COMP10001 Foundations of Computing
Semester 1, 2020
Project 2 Game Description

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1 Game Description

In this project, you will implement a program that plays a game called "Comp10001-huxxy",[1] which is a variant of Rummy and based around multiples of 6, hence the very cheesy name. Why a variant? Because Tim can *never* help himself ... or more seriously, because Tim wanted to come up with a version that was more compatible with a computational implementation (e.g. not too long, and suitably algorithmically complex, esp. if you get carried away with strategy).

We will play Comp10001-huxxy with two standard packs of 52 cards. Each card has a "suit" (Spades, Clubs, Hearts, Diamonds) as well as a "value" (numbers 2 to 10, as well as Jack, Queen, King and Ace). For the purposes of this game, Aces are considered to have value 1, Jacks 11, Queens 12, and Kings 13. The game makes strong use of the notion of the "colour" of a card, where Spades and Clubs are black, and Hearts and Diamonds are red.

We will refer to the cards by way of a two-character string, made up of the value (`'A234567890JQK'`, where `'A'` refers to an Ace, `'0'` a 10, `'J'` a Jack, `'Q'` a Queen, and `'K'` a King) and suit (`'SHDC'`, indicating Spades, Hearts, Diamonds, and Clubs, respectively). For example, `'0C'` is the 10 of Clubs, and `'AS'` is the Ace of Spades.

2 The Rules of Comp10001-huxxy

2.1 Overview

Comp10001-huxxy is a 4-player game, where the objective is to be the first player to get rid of all your cards.

The primary components of the game are:

- a "hand" of 1 or more cards, from which cards are selected to play to the table;

- a "stock" of cards that players draw from when they are unable to (or choose not to) play cards from their hand.

- a "table", made up of groups of cards (either *N*-of-a-kind groups or runs; see below for details)

Note that a player's hand is not revealed to other players, and the contents of the stock are hidden from all players, in that the stock cards are turned face-down throughout the game.

A single turn proceeds as follows. Each player either picks up a single card from the stock, or alternatively performs a series of plays of card(s) from their hand to the table to form groups and movements of cards already on the table between groups.

Play continues until a player has played all cards from their hand, or the stock is exhausted.

2.2 Starting a Game

At the start of a new game, the combined deck of 104 cards is shuffled, and each player is dealt 12 cards. The remaining cards are placed face down in the middle of the table and form the "stock".

The sequence of players is fixed throughout the game, and play proceeds clockwise.

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[1]A play on "hex" and "rummy"; alternative names which were vetoed at various levels include "Comp10001-hexxy", "Comp10001-hummy", and "Comp10001-timmy".

2.3   An Individual Turn

A single turn consists of either:

- selecting the single top card from the stock, and adding it to the player's hand; OR

- playing at least one card from the player's hand to a group on the table (including the possibility of starting a new group), and up to another 5 plays, either in the form of other cards played to the table, or individual cards moved between groups (see below for details); importantly, in a "table" turn, the first play must be from the player's hand to the table, and each play of a single card from the hand or move of a single card between groups on the table constitutes a single play (i.e. up to six cards in total can be moved in a turn, with at least one of those to be a card from the player's hand).

2.4   Opening Turn

The first time each player plays to the table is called an "opening turn", in which cards of at least 24 points in face value must be played to the table to form groups (possibly building off groups already on the table, and possibly in the form of new group(s)). For example, playing three Eights (or any 3-of-a-kind of higher face value) constitutes an opening turn, whereas playing a run of four cards from Two to Five (e.g. `['2C', '3H', '4S', '5H']` = combined face value of 14) does not. Note that on completion of the turn, all groups must form valid N-of-a-kind groups or runs, but that during the turn, it is possible that the table state is not valid (e.g. because of placing a single card to start a new group).

Once a player has completed their opening turn, in subsequent turns, they can build on and rearrange existing groups, and there is no constraint on the minimum value of the cards they can play (but they must play at least one card to the table if they are not picking up from the stock). Note that each player must complete their own opening turn in order to be able to play to the table.

2.5   Table Groups

A group on the table can take one of two forms:

- a "run" of three or more cards, where the values of the cards form a continuous sequence in terms of value (e.g. 6, 7, 8, 9), and alternate in colour (e.g. red, black, red, black); note that runs cannot wrap around from King back to Ace;

- an N-of-a-kind group of three or more cards, all of the same value; if there are four or less cards, all cards must be of different suits (noting that the game is played with two decks of cards, meaning that two of every card are in play), and if there are more than four cards, all suits must be present.

The importance of moving tabled cards between groups becomes evident once a number of groups are on the table. For example, if there were a run of `['2C', '3H', '4S', '5H']` and the player held a `'4C'` and `'3D'`, they could remove the `'2C'` to start a new group, and place the two cards from their hand to make the new run `['2C', '3D', '4C']`, leaving three cards in the original run as a second (smaller but still valid) run (`['3H', '4S', '5H']`.[2] Remember, however, that at least one card must always be played from the hand, the maximum number of plays in a turn is six, and the configuration of the groups at the end of the turn must be valid (i.e. they must all be valid runs or N-of-a-kind groups).

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[2]Or alternatively, remove `'4S'` and `'5H'` from the original run to make a new group, and add `'4C'` to the original run to make `['2C', '3H', '4C']`, and `'3D'` to the new group to make the run `['3D', '4S', '5H']`.

2.6 The End of the Game

The game ends when a player exhausts their hand, in which case the ranking of players is determined in increasing order of the total face value of cards in their hand (with the player who exhausted their hand getting a score of 0). Alternatively, if no player is able to play all their cards but the stock is exhausted, the game ends, and again, the ranking of players is determined by the total face value of the cards in their hand.

3 Bonus Version of Game

The bonus version of the game (as used in the bonus question) has the following additional element:

- 2 Jokers (represented as `'XX'`) are added to the pack of cards;

- Jokers act as wild cards (i.e. they take on the value/suit of any non-Joker card) when they are played to a group on the table; as long as there is at least one card that the Joker can represent to form a valid group, the exact value of the Joker can remain indeterminate. For example, if the case of the group `['2C', '3H', 'XX']`, the Joker could be any of `'AH'`,`'AD'`,`'4S'`,`'4C'`, to form a valid run; and for `['3C', '3H', 'XX']`, the Joker could be either `'3D'` or `'3S'` . The only constraint here is that there can be at most one instance of the card the Joker represents in that group (the only practical upshot of which is that a Joker can't be played on an 8-of-a-kind group to make a 9-of-a-kind!);

- For the purposes of scoring an opening turn, Jokers score 0 points (i.e. they can be played, but do not contribute to the 24 point threshold for cards played from the hand);

- Jokers may be moved from one group to another as per usual (potentially changing the card(s) they represent in the process), but the usual requirement on the validity of the table state at the end of the turn holds; in practice, this means that in order to "free up" a Joker from one group where the Joker is required for the group to be valid (e.g. for a run such as `['2C', '4S', '5H', 'XX']` the group is invalidated if the Joker is removed, whereas in the case of `['3H', '4S', '5H', 'XX']` the Joker can be removed without invalidating the group), a card must be added to that group which instantiates a card type required for the group to be valid (e.g. in the case of the first run, `'3H'` or `'3D'`);

- Only one Joker may be played to a given group;

- Jokers are scored as 48 points if they are left in the hand at the end of play.