Homework #3 OldMaid Extensions

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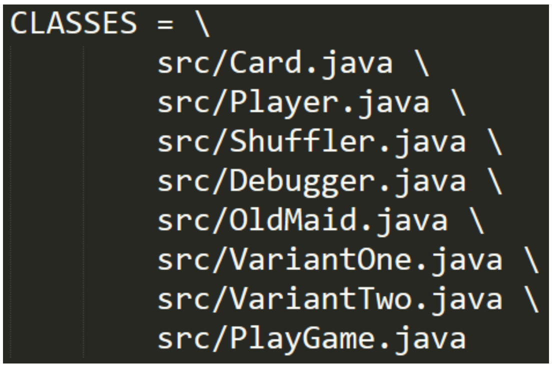
1. My design of class structures and reasons



```
CLASSES = \
        src/Card.java \
        src/Player.java \
        src/Shuffler.java \
        src/Debugger.java \
        src/OldMaid.java \
        src/VariantOne.java \
        src/VariantTwo.java \
        src/PlayGame.java
```

I use the structures similar to **hw2** as shown on the right.

Card holds the information of each card (e.g., suit, face…).

Player holds a hand of cards and can do some actions with cards (e.g., dropCards()).

Shuffler can shuffle any input array user specified. Therefore, I shuffle the IDs of each player instead of a deck of cards, and assign each card to player based on the shuffled array. For example:

Input array: [0, 0, …, 0, 1, …, 1, …, 2, …, 2, 3, …, 3]
Shuffled array: [1, 3, 1, 0, 0, 2, …]
Deal cards: card[0] → player1, card[1] → player3, card[2] → player1, …

In this way, there is no need to sort the players' hands after dealing cards and would save much time.

OldMaid is the original(parent) class, and VariantOne, VariantTwo are the extended(child) classes.

OldMaid is an abstract class and defines two abstract methods: initPlayers() and initCards().

Since the main differences between my variants are:

(1) The components of cards (or the definition of JOKER).
(2) The rules of dropping cards

Therefore, I force each variant to define their cards and player actions by implementing the methods.

The rest of game actions are all in OldMaid.

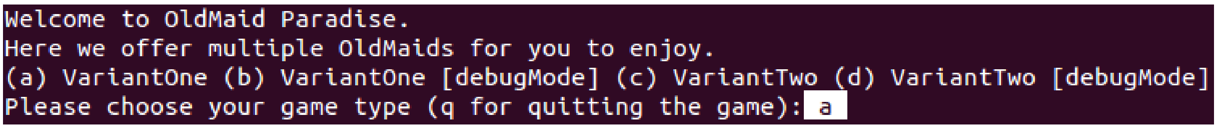
PlayGame is the main class to start the game, it contains multiple game types for user to choose.

Debugger is used to trace the correctness of the program.

2. How to play the game

(1) In the correct folder (i.e., hw3/), enter "make" and "make run" to start the game.

(2) Choose your game type:



```
Welcome to OldMaid Paradise.
Here we offer multiple OldMaids for you to enjoy.
(a) VariantOne (b) VariantOne [debugMode] (c) VariantTwo (d) VariantTwo [debugMode]
Please choose your game type (q for quitting the game): a
```

VariantOne:

(a) There are two JOKERS, R0 and B0, in each deck of cards.
(b) A valid pair is defined as two cards with the same rank and color.
That is, [D3, H3], [C6, S6] are pairs, while [H7, HK], [S5, D5] are not.

VariantTwo:

(a) A random card is removed from 52 cards.
The last card in the loser's hand would be the JOKER.
(b) A valid pair is defined as two cards with the same rank (same as hw1).

3. Methods used to test the correctness of my program

I implement the class Debugger.java to check the correctness of my program.

Debugger holds a cards-recycle array CARDS to trace the status of each card.

CARD[i] has the initial value 0, which means the card is currently in one of the players' hand.

