

Developing strategies for the bidding card game 'Diamonds' with GenAI

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March 26, 2024

INTRODUCTION

This report details my process of teaching ChatGPT the "Diamonds" card game and refining its understanding to develop effective strategies. We started with the game's rules and scoring system, but initial gameplay showed errors like incorrect card distribution and bidding on diamond cards. With iterative prompts, ChatGPT improved. We discussed strategies such as bidding the highest card higher than any previously played card, emphasizing strategic use of high-ranking cards. The player with the highest card not lower than any previously played card wins the diamond card, stressing the need for strategic bidding. This shows how AI systems can learn new games with guidance, leading to better gameplay strategies in "Diamonds."

PROBLEM STATEMENT

Teaching GenAI a new card game called "Diamonds." This game is completely unknown to the GenAI tool, the challenge is to make the tool learn and strategize and come up with the best possible tricks and moves.

TEACHING GENAI THE GAME

I start by giving a prompt to ChatGPT explaining the rules of the game.

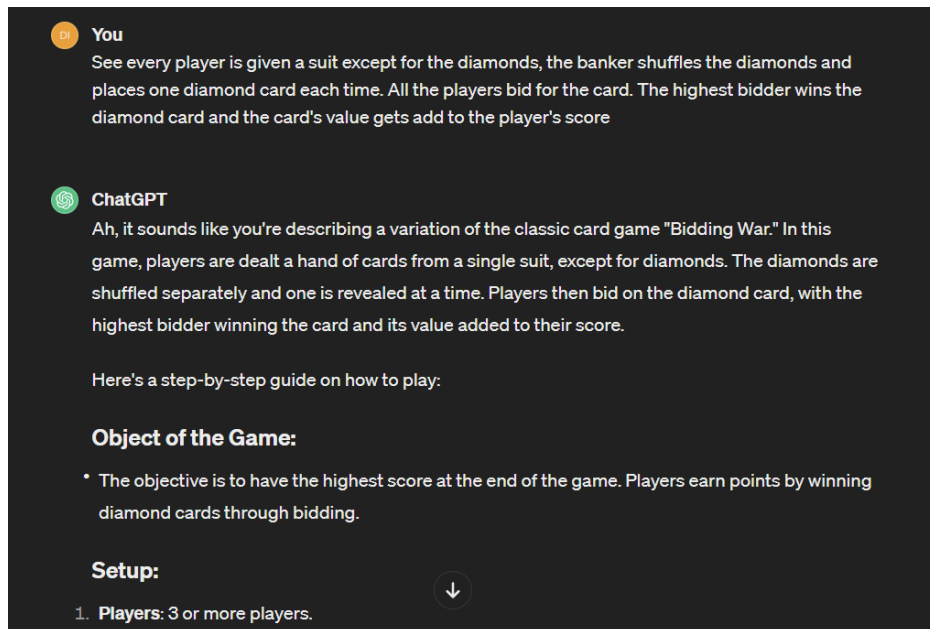


Figure 1. First Prompt given to ChatGPT to explain the game.

ChatGPT searched the internet and initially provided information on a different card game than the one referred to. After a few more iterations and more specific prompts, ChatGPT was able to understand the game better. Following images are the prompts given to ChatGPT:

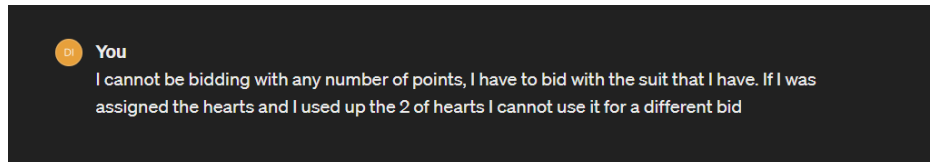


Figure 2. Correcting ChatGPT's understanding of the game

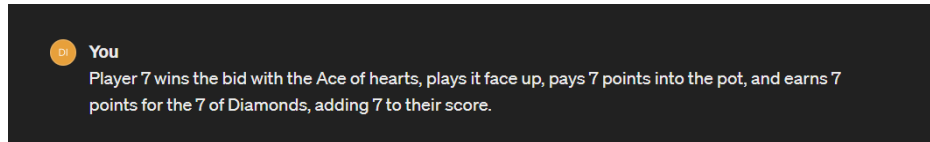


Figure 3. Correcting ChatGPT's understanding of the game

The issue with ChatGPT's understanding of the game is that it allows a player to bid a card more than once per round. This contradicts the purpose of the highest bidder winning the diamond card.

