Biplab Thapa Magar
OPL – Fall 2020

Manual for Pinochle for C++

Bug Report

No known bugs in program

Feature Report:

Missing features:

All features have been implemented

Extra features:

No extra features were implemented

Description of Data Structures/Classes:

Classes:

1. **Card**: Represents a card in a game of Pinochle. Each card is comprised of a rank (of enum type Rank), suit (of enum type suit), and id.
2. **Deck**: Represents the stack of 48 cards to be used for the game of Pinochle. It also acts as the stock pile once cards have been taken out of the deck and distributed. Consists of a vector of 48 card objects
3. **Game:** The Game class represents the game of Pinochle. It manages all the rounds in a game and keeps track of the overall game score
4. **Round:** The Round class represents a round in a game of Pinochle. It manages everything about a round, including saving and loading data from files to populate a round in a game. It makes use of Player objects, Card objects, and Deck objects. It handles the playing out of a round of Pinochle and mediates the game between the players.
5. **Serialization**: This class handles the conversion of string data from file into object data concerning the cards that each player possesses in their various card piles. It also handles converting the same object data into serialized data to store in a file. In doing this, it interprets and translates how game state is stored in the save file and in the program during gameplay. It makes use of GroupOfCards and MeldsStorage objects.
6. **Player:** Represents a player in a game of Pinochle. It also generates the logic for what card to play and what melds to play. This logic is used differently by its child classes. It has two child class: Human and Computer. Its composition includes MeldServices object and GroupOfCards object.

7. **Computer:** Represents the computer player in a game of Pinochle. It inherits from the Player class. It uses logic from Player class to play cards and melds during a game of Pinochle.

8. **Human:** Represents a human player (user) in a game of Pinochle. It handles prompting user for input on what cards to throw and what cards to play for meld. It inherits from the Player class. It also provided suggestions, using logic from the player class, to the user on what card/melds to play

9. **GroupOfCards:** Represents a group of cards, in any order, in a game of Pinochle. It handles retrieval and searching of cards in terms of various parameters. It has one child class: MeldInstance.

10. **MeldInstance:** Represents a group of cards that combine to create a meld. It is a child class of GroupOfCards. A meld instance can contain cards that do no combine to create a meld as well. However, the MeldInstance object marks itself as an invalid meld if that happens. This class self-contains the logic to validate whether a group of cards combine to create a meld or not. MeldInstance makes use of Card class objects.

11. **MeldsStorage:** Represents a group of MeldInstance objects. MeldsStorage stores MeldInstance objects by separating them based on meld types. A MeldsStorage object can be used to store the melds a player has played during a round.

12. **MeldServices:** This class encapsulates various services pertaining to melds. It is used especially by the Player class and its subclasses to help figure out what melds can be played and should be played. It also keeps track of the melds a player has played during a round. It uses a MeldsStorage object to store players' melds.

13. **StringUtilities:** This class encapsulates the various functionalities for cleaning, interpreting, parsing, and converting strings in the Pinochle program. It is a utility class whose functions are all static functions.

14. **PinochleException:** A class that inherits from the C++ exception class. This class represents an exception in the Pinochle program and has to do with exceptions pertaining especially to the game's logic.

Enums:

Rank : Ace, Ten, King, Queen, Jack, Nine
Suit: Clubs, Hearts, Diamonds, Spades
Meld: Flush, RoyalMarriage, Marriage, Dix, FourAces, FourKings, FourQueens, FourJacks, and Pinochle

How to Run
1) In terminal, navigate into the src directory
2) Enter "make" into the terminal and press enter
3) Enter "./pinochle" into the terminal to run the game of pinochle
4) Enter "make clean" into the terminal once you are done with the game