Every time when a player drops a pair, we can use debugger.addCards(pair) to change the value of CARDS[i] to 1, which means the card is recycled by debugger.

Debugger can check the following things:

(1) The correctness of shuffling and dealing cards.
After dealing cards, I add all of the players' hand to debugger and check if the values in CARDS are all changed to 1. If yes, it guarantees that cards are shuffled and dealt to players correctly.

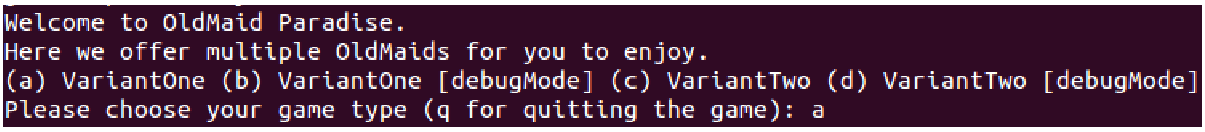
(2) The correctness of dropping existing pairs before drawing cards.
After dropping pairs, I initialize debugger.CARDS and add all of the players' remaining hand again.
This time, CARD[i] with the value 0 stands for dropped card (and therefore not in player's hand).
Then I check every two adjacent cards and see if they are pair.
For example, when I find CARDS[i] and CARDS[j] equal to 0 and assume CARDS[i] is D3, then the possible CARDS[j] would be H3 and S3, the validRange is 2.
Therefore, I check the statement (j <= i + 2) to see if CARD[i] and CARD[j] is a pair.

(3) The correctness of dropping a pair after drawing a card from another player.
When player drops a pair, I add the pair to debugger for further cards status tracing.
I also use the same method above to do pair checking.

(4) The correctness of cards status after the game is over.
After the game is over, I add JOKER to debugger and check if all values in CARDS are changed to 1.
If yes, it guarantees that all cards are recycled from players correctly.

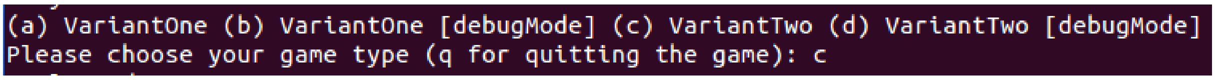
4. The output from each variant of the game

(1) Play VariantOne :



```
Welcome to OldMaid Paradise.
Here we offer multiple OldMaids for you to enjoy.
(a) VariantOne (b) VariantOne [debugMode] (c) VariantTwo (d) VariantTwo [debugMode]
Please choose your game type (q for quitting the game): a
```

(2) Play VariantTwo:



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(a) VariantOne (b) VariantOne [debugMode] (c) VariantTwo (d) VariantTwo [debugMode]
Please choose your game type (q for quitting the game): c
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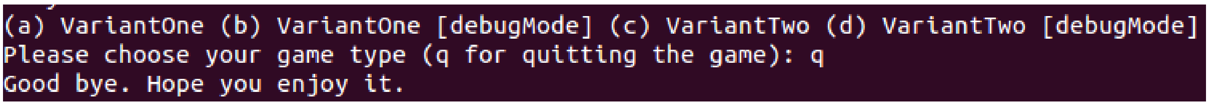
(3) Quit game:



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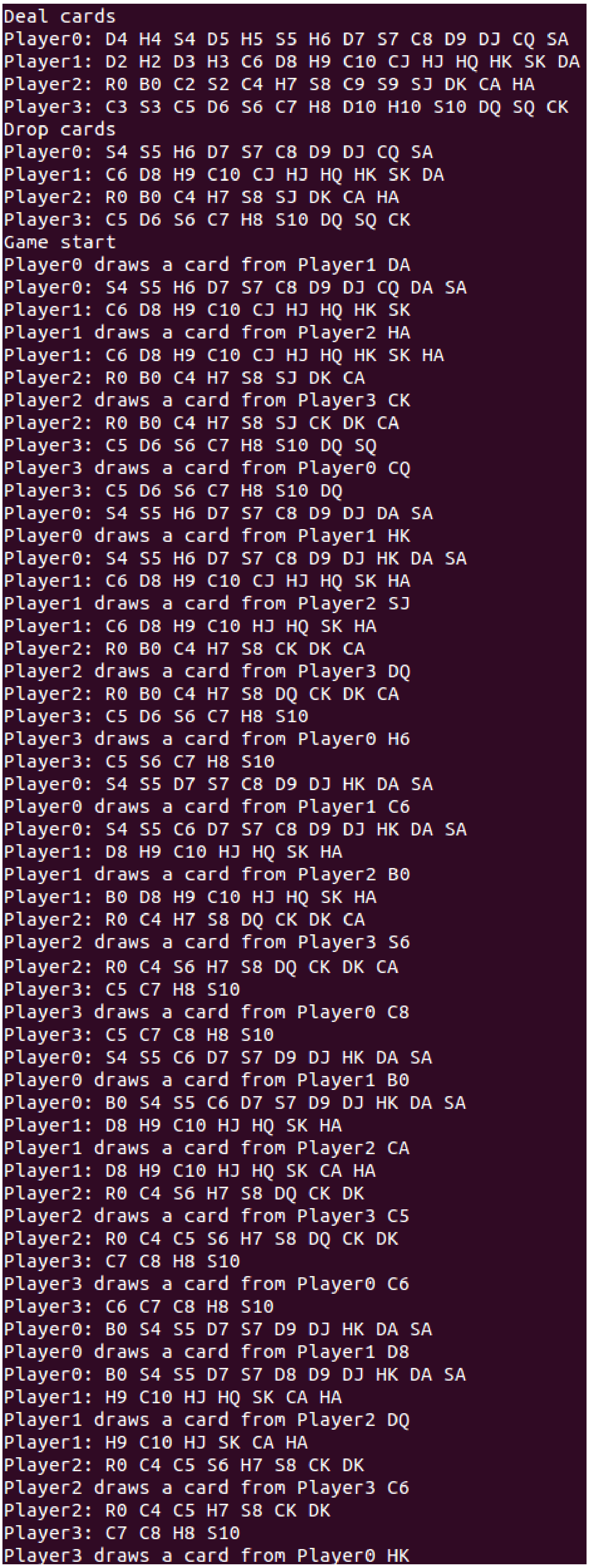
(a) VariantOne (b) VariantOne [debugMode] (c) VariantTwo (d) VariantTwo [debugMode]
Please choose your game type (q for quitting the game): q
Good bye. Hope you enjoy it.
```

(1) VariantOne output:



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Deal cards
Player0: D4 H4 S4 D5 H5 S5 H6 D7 S7 C8 D9 DJ CQ SA
Player1: D2 H2 D3 H3 C6 D8 H9 C10 CJ HJ HQ HK SK DA
Player2: R0 B0 C2 S2 C4 H7 S8 C9 S9 SJ DK CA HA
Player3: C3 S3 C5 D6 S6 C7 H8 D10 H10 S10 DQ SQ CK
Drop cards
Player0: S4 S5 H6 D7 S7 C8 D9 DJ CQ SA
Player1: C6 D8 H9 C10 CJ HJ HQ HK SK DA
Player2: R0 B0 C4 H7 S8 SJ DK CA HA
Player3: C5 D6 S6 C7 H8 S10 DQ SQ CK
Game start
Player0 draws a card from Player1 DA
Player0: S4 S5 H6 D7 S7 C8 D9 DJ CQ DA SA
Player1: C6 D8 H9 C10 CJ HJ HQ HK SK
Player1 draws a card from Player2 HA
Player1: C6 D8 H9 C10 CJ HJ HQ HK SK HA
Player2: R0 B0 C4 H7 S8 SJ DK CA
Player2 draws a card from Player3 CK
Player2: R0 B0 C4 H7 S8 SJ CK DK CA
Player3: C5 D6 S6 C7 H8 S10 DQ SQ
Player3 draws a card from Player0 CQ
Player3: C5 D6 S6 C7 H8 S10 DQ
Player0: S4 S5 H6 D7 S7 C8 D9 DJ DA SA
Player0 draws a card from Player1 HK
Player0: S4 S5 H6 D7 S7 C8 D9 DJ HK DA SA
Player1: C6 D8 H9 C10 CJ HJ HQ SK HA
Player1 draws a card from Player2 SJ
Player1: C6 D8 H9 C10 HJ HQ SK HA
Player2: R0 B0 C4 H7 S8 CK DK CA
Player2 draws a card from Player3 DQ
Player2: R0 B0 C4 H7 S8 DQ CK DK CA
Player3: C5 D6 S6 C7 H8 S10
Player3 draws a card from Player0 H6
Player3: C5 S6 C7 H8 S10
Player0: S4 S5 D7 S7 C8 D9 DJ HK DA SA
Player0 draws a card from Player1 C6
Player0: S4 S5 C6 D7 S7 C8 D9 DJ HK DA SA
Player1: D8 H9 C10 HJ HQ SK HA