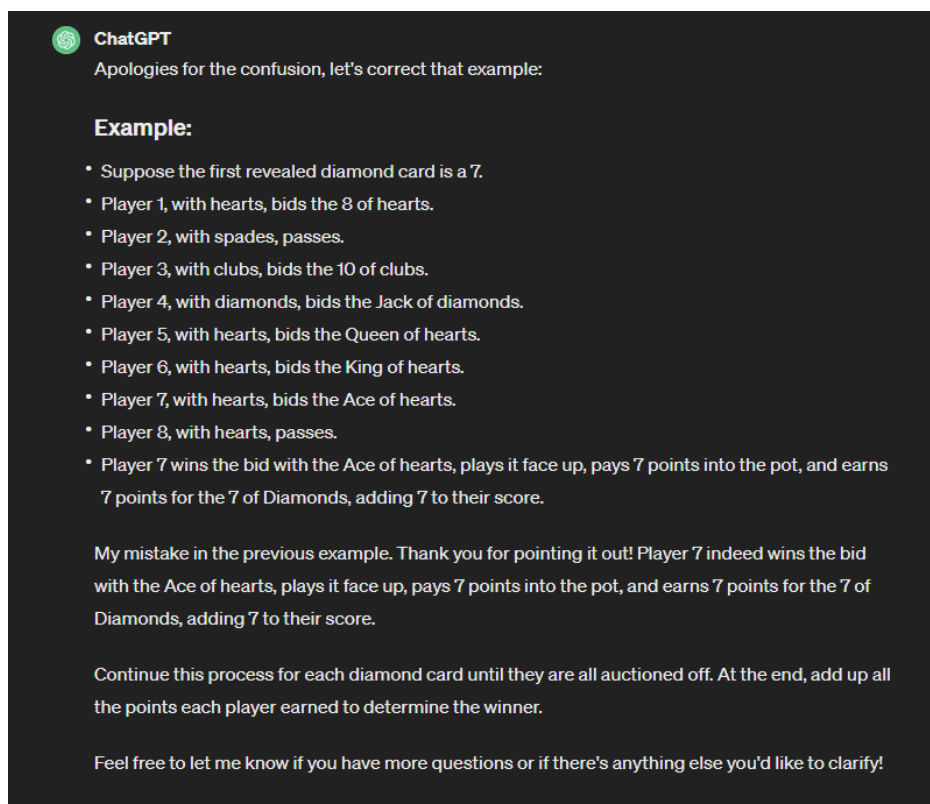


Figure 4. ChatGPT's understanding of the game with an example

ChatGPT's understanding of the game isn't correct but instead of rectifying it, I decide to play a test game and correct those mistakes during the test. Before starting the test game, I explain the scoring system for "Diamonds" to ChatGPT. In this system, Jack is worth 11 points, Queen is 12 points, King is 13 points, and Ace is 14 points.

While playing the test game, I noticed that ChatGPT was distributing some cards of a particular suit to a player instead of assigning the entire suit to a player. Additionally, ChatGPT was bidding the diamond cards instead of keeping them with the banker. It also made errors in the scoring system of the game, failing to score the players correctly according to their bids. Another mistake was ChatGPT's failure to understand that if two players bid the same number, then the score of the diamond card is divided between them. After multiple prompts and iterations, ChatGPT still failed to understand that the game is between 3 players and not 4 players. However, with continued prompting and clarification, ChatGPT gradually gained more clarity on the game.

