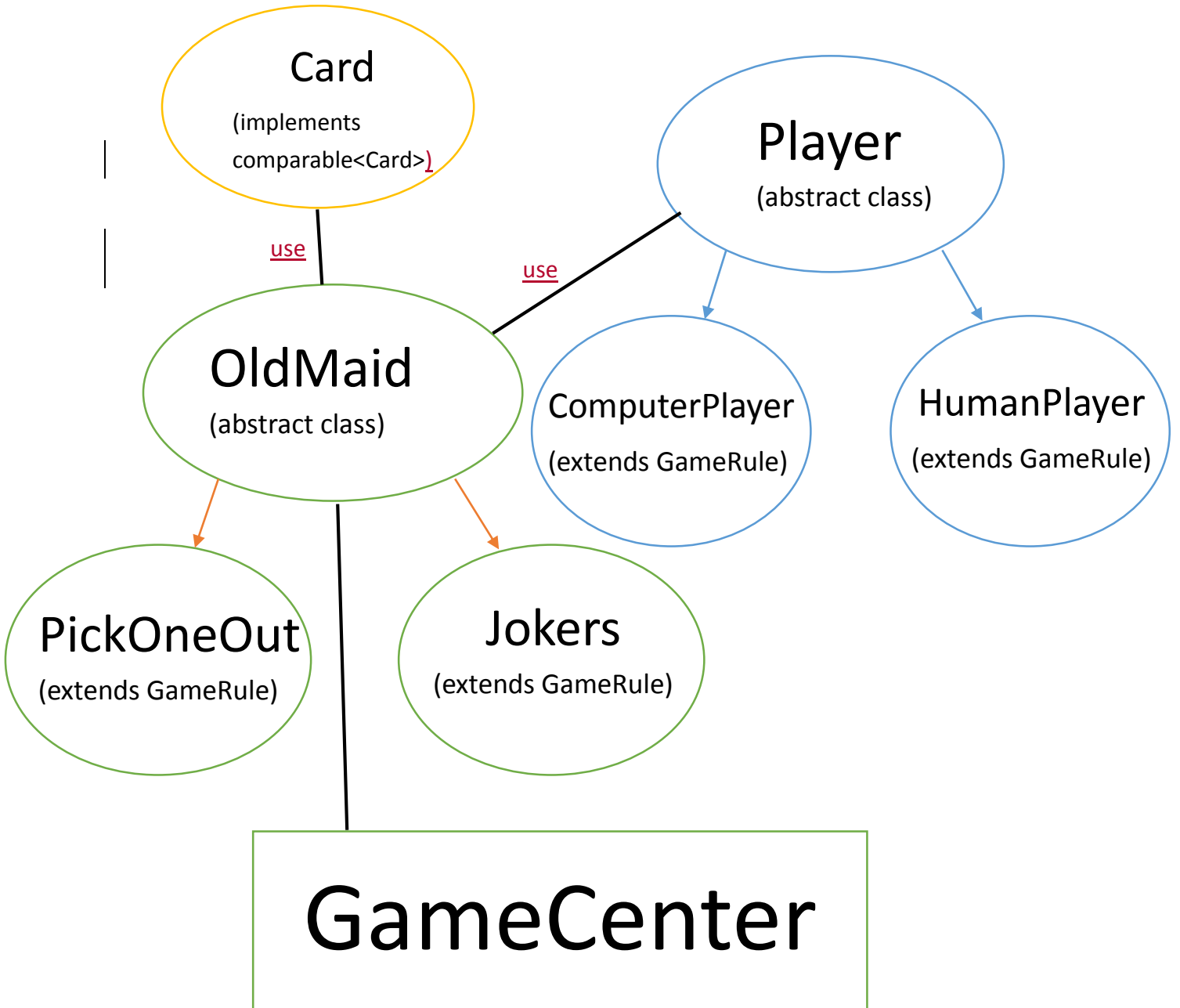資工三　B02902031　李彥霆

1. Design of Class Structure

a. OldMaid describes all the basic rules and elements of old-maid, that is, some cards, players, and the game process.
It is abstract because it does not determine which cards to play with, and this is all variants are different with.
Jokers and PickOneOut extend OldMaid and implement the abstract method to determine which cards to play with and how to deal the cards.
I use this class structure because all variant of the game have much common in game process, number of players, and the reason that I don't use a structure like other variant extends one variant is that I think all variant are at the same level, no variant should be the parent class.