Player1 draws a card from Player2 B0
Player1: B0 D8 H9 C10 HJ HQ SK HA
Player2: R0 C4 H7 S8 DQ CK DK CA
Player2 draws a card from Player3 S6
Player2: R0 C4 S6 H7 S8 DQ CK DK CA
Player3: C5 C7 H8 S10
Player3 draws a card from Player0 C8
Player3: C5 C7 C8 H8 S10
Player0: S4 S5 C6 D7 S7 D9 DJ HK DA SA
Player0 draws a card from Player1 B0
Player0: B0 S4 S5 C6 D7 S7 D9 DJ HK DA SA
Player1: D8 H9 C10 HJ HQ SK HA
Player1 draws a card from Player2 CA
Player1: D8 H9 C10 HJ HQ SK CA HA
Player2: R0 C4 S6 H7 S8 DQ CK DK
Player2 draws a card from Player3 C5
Player2: R0 C4 C5 S6 H7 S8 DQ CK DK
Player3: C7 C8 H8 S10
Player3 draws a card from Player0 C6
Player3: C6 C7 C8 H8 S10
Player0: B0 S4 S5 D7 S7 D9 DJ HK DA SA
Player0 draws a card from Player1 D8
Player0: B0 S4 S5 D7 S7 D8 D9 DJ HK DA SA
Player1: H9 C10 HJ HQ SK CA HA
Player1 draws a card from Player2 DQ
Player1: H9 C10 HJ SK CA HA
Player2: R0 C4 C5 S6 H7 S8 CK DK
Player2 draws a card from Player3 C6
Player2: R0 C4 C5 H7 S8 CK DK
Player3: C7 C8 H8 S10
Player3 draws a card from Player0 HK
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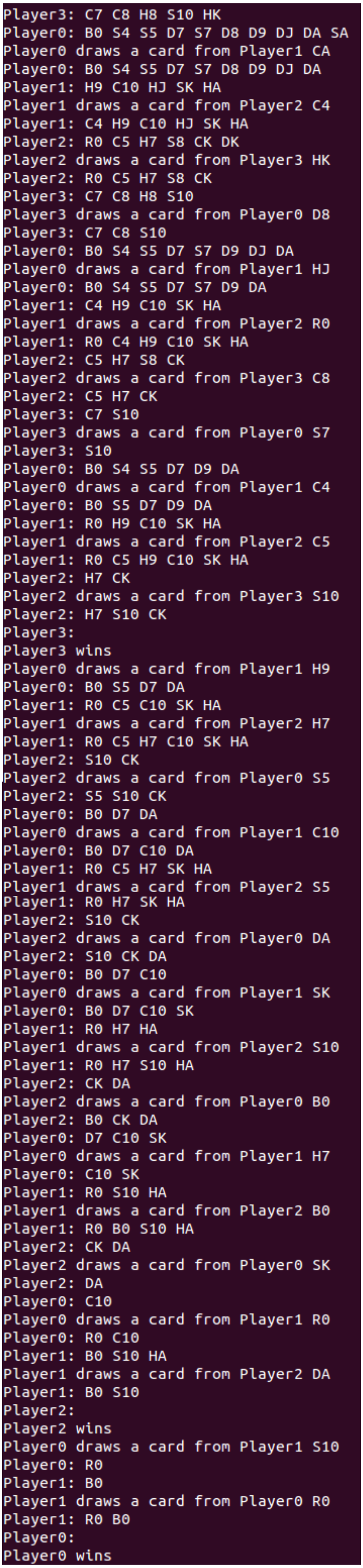

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Player3: C7 C8 H8 S10 HK
Player0: B0 S4 S5 D7 S7 D8 D9 DJ DA SA
Player0 draws a card from Player1 CA
Player0: B0 S4 S5 D7 S7 D8 D9 DJ DA
Player1: H9 C10 HJ SK HA
Player1 draws a card from Player2 C4
Player1: C4 H9 C10 HJ SK HA
Player2: R0 C5 H7 S8 CK DK
Player2 draws a card from Player3 HK
Player2: R0 C5 H7 S8 CK
Player3: C7 C8 H8 S10
Player3 draws a card from Player0 D8
Player3: C7 C8 S10
Player0: B0 S4 S5 D7 S7 D9 DJ DA
Player0 draws a card from Player1 HJ
Player0: B0 S4 S5 D7 S7 D9 DA
Player1: C4 H9 C10 SK HA
Player1 draws a card from Player2 R0
