Universe 7

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Blackjack Report

Introduction

Blackjack is a well-liked card game where the objective is to defeat the dealer by building a hand with a greater value while staying under 21. In the context of blackjack, we compare the effectiveness of five various Monte Carlo policies in our research. We tried developing different policies about the best playing approaches under various game limits and regulations. We also evaluated the effects of other game circumstances, including variants with an infinite deck and a single deck that employ various policies.

Motivation

Our motivation for this project was to comprehend the success rate of various Monte Carlo policies in the context of blackjack which was the driving force behind this project. We want to get insights on the most effective playing approaches under various game rules and limitations by examining various policies and their effects while playing. Additionally, we want to assess how various game parameters, such as the infinite deck and single deck variants, affect these policies' effectiveness.

Problem Statement

In this project, implementing the five different Blackjack policies was the primary objective that we had to tackle. We took into account the infinite deck and single deck game situations. Our objective is to examine how policy changes affect the success rate of a strategy and to get insight on what the best best ways to make choices and play the game was.

Approach

Our approach for this project entails a number of procedures that are intended to evaluate the effectiveness of different policies under two gaming scenarios. Prior to defining methods to draw cards from infinite and single decks, we imported the necessary libraries. Next, we develop routines to determine soft hand values, compute hand values, and detect whether a hand contains an Ace. Then, in order to compare the three provided policies with two more policies, we define them.

Once the policies have been defined, we developed a function to produce a single and infinite drawing deck. Additionally, we create a function that can mimic a game of blackjack with a certain policy and deck type. We use a Monte Carlo function, which accepts a policy, deck type, and number of runs as inputs, to evaluate each policy's effectiveness.

We initialize the count of dealer wins, player wins, and draws before starting the Monte Carlo simulations. For each policy and deck type, we run the simulations, adjusting the number of wins and draws as required. We determine the player winning probability for each policy and deck type when the simulations are complete. Then, for each policy and deck type, we report the player winning probability, dealer wins, player wins, and draws.

Finally, we repeat the procedure, carrying out the aforementioned stages for every possible combination of policies and deck types. We can better understand the effectiveness of various policies under various game situations by examining the results together at the very end.

Tests/Results and Key Findings

In our research, we ran a number of tests with a focus on policy comparison and deck type modifications. To evaluate each policy's effectiveness in terms of winning probability and game outcomes, we examined five different blackjack strategies, ranging from simple to complex. To study the effect of deck type on policy performance, we also assessed each policy with an infinite deck and single deck types.

For each policy and deck type combination, we ran 100,000 simulations using the Monte Carlo approach to ensure reliable results. Our results were as follows, from worst to best win rate, policy 2 with 35%, policy 3 with 38.8%, policy 1 with 41.4%, policy 4 with 43.3%, and policy 5 with 43.8%. Complex strategies typically performed better in infinite and single deck scenarios, according to our data. This shows that making decisions with more complex strategies can increase your chances of winning at blackjack.

Conclusion

In conclusion, our findings provide important light on the effectiveness of different approaches in various game contexts. Although complicated policies typically perform better, it's crucial to remember that additional research and policy modification could produce even better outcomes. This would improve the players' ability to make decisions while playing the game and their understanding of it. Players can create more efficient strategies and raise their chances of winning at the game of blackjack by comprehending the effects of numerous policies and game conditions.

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