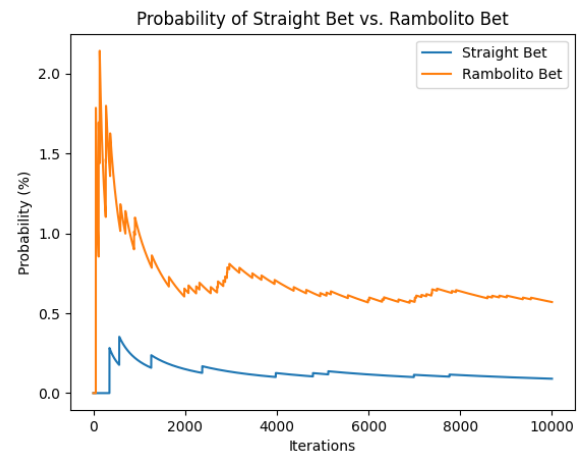

Figure 2. *Probability of Straight vs Rambolito bet(10000 iterions*)

These results indicate that the winning probabilities for both the straight bet and rambolito bet types in Swertress Lotto remain relatively consistent across different iterations. The rambolito bet type consistently demonstrates a higher probability of winning compared to the straight bet type. Interestingly, in Figure 2, it can be observed that around the 4000th iteration, both probabilities start to stabilize, suggesting that the simulation has reached a point where further iterations do not significantly impact the estimated probabilities. This stabilization indicates that a sufficient number of iterations have been performed to obtain reliable and representative results.

B. *Return of Investment Results*

The initial program results obtained from the Monte Carlo Simulation offer valuable insights into the profitability of the straight bet and rambolito bet types in Swertress Lotto through the calculation of the return on investment (ROI). The simulation was conducted across three iterations, specifically 1,000, 10,000, and 100,000, providing a comprehensive analysis of the outcomes.

The results of the Monte Carlo Simulation for the return on investment (ROI) of the straight bet in Swertress Lotto are presented in the following table:

Table 2: Return of Investment for Straight bet

Iterations	Total bet cost	Total winnings	ROI
1,000	P12,000	-P7,512	-62.60%
10,000	P120,000	-P79,608	-66.34%
100,000	P1,200,000.00	-P737,736	-61.48%

In the simulation with 1,000 iterations, the total bet cost amounted to 12,000 PHP. However, the total winnings resulted in a negative value of -7,512 PHP. This indicates an ROI of -62.60%, indicating a loss of approximately 62.60% of the total bet cost on average. With 10,000 iterations, the total bet cost increased to 120,000 PHP. The total winnings also increased to a negative value of -79,608 PHP, resulting in an ROI of -66.34%. This indicates a higher average loss compared to the previous iteration. In the simulation with 100,000 iterations, the total bet cost further increased to 1,200,000 PHP. The total winnings amounted to a negative value of -737,736 PHP, leading to an ROI of -61.48%. Although the ROI improved slightly compared to the previous iteration, it still indicates a significant average loss over the long run.

The results of the Monte Carlo Simulation for the return on investment (ROI) of the rambolito bet in Swertress Lotto are presented in the following table:

Table 3: Return of Investment for Rambolito bet

Iterations	Total bet cost	Total winnings	ROI
1,000	P62,136.00	-P58,068	-93.45%
10,000	P618,528	-P572,808	-92.61%
100,000	P6,166,572	-P5,742,300	-93.12%

In the simulation with 1,000 iterations, the total bet cost amounted to 62,136 PHP. However, the total winnings resulted in a negative value of -58,068 PHP. This indicates an ROI of -93.45%, indicating a substantial loss of approximately 93.45% of the total bet cost on average. With 10,000 iterations, the total bet cost increased to 618,528 PHP. The total winnings also increased to a negative value of -572,808 PHP, resulting in an ROI of -92.61%. This indicates a similar average loss as the previous iteration. In the simulation with 100,000 iterations, the total bet cost further increased to 6,166,572 PHP. The total winnings amounted to a negative value of -5,742,300 PHP, leading to an ROI of -93.12%. Once again, this indicates a significant average loss over the long run.
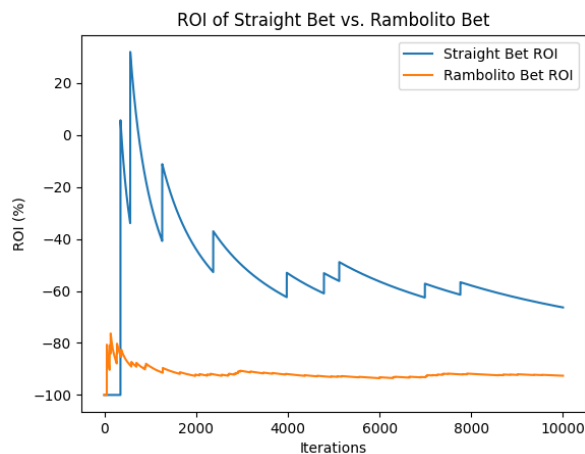