Player1: R0 C4 H9 C10 SK HA
Player2: C5 H7 S8 CK
Player2 draws a card from Player3 C8
Player2: C5 H7 CK
Player3: C7 S10
Player3 draws a card from Player0 S7
Player3: S10
Player0: B0 S4 S5 D7 D9 DA
Player0 draws a card from Player1 C4
Player0: B0 S5 D7 D9 DA
Player1: R0 H9 C10 SK HA
Player1 draws a card from Player2 C5
Player1: R0 C5 H9 C10 SK HA
Player2: H7 CK
Player2 draws a card from Player3 S10
Player2: H7 S10 CK
Player3:
Player3 wins
Player0 draws a card from Player1 H9
Player0: B0 S5 D7 DA
Player1: R0 C5 C10 SK HA
Player1 draws a card from Player2 H7
Player1: R0 C5 H7 C10 SK HA
Player2: S10 CK
Player2 draws a card from Player0 S5
Player2: S5 S10 CK
Player0: B0 D7 DA
Player0 draws a card from Player1 C10
Player0: B0 D7 C10 DA
Player1: R0 C5 H7 SK HA
Player1 draws a card from Player2 S5
Player1: R0 H7 SK HA
Player2: S10 CK
Player2 draws a card from Player0 DA
Player2: S10 CK DA
Player0: B0 D7 C10
Player0 draws a card from Player1 SK
Player0: B0 D7 C10 SK
Player1: R0 H7 HA
Player1 draws a card from Player2 S10
Player1: R0 H7 S10 HA
Player2: CK DA
Player2 draws a card from Player0 B0
Player2: B0 CK DA
Player0: D7 C10 SK
Player0 draws a card from Player1 H7
Player0: C10 SK
Player1: R0 S10 HA
Player1 draws a card from Player2 B0
Player1: R0 B0 S10 HA
Player2: CK DA
Player2 draws a card from Player0 SK
Player2: DA
Player0: C10
Player0 draws a card from Player1 R0
Player0: R0 C10
Player1: B0 S10 HA
Player1 draws a card from Player2 DA
Player1: B0 S10
Player2:
Player2 wins
Player0 draws a card from Player1 S10
Player0: R0
Player1: B0
Player1 draws a card from Player0 R0
Player1: R0 B0
Player0:
Player0 wins
```
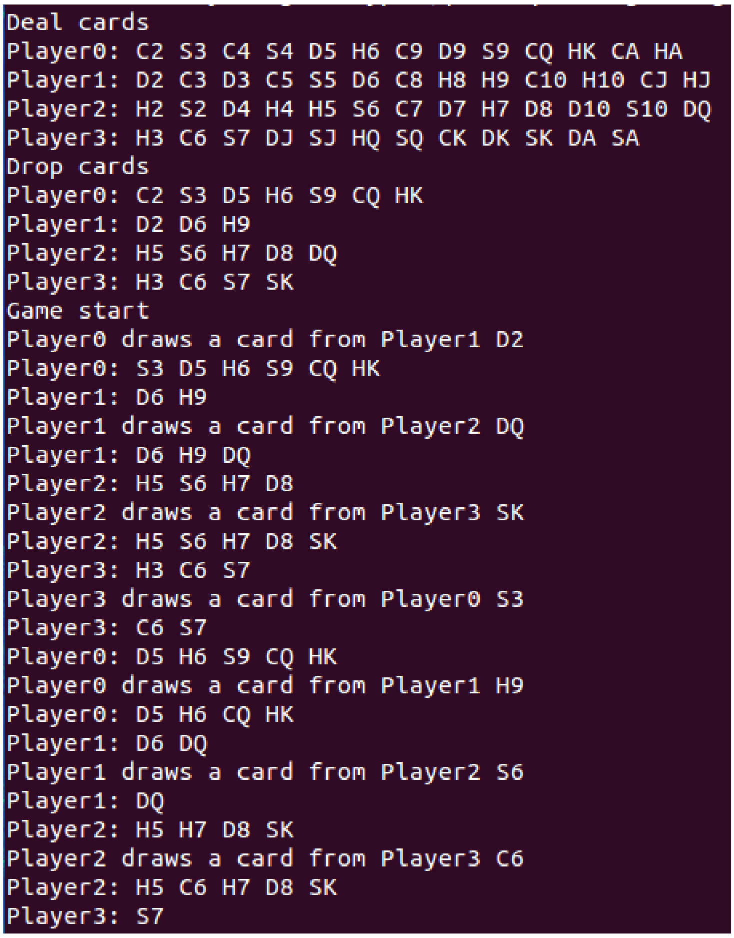
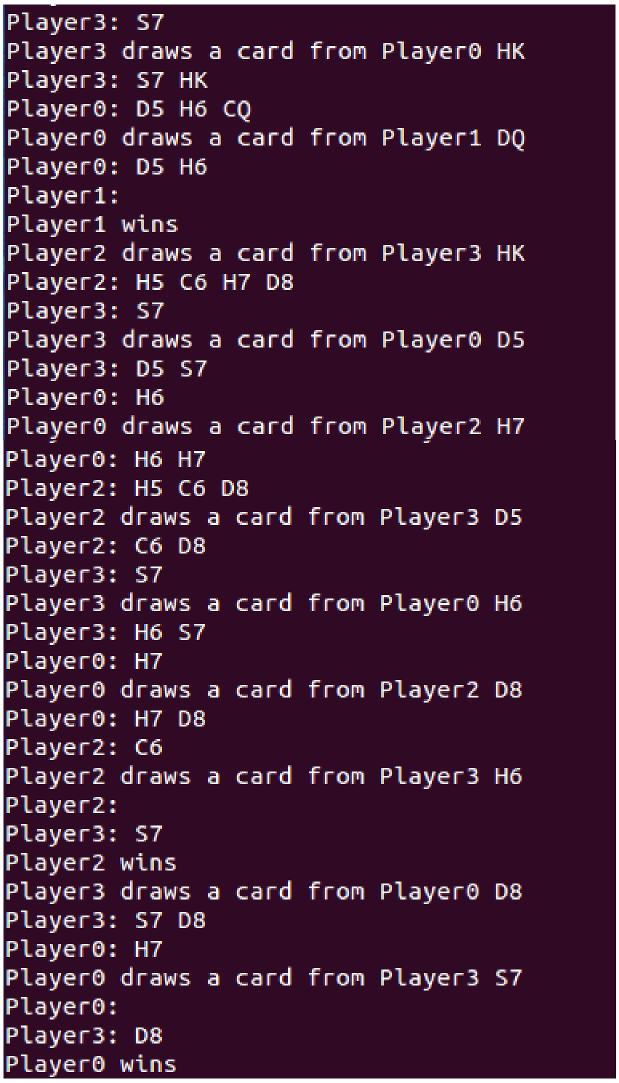

