

Project 2

Design and Implementation:

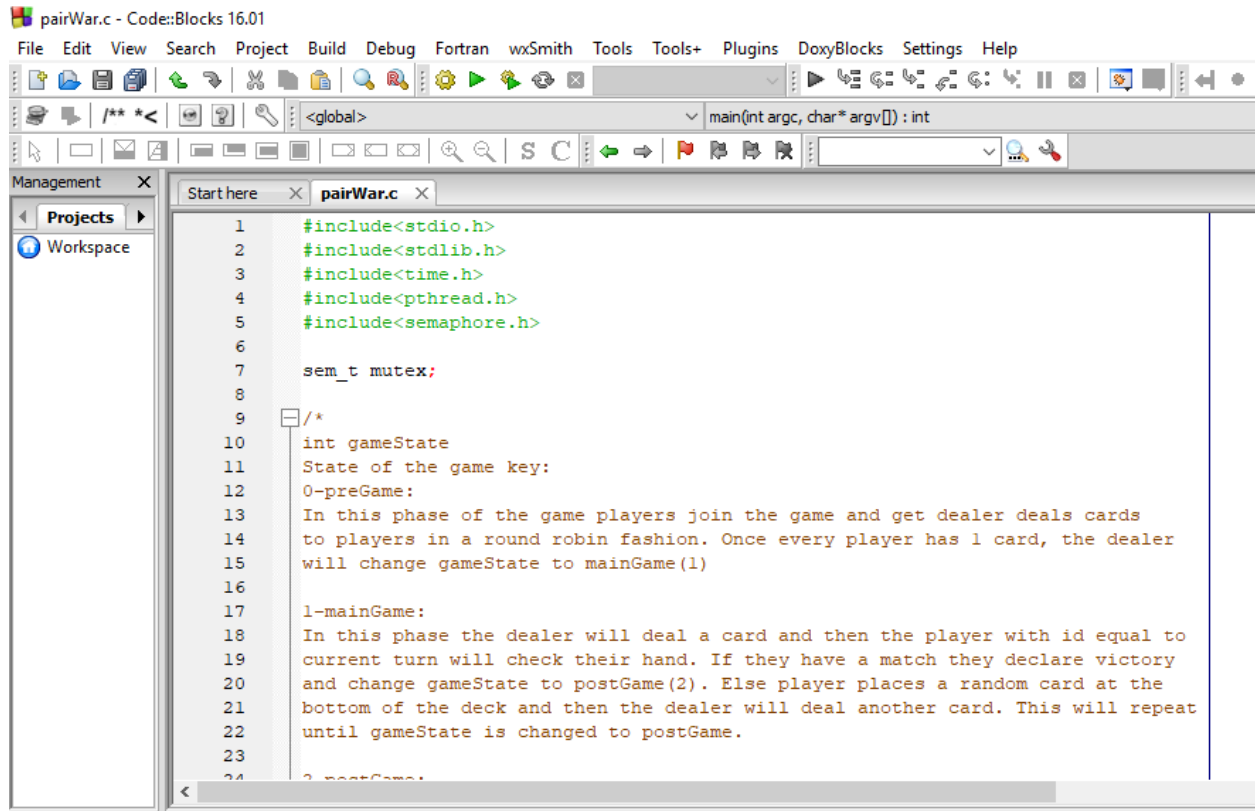
This design of this program is based off the structure of games used in a game engine called Game Maker. In this engine the dealer and each of the 3 players would be objects and would execute any code associated with them in parallel and in sync. In this engine this game would be made using a state machine that tells each object what to do. The following photo shows an example using the dealer.