Screenshots

1. Starting a new game

```
● ● ●                    📁 src — pinochle — 119×38
[(base) biplabthapamagar@biplabs-mbp src % ./pinochle
Welcome to Pinochle!
Would you like to (1) start a new game or (2) load a previous game? Enter 1 or 2: 1
Starting round 1...

Let's begin the round.


Distributing cards:
Giving human four cards...
Giving computer four cards...
Giving human four cards...
Giving computer four cards...
Giving human four cards...
Giving computer four cards...
The trump card for this round is Jack of Hearts

Deciding who goes first based on a coin toss. Enter your prediction (heads/tails): █
```

2. Coin toss

```
● ● ●                    📁 src — pinochle — 119×38
The trump card for this round is Jack of Hearts

Deciding who goes first based on a coin toss. Enter your prediction (heads/tails): heads
The toss resulted in a tails.
Computer wins. The computer goes first.



--------------------------------------------------------------------------------------
Current Game Table:

Round: 1

Computer:
    Score: 0 / 0
    Hand: QH(0) KC(1) KH(2) JH(3) QH(4) QC(5) AD(6) AD(7) AC(8) XH(9) AS(10) 9S(11)
    Capture Pile:
    Melds:

Human:
    Score: 0 / 0
    Hand: KS(0) KH(1) 9S(2) 9D(3) AS(4) 9C(5) XC(6) KD(7) JD(8) XS(9) 9D(10) QD(11)
    Capture Pile:
    Melds:

Trump Card: JH
Stock: JC QC XH KC KS AC 9H AH XD 9H JC KD 9C JS XD XC XS JD QS QS QD JS AH

Next Player: Computer
--------------------------------------------------------------------------------------

It is the computer's turn to play a card. What would you like to do?

Pick an action:

1.  Ask computer to make a move
2.  Quit the game

█
```

3. Asking computer to make a move

```
●●●                         📁 src — pinochle — 119×38
Computer:
     Score: 0 / 0
     Hand: QH(0) KC(1) KH(2) JH(3) QH(4) QC(5) AD(6) AD(7) AC(8) XH(9) AS(10) 9S(11)
     Capture Pile:
     Melds:

Human:
     Score: 0 / 0
     Hand: KS(0) KH(1) 9S(2) 9D(3) AS(4) 9C(5) XC(6) KD(7) JD(8) XS(9) 9D(10) QD(11)
     Capture Pile:
     Melds:

Trump Card: JH
Stock: JC QC XH KC KS AC 9H AH XD 9H JC KD 9C JS XD XC XS JD QS QS QD JS AH

Next Player: Computer
--------------------------------------------------------------------------------------

It is the computer's turn to play a card. What would you like to do?

Pick an action:

1.  Ask computer to make a move
2.  Quit the game

1
The computer chose to play XH as its lead card because throwing this card would preserve the most favorable hand (meld-
wise) and it would increase the chance of winning because it is a trump card.
It is your turn to play a card. What would you like to do?

Pick an action:

1.  Make a move
2.  Ask for help
3.  Quit the game

▮
```

4. Asking for help throwing a card

```
●●●                         📁 src — pinochle — 119×38
Human:
     Score: 0 / 0
     Hand: KS(0) KH(1) 9S(2) 9D(3) AS(4) 9C(5) XC(6) KD(7) JD(8) XS(9) 9D(10) QD(11)
     Capture Pile:
     Melds:

Trump Card: JH
Stock: JC QC XH KC KS AC 9H AH XD 9H JC KD 9C JS XD XC XS JD QS QS QD JS AH

Next Player: Computer
--------------------------------------------------------------------------------------

It is the computer's turn to play a card. What would you like to do?

Pick an action:

1.  Ask computer to make a move
2.  Quit the game

1
The computer chose to play XH as its lead card because throwing this card would preserve the most favorable hand (meld-
wise) and it would increase the chance of winning because it is a trump card.
It is your turn to play a card. What would you like to do?

Pick an action:

1.  Make a move
2.  Ask for help
3.  Quit the game

2

Hint: I recomment that you present 9S(2) as your chase card because there is no way to win this turn, so throwing the l
east ranked card will increase chances of winning next turn.

Your opponent played XH as the lead card.
What card do you want to throw?
     Enter the card position (first card has position 0): ▮
```