(2) VariantTwo output:



```
Deal cards
Player0: C2 S3 C4 S4 D5 H6 C9 D9 S9 CQ HK CA HA
Player1: D2 C3 D3 C5 S5 D6 C8 H8 H9 C10 H10 CJ HJ
Player2: H2 S2 D4 H4 H5 S6 C7 D7 H7 D8 D10 S10 DQ
Player3: H3 C6 S7 DJ SJ HQ SQ CK DK SK DA SA
Drop cards
Player0: C2 S3 D5 H6 S9 CQ HK
Player1: D2 D6 H9
Player2: H5 S6 H7 D8 DQ
Player3: H3 C6 S7 SK
Game start
Player0 draws a card from Player1 D2
Player0: S3 D5 H6 S9 CQ HK
Player1: D6 H9
Player1 draws a card from Player2 DQ
Player1: D6 H9 DQ
Player2: H5 S6 H7 D8
Player2 draws a card from Player3 SK
Player2: H5 S6 H7 D8 SK
Player3: H3 C6 S7
Player3 draws a card from Player0 S3
Player3: C6 S7
Player0: D5 H6 S9 CQ HK
Player0 draws a card from Player1 H9
Player0: D5 H6 CQ HK
Player1: D6 DQ
Player1 draws a card from Player2 S6
Player1: DQ
Player2: H5 H7 D8 SK
Player2 draws a card from Player3 C6
Player2: H5 C6 H7 D8 SK
Player3: S7
```