Figure 3. ROI of Straight vs Rambolito bet(10000 iterations)

These results highlight that the straight bet in Swertress Lotto is not a profitable investment strategy, as the expected returns are negative in all iterations. Players can expect to suffer losses on average when playing the straight bet. Similarly, the results demonstrate that the rambolito bet in Swertress Lotto is also not a profitable investment strategy, as the expected returns are negative

in all iterations. Players can expect to suffer substantial losses on average when playing the rambolito bet.

These findings emphasize the importance of understanding the financial risks associated with both the straight and rambolito bet types in Swertress Lotto. Although neither bet type can be considered profitable, the straight bet exhibits relatively smaller negative returns on average. This observation underscores the relative disadvantage of the rambolito bet in terms of financial outcomes. However, it is crucial for players to approach both bet types with caution, as the potential losses associated with both options should be carefully considered.

C. Additional Test Cases

To gain a deeper understanding of the Swertress Lotto game and explore potential variations in the betting strategies, additional test cases were conducted. These test cases aimed to examine different scenarios and variations in the straight bet and rambolito bet types, shedding light on the impact of these variations on the probability of winning and the profitability of the betting strategies. While the primary focus of this study was on the initial program results, these additional test cases provide valuable insights into the dynamics of the game and offer a more comprehensive analysis of the betting options available to players. In this section, we present and discuss the results of these additional test cases, highlighting any notable differences and their implications for the Swertress Lotto players.

The results from the first test case, which involves a fixed list of combinations for both type of bets, are as follows:

Table 4: Probability Results(fixed list)

Iterations	Straight Wins	Rambolito Wins	Straight Probability	Rambolito Probability
1,000	6	2	0.60%	0.20%
10,000	59	53	0.59%	0.53%
100,000	559	567	0.56%	0.57%

In first test case, which involved a fixed list of straight bet combinations ["321", "232", "976", "010", "243", "567"] and a single rambolito bet combination ["456"], both the straight bet and rambolito bet demonstrated low probabilities of winning. The straight bet probabilities ranged from 0.56% to 0.60%, while the rambolito bet probabilities ranged from 0.20% to 0.57%. These results indicate that even with a fixed list of straight bet combinations or a single rambolito combination, the chances of winning were relatively low.

Table 5: Return of Investment for Straight bet

Iterations	Total bet cost	Total winnings	ROI
1,000	P72,000	-P25,740	-35.75%
10,000	P720,000	-P458,748	-63.72%
100,000	P7,200,000.00	-P4,724,748	-65.62%

Table 6: Return of Investment for Rambolito bet

Iterations	Total bet cost	Total winnings	ROI
1,000	P72,000.00	-P69,750	-96.88%
10,000	P720,000	-P684,066	-95.01%
100,000	P7,200,000	-P6,815,574	-94.66%

Furthermore, the ROI analysis of test case 1 revealed significant losses for both the straight bet and rambolito bet in Swertress

Lotto. The straight bet showed negative ROI values ranging from -35.75% to -65.62%, indicating expected losses on average. The rambolito bet resulted in even larger losses, with ROI values ranging from -94.66% to -96.88%.

The first test case is significant as it allows users to manipulate the 3-digit combinations for a potentially more favorable scenario. Despite having the same probability of winning (6 out of 1000 iterations), a fixed list of straight bets ["321", "232", "976", "010", "243", "567"] and a single rambolito bet ["456"] together increase the cumulative odds to 12 out of 1000 iterations. However, both bet types still result in losses, underscoring the importance of cautious decision-making considering potential financial implications.

