

1.Design of class structures:

PlayGame.class : the main function class,to initiate and terminal the game.

Card.class : Object of Cards.

Player.class : Object of Players.

CardComparator.class : Implement the comparator which is needed for sorting.

Oldmaid.class : The father class who has three extension for different variants.

Tradition_Version.class : Implement the game that randomly remove one card.

One_Ghost_Version : Implement the game that add one ghost card.

Two_Ghost_Version : Implement the game that add two ghost cards.

2.How to play with the program:

After running PlayGame,there will be 4 options for player to choose.Each option leads to different variant of Oldmaid,and the last option is to terminate the game.Once the chosen game ends,PlayGame will ask player to choose option again,until the player terminate PlayGame.

3.How do I test the correctness:

First,I have to make sure that three variant-game will terminate,and they do.

Second,I check the result for each variant.

Tradition_Version :

The loser has only one card,and other players have no card.

One_Ghost_Version :

The loser has one ghost card,and other players have no card.

Two_Ghost_Version :

The loser has two ghost cards,and other players have no card.

After several test,the results are all correct.

4.Sample Outputs of different variants:

Because the length of game maybe too long,I only present start and end of the game.

Tradition_Version :

```
Now You can choose different variants of Oldmaid.
(a) Tradition_Version (Remove any one card,)
(b) One-Ghost-Version (Adding one ghost card.)
(c) Two-Ghost-Version (Adding two ghost card.)
(d) Quit Game.
a
Deal Cards
player0: C1 D2 S2 C3 H4 C5 H5 S6 H8 C10 S10 D11 H13
player1: H1 D3 H3 D4 D5 H7 S8 C9 H9 C11 H11 C12 S12
player2: D1 H2 S3 S5 C6 H6 S7 C8 D9 S9 D10 H10 C13
player3: S1 C2 C4 S4 D6 C7 D7 D8 S11 D12 H12 S13
Drop cards
player0: C1 C3 H4 S6 H8 D11 H13
player1: H1 D4 D5 H7 S8
player2: D1 H2 S3 S5 S7 C8 C13
player3: S1 C2 D6 D8 S11 S13
Game start
```

result:

```
player0 draws a card from player3 C3
player0:
player3: H13
player0 wins
Bonus game over
-----
player3 loses.
Record :
Player0 : 0
Player1 : 0
Player2 : 0
Player3 : 1
-----
```

One_Ghost_Version :

```
Now You can choose different variants of Oldmaid.
(a) Tradition_Version (Remove any one card,)
(b) One-Ghost-Version (Adding one ghost card.)
(c) Two-Ghost-Version (Adding two ghost card.)
(d) Quit Game.
b
Deal Cards
player0: D1 S1 D3 D4 C7 C8 S9 C11 D11 D12 H12 C13 H13 S13
player1: C1 C2 S2 S3 H4 S4 H5 S5 D6 S8 D9 H10 S12
player2: H1 D2 C3 H3 C4 C6 H6 D7 C9 H9 D10 H11 D13
player3: R0 H2 C5 D5 S6 H7 S7 D8 H8 C10 S10 S11 C12
Drop cards
player0: D3 D4 C7 C8 S9 S13
player1: C1 S3 D6 S8 D9 H10 S12
player2: H1 D2 C4 D7 D10 H11 D13
player3: R0 H2 S6 S11 C12
Game start
```

result:

```
player1 draws a card from player3 D10
player1:
player3: R0
player1 wins
Bonus game over
-----
player3 loses.
Record :
Player0 : 0
Player1 : 0
Player2 : 0
Player3 : 2
-----
```

Two_Ghost_Version :

```
Well come to Oldmaid Game Center.
You have played 2 round.
Now You can choose different variants of Oldmaid.
(a) Tradition_Version (Remove any one card,)
(b) One-Ghost-Version (Adding one ghost card.)
(c) Two-Ghost-Version (Adding two ghost card.)
(d) Quit Game.
c
Deal Cards
player0: D2 H2 D3 S3 H5 S7 H8 S8 C10 H11 H12 S12 C13 D13
player1: C1 D1 D4 D5 S5 C7 H7 D8 C9 H9 S10 C11 H13 S13
player2: R0 H1 S1 C3 C6 S6 C8 S9 H10 D11 S11 C12 D12
player3: B0 C2 S2 H3 C4 H4 S4 C5 D6 H6 D7 D9 D10
Drop cards
player0: H5 S7 C10 H11
player1: D4 D8 S10 C11
player2: R0 C3 C8 S9 H10
player3: B0 H3 S4 C5 D7 D9 D10
Game start
```

result:

```
player2 draws a card from player0 B0
player2: R0 B0
player0:
player0 wins
Bonus game over
-----
player2 loses.
Record :
Player0 : 0
Player1 : 0
Player2 : 1
Player3 : 2
-----
```

5.Things' worth for Bonus:

1. I make a game center PlayGame,thus the user don't need to run multiprogram to play different variants.
2. I count the lose record of players which indicate how many times does the player lose.
3. If the user enters illegal input,the process will ask the user to enter again.

```
Well come to Oldmaid Game Center.  
You have played 3 round.  
Now You can choose different variants of Oldmaid.  
(a) Tradition_Version (Remove any one card,)  
(b) One-Ghost-Version (Adding one ghost card.)  
(c) Two-Ghost-Version (Adding two ghost card.)  
(d) Quit Game.  
qwerqwerqwer  
Please enter a valid option.  
Well come to Oldmaid Game Center.  
You have played 3 round.  
Now You can choose different variants of Oldmaid.  
(a) Tradition_Version (Remove any one card,)  
(b) One-Ghost-Version (Adding one ghost card.)  
(c) Two-Ghost-Version (Adding two ghost card.)  
(d) Quit Game.
```