**Object-Oriented Programming Using Python**

SOUTHERN METHODIST UNIVERSITY
MS Data Science

Video Poker Project #1

This project involves designing and implementing a video poker game using object oriented principles and the Python language. The diagram below illustrates the components of a GUI interface for such a game. For purposes of this project a simple console-based user interface shall be used.
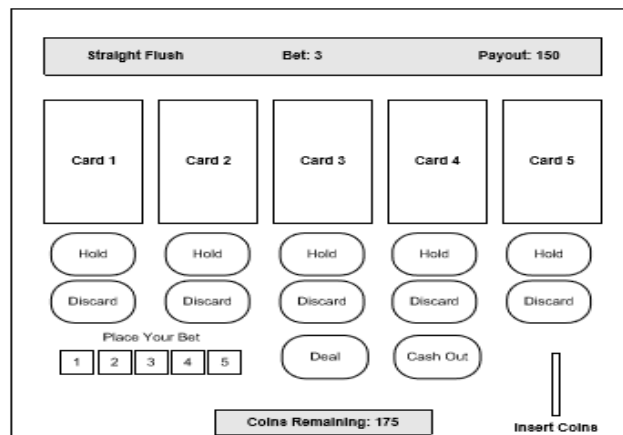
The Basic Game Mechanics

Our game will simulate a single hand of five-card stud poker. The basic rules and mechanics of the game are as follows:

- A player deposits an arbitrary number of coins into the machine. Each coin has equal value. The number of coins deposited is the player's bankroll.
- The player makes a bet of one to five coins (but not more than the bankroll).
- A hand of five cards is dealt from a deck of 52 cards. The deck is reshuffled before each game.
- After viewing his/her hand, the player decides which cards he/she would like to keep and which cards he/she would like to replace.
- New cards are dealt for those the player has discarded.
- The hand is evaluated and scored.
- If the hand is a winner, a payout amount is added to the bankroll. Otherwise, the bet amount is deducted from the bankroll.
- The player can quit and cash out at any time.
- The player can continue to play as long as the bankroll is not depleted.
- The player can add coins to the bankroll before each game.

Scoring the Game

A deck of cards consists of 52 different cards. Each card has a rank or value as well as a suit (hearts, diamonds, spades, and clubs). The ordered ranks are as follows:

Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King

The winning hands, listed in highest to lowest precedence, are as follows:

- **Royal Flush**: 10, Jack, King, Queen, Ace, all of the same suit. Pays 250 to 1. For example, if a player bets one coin and is dealt a royal flush, then the player wins 250 coins.
- **Straight Flush**: Five cards in rank sequence, all of the same suit, but not a royal flush. For example, Ace, 2, 3, 4, 5 all hearts. Pays 50 to 1.
- **Four of a Kind**: For cards of the same rank. For example, 3 of hearts, 3 of diamonds, 3 of spades, and 10 of clubs. Pays 25 to 1.
- **Full House**: Three cards of one rank and two of another. For example, 4 of hearts, 4 of spades, 4 of clubs, 7 of clubs, 7 of diamonds. Pays 9 to 1.
- **Flush**: All five cards of the same suit, but not a straight flush. For example, 3 of hearts, 6 of hearts, 7 of hearts, 10 of hearts, Jack of hearts. Pays 6 to 1.
- **Straight**: Five cards in rank sequence, but not a flush. For example, Ace of hearts, 2 of spades, 3 of hearts, 4 of clubs, and 5 of diamonds. Pays 4 to 1.
- **Three of a Kind**: Three cards of the same rank and two cards of two other ranks that is not a full house or four of a kind. For example, 5 of hearts, 5 of clubs, 5 of spades, 7 of clubs, 9 of diamonds. Pays 3 to 1.
- **Two Pair**: Two cards of one rank, two of another and one card of a third. For example, 6 of hearts, 6 of clubs, 9 of clubs, 9 of spades, Ace of hearts. Pays 2 to 1.
- **Jacks or Better**: Exactly one pair of Jacks, Queens, Kings, or Aces, and nothing else of interest. For example, Jack of hearts, Jack of clubs, 2 of spades, 3 of clubs, 3 of hearts. Pays 1 to 1.

Project Deliverables

- A class diagram
- All source code
- A screen capture illustrating the results of a single hand

Put all deliverables in a single zip file named (assuming your name is Jane Smith) as follows: project1_jsmith.zip.