5. Computer Winning a turn

```
•  •  •                     ▣ src — pinochle — 119×38

Next Player: Computer
------------------------------------------------------------------------------------------
It is the computer's turn to play a card. What would you like to do?

Pick an action:

1.  Ask computer to make a move
2.  Quit the game

1
The computer chose to play KH as its lead card because throwing this card would preserve the most favorable hand (meld-
wise) and it would increase the chance of winning because it is a trump card.
It is your turn to play a card. What would you like to do?

Pick an action:

1.  Make a move
2.  Ask for help
3.  Quit the game

1
Your opponent played KH as the lead card.
What card do you want to throw?
    Enter the card position (first card has position 0): 3
You chose to play AS as your chase card

Your chase card was beaten by the computer's lead card. You lose this turn.
The computer takes both cards for their capture pile.
The computer won 15 points.

Now, the winner creates a meld.
The computer won 20 points for playing a Marriage meld.

Winner of the round picks a card from the stock pile first.
The other players also picks a card from the stock pile.
Would you like to save your progress so far? (y/n): ▮
```

6. Human making a move

```
•  •  •                     ▣ src — pinochle — 119×38

It is the computer's turn to play a card. What would you like to do?

Pick an action:

1.  Ask computer to make a move
2.  Quit the game

1
The computer chose to play XH as its lead card because throwing this card would preserve the most favorable hand (meld-
wise) and it would increase the chance of winning because it is a trump card.
It is your turn to play a card. What would you like to do?

Pick an action:

1.  Make a move
2.  Ask for help
3.  Quit the game

2

Hint: I recomment that you present 9S(2) as your chase card because there is no way to win this turn, so throwing the l
east ranked card will increase chances of winning next turn.

Your opponent played XH as the lead card.
What card do you want to throw?
    Enter the card position (first card has position 0): 2
You chose to play 9S as your chase card

Your chase card was beaten by the computer's lead card. You lose this turn.
The computer takes both cards for their capture pile.
The computer won 10 points.

Now, the winner creates a meld.
The computer won 40 points for playing a Royal Marriage meld.

Winner of the round picks a card from the stock pile first.
The other players also picks a card from the stock pile.
Would you like to save your progress so far? (y/n): ▮
```

7. Asking for help for a meld

```
                           📁 src — pinochle — 119×38
Pick an action:

1.  Make a move
2.  Ask for help
3.  Quit the game

2

Hint: I recomment that you present KH(1) as your chase card because throwing a trump-suit card that is higher than but
still closest to the opponent's trump-suit card will be the least expensive winning move.

Your opponent played QH as the lead card.
What card do you want to throw?
    Enter the card position (first card has position 0): 1
You chose to play KH as your chase card

Your chase card has beaten the computer's lead card. You win this turn!
You take both cards for your capture pile.
You won 7 points.

Now, the winner creates a meld.
You won this turn, so you can create a meld.
Pick cards from your hand to create a meld:
-------------------------------------------------
Hand: KS(0) 9C(1) XC(2) KD(3) JD(4) XS(5) 9D(6) QD(7) QC(8) KC(9) AC(10)
Trump Suit: Hearts
Melds Played:
-------------------------------------------------

Pick an action:
1.      Play a meld
2.      Ask for help
2

Hint: I recomment that you present KD(3), and QD(7) to create a Marriage meld because playing this meld will yield the
highest possible points and will also ensure that the best melds are preserved for the next turn..

List out the positions (separated by spaces) of all the cards you would like to play for your meld: ▮
```