In order to adapt this to C and use `p_threads`, I used monitor variables and a few semaphores for extra protection. The main variables used for control is `currentTurn` and `gameState`. Both the thread functions for the dealer and the player execute different actions based on if `currentTurn` is equal to 0 for the dealer or the `playerid` for each of the player threads and on what `gameState` is set to. The variable `currentTurn` is changed at the end of each action by the threads. The players will always change to the dealer to force the dealer to act as a layer of protection for the deck since the dealer is designed to only access the deck when it deals cards at the start of each round. The dealer will always give the turn to the next player after the player that gave the dealer its turn. The `gameState` variable will tell each thread what part of the game the program is in. It will be set to 0 for when the dealer is dealing cards, 1 when the players are drawing cards and discarding until they get a pair, and 2 when they are exiting the round and setting up for the next. The `gameState` variable has a comment section at the beginning of the code that explains in more detail what will be happening in each state. Semaphore functions are used to lock the code whenever the program will be accessing the deck as an extra layer of protection.

At the start of the main function it will first create a deck of 24 cards with cards ranging 1-6 and 4 copies of each card. It will then do the initial shuffle and create print the deck. Then the threads will be created and the game will be played. Once all of the threads exit, the program will return 0 and exit.

How to compile and run:

This program was compiled and created in the CodeBlocks IDE and MUST be run in that IDE. Place the file `pairWar.c` from the zip file into a convenient directory. Open the file with CodeBlocks and once open click the run and compile button.



The run and compile button is the one with the gear and play button over each other

To change the seed change this variable in main to any integer

```

int main(int argc, char *argv[])
{
    int argSeed = 2;
    ...
}

```

Due to an unknown bug the program must be compiled and run once and then run again for it to work as intended.

Trial runs:

This run was with a seed of 2

```
Deck Contains: 6 3 2 4 5 6 6 1 1 4 3 1 6 5 4 2 2 5 2 5 3 3 1 4
Let the game begin player 1 is first.
Deck contains: 4 5 6 6 1 1 4 3 1 6 5 4 2 2 5 2 5 3 3 1 4
Player 1 Hand: 6 4
Deck contains: 5 6 6 1 1 4 3 1 6 5 4 2 2 5 2 5 3 3 1 4 4
Player 1 did not win this round.
Player 2 Hand: 3 5
Deck contains: 6 6 1 1 4 3 1 6 5 4 2 2 5 2 5 3 3 1 4 4 5
Player 2 did not win this round.
Player 3 Hand: 2 6
Deck contains: 6 1 1 4 3 1 6 5 4 2 2 5 2 5 3 3 1 4 4 5 6
Player 3 did not win this round.
Player 1 Hand: 6 6
Player 1 has won this round!
Deck contains: 1 1 4 3 1 6 5 4 2 2 5 2 5 3 3 1 4 4 5 6

Time for round 2
Dealer: deck shuffled.
Deck contains: 4 6 1 4 1 1 5 6 4 3 4 2 6 2 2 5 5 3 5 2 1 3 6 3
Let the game begin player 2 is first.
Deck contains: 4 1 1 5 6 4 3 4 2 6 2 2 5 5 3 5 2 1 3 6 3
Player 2 Hand: 4 4
Player 2 has won this round!
Deck contains: 1 1 5 6 4 3 4 2 6 2 2 5 5 3 5 2 1 3 6 3

Time for round 3
Dealer: deck shuffled.
Deck contains: 3 4 6 3 6 2 3 6 6 4 2 5 1 5 5 1 2 4 2 1 4 1 5 3
Let the game begin player 3 is first.
Deck contains: 3 6 2 3 6 6 4 2 5 1 5 5 1 2 4 2 1 4 1 5 3
Player 3 Hand: 3 3
Player 3 has won this round!
Deck contains: 6 2 3 6 6 4 2 5 1 5 5 1 2 4 2 1 4 1 5 3
Dealer: The game is over.

Process returned 0 (0x0)   execution time : 8.230 s
Press any key to continue.
```