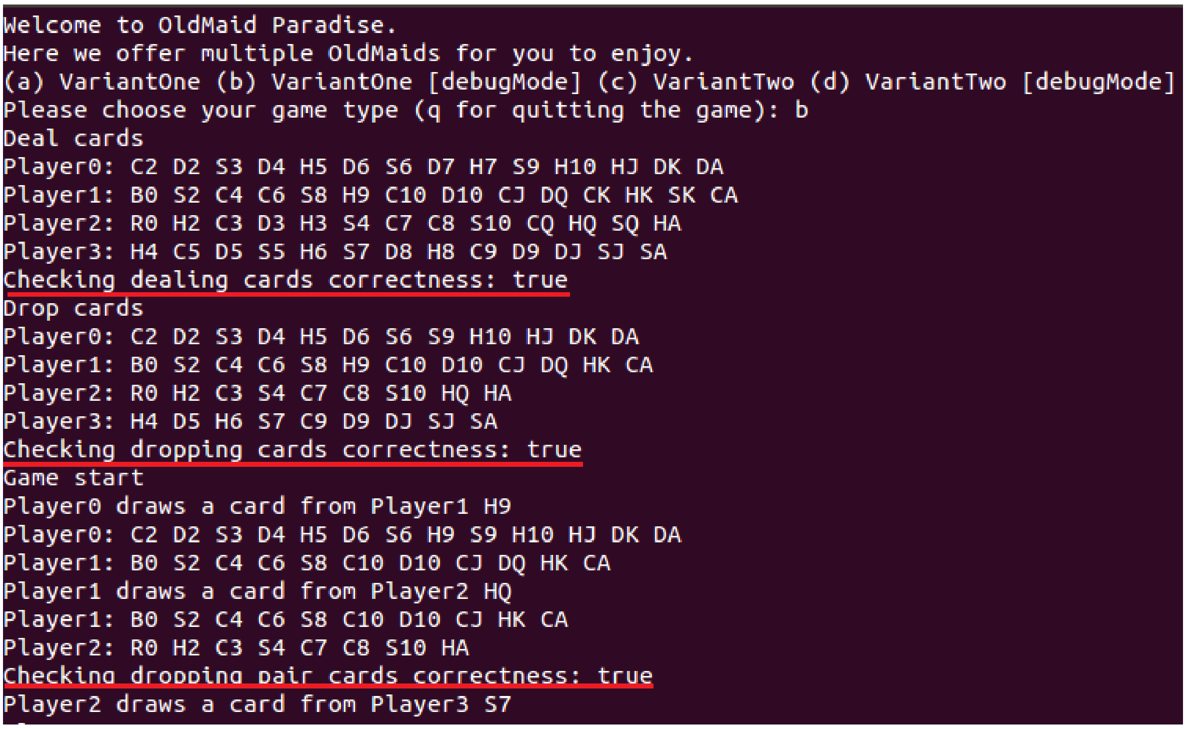


```
Player3: S7
Player3 draws a card from Player0 HK
Player3: S7 HK
Player0: D5 H6 CQ
Player0 draws a card from Player1 DQ
Player0: D5 H6
Player1:
Player1 wins
Player2 draws a card from Player3 HK
Player2: H5 C6 H7 D8
Player3: S7
Player3 draws a card from Player0 D5
Player3: D5 S7
Player0: H6
Player0 draws a card from Player2 H7
Player0: H6 H7
Player2: H5 C6 D8
Player2 draws a card from Player3 D5
Player2: C6 D8
Player3: S7
Player3 draws a card from Player0 H6
Player3: H6 S7
Player0: H7
Player0 draws a card from Player2 D8
Player0: H7 D8
Player2: C6
Player2 draws a card from Player3 H6
Player2:
Player3: S7
Player2 wins
Player3 draws a card from Player0 D8
Player3: S7 D8
Player0: H7
Player0 draws a card from Player3 S7
Player0:
Player3: D8
Player0 wins
```

