

Coin Flip Simulator Report

Introduction

The Coin Flip Simulator is a Python program designed to simulate a series of coin flip games between two players (Alice and Bob). The program calculates the theoretical probabilities of each player winning or tying based on the number of coins flipped in each game.

Approach

Simulating Coin Flip Games

The program simulates coin flip games by generating a random sequence of coin flips for each game. The number of coins flipped in each game is specified by the user.

Calculating Theoretical Probabilities

The theoretical probabilities of each player winning or tying are calculated using combinatorial analysis. By considering all possible outcomes of the coin flips, including the number of heads and tails for each player, we can determine the probabilities of different game outcomes.

Analysis

Theoretical Probability Calculation

The theoretical probabilities of each player winning or tying are calculated based on the following approach:

Enumerating Possible Outcomes: We enumerate all possible outcomes of the coin flips for each game.

Counting Winning Outcomes: We count the number of outcomes where Alice wins, Bob wins, or the game ends in a tie.

Calculating Probabilities: We calculate the probabilities of each outcome by dividing the number of winning outcomes by the total number of possible outcomes.

Results

Theoretical Probabilities

For the specified values of n (the number of coins flipped in each game), the theoretical probabilities are as follows:

$P(\text{Alice wins})$: Probability of Alice winning the game.

$P(\text{Bob wins})$: Probability of Bob winning the game.

$P(\text{Tie})$: Probability of the game ending in a tie.

The probabilities are calculated as follows:

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Theoretical Probabilities

$P(\text{Alice wins}) = [\text{Calculated Probability}]$

$P(\text{Bob wins}) = [\text{Calculated Probability}]$

$P(\text{Tie}) = [\text{Calculated Probability}]$

Observations and Conclusions

The probability of each player winning or tying the game depends on the number of coins flipped in each game.

As the number of coins flipped increases, the theoretical probabilities approach certain limiting values.

By analyzing the theoretical probabilities, we can gain insights into the expected outcomes of the coin flip games and make informed decisions.

Conclusion

The Coin Flip Simulator provides a valuable tool for analyzing the outcomes of coin flip games and understanding the underlying probabilities. By simulating a large number of games and calculating theoretical probabilities, we can make predictions about the likely outcomes and improve our decision-making process.