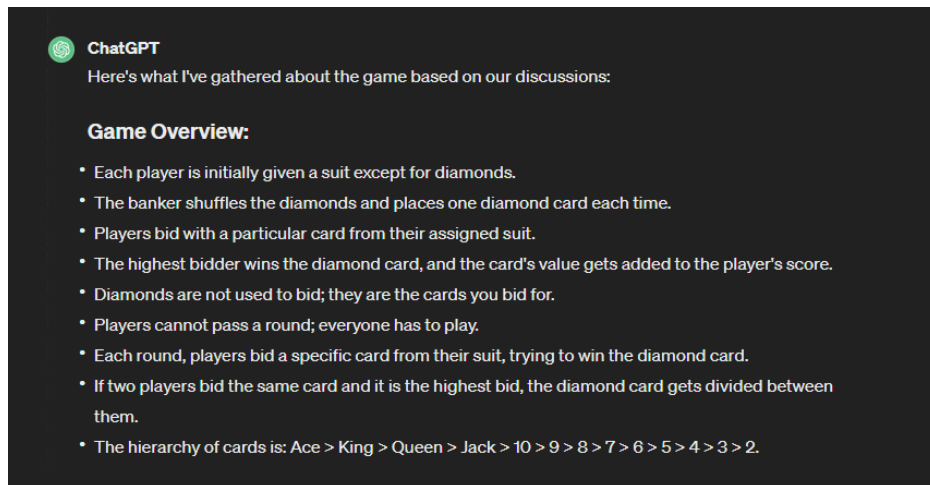


Figure 5. ChatGPT's Summary of the game

ITERATING UPON STRATEGY

Next, I ask ChatGPT for various strategies that can be used in the game some strategies that it suggested me were:

- Card Hierarchy: Understand Ace, King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3, 2.
- Analyze Your Hand: Look for Aces, Kings, Queens, and Jacks. Consider suit distribution.
- Bid Wisely: Balance bidding high cards to secure diamonds with strategic bidding.
- Opponents' Bids: Pay attention to opponents' bids. Save high cards if opponents bid high.
- Plan for Division: If two players bid the same high card, the diamond card is divided. Use this to your advantage.
- Use Low Cards: Win bids without high cards. Split diamond cards with low cards in a tie.
- Adapt: Adjust strategy based on played cards and remaining suits.
- Point Tracking: Keep track of points for informed bidding.
- Strategic Passing: Pass with low cards to save high ones for better rounds.
- Bluff: Occasionally bluff with high cards to mislead opponents.

Next, I asked ChatGPT to give strategies to understand the opponent, it mentioned that observing opponents' bidding patterns can provide insights into the strength of their hands. According to ChatGPT, high bids often indicate strong cards, while mixing with low cards may suggest bluffing. It also recommended recognizing opponents' preferences for certain suits and adjusting bidding strategies accordingly. ChatGPT highlighted the importance of remembering the cards played in previous rounds to predict opponents' remaining hands and potential strengths. Additionally, it mentioned that analyzing how diamond cards are divided among players can reveal shared strategies or favored suits. According to ChatGPT, watching opponents' reactions to cards can unveil emotions and indicate the strength of their hands. It also emphasized assessing opponents' risk-taking tendencies, such as conservative play versus aggressive bluffing, to make informed decisions. ChatGPT suggested being aware of bluffing tactics and adapting to changing strategies throughout the game. It mentioned that utilizing card counting techniques can give a strategic advantage by predicting opponents' hands and adjusting bids accordingly. Lastly, ChatGPT advised observing opponents' body language and maintaining a neutral demeanor to prevent giving away information about one's own hand.