You will be graded based upon the clarity & correctness of your design and code, proper use of object-oriented design and coding principles, understandability of your solution. Be sure to follow the style guidelines we developed in class.

This project will require you to write your Python code implementation using strong Pythonic data structures such as filters, maps, dictionaries, sets, list comprehension, and lambda. This will help get more comfortable with the Pythonic data structures.

Online documentation on the Pythonic Data Structures
- http://www.u.arizona.edu/~erdmann/mse350/topics/list_comprehensions.html
- https://www.python-course.eu/list_comprehension.php
- http://www.secnetix.de/olli/Python/list_comprehensions.hawk
- https://docs.quantifiedcode.com/python-anti-patterns/readability/using_map_or_filter_where_list_comprehension_is_possible.html
- http://interactivepython.org/runestone/static/pip/Sequences/listcomprehensions.html
- http://treyhunner.com/2015/12/python-list-comprehensions-now-in-color/
- https://caisbalderas.com/blog/iterating-with-python-lambdas/

Rank	Name	Example		Rank	Name	Example
0	Five of a kind*		6	Three of a kind	
1	Straight flush**		7	Two pair	
2	Four of a kind		8	One pair	
3	Full house		9	High card	
4	Flush**				
5	Straight**				
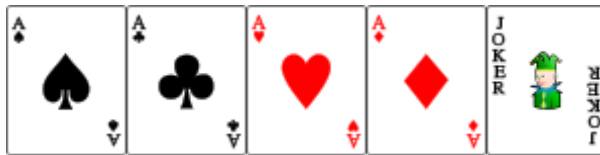
Five of a kind

Five of a kind, aces

Five of a kind is a poker hand containing five cards of the same rank, such as 3♥ 3♦ 3♣ 3♠ 3 ("five of a kind, threes"). It ranks above a straight flush but is only possible when using one or more wild cards, as there are only four cards of each rank in a standard 52-card deck. A five of a kind becomes possible when a joker is added to the deck as a bug, a form of wild card that may either act as a fifth ace or be used to complete any straight, flush or straight flush. Under these rules, the only possible five of a kind is five aces, A♥ A♦ A♣ A♠ Joker. Other wild card rules allow jokers or other designated wild cards to represent any card in the deck, enabling the formation of five of a kind of any rank.

Each five of a kind is ranked by the rank of its quintuplet. For example, Q♠ Q♥ Q♣ Q♦ Q ranks higher than 6♣ 6♠ 6♦ 6♥ 6.

Straight flush

"Straight flush" redirects here. For other uses, see Straight flush (disambiguation).
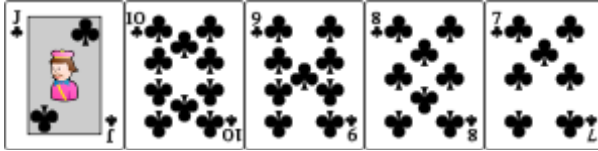
A jack-high straight flush

A **straight flush** is a poker hand containing five cards of sequential rank, all of the same suit, such as Q♥ J♥ 10♥ 9♥ 8♥ (a "queen-high straight flush"). It ranks below five of a kind and above four of a kind. As part of a straight flush, an ace can rank either above a king or below a two, depending on the rules of the game. Under high rules, an ace can rank either high (e.g. A♥ K♥ Q♥ J♥ 10♥ is an ace-high straight flush) or low (e.g. 5♦ 4♦ 3♦ 2♦ A♦ is a five-high straight flush), but cannot rank both high and low in the same hand (e.g. Q♣ K♣ A♣ 2♣ 3♣ is an ace-high flush, not a straight flush). Under deuce-to-seven low rules, aces can only rank high, so a hand such as 5♠ 4♠ 3♠ 2♠ A♠ is actually an ace-high flush. Under ace-to-six low rules, aces can only rank low, so a hand such as A♥ K♥ Q♥ J♥ 10♥ is actually a king-high flush. Under ace-to-five low rules, straight flushes are not recognized, and a hand that would be categorized as a straight flush is instead a high card hand.

There are 40 possible straight flush hands and 10 distinct ranks of straight flush under high rules when using a standard 52-card deck. Each straight flush is ranked by the rank of its highest-ranking card. For example, 10♣ 9♣ 8♣ 7♣ 6♣ ranks higher than 8♥ 7♥ 6♥ 5♥ 4♥, which ranks higher than 6♠ 5♠ 4♠ 3♠ 2♠. Straight flush hands that differ by suit alone, such as 7♦ 6♦ 5♦ 4♦ 3♦ and 7♠ 6♠ 5♠ 4♠ 3♠, are of equal rank.