b. Player describes all the actions a player has to do, but leave the "pick" method abstract because this is different from human and computer.
I think it's less reasonable to let HumanPlayer extends ComputerPlayer, so I choose this class structure.

c. GameCenter handles the whole game process because I left GameRule handling the basic rules.

2. type "make" to compile and "make run" to start the game.
In the beginning of the game, enter the player name, and select the variant to play, A or B, other for exit. Each turn for you to pick a card, it will hint for the range to choose. (Any choice out of range is not guarantee for the consequence.) After the end of the game, it will go to the select part, and keep looping if you still choose to play.

3. I test the correctness of my program by playing many times by all computer players, and check for unusual output. Then, I play the game many times to ensure the interaction is correct.

4. sample output

Variant A – with human player   Variant B – with human player

```
Welcome to GameCenter, please enter your name.
Ralph
Welcome, Ralph
Please choose which game to play.
(A) Old-Maid -- Two Jokers.
(B) Old-Maid -- Random Pick A Card Out.
(C) Old-Maid -- Two Jokers, all computer players.
(D) Old-Maid -- Random Pick A Card Out, all computer players.
(Else) Quit.
A
You are player 2
Deal cards
Player0 :H3 C4 H4 H5 S6 H8 C9 D9 H9 S9 DQ SQ CA SA
Player1 :D2 D3 S4 C5 D5 S5 C7 H7 CJ HJ SJ HK HA B0
Ralph :S2 S3 D4 D7 S7 C8 D8 S8 C10 D10 DJ HQ DA
Player2 :C2 H2 C3 C6 D6 H6 H10 S10 CQ CK DK SK R0
Drop cards
Player0 :H3 H5 S6 H8
Player1 :D2 D3 S4 S5 SJ HK HA B0
Ralph :S2 S3 D4 S8 DJ HQ DA
Player2 :C3 H6 CQ SK R0
Game Start
Player0 draws S4 from Player1
Player0 :H3 S4 H5 S6 H8
Player1 :D2 D3 S5 SJ HK HA B0
Player1 draws DA from Ralph
Player1 :D2 D3 S5 SJ HK B0
Ralph :S2 S3 D4 S8 DJ HQ
Which card to pick? 0~4 : 0
Ralph draws C3 from Player2
Ralph :S2 D4 S8 DJ HQ
Player2 :H6 CQ SK R0
```

```
Welcome to GameCenter, please enter your name.
Ralph
Welcome, Ralph
Please choose which game to play.
(A) Old-Maid -- Two Jokers.
(B) Old-Maid -- Random Pick A Card Out.
(C) Old-Maid -- Two Jokers, all computer players.
(D) Old-Maid -- Random Pick A Card Out, all computer players.
(Else) Quit.
B
You are player 2
Deal cards
Player0 :D2 H3 H4 S5 H6 S6 H8 C9 D9 SQ SK CA DA
Player1 :S2 D4 C7 D8 H9 C10 D10 CJ HJ SJ CQ CK DK
Ralph :C2 H2 C3 D3 S3 S4 D6 S8 H10 DJ DQ HK SA
Player2 :C4 C5 D5 H5 C6 D7 H7 S7 C8 S10 HQ HA
Drop cards
Player0 :D2 H3 H4 S5 H8 SQ SK
Player1 :S2 D4 C7 D8 H9 SJ CQ
Ralph :S3 S4 D6 S8 H10 DJ DQ HK SA
Player2 :C4 H5 C6 S7 C8 S10 HQ HA
Game Start
Player0 draws CQ from Player1
Player0 :D2 H3 H4 S5 H8 SK
Player1 :S2 D4 C7 D8 H9 SJ
Player1 draws SA from Ralph
Player1 :S2 D4 C7 D8 H9 SJ SA
Ralph :S3 S4 D6 S8 H10 DJ DQ HK
Which card to pick? 0~7 : 4
Ralph draws C8 from Player2
Ralph :S3 S4 D6 H10 DJ DQ HK
Player2 :C4 H5 C6 S7 S10 HQ HA
```