Strategies:

- Understanding the card hierarchy is crucial.
- Analyzing your hand for strong cards and suit distribution.
- Bidding wisely to secure diamond cards without revealing too much about your hand.
- Considering opponents' bids and adjusting strategy based on their patterns.
- Planning for the division of cards when multiple players bid the same high card.
- Using low cards strategically to win bids without using high cards.
- Adapting to changing situations and opponents' strategies.
- Keeping track of points and opponents' scores to make informed decisions.
- Utilizing bluffing tactics sparingly and tactfully.
- Understanding opponents' tendencies through observation of bidding patterns, suit preferences, and reactions.
- Being aware of opponents' risk-taking behavior and adaptability.
- Counting cards if possible to estimate opponents' remaining cards.

Figure 6. ChatGPT's Summary of the Strategies

When instructed to code up a strategy, ChatGPT initially suggested bidding the highest card in hand, which was not considered an optimal strategy. Upon requesting a better one, it iterated and proposed a revised strategy: players should now bid the highest card that is higher than any previously played card, if possible. This ensures that players use their high-ranking cards strategically. Following was the code:

```
import random

# Card hierarchy
card_values = {
    "Ace": 14,
    "King": 13,
    "Queen": 12,
    "Jack": 11,
    "10": 10,
    "9": 9,
    "8": 8,
    "7": 7,
    "6": 6,
    "5": 5,
    "4": 4,
    "3": 3,
    "2": 2
}

# Function to create a deck of cards
def create_deck():
    suits = ["Hearts", "Spades", "Clubs"]
    deck = [{"card": card, "suit": suit, "value": card_values[card]} for suit in suits for card in card_values
    random.shuffle(deck)
    return deck

# Function to deal cards to players
def deal_cards(deck, num_players):
    return [deck[i::num_players] for i in range(num_players)]

# Function to simulate bidding for diamond cards
def bid_for_diamonds(hands):
    diamond_cards = []
    scores = [0] * len(hands)

    for _ in range(4): # Four diamond cards to bid for
        diamond_card = deck.pop()
```

```

        diamond_cards.append(diamond_card)

        print("\nDiamond Card:", diamond_card["card"], "of", diamond_card["suit"])

        bids = []
        for player, hand in enumerate(hands):
            print("\nPlayer", player + 1, "Hand:", [card["card"] + " of " + card["suit"]
            valid_bids = [card for card in hand if card["suit"] != "Diamonds"]

            if valid_bids:
                # Bid the highest non-diamond card
                highest_non_diamond = max(valid_bids, key=lambda x: x["value"])
                print("Player", player + 1, "Bids:", highest_non_diamond["card"], "of
                bids.append((player, highest_non_diamond))
            else:
                print("Player", player + 1, "Passes")

        # Determine the winner of the bid
        if bids:
            winning_bid = max(bids, key=lambda x: x[1]["value"])
            print("\nPlayer", winning_bid[0] + 1, "wins the bid with", winning_bid[1]
            scores[winning_bid[0]] += diamond_card["value"]
        else:
            print("\nAll players passed. No winner for this round.")

    return scores

# Main function to run the game
def play_game(num_players):
    global deck
    deck = create_deck()
    hands = deal_cards(deck, num_players)

    print("Initial Hands:")
    for i, hand in enumerate(hands):
        print("Player", i + 1, "Hand:", [card["card"] + " of " + card["suit"] for car

    scores = bid_for_diamonds(hands)

    print("\nFinal Scores:")
    for i, score in enumerate(scores):
        print("Player", i + 1, "Score:", score)

# Example: Play the game with 3 players
play_game(3)

```

Figure 8. Coding up the strategy

ANALYSIS AND CONCLUSION

The struggles faced by ChatGPT in understanding the "Diamonds" card game highlight the complexity and nuances involved in teaching AI systems new games. These challenges include distributing cards correctly, bidding procedures, scoring mechanisms, and player count, all of which are crucial aspects of the game. However, through iterative prompts and clarifications from the user, ChatGPT gradually gained a better understanding of the game's rules and strategies. This iterative learning process underscores the potential for improvement and adaptation in AI systems when faced with new tasks or games. By receiving feedback and additional prompts, ChatGPT was able to refine its understanding and ultimately provide more accurate strategies for playing "Diamonds."