This run was with a seed of 1

```
Deck Contains: 5 4 1 5 5 2 6 4 6 1 3 2 1 2 3 3 5 1 6 4 2 3 4 6
Let the game begin player 1 is first.
Deck contains: 5 5 2 6 4 6 1 3 2 1 2 3 3 5 1 6 4 2 3 4 6
Player 1 Hand: 5 5
Player 1 has won this round!
Deck contains: 5 2 6 4 6 1 3 2 1 2 3 3 5 1 6 4 2 3 4 6

Time for round 2
Dealer: deck shuffled.
Deck contains: 5 3 6 3 4 2 6 5 2 6 6 1 4 4 3 5 5 1 2 1 4 2 3 1
Let the game begin player 2 is first.
Deck contains: 3 4 2 6 5 2 6 6 1 4 4 3 5 5 1 2 1 4 2 3 1
Player 2 Hand: 5 3
Deck contains: 4 2 6 5 2 6 6 1 4 4 3 5 5 1 2 1 4 2 3 1 3
Player 2 did not win this round.
Player 3 Hand: 3 4
Deck contains: 2 6 5 2 6 6 1 4 4 3 5 5 1 2 1 4 2 3 1 3 4
Player 3 did not win this round.
Player 1 Hand: 6 2
Deck contains: 6 5 2 6 6 1 4 4 3 5 5 1 2 1 4 2 3 1 3 4 2
Player 1 did not win this round.
Player 2 Hand: 5 6
Deck contains: 5 2 6 6 1 4 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6
Player 2 did not win this round.
Player 3 Hand: 3 5
Deck contains: 2 6 6 1 4 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5
Player 3 did not win this round.
Player 1 Hand: 6 2
Deck contains: 6 6 1 4 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2
Player 1 did not win this round.
Player 2 Hand: 5 6
Deck contains: 6 1 4 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6
Player 2 did not win this round.
Player 3 Hand: 3 6
Deck contains: 1 4 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6
Player 3 did not win this round.
Player 1 Hand: 6 1
Deck contains: 4 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6 1
Player 1 did not win this round.
Player 2 Hand: 5 4
Deck contains: 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6 1 4
Player 2 did not win this round.
Player 3 Hand: 3 4
Deck contains: 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6 1 4 4
Player 3 did not win this round.
Player 1 Hand: 6 2
```

```
Player 1 Hand: 6 1
Deck contains: 4 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6 1
Player 1 did not win this round.
Player 2 Hand: 5 4
Deck contains: 4 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6 1 4
Player 2 did not win this round.
Player 3 Hand: 3 4
Deck contains: 3 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6 1 4 4
Player 3 did not win this round.
Player 1 Hand: 6 3
Deck contains: 5 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6 1 4 4 3
Player 1 did not win this round.
Player 2 Hand: 5 5
Player 2 has won this round!
Deck contains: 5 1 2 1 4 2 3 1 3 4 2 6 5 2 6 6 1 4 4 3

Time for round 3
Dealer: deck shuffled.
Deck contains: 5 5 6 4 3 6 1 6 2 2 1 4 3 6 5 2 5 3 3 4 1 4 2 1
Let the game begin player 3 is first.
Deck contains: 4 3 6 1 6 2 2 1 4 3 6 5 2 5 3 3 4 1 4 2 1
Player 3 Hand: 5 4
Deck contains: 3 6 1 6 2 2 1 4 3 6 5 2 5 3 3 4 1 4 2 1 4
Player 3 did not win this round.
Player 1 Hand: 5 3
Deck contains: 6 1 6 2 2 1 4 3 6 5 2 5 3 3 4 1 4 2 1 4 3
Player 1 did not win this round.
Player 2 Hand: 6 6
Player 2 has won this round!
Deck contains: 1 6 2 2 1 4 3 6 5 2 5 3 3 4 1 4 2 1 4 3
Dealer: The game is over.

Process returned 0 (0x0)   execution time : 1.190 s
Press any key to continue.
```

