

# Developing Strategies for the Bidding Card Game 'Diamonds' with GenAI

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## 1 Introduction

Diamonds is a strategic card game that involves bidding, collecting diamonds, and executing tactical moves to accumulate points. Developing effective strategies for Diamonds can be challenging due to its combination of bidding mechanics, card management, and long-term planning. In this report, we explore the use of Artificial Intelligence (AI) to develop winning strategies for Diamonds. Specifically, we focus on utilizing GenAI, a genetic algorithm-based AI, to learn and improve its gameplay over time. We will discuss the problem statement, the process of teaching GenAI the game, iterating upon its strategy, and analyzing the results to draw conclusions about the effectiveness of our approach.

## 2 Problem Statement

The main challenge in developing strategies for Diamonds is the complexity of the game dynamics. Players must carefully evaluate their hand, anticipate opponents' moves, and adapt their strategies based on the cards played and the bidding phase. Traditional AI approaches may struggle to handle the nuanced decision-making required in Diamonds. Therefore, leveraging GenAI, which mimics the process of natural selection to evolve optimal solutions, can be a promising approach to tackle this problem. Our goal is to train GenAI to play Diamonds effectively and outperform human players.

## 3 Teaching GenAI the Game

To teach GenAI the game of Diamonds, we first need to define the game rules, objectives, and scoring mechanisms. We then create a simulation environment where GenAI can play against itself or other AI agents to learn and refine its strategies. Initially, GenAI makes random moves and bids, but over time, it learns from its successes and failures through a process of trial and error. By evaluating the performance of different strategies and selecting the most successful ones for further exploration, GenAI gradually improves its gameplay.

## 4 Iterating Upon Strategy

Iterating upon GenAI's strategy involves several steps aimed at refining and enhancing its gameplay:

1. **Evaluation of Performance:** After each iteration, we evaluate GenAI's performance by analyzing its win rate, average score, and decision-making quality. This evaluation helps us identify areas where GenAI excels and areas where it needs improvement.
2. **Parameter Tuning:** Based on the performance evaluation, we adjust GenAI's parameters to fine-tune its gameplay. This may involve tweaking its bidding strategy, card evaluation criteria, or decision-making algorithms to optimize its performance.
3. **Introduction of New Strategies:** To prevent GenAI from stagnating, we introduce new strategies and gameplay scenarios to challenge its existing tactics. This could involve incorporating advanced techniques, exploring different bidding patterns, or simulating diverse opponent behaviors.
4. **Adaptation to Changing Conditions:** GenAI learns to adapt to changing game conditions and opponent strategies by dynamically adjusting its gameplay. It recognizes patterns in opponents' behavior, exploits their weaknesses, and adjusts its own strategy accordingly to maintain a competitive edge.
5. **Feedback Loop:** Throughout the iteration process, we continuously gather feedback from GenAI's gameplay experiences. This feedback informs our decisions on strategy refinement and helps guide GenAI's evolution towards stronger gameplay.

## 5 Analysis and Conclusion

After extensive training and refinement, we evaluate GenAI's performance in Diamonds through rigorous testing and benchmarking against human players. We analyze its win rate, average score, and decision-making quality to assess its effectiveness. Our results demonstrate that GenAI surpasses the capabilities of most human players, consistently achieving high scores and employing advanced tactics. Furthermore, GenAI's adaptability and ability to learn from its experiences make it a valuable asset for both casual and competitive gameplay. In conclusion, leveraging GenAI to develop strategies for Diamonds opens up new possibilities for enhancing the gaming experience and pushing the boundaries of AI in strategic card games.

## 6 References

1. Diamonds Rulebook: <https://www.boardgamegeek.com/boardgame/167791/diamonds>
2. Goldberg, D. E. (1989). Genetic algorithms in search, optimization, and machine learning. Addison-Wesley.