5. BONUS implementation

(1) Player can choose which game type to play.

(2) When playing with debug mode, the output will show the correctness checking results.



```
Welcome to OldMaid Paradise.
Here we offer multiple OldMaids for you to enjoy.
(a) VariantOne (b) VariantOne [debugMode] (c) VariantTwo (d) VariantTwo [debugMode]
Please choose your game type (q for quitting the game): b
Deal cards
Player0: C2 D2 S3 D4 H5 D6 S6 D7 H7 S9 H10 HJ DK DA
Player1: B0 S2 C4 C6 S8 H9 C10 D10 CJ DQ CK HK SK CA
Player2: R0 H2 C3 D3 H3 S4 C7 C8 S10 CQ HQ SQ HA
Player3: H4 C5 D5 S5 H6 S7 D8 H8 C9 D9 DJ SJ SA
Checking dealing cards correctness: true
Drop cards
Player0: C2 D2 S3 D4 H5 D6 S6 S9 H10 HJ DK DA
Player1: B0 S2 C4 C6 S8 H9 C10 D10 CJ DQ HK CA
Player2: R0 H2 C3 S4 C7 C8 S10 HQ HA
Player3: H4 D5 H6 S7 C9 D9 DJ SJ SA
Checking dropping cards correctness: true
Game start
Player0 draws a card from Player1 H9
Player0: C2 D2 S3 D4 H5 D6 S6 H9 S9 H10 HJ DK DA
Player1: B0 S2 C4 C6 S8 C10 D10 CJ DQ HK CA
Player1 draws a card from Player2 HQ
Player1: B0 S2 C4 C6 S8 C10 D10 CJ HK CA
Player2: R0 H2 C3 S4 C7 C8 S10 HA
Checking dropping pair cards correctness: true
Player2 draws a card from Player3 S7
```