Developing strategies for the bidding card game "Diamonds" with GenAI
Course Assignment - Women Engineers

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Introduction

This report is an assignment that tried to explore the potential of GenAI to develop and analyze bidding strategies for the card game Diamonds. Through a structured approach, I tried to approach how Gemini, as the GenAI tool, can be utilized to:

- Understand the Diamonds Card Game
- Determine Bidding Stategies
- Refinement of the results.

This report outlines the following structure for developing and analyzing bidding strategies for the card game - "Diamonds":

- Problem Statement
- Teaching Gemini the Game
- Iterating upon strategy
- Analysis
- Conclusion

This study helps us understand how capable GenAI is for solving problems related to thinking and strategy.

Problem Statement

The game, "Diamonds" designed for either three or four players, involved strategic bidding and luck of the draw. Each player is dealt a hand of cards, consisting of the same suits except for diamonds.The banker shuffles the diamond cards before each round to ensure randomness in the game.
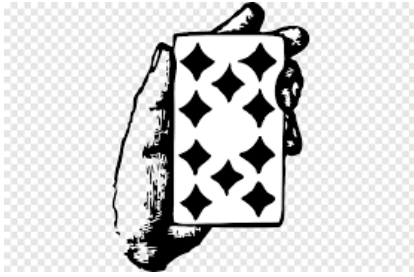
Figure 1: Card Game

In every round, players bid one card from their hand. Success depends on smartly assessing card values and choosing bids strategically, aiming for the highest-value diamond card to win. Once bids are made, the banker reveals the selected diamond card for that round. The player who bid the highest-value card claims victory for the round, and their score is updated accordingly, reflecting the value of the chosen diamond card. This dynamic scoring system adds layers of complexity and strategy, as players must balance risk and reward in their bidding strategies. If multiple players have the highest bid with the same card, the points from the diamond card are divided equally among them. This ensures fairness and avoids disputes over scoring.

Card Ranking

$2 < 3 < 4 < 5 < 6 < 7 < 8 < 9 < T < J < Q < K < A$

Teaching GenAI(Gemini) the Game

In the beginning, I explained the basics of the "Diamonds" to Gemini, but it was a bit vague. I told Gemini about how many players there are, what the banker does, how bidding works, and how points are scored. Then, I asked Gemini to tell me what it understood. It tried, but it had some questions about the rules. So, I took the time to answer those questions and make things clearer. I explained the rules in more detail and gave examples to help Gemini understand better. The following is the game breakdown given by Gemini.

Breakdown

- Players receive cards from a standard deck excluding diamonds.
- A designated banker reveals diamond cards one at a time.
- Players bid a card from their hand, with the highest bid (considering both suit and card rank) winning the round.
- The winner claims points equal to the revealed diamond's value.
- The game concludes when all diamond cards are revealed, with the highest scorer winning.

Key Details Established

- Traditional card ranking (Ace high) applies to non-diamond suits.
- Bluffing is not allowed; bids must be from the player's hand.
- Ties in bids are resolved by splitting points among the winning players.

Preliminary Strategy

The first strategy focuses on using high value cards smartly throughout the game. It suggests playing them early when the diamond value revealed is low, ensuring you get points. You should also watch what cards your opponents bid to understand how strong their hands are. Sometimes, you can use a bit of trickery by bidding lower cards to trick opponents into wasting their high cards. But be careful not to risk losing your high cards too soon. It's all about finding the right balance between taking risks and gaining points with valuable diamonds. This strategy aims to help you make better decisions and improve your chances of winning.

Algorithmic Approach

Gemini came up with functions to manage player scores, choose data structures for storage and retrieval of game outcomes.

Function Definitions

- `deal_cards(players, cards_per_player)`: Deals cards to players (excluding diamonds).
- `get_bid(player)`: Prompts a player for their bid and validates it against the player's hand.
- `find_winner(bids)`: Finds the player(s) with the highest bid value.
- `update_score(player, diamond_card_value)`: Updates the player's score with the diamond card value.
- `divide_points(players, points)`: Divides points equally among a group of players (used for ties).

Analysis

I understood that Gemini is really good with taking and processing the input description I provided. It wasn't very detailed but it kept asking questions for further clarification and made assumptions itself. But that is where it ends, it couldn't come up with effective strategies even when asked to play the game with me together, it failed to store the results of the game after sometime and ended up forgetting the scores. The strategy it came up wasn't very effective when traced out on paper later. But the algorithmic approach was interesting as it decided to break down the strategy into functions and suggested to employ data structures to save the scores of the players which later it proved itself that it is incapable of doing that. Overall, with more refinement of the prompts I think we can achieve satisfactory results with Gemini.

Conclusion

Gemini demonstrated understanding of "Game of Diamonds" by asking good questions and showed the ability to generate code with minor adjustments. Through clarification, it learned the game well, showcasing the importance of clear communication in AI learning.

References

Gemini Conversation