

Rummy 500 Skeletal Plan

This is the first in what is most likely a series of plans for this extensive research project. This plan will give the project a title, provide an overview of the project, and define preliminary tasks.

Project Title

Rummy 500 with Symbolic AI Opponent

Project Overview

This will be a Rummy 500 card game written in Prolog with a symbolic AI opponent. The User will be a human playing against the computer. At first the program will be designed to play in a random fashion. No heuristics used for drawing a card, it will check to see if it has a move and will play the first one it finds. It will discard a random card from the deck. Once this is in place and working, heuristics will be added to a knowledge base for the program to use. Starting with one heuristic and working towards more than one to use.

Task 0: Start the Paper

Start by planning out the paper, finding good reputable sources, and writing an outline, before starting to actually write it.

Task 1: Representing Cards, The Deck, and the Discard Pile

Three components of this game shared by players of all types, whether human or machine, are the cards, the deck and the discard pile. These need a representation that is easy to access and modify.

Task 2: Representing the Players

The players of the game are key components in having an actual game. They consist of a set of melds, a score, their name, and the cards in their hand.

Task 3: Drawing from the Deck

The first task done during a Rummy turn is to draw a card. Since it requires a heuristic to draw from the discard pile (must know if you can make a move with a card) it can not be done randomly. So for now the opponent will just draw from the deck.

Task 4: Finding a Meld of 3 Cards of the same Face Value

A meld consists of at least 3 cards with the same face value (ex: 3 kings). A player's hand will be checked to see if it has three cards which are the same.

Task 5: Discarding from the top of the Hand

The simplest possible way for a player to discard from their hand is to pick the same index in their hand to discard every turn. A player will discard from the top of their hand with this task.

Task 6: Random Discard

The last part of any turn is discarding. There are many heuristics to determine which card to discard, but for now a card will be chosen at random from the opponent's hand.

Task 7: Turns

All of the functionality needed to take a turn in a rummy 500 round is now in place. Putting it all together, a player will pick a card from the top of the the deck, check to see if they have a 3 of a kind in their hand, and then discard a card randomly from their hand.

Task 8: Simple Rummy Rounds

Now that the functionality to have turns is added, an entire round of Rummy 500 can be played. A round of rummy ends when either player has no more hands or the deck is empty.

Task 9: Scoring

When a round of rummy scores need to be counted. Within the melds you've played, 2 – 10 is worth 5 points, Jack is worth 11, Queen is worth 12, King is worth 13, and ace is worth 1 or 15 depending on the context it's played in. Any cards that are left in your hand when the round is over are subtracted from your score.

Task 10: Simple Rummy Game

An entire game can now be played until a player reaches 500. All other tasks will modify this simple game to make it more complex.

Task 11: Finding a Run of Three or More Cards

The other type of meld which can be played is a run of cards in increasing order all in the same suit. Each card must be one rank higher than the card it succeeds. Implementing this will allow for a better performing opponent.

Task 12: Playing Off of Previously Played Sets

Now that a rummy 500 opponent could successfully play in a game making random moves, other functionality can be added to the opponent. First, a player can play on any meld that has been played on the board. To start we implement the ability for a player to play on any previously played set.

Task 13: Playing Off of Previously Played Runs

Similar to the previous task, lets expand where melds can be played. A player will have the ability to play on a previously played run.

Task 14: Various Rummy Opponents

At this point, enough heuristics have been added to the game to make a variety of opponents. Testing their performance is beneficial for any results of the program. The following matches will be played:

Other = Playing off of previously played melds

Player1(Sets)	vs	Player2(Runs)
Player1(Sets)	vs	Player2(Runs + Other)
Player1(Sets)	vs	Player2(Sets + Other)
Player1(Sets + Runs)	vs	Player2(Sets)
Player1(Sets + Runs)	vs	Player2(Runs)
Player1(Sets + Runs)	vs	Player2(Sets + Other)
Player1(Sets + Runs)	vs	Player2(Runs+ Other)
Player1(Sets + Runs + Other)	vs	Player2(Sets)
Player1(Sets + Runs + Other)	vs	Player2(Runs)
Player1(Sets + Runs + Other)	vs	Player2(Runs + Other)
Player1(Sets + Runs + Other)	vs	Player2(Sets + Other)
Player1(Sets + Runs + Other)	vs	Player2(Sets + Runs)

Task 15: Discarding Heuristic

A simple heuristic to stop the opponent from discarding a card which can be played as a move will be added to the rule base.

Task 16: Drawing Heuristic

A heuristic will be added to allow the opponent to see if it can use any cards in the discard pile, draw from the discard pile if that is the case, and use the card in the move.

Task 17: Drawing Heuristic 2

One of the other heuristics is to check how many cards your opponent has before taking from the discard pile. If you're opponent has a low amount of cards, then you should not pick from the discard pile, unless the desired card is near the top of the discard pile. If the opponent has a moderate to high number of cards, pick from the discard pile.

Task 18: Move Heuristic

This heuristic will try to find the highest scoring move in the computer opponent's hand and allow for multiple moves to be made if possible.

Task 19: Discard Statistics (If time)

A lot of heuristics have been used to benefit the computer opponent. Now it is time to use some statistics to benefit it as well. The probability of an opponent being able to use your card in a move after it is discarded will be calculated. There are two types of moves in rummy so the statistics that the User has all of the cards necessary to create an original move with it have to be calculated for each card in the computer opponent's hand.

Task 20: Write the User Interface (If time)

This may be split up into multiple tasks over time. The user interface will be text based and print out the user's hand, the moves that have been played, the discard pile, and the user's and opponent's scores.