Seed 0

```
Deck Contains: 6 6 4 5 5 4 4 1 1 5 1 2 2 3 1 5 3 2 6 4 2 3 6 3
Let the game begin player 1 is first.
Deck contains: 5 5 4 4 1 1 5 1 2 2 3 1 5 3 2 6 4 2 3 6 3
Player 1 Hand: 6 5
Deck contains: 5 4 4 1 1 5 1 2 2 3 1 5 3 2 6 4 2 3 6 3 6
Player 1 did not win this round.
Player 2 Hand: 6 5
Deck contains: 4 4 1 1 5 1 2 2 3 1 5 3 2 6 4 2 3 6 3 6 6
Player 2 did not win this round.
Player 3 Hand: 4 4
Player 3 has won this round!
Deck contains: 4 1 1 5 1 2 2 3 1 5 3 2 6 4 2 3 6 3 6 6

Time for round 2
Dealer: deck shuffled.
Deck contains: 4 2 5 4 1 5 3 6 6 6 4 4 1 2 2 3 5 3 2 5 6 1 3 1
Let the game begin player 2 is first.
Deck contains: 4 1 5 3 6 6 6 4 4 1 2 2 3 5 3 2 5 6 1 3 1
Player 2 Hand: 4 4
Player 2 has won this round!
Deck contains: 1 5 3 6 6 6 4 4 1 2 2 3 5 3 2 5 6 1 3 1

Time for round 3
Dealer: deck shuffled.
Deck contains: 5 4 6 1 4 4 1 2 2 3 3 5 6 6 1 5 4 2 3 3 5 6 1 2
Let the game begin player 3 is first.
Deck contains: 1 4 4 1 2 2 3 3 5 6 6 1 5 4 2 3 3 5 6 1 2
Player 3 Hand: 5 1
Deck contains: 4 4 1 2 2 3 3 5 6 6 1 5 4 2 3 3 5 6 1 2 5
Player 3 did not win this round.
Player 1 Hand: 4 4
Player 1 has won this round!
Deck contains: 4 1 2 2 3 3 5 6 6 1 5 4 2 3 3 5 6 1 2 5
Dealer: The game is over.

Process returned 0 (0x0)   execution time : 1.147 s
Press any key to continue.
```

Seed 3

Round 1:

```
Deck Contains: 4 5 6 1 1 5 3 5 2 1 3 2 4 6 4 2 4 3 6 6 2 5 3 1
Let the game begin player 1 is first.
Deck contains: 1 1 5 3 5 2 1 3 2 4 6 4 2 4 3 6 6 2 5 3 1
Player 1 Hand: 4 1
Deck contains: 1 5 3 5 2 1 3 2 4 6 4 2 4 3 6 6 2 5 3 1 4
Player 1 did not win this round.
Player 2 Hand: 5 1
Deck contains: 5 3 5 2 1 3 2 4 6 4 2 4 3 6 6 2 5 3 1 4 5
Player 2 did not win this round.
Player 3 Hand: 6 5
Deck contains: 3 5 2 1 3 2 4 6 4 2 4 3 6 6 2 5 3 1 4 5 6
Player 3 did not win this round.
Player 1 Hand: 3 1
Deck contains: 5 2 1 3 2 4 6 4 2 4 3 6 6 2 5 3 1 4 5 6 3
Player 1 did not win this round.
Player 2 Hand: 5 1
Deck contains: 2 1 3 2 4 6 4 2 4 3 6 6 2 5 3 1 4 5 6 3 5
Player 2 did not win this round.
Player 3 Hand: 2 5
Deck contains: 1 3 2 4 6 4 2 4 3 6 6 2 5 3 1 4 5 6 3 5 2
Player 3 did not win this round.
Player 1 Hand: 1 1
Player 1 has won this round!
Deck contains: 3 2 4 6 4 2 4 3 6 6 2 5 3 1 4 5 6 3 5 2
```

Round 2:

```
Time for round 2
Dealer: deck shuffled.
Deck contains: 2 5 1 1 4 4 6 3 6 6 4 5 5 2 3 5 1 1 3 2 6 3 2 4
Let the game begin player 2 is first.
Deck contains: 1 4 4 6 3 6 6 4 5 5 2 3 5 1 1 3 2 6 3 2 4
Player 2 Hand: 2 1
Deck contains: 4 4 6 3 6 6 4 5 5 2 3 5 1 1 3 2 6 3 2 4 2
Player 2 did not win this round.
Player 3 Hand: 5 4
Deck contains: 4 6 3 6 6 4 5 5 2 3 5 1 1 3 2 6 3 2 4 2 5
Player 3 did not win this round.
Player 1 Hand: 1 4
Deck contains: 6 3