8. Human creating a meld

```
                           📁 src — pinochle — 119×38
2

Hint: I recomment that you present KH(1) as your chase card because throwing a trump-suit card that is higher than but
still closest to the opponent's trump-suit card will be the least expensive winning move.

Your opponent played QH as the lead card.
What card do you want to throw?
    Enter the card position (first card has position 0): 1
You chose to play KH as your chase card

Your chase card has beaten the computer's lead card. You win this turn!
You take both cards for your capture pile.
You won 7 points.

Now, the winner creates a meld.
You won this turn, so you can create a meld.
Pick cards from your hand to create a meld:
-------------------------------------------------
Hand: KS(0) 9C(1) XC(2) KD(3) JD(4) XS(5) 9D(6) QD(7) QC(8) KC(9) AC(10)
Trump Suit: Hearts
Melds Played:
-------------------------------------------------

Pick an action:
1.      Play a meld
2.      Ask for help
2

Hint: I recomment that you present KD(3), and QD(7) to create a Marriage meld because playing this meld will yield the
highest possible points and will also ensure that the best melds are preserved for the next turn..

List out the positions (separated by spaces) of all the cards you would like to play for your meld: 3 7
You played a Marriage for your meld.
You won 20 points for playing a Marriage meld.

Winner of the round picks a card from the stock pile first.
The other players also picks a card from the stock pile.
Would you like to save your progress so far? (y/n): ▮
```

9. Human winning a turn


```
1
The computer chose to play QH as its lead card because throwing this card would preserve the most favorable hand (meld-
wise) and it would increase the chance of winning because it is a trump card.
It is your turn to play a card. What would you like to do?

Pick an action:

1.  Make a move
2.  Ask for help
3.  Quit the game

2

Hint: I recomment that you present KH(1) as your chase card because throwing a trump-suit card that is higher than but
still closest to the opponent's trump-suit card will be the least expensive winning move.

Your opponent played QH as the lead card.
What card do you want to throw?
    Enter the card position (first card has position 0): 1
You chose to play KH as your chase card

Your chase card has beaten the computer's lead card. You win this turn!
You take both cards for your capture pile.
You won 7 points.

Now, the winner creates a meld.
You won this turn, so you can create a meld.
Pick cards from your hand to create a meld:
----------------------------------------------------
Hand: KS(0) 9C(1) XC(2) KD(3) JD(4) XS(5) 9D(6) QD(7) QC(8) KC(9) AC(10)
Trump Suit: Hearts
Melds Played:
----------------------------------------------------

Pick an action:
1.      Play a meld
2.      Ask for help
```

10. Asking if user wants to play another round


```
Your chase card was beaten by the computer's lead card. You lose this turn.
The computer takes both cards for their capture pile.
The computer won 7 points.

The winner of this turn does not have any cards in hand to create melds with. Moving on to the next turn...

No more cards left in stock. Play until hand cards are exhausted.
Would you like to save your progress so far? (y/n): n
Round ended.
You won this round!


Your score this round: 160
Computer's score this round: 119

Your total score so far: 160
Computer's total score so far: 119

Would you like to play another round? (y/n)
y
Starting round 2...

Let's begin the round.


Distributing cards:
Giving human four cards...
Giving computer four cards...
Giving human four cards...
Giving computer four cards...
Giving human four cards...
Giving computer four cards...
The trump card for this round is Queen of Hearts

Since you have a higher score from previous rounds, you go first!
```

11. Player refusing to play another round

```
3.  Quit the game

1
Your opponent played 9H as the lead card.
What card do you want to throw?
    Enter the card position (first card has position 0): n
You must enter a valid number. Please try again: 1
You must enter a number between 0 and 0. Please try again: 0
You chose to play QS as your chase card

Your chase card was beaten by the computer's lead card. You lose this turn.
The computer takes both cards for their capture pile.
The computer won 3 points.

The winner of this turn does not have any cards in hand to create melds with. Moving on to the next turn...

No more cards left in stock. Play until hand cards are exhausted.
Would you like to save your progress so far? (y/n): n
Round ended.
You lost this round.


Your score this round: 110
Computer's score this round: 129

Your total score so far: 110
Computer's total score so far: 129

Would you like to play another round? (y/n)
n
Your total score this game was: 110
The computer's total score this game was: 129

The computer won this game.

Thank you for playing Pinochle!
(base) biplabthapamagar@biplabs-mbp src %
```

