— VERSION: 914, DATE: MAY 9, 2016 —

1 Game Description

In this project, you will implement a program that plays a game called Oh Hell! ... or actually a variant thereof dreamed up by Tim, because he can't help himself (and which he'd like to call Oh Tim! if he's honest with himself). Your solution to each component of the project should take the form of a function, with function name and behaviour as defined below. All of your code should be written exclusively in Python3 and contained within a single file. The code should run successfully to completion within IDLE. The file should be named as follows:

```
program.py
```

We will play Oh Hell! with a standard deck of 52 cards. Each card has a suit (Spades, Clubs, Hearts, Diamonds) as well as a face value (numbers 2 to 10, as well as Jack, Queen, King and Ace).

2 The Rules of Oh Hell!

2.1 Overview

Oh Hell! is a 4-player trick-winning game played over a total of 19 "phases", where at the start of each phase, each player simultaneously predicts how many tricks they will win in that phase, and wins points primarily for achieving that target (and secondarily for each trick that they win). Each player is dealt N cards at the start of each phase, where N varies across phases, starting with $N = 1$ in phase one, and increasing by one up to phase 10 (where $N = 10$), and then decreasing by one to phase 19 (the final phase, where $N = 1$ once again). In phase 5, for example, players are each dealt 5 cards ($N = 5$), and in phase 17, players are dealt 3 cards ($N = 3$). After the cards are dealt for a given phase, the next card in the deck is turned up, to determine "trumps" for that phase (see below). Each player can then view their own hand (with the exceptions of phases 1 and 19 — see below), and individually determine their "bid" on the basis of the composition of the hand, the identity of the trump suit, and knowledge of which player has the "lead" for the first trick. A bid takes the form of the number of "tricks" the player predicts they will win in that phase (from 0 up to N). Once all players have confirmed that they have determined their bid, they simultaneously reveal their bid through a show of fingers on a count of three. The bids are then tabulated, and play commences. On completion of play, the score for the phase is determined based on the number of tricks the player wins, plus a 10 point bonus in the instance that they made their bid. Scores are tallied up over the 19 phases, and the player with the highest overall score wins the game.

The full details of the deal, bidding process, and rules for each trick are outlined in the following sections.

2.2 The Deal

The sequence of play is fixed throughout the game (based on clockwise sequence between the players), but the dealing of cards for each phase rotates between players (also clockwise, by one player per phase), and the lead player for each phase also rotates, with the player to the left of the dealer leading. All cards played in a given phase, along with the turned-up card on top of the deck, are placed in a discard pile at the end of each phase, which accumulates across phases until the deck has been exhausted, at which point the discard pile is reshuffled to form the new deck.

2.3 Bidding

Bidding is done after all cards have been dealt for the phase and trumps have been determined via the card on top of the deck. Players always have access to the trump suit, and for phases 2–18, they are allowed to view their own cards in forming their bid. In phases 1 and 19 (when all players have one card only), players pick up their downturned card and place it on their forehead without looking at it, so they can see every other player's card, but not their own. Based on this information, they determine their bid. In phases 4, 8, 12 and 16, a forced bid takes placed, whereby all players automatically receive a bid of $\frac{N}{4}$ (i.e. the optimal outcome is for all players to win the same number of tricks); for example, in phase 12, all players receive a bid of 2. Similarly, in phase 10, all players receive a forced bid, but of 0 (i.e. everyone is playing to lose every trick). For all other phases (1–3, 5–7, 9, 11, 13–15, 17–19), players can self-determine their bid, and must declare it simultaneously via a show of (0 to 10) fingers on a count of three. The bid for each player is noted, for use in scoring at the end of the phase.

2.4 Rules for each trick

For the first trick in the phase, the player to the left of the dealer leads, and for all subsequent tricks, the player who won the preceding trick leads. The lead player can play whatever (single) card they want, and the other plays then play in sequence (clockwise). Players must follow suit if they hold a card of that suit, but if not, can play whatever suit they want, including trumps. Aces (`'A'`) have the highest value; the value of the cards in descending order is: `AKQJ098765432`. For a given trick, the winning card is the highest trump card, or if no trumps were played, the card of the highest value in the suit that was led.

2.5 Scoring each phase

At the end of each phase, the score is determined as follows:

- the player receives a score based on the number of tricks they won

- if the bid is "made" (i.e. the number of tricks won is the exact same as the number of tricks that was bid at the start of the phase), the player receives 10 bonus points

For example, if a player bids and makes 2 tricks, they receive a score of $2 + 10 = 12$ for that phase, whereas if they bid 3 tricks but made 4, they receive a score of 4.

We will play Oh Hell! over 19 phases, and determine the winner of the game on the basis of the cumulative score over the 19 phases.

2.6 Glossary

- **bid:** the number of tricks a player predicts they will win in a given game

- **lead:** the player who plays the first card in a given trick

- **phase:** a sequence of tricks associated with a given deal of cards (as defined by the number of cards dealt in that phase, e.g. phase 3 is made up of three tricks)

- **trick:** a single "round" of four cards (one player per card), which a unique player is designated the winner of, based on the cards player and the rules of the game in question