CPSC 490 Project Proposal

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Game Description

Background

Rummikub is a turn-based game of imperfect information played by 2-4 people. The game state consists of the players' *hands*, private to each player, the *board*, the public tiles previously played, and the *pool* of unknown tiles. There are 2 sets of tiles numbered from 1 to 13 and in four different colors: red, blue, yellow, and black. There are also two joker tiles bringing the total to 106 tiles.

Gameplay

Players are initially dealt a hand of 14 random tiles from the pool. In the starting phase, each player can either draw a tile from the pool or perform an *opening move* by placing tiles on the board in one or more *sets* that total to at least 30 points. There are two types of valid sets:

1. A *group* is a set of three or four tiles of the same number in uniquely different colors
2. A *run* is a set of three or more consecutive, strictly increasing, numbers all in the same color.

After this opening move, players can draw a tile (if any remain in the pool), place tiles on the board, or rearrange tiles on the board. At the end of a player's turn, the board must be composed of valid groups and/or runs, meaning that a player cannot perform a placement or a rearrangement that leaves the board in an invalid state.

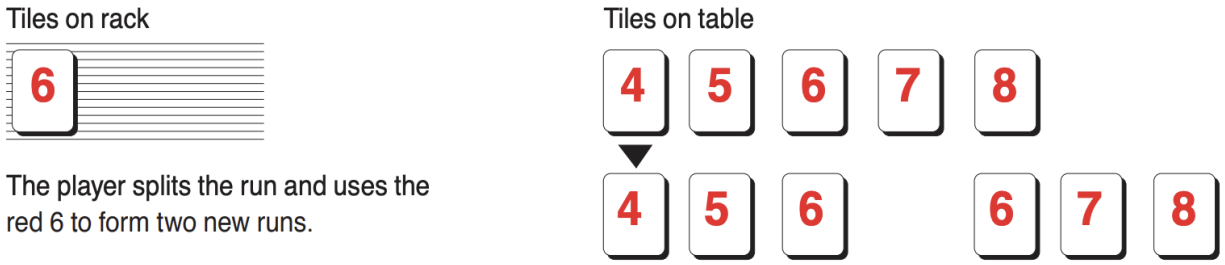
Jokers

There are 2 special tiles known as the jokers. Each joker can be used as any combination of number and color when initially placed on the board. On future turns, a joker can be retrieved from a set on the table by a player who can replace it during their turn with any tiles that keeps the set valid. After retrieving the joker (clearing the joker), its color and value reset and must be used on the current turn. Retrieving the joker is considered a rearrangement, and can only be done after a player's opening move.

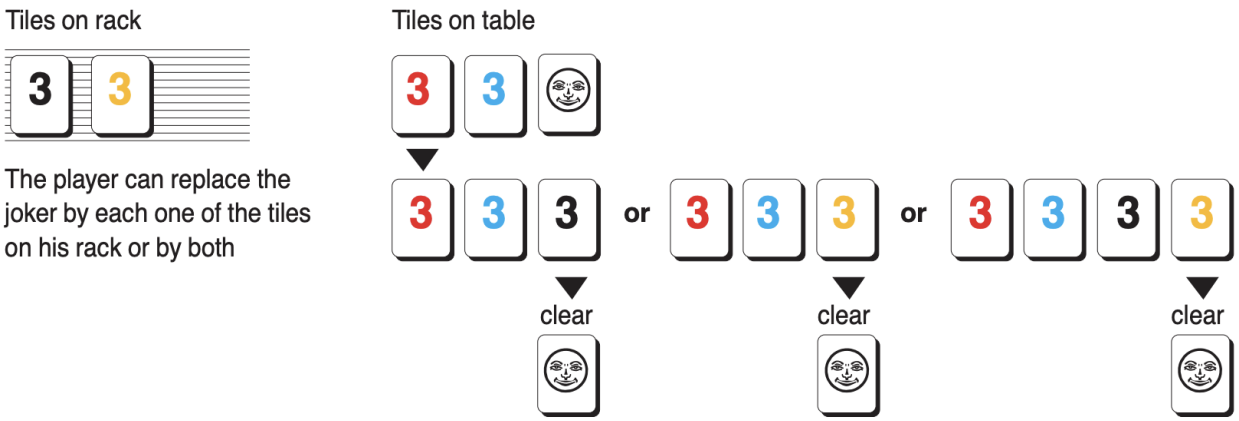
Examples

1. Opening move

2. Rearrangement



3. Replacing a joker



Scoring

The game ends when a player has no more tiles or there are no more tiles in the pool, and no more plays can be made. The score of each player is calculated by summing up the number of each remaining tile in the player's hand, where a joker counts as 30 points. The objective is to have the smallest total score, played over several games.

Project Description

Here I present an alternative game called Dummykub. Dummykub is identical to Rummikub except that there are two players, tiles are numbered from one to seven, there are three colors, opening move constraint will be reduced, and no jokers. I will use the Monte Carlo Counterfactual Regret Minimization

(MCCFR) method and compare it to a greedy agent, which picks the move that removes the greatest score from the agent's hand, and a heuristic-based agent, which tries to strategically hold tiles.

Deliverables

1. Study MCCFR material and similar approaches
2. Develop working code for Dummykub game and rules
3. Code greedy algorithm and a basic heuristic for strategically holding tiles
4. Implement MCCFR for Dummykub
5. If time permits, work on multiplayer Dummykub
6. Final report writeup and project poster