Another test case explored involve a random list of 3-digit combinations for both bet types. Each list contains around 1to 10 three-digit combinations. The result for the test case are as follows:

Table 7: Probability Results(Random List)

Iterations	Straight Wins	Rambolito Wins	Straight Probability	Rambolito Probability
1,000	15	39	1.50%	3.90%
10,000	64	273	0.64%	2.73%
100,000	556	2770	0.56%	2.77%

The test case results show that the rambolito bet consistently had higher probabilities of winning compared to the straight bet. In the 1,000 iteration test case, the rambolito bet had a probability of 3.90% compared to the straight bet's 1.50%. In the 10,000 and 100,000 iteration test cases, the rambolito bet maintained its advantage with probabilities of 2.73% and 2.77% respectively, while the straight bet's probabilities decreased to 0.64% and 0.56%. These findings indicate that the rambolito bet had a higher likelihood of winning in all test cases.

Table 8: Return of Investment for Straight bet

Iterations	Total bet cost	Total winnings	ROI
1,000	P66,756	-P576	-0.86%
10,000	P662,076	-P379,584	-57.33%
100,000	P6,590,088.00	-P4,134,696	-62.74%

Table 9: Return of Investment for Rambolito bet

Iterations	Total bet cost	Total winnings	ROI
1,000	P332,976.00	-P320,076	-96.13%
10,000	P3,340,320	-P3,256,224	-97.48%
100,000	P33,381,384	-P32,473,182	-97.28%

The test case results indicate that both the straight bet and rambolito bet in the random list test case resulted in losses. The straight bet had ROI values ranging from -0.86% to -62.74%, while the rambolito bet had ROI values ranging from -96.13% to -97.48%. These findings demonstrate that both bet types suffered substantial losses, with the rambolito bet experiencing larger losses compared to the straight bet.

In the second test case, both the straight bet and rambolito bet still had low probabilities of winning, but these probabilities were notably higher compared to the initial program. However, despite the higher probabilities, the losses were also higher due to the generation of more combinations. This suggests that the increased number of combinations in the random list test case led to a higher likelihood of winning, but it also resulted in

larger losses. While the higher probabilities may seem more favorable, it is important to consider the potential financial implications and losses associated with playing these additional combinations.

D. Discussion

The study examined the probabilities of winning and profitability of the straight bet and rambolito bet in the context of Swertres Lotto. The results indicate that the rambolito bet has a higher probability of winning compared to the straight bet due to its flexible combination order. However, neither bet type demonstrated profitability, as both incurred overall losses. Notably, the rambolito bet exhibited significantly higher losses than the straight bet.

The test cases included in the study aimed to replicate realistic betting scenarios encountered by individuals at betting outlets. These cases explored factors such as pre-determined fixed combination lists, and varying list lengths. The findings consistently showed that even with prepared combination lists and the utilization of both bet types, profitability remained at a loss.It is important to note that the test cases represented a minimum number of bets, while in real-life scenarios, individuals often spend more and place bets multiple times a day. This suggests that the financial implications and potential losses in actual betting situations could be even greater.

Considering these findings, individuals should carefully evaluate their betting habits, financial constraints, and the associated risks when participating in Swertres Lotto or similar games. While the rambolito bet may offer slightly higher probabilities of winning, it is crucial to approach these games with caution and make informed decisions to mitigate potential losses.

IV.   CONCLUSION

Based on the analysis and results obtained from this study, it can be concluded that the straight bet and rambolito bet in Swertres Lotto do not offer significant profitability or positive returns. The probabilities of winning for both bet types are generally low, with the rambolito bet showing slightly higher chances of winning due to its flexible combination order. However, both bet types result in overall losses, with the rambolito bet suffering larger losses compared to the straight bet. The test cases conducted in this study provide valuable insights into the probabilities and profitability of these bet types. It is also worth noting that gambling games like this often favors the house, its how they make profit. However, there is room for further experimentation and improvements in the simulation. Future research should consider exploring different parameters, such as varying the size and composition of the combination lists, to gain a deeper understanding of their impact on the probabilities and profitability. Additionally, it would be beneficial to extend the simulation to include other lotto games apart from Swertres Lotto. This expansion would allow for a comparative analysis of different games and their respective bet types, providing a broader perspective on the probabilities and profitability in the realm of lotto betting.

ACKNOWLEDGEMENT

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