An ace-high straight flush, such as A♦ K♦ Q♦ J♦ 10♦, is commonly known as a *royal flush* or *royal straight flush* and is the best possible hand in high games when not using wild cards. A five-high straight flush, such as 5♥ 4♥ 3♥ 2♥ A♥, is called a *steel wheel* and is significant in ace-to-five high-low split games for being both the best low hand *and* usually the best high hand of the showdown.

Four of a kind

Four of a kind, fives

Four of a kind, also known as **quads**, is a poker hand containing four cards of the same rank and one card of another rank (the kicker), such as 9♣ 9♠ 9♦ 9♥ J♥ ("four of a kind, nines"). It ranks below a straight flush and above a full house.

There are 624 possible four of a kind hand's and 156 distinct ranks of four of a kind when using a standard 52-card deck. Each four of a kind is ranked first by the rank of its quadruplet, and then by the rank of its kicker. For example, K♠ K♥ K♣ K♦ 3♥ ranks higher than 7♥ 7♦ 7♠ 7♣ Q♥, which ranks higher than 7♥ 7♦ 7♠ 7♣ 10♠. Four of a kind hands that differ by suit alone, such as 4♣ 4♠ 4♦ 4♥ 9♣ and 4♣ 4♠ 4♦ 4♥ 9♦, are of equal rank.

Full house
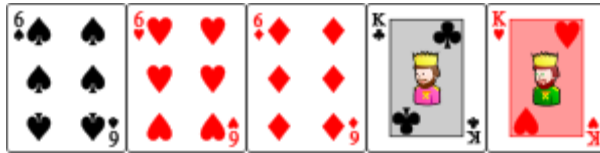
A full house, sixes over kings

A **full house**, also known as a **full boat** or **tight** (and originally called a **full hand**), is a poker hand containing three cards of one rank and two cards of another rank, such as 3♣ 3♠ 3♦ 6♣ 6♥ (a "full house, threes over sixes" or "threes full of sixes" or "threes full"). It ranks below four of a kind and above a flush.

There are 3,744 possible full house hands and 156 distinct ranks of full house when using a standard 52-card deck. Each full house is ranked first by the rank of its triplet, and then by the rank of its pair. For example, 8♠ 8♦ 8♥ 7♦ 7♣ ranks higher than 4♦ 4♠ 4♣ 9♦ 9♣, which ranks higher than 4♦ 4♠ 4♣ 5♣ 5♦. Full house hands that differ by suit alone, such as K♣ K♠ K♦ J♣ J♠ and K♣ K♥ K♦ J♣ J♥, are of equal rank.

Flush
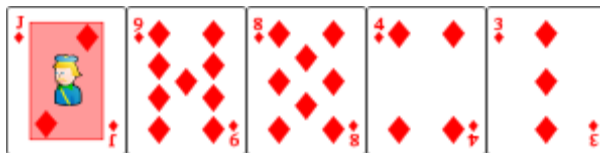

A jack-high flush

A **flush** is a poker hand containing five cards all of the same suit, not all of sequential rank, such as K♣ 10♣ 7♣ 6♣ 4♣ (a "king-high flush" or "king-ten-high flush"). It ranks below a full house and above a straight. Under ace-to-five low rules, flushes are not recognized, and a hand that would be categorized as a flush is instead a high card hand.

There are 5,108 possible flush hands and 1,277 distinct ranks of flush under high rules when using a standard 52-card deck. Each flush is ranked first by the rank of its highest-ranking card, then by the rank of its second highest-ranking card, then by the rank of its third highest-ranking card, then by the rank of its fourth highest-ranking card, and finally by the rank of its lowest-ranking card. For example, K♦ J♦ 9♦ 6♦ 4♦ ranks higher than Q♣ J♣ 7♣ 6♣ 5♣, which ranks higher than J♥ 10♥ 9♥ 4♥ 2♥, which ranks higher than J♠ 10♠ 8♠ 6♠ 3♠, which ranks higher than J♥ 10♥ 8♥ 4♥ 3♥, which ranks higher than J♣ 10♣ 8♣ 4♣ 2♣. Flush hands that differ by suit alone, such as 10♦ 8♦ 7♦ 6♦ 5♦ and 10♠ 8♠ 7♠ 6♠ 5♠, are of equal rank.