Variant A – with all computer

```
Welcome to GameCenter, please enter your name.
Ralph
Welcome, Ralph
Please choose which game to play.
(A) Old-Maid -- Two Jokers.
(B) Old-Maid -- Random Pick A Card Out.
(C) Old-Maid -- Two Jokers, all computer players.
(D) Old-Maid -- Random Pick A Card Out, all computer players.
(Else) Quit.
C
Deal cards
Player0 :C4 H5 D7 C9 D9 C10 H10 S10 CJ CK DK HK CA B0
Player1 :C2 S2 C3 D3 S3 C6 D6 C7 D8 S8 S9 HA SA R0
Player2 :D2 D4 H4 H6 S6 S7 H8 H9 HJ SJ CQ HQ SQ
Player3 :H2 H3 S4 C5 D5 S5 H7 C8 D10 DJ DQ SK DA
Drop cards
Player0 :C4 H5 D7 S10 CJ HK CA B0
Player1 :S3 C7 S9 R0
Player2 :D2 S7 H8 H9 SQ
Player3 :H2 H3 S4 S5 H7 C8 D10 DJ DQ SK DA
Game Start
Player0 draws C7 from Player1
Player0 :C4 H5 S10 CJ HK CA B0
Player1 :S3 S9 R0
Player1 draws SQ from Player2
Player1 :S3 S9 SQ R0
Player2 :D2 S7 H8 H9
Player2 draws H3 from Player3
Player2 :D2 H3 S7 H8 H9
Player3 :H2 S4 S5 H7 C8 D10 DJ DQ SK DA
Player3 draws HK from Player0
Player3 :H2 S4 S5 H7 C8 D10 DJ DQ DA
Player0 :C4 H5 S10 CJ CA B0
```

```
Welcome to GameCenter, please enter your name.
Ralph
Welcome, Ralph
Please choose which game to play.
(A) Old-Maid -- Two Jokers.
(B) Old-Maid -- Random Pick A Card Out.
(C) Old-Maid -- Two Jokers, all computer players.
(D) Old-Maid -- Random Pick A Card Out, all computer players.
(Else) Quit.
D
Deal cards
Player0 :C3 D3 S3 C4 C7 H7 H9 C10 S10 CQ SQ HK SK
Player1 :D2 S2 H5 D6 S6 D7 S7 C9 CJ HJ SJ HQ DA
Player2 :H3 D4 H4 S4 C5 D5 S5 C6 S8 DJ CK DK SA
Player3 :C2 H2 H6 C8 D8 H8 D9 S9 D10 DQ CA HA
Drop cards
Player0 :S3 C4 H9
Player1 :H5 C9 SJ HQ DA
Player2 :H3 S4 S5 C6 S8 DJ SA
Player3 :H6 H8 D10 DQ
Game Start
Player0 draws H5 from Player1
Player0 :S3 C4 H5 H9
Player1 :C9 SJ HQ DA
Player1 draws S4 from Player2
Player1 :S4 C9 SJ HQ DA
Player2 :H3 S5 C6 S8 DJ SA
Player2 draws DQ from Player3
Player2 :H3 S5 C6 S8 DJ DQ SA
Player3 :H6 H8 D10
Player3 draws S3 from Player0
Player3 :S3 H6 H8 D10
Player0 :C4 H5 H9
```

5. bonus implement:

I implement human player to play with three computers!