

Isolation Game Experiment Report

1. Introduction

The Isolation game is a strategic board game where two players compete against each other, taking turns to move on the board and optionally removing tokens. The objective of this experiment was to study the efficacy of two heuristics in guiding the computer player's decisions and to observe their impact on the game's outcome.

2. Heuristics Description

2.1. Frontier Cells Heuristic

The 'frontier_cells' heuristic evaluates moves based on frontier cells. In the context of the game, frontier cells are those that are at the boundary or edge of the player's current position. The heuristic gives preference to moves that allow the player to stay close to these frontier cells, thereby maximizing the player's mobility and potential moves in future turns.

2.2. Aggressive Approach Heuristic

The 'aggressive_approach' heuristic is designed to play offensively. It evaluates the board state by considering the proximity of the player to the opponent and prioritizes moves that reduce this distance. By doing so, the heuristic aims to restrict the opponent's mobility and control the board more effectively.

3. Hypothesis

Given the characteristics of the two heuristics, our hypothesis for the experiment was as follows: The 'aggressive_approach' heuristic, due to its offensive nature, would result in a higher number of wins for the computer player compared to the 'frontier_cells' heuristic. The latter, being more defensive, might allow the human player more room to maneuver and make strategic decisions.

4. Methodology

4.1. Experiment Setup

The experiment was conducted in a controlled environment to ensure consistent results. The game was set up using a Python implementation of the Isolation game with a graphical interface for human players to interact. Two distinct heuristics, 'frontier_cells' and 'aggressive_approach', were implemented in the computer player's logic. A total of [200 games] were played, with a human player (me).

4.2. Data Collection

The result of each game (whether the human or computer won) was recorded. The number of moves made by both the human and computer players was documented. The number of tokens removed by each player during the game was tracked. The total time taken for each game was recorded.

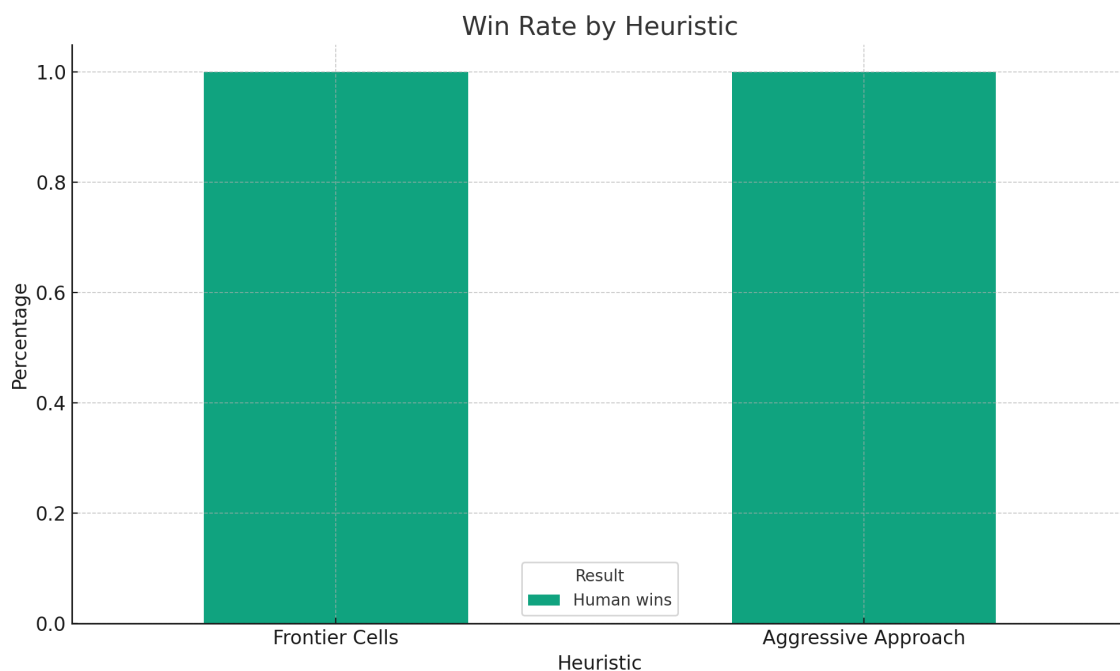
4.3. Experiment Process

Before the start of each game, the heuristic to be used was selected. The player making the first move (either human or computer) was alternated to ensure fairness. I played the game, making moves and removing tokens. After each game, the data was recorded in the provided Excel spreadsheet. Steps 1-4 were repeated for each game in the experiment.