Straight
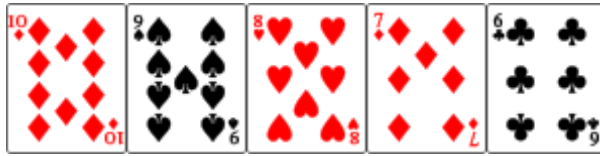
A ten-high straight

A **straight** is a poker hand containing five cards of sequential rank, not all of the same suit, such as 7♣ 6♠ 5♠ 4♥ 3♥ (a "seven-high straight"). It ranks below a flush and above three of a kind. As part of a straight, an ace can rank either above a king or below a two, depending on the rules of the game. Under high rules, an ace can rank either high (e.g. A♦ K♣ Q♣ J♦ 10♠ is an ace-high straight) or low (e.g. 5♣ 4♦ 3♥ 2♥ A♠ is a five-high straight), but the ace cannot rank both high and low in the same hand (e.g. Q♠ K♠ A♣ 2♥ 3♦ is an ace-high high-card hand, not a straight). Under deuce-to-seven low rules, aces can only rank high, so a hand such as 5♥ 4♠ 3♥ 2♣ A♦ is actually an ace-high high-card hand. Under ace-to-six low rules, aces can only rank low, so a hand such as A♣ K♠ Q♠ J♦ 10♠ is actually a king-high high-card hand. Under ace-to-five low rules, straights are not recognized, and a hand that would be categorized as a straight is instead a high-card hand.

There are 10,200 possible straight hands and 10 distinct ranks of straight under high rules when using a standard 52-card deck. Each straight is ranked by the rank of its highest-ranking card. For example, J♥ 10♥ 9♣ 8♠ 7♥ ranks higher than 10♠ 9♠ 8♣ 7♥ 6♠, which ranks higher than 6♣ 5♠ 4♥ 3♠ 2♦. Straight hands that differ by suit alone, such as 9♣ 8♣ 7♣ 6♦ 5♦ and 9♠ 8♠ 7♠ 6♥ 5♥, are of equal rank.

An ace-high straight, such as A♣ K♣ Q♦ J♠ 10♠, is otherwise known as a *broadway straight*, while a five-high straight, such as 5♠ 4♦ 3♦ 2♠ A♥, is otherwise known as a *baby straight*, *bicycle* or *wheel* and is the best possible hand in ace-to-five low games, where it is instead categorized as a high card hand.

Three of a kind

Three of a kind, queens

Three of a kind, also known as **trips** or a **set**, is a poker hand containing three cards of the same rank and two cards of two other ranks (the kickers), such as 2♦ 2♠ 2♣ K♠ 6♥ ("three of a kind, twos" or "trip twos" or a "set of twos"). It ranks below a straight and above two pair.

There are 54,912 possible three of a kind hands and 858 distinct ranks of three of a kind when using a standard 52-card deck. Each three of a kind is ranked first by the rank of its triplet, then by the rank of its highest-ranking kicker, and finally by the rank of its lowest-ranking kicker. For

example, 6♥ 6♦ 6♠ Q♣ 4♠ ranks higher than 3♦ 3♠ 3♣ K♠ 2♠, which ranks higher than 3♦ 3♠ 3♣ J♣ 7♥, which ranks higher than 3♦ 3♠ 3♣ J♠ 5♦. Three of a kind hands that differ by suit alone, such as 9♠ 9♥ 9♦ 10♦ 8♥ and 9♣ 9♠ 9♥ 10♦ 8♦, are of equal rank.

In [community card](#) games, such as Texas hold 'em, three of a kind is called a *set* only when it comprises a [pocket pair](#) and a third card on the [board](#).

Two pair
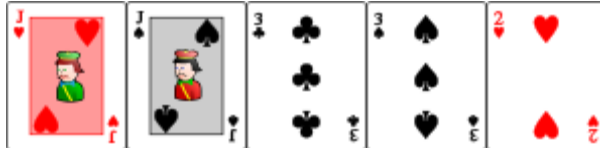
Two pair, jacks and threes

Two pair is a poker hand containing two cards of the same rank, two cards of another rank and one card of a third rank (the kicker), such as J♥ J♣ 4♣ 4♠ 9♥ ("two pair, jacks and fours" or "two pair, jacks over fours" or "jacks up"). It ranks below three of a kind and above one pair.