12. Loading a previous game from a save file

```
Thank you for playing Pinochle!

(base) biplabthapamagar@biplabs-mbp src % ./pinochle
Welcome to Pinochle!
Would you like to (1) start a new game or (2) load a previous game? Enter 1 or 2: 2
Enter save file name: saveFile.p
Error: could not load save file.
Enter save file name: saveFile1.p
Game successfully loaded!
Loading round 1 from the load file...



-------------------------------------------------------------------------------
Current Game Table:

Round: 1

Computer:
    Score: 0 / 50
    Hand: KC(0) JH(1) QH(2) QC(3) AD(4) AD(5) AC(6) AS(7) 9S(8) JC(9) KH(10) QH(11)
    Capture Pile: XH 9S
    Melds:  KH(10) QH(11) [Royal Marriage],

Human:
    Score: 0 / 0
    Hand: KS(0) KH(1) 9D(2) AS(3) 9C(4) XC(5) KD(6) JD(7) XS(8) 9D(9) QD(10) QC(11)
    Capture Pile:
    Melds:

Trump Card: JH
Stock: XH KC KS AC 9H AH XD 9H JC KD 9C JS XD XC XS JD QS QS QD JS AH

Next Player: Computer
-------------------------------------------------------------------------------

It is the computer's turn to play a card. What would you like to do?
```

13. Player quitting in the middle of a game

```
The other players also picks a card from the stock pile.
Would you like to save your progress so far? (y/n): n


------------------------------------------------------------------------------------
Current Game Table:

Round: 1

Computer:
    Score: 0 / 222
    Hand: KC(0) QC(1) AD(2) AC(3) AS(4) 9S(5) JC(6) KS(7) XD(8) JC(9) 9C(10) XC(11)
    Capture Pile: XH 9S KH AS XH 9D AC JH AH 9C QH 9D
    Melds:   KH() QH() [Royal Marriage], KC(0) QC(1) [Marriage], AC(3) AD() AH() AS(4) [Four Aces],

Human:
    Score: 0 / 48
    Hand: KS(0) XC(1) KD(2) JD(3) XS(4) QD(5) QC(6) KC(7) 9H(8) KD(9) JS(10) XD(11)
    Capture Pile: QH KH AD 9H
    Melds:   KD(2) QD(5) [Marriage], 9H(8) [Dix],

Trump Card: JH
Stock: XS JD QS QS QD JS AH

Next Player: Human
------------------------------------------------------------------------------------
It is your turn to play a card. What would you like to do?

Pick an action:

1.  Make a move
2.  Ask for help
3.  Quit the game

3
Thank you for playing Pinochle! Exiting game...
(base) biplabthapamagar@biplabs-mbp src %
```

14. Saving a game

```
1
The computer chose to play XH as its lead card because throwing this card would preserve the most favorable hand (meld-
wise) and it would increase the chance of winning because it is a trump card.
It is your turn to play a card. What would you like to do?

Pick an action:

1.  Make a move
2.  Ask for help
3.  Quit the game

2

Hint: I recomment that you present 9S(2) as your chase card because there is no way to win this turn, so throwing the l
east ranked card will increase chances of winning next turn.

Your opponent played XH as the lead card.
What card do you want to throw?
    Enter the card position (first card has position 0): 2
You chose to play 9S as your chase card

Your chase card was beaten by the computer's lead card. You lose this turn.
The computer takes both cards for their capture pile.
The computer won 10 points.

Now, the winner creates a meld.
The computer won 40 points for playing a Royal Marriage meld.

Winner of the round picks a card from the stock pile first.
The other players also picks a card from the stock pile.
Would you like to save your progress so far? (y/n): y
Name your save file: saveFile1.p

Game successfully save.

Thank you for playing Pinochle!

(base) biplabthapamagar@biplabs-mbp src %
```