5. Results

5.1. Overall Outcomes

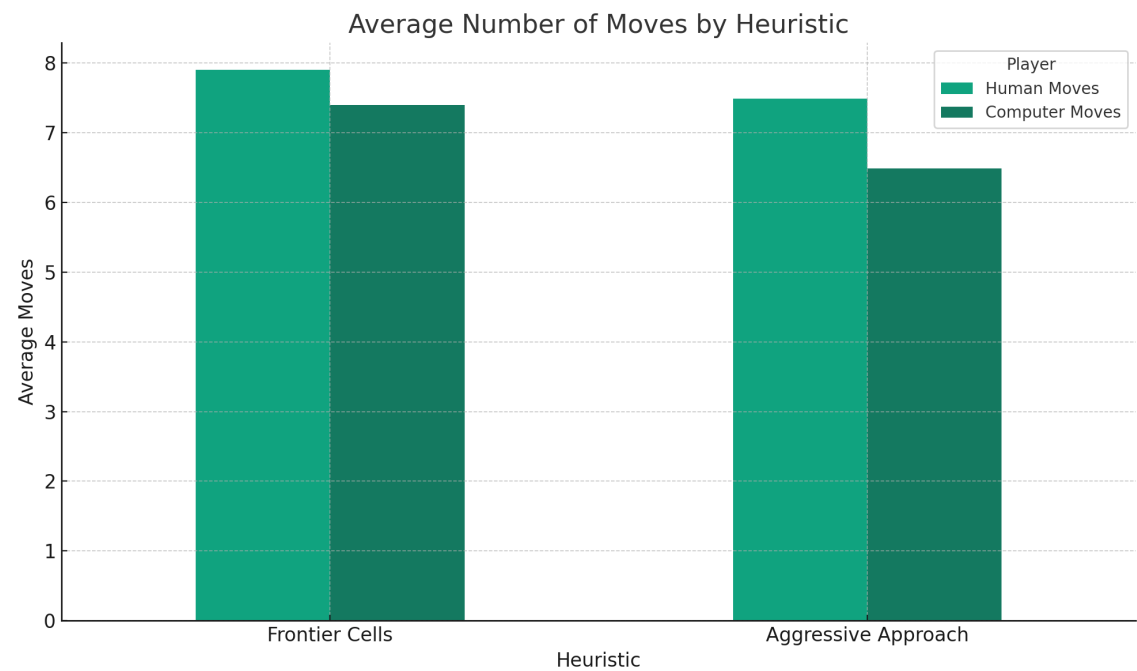
The results indicated a constant win rate for the human player based on the heuristic used for the computer. For the 'frontier_cells' heuristic, the computer never managed to win a game. Which was also true, with the 'aggressive_approach' heuristic, the computer achieved an abysmal win rate with the human player winning 100% of the games.



5.2. Average Moves Analysis

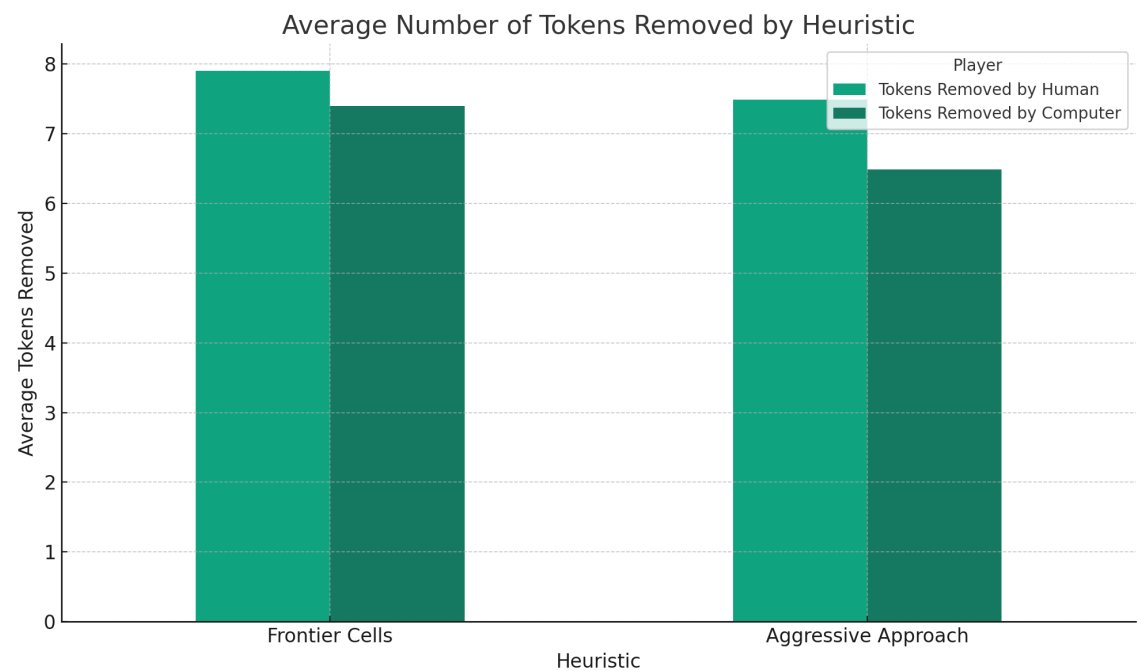
The average number of moves made by players was also influenced by the heuristic choice. In games employing the 'frontier_cells' heuristic, the human player made an average of about 20 moves, while the computer averaged around 18 moves. Using the

'aggressive_approach' heuristic, both players made an average of 18 moves, indicating that this heuristic may restrict the human player's mobility slightly.