There are 123,552 possible two pair hands and 858 distinct ranks of two pair when using a standard 52-card deck. Each two pair is ranked first by the rank of its highest-ranking pair, then by the rank of its lowest-ranking pair, and finally by the rank of its kicker. For example, 10♦ 10♠ 2♠ 2♣ K♣ ranks higher than 5♣ 5♠ 4♦ 4♥ 10♥, which ranks higher than 5♣ 5♠ 3♣ 3♦ Q♠, which ranks higher than 5♣ 5♠ 3♣ 3♦ J♠. Two pair hands that differ by suit alone, such as K♦ K♠ 7♦ 7♥ 8♥ and K♣ K♠ 7♣ 7♥ 8♣, are of equal rank.

One pair

One pair, tens

One pair, or simply a **pair**, is a poker hand containing two cards of the same rank and three cards of three other ranks (the kickers), such as 4♥ 4♠ K♠ 10♦ 5♠ ("one pair, fours" or a "pair of fours"). It ranks below two pair and above high card.

There are 1,098,240 possible one pair hands and 2,860 distinct ranks of one pair when using a standard 52-card deck. Each one pair is ranked first by the rank of its pair, then by the rank of its highest-ranking kicker, then by the rank of its second highest-ranking kicker, and finally by the rank of its lowest-ranking kicker. For example, 9♣ 9♦ Q♠ J♥ 5♥ ranks higher than 6♦ 6♥ K♠ 7♥ 4♣, which ranks higher than 6♦ 6♥ Q♥ J♠ 2♣, which ranks higher than 6♦ 6♥ Q♠ 8♣ 7♦, which ranks higher than 6♦ 6♥ Q♦ 8♥ 3♠. One pair hands that differ by suit alone, such as 8♠ 8♦ 10♥ 6♣ 5♠ and 8♥ 8♣ 10♣ 6♠ 5♣, are of equal rank.

High card
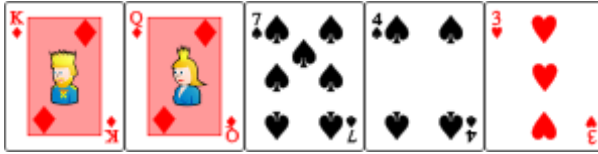
High card, king

High card, also known as **no pair** or simply *nothing*, is a poker hand containing five cards not all of sequential rank or of the same suit, and none of which are of the same rank, such as K♥ J♥ 8♣ 7♦ 4♠ ("high card, king" or "king-jack-high" or "king-high"). Under ace-to-five low rules, where straights, flushes and straight flushes are not recognized, hands that would fall into these categories are also high card hands. It ranks below one pair.

There are 1,302,540 possible high cards hands and 1,277 distinct ranks of high card hand under high rules when using a standard 52-card deck. Each high card hand is ranked first by the rank of its highest-ranking card, then by the rank of its second highest-ranking card, then by the rank of its third highest-ranking card, then by the rank of its fourth highest-ranking card, and finally by the rank of its lowest-ranking card. For example, K♠ 6♣ 5♥ 3♦ 2♣ ranks higher than Q♠ J♦ 6♣ 5♥ 3♣, which ranks higher than Q♠ 10♦ 8♣ 7♦ 4♠, which ranks higher than Q♥ 10♥ 7♣ 6♥ 4♠, which ranks higher than Q♣ 10♣ 7♦ 5♣ 4♦, which ranks higher than Q♥ 10♦ 7♠ 5♠ 2♥. High card hands that differ by suit alone, such as 10♣ 8♠ 7♠ 6♥ 4♦ and 10♦ 8♦ 7♠ 6♣ 4♣, are of equal rank.

Under deuce-to-seven low rules, a seven-five-high hand, such as 7♠ 5♣ 4♦ 3♦ 2♣, is the best possible hand. Under ace-to-six low rules, where aces have the lowest rank, a six-four-high hand, such as 6♣ 4♠ 3♥ 2♥ A♦, is the best possible hand. Under ace-to-five low rules, where aces have the lowest rank *and* straights, flushes and straights are not recognized, a five-high hand, such as 5♣ 4♠ 3♥ 2♥ A♦ or 5♠ 4♠ 3♠ 2♠ A♠, commonly known as a *bicycle* or *wheel*, is the best possible hand.