

CSE 341, Spring 2004, Homework 7

Card-Game Description

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This document provides a high-level description of the card game for which you are writing a player. The purpose of this assignment is to use good OO-design to write an “agent” that “plays” in a non-trivial world. The purpose is not to make you understand some strange game, so if something is unclear please ask.

Basic Terms and Structure:

- Your player will participate in a *tournament*.
- A tournament consists of *matches*. A match has 4 players. If a player does something illegal in the match or raises a MessageNotUnderstood error or consumes too much space or time, that player is eliminated from the tournament and the other 3 players are not. Otherwise, the players with the two lowest scores at the end of a match are eliminated and the other two are not. A match ends when scores become “sufficiently far apart” or the match has continued for “a long time”. The exact definitions of “sufficiently far apart” and “a long time” have not yet been determined.
- Throughout a match, a player is in one of four *positions* (1, 2, 3, or 4).
- A match consists of some number of *shuffles*.
- Each shuffle consists of 10 *rounds*.
- For each round, one player *starts*; which player starts rotates throughout the match. Player 2 always *follows* 1, 3 follows 2, 4 follows 3, and 1 follows 4.
- Each player has a *score* that begins at 0 and changes after each round.

The Actual Game:

- A shuffle begins with a *deck* of (52) cards being put in an order unknown to the players. The first round uses the first 5 cards, the second round the next 5, and so on. (Note that for each shuffle, two cards are unused.)
- A hand begins with each player *receiving* 1 of the 5 cards. (A player knows which card it receives but not which card the other players receive.)
- The 5th card is the *dealer-card*; all players know what it is.
- The player that starts then chooses to either *do nothing* or *swap* its received card with the dealer-card. If swapping, its received card becomes the dealer-card and all players learn which card it is (and the dealer-card becomes its received card).
- The following player then chooses to do nothing or swap. This continues until each player decides *one time* whether to do nothing or swap.
- At this point each player *bids* (one time), again starting with the player who *starts* and continuing with the following players. A bid must be an even number between 2 and 10 (inclusive) or the special bid “quit for 2”. **A bid that is not “quit for 2” must be greater than or equal to every previous bid in the hand.**
- The hand is now over; two things happen:
 - Cards are revealed: All players learn what cards all *non-quitting* players hold. Nobody learns what cards quitters hold (though the quitter will already know and if the quitter previously swapped, then everybody will know)

- Scores adjust as follows (it’s simpler than it sounds): The *last bid* is the highest bid that is not “quit for 2”. The *total bid* is $2q + \ell(4 - q)$ where q is the number of players bidding “quit for 2” and ℓ is the last bid. If a player bid “quit for 2”, the player’s score decreases by 2. Else consider the set of cards held by players that did not bid “quit for 2”. The score of the player holding the *highest* card in this set increases by $t/2 - \ell$ where t is the total bid and ℓ is the last bid. The score of the player holding the *lowest* card increases by the same amount. The score of other players decreases by ℓ .

Note that if 3 players bid “quit for 2”, then the fourth player’s score increases by 6. If 4 players bid “quit for 2”, all scores decrease by 2.

Notes:

- The game is unlike “real” card games in many ways. Particularly, players bid only once. If they do not bid “quit for 2”, their score may decrease by 10, even if their bid is less.
- Being the third or fourth player to “quit for 2” is a legal-but-bad move because you are guaranteed to win.
- Even before bidding starts, there are two ways to have enough information to know you do (or do not) have the highest (or lowest) card:
 - You may know all 5 cards in the round because the other 3 players chose to swap.
 - You may know that the highest and/or lowest cards remaining in the deck are in certain positions in the current round. (If you hold the highest or lowest card remaining in the deck, you are guaranteed to win. If other players hold the highest and lowest card remaining in the deck, you are guaranteed to lose.)

Background on Card Values:

- A card has a suit (clubs, diamonds, hearts, or spades) and a value (a number between 1 and 13 inclusive).
- For two cards with different values, the card with greater value is “higher” (and the other is “lower”) *except 1 is greater than every other value.* (Yes, really.)
- For two cards with the same value, spades are higher than hearts, which are higher than diamonds, which are higher than clubs.
- A deck has 52 cards. No two cards have the same suit and value.