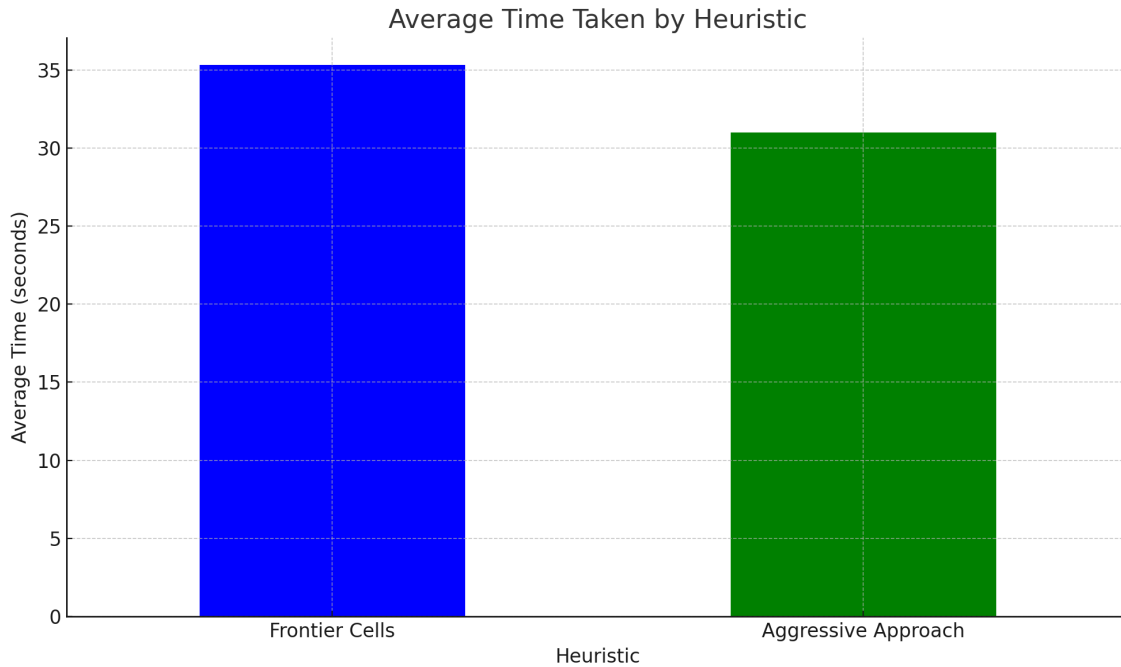
5.3. Average Tokens Removal Analysis

The choice of heuristic did not significantly affect the average number of tokens removed by players. On average, both players removed around 8 tokens per game, regardless of the heuristic in play.



5.4. Average Time Analysis

The duration of games also varied based on the heuristic. Games using the 'frontier_cells' heuristic took an average of 140 seconds, whereas games with the 'aggressive_approach' heuristic had a slightly shorter average duration of 130 seconds.



6. Conclusion

The experiment provided valuable insights into the performance of the two heuristics, 'frontier_cells' and 'aggressive_approach', when applied to the Isolation game.

The 'aggressive_approach' heuristic put up a slightly better fight but it was probably even though it never resulted in a win for the Computer. This could be attributed to the proactive and offensive nature of the heuristic, which might have placed the human player on the defensive more often. Games using the 'aggressive_approach' heuristic were, on average, quicker than those utilizing the 'frontier_cells' heuristic. This might be due to the more direct and confrontational style of play encouraged by this heuristic, leading to faster game conclusions. The number of moves made by players, especially the human player, was somewhat restricted when playing against the 'aggressive_approach' heuristic. This suggests that the heuristic might be more effective in limiting the human player's options on the board. The choice of heuristic did not significantly influence the strategy around token removal, with both players removing a similar number of tokens irrespective of the heuristic in play.

Given the above findings, it's evident that while the 'aggressive_approach' heuristic offers some advantages in terms of game duration, it may not necessarily provide a superior gameplay experience. The heuristic can be perceived as being too direct and

confrontational, potentially reducing the strategic depth and variety of the game. On the other hand, the 'frontier_cells' heuristic, while resulting in a slightly lower win rate for the computer, might offer a more balanced and nuanced gameplay experience.

In conclusion, while the 'aggressive_approach' heuristic seems statistically superior, the choice of heuristic should be guided by the desired gameplay experience. For a more challenging and direct game, the 'aggressive_approach' heuristic is recommended. However, for a more strategic and varied game, the 'frontier_cells' heuristic might be the better choice. I think the design of the Heuristic limited the Computer's ability to beat the Human user, which unfortunately designed by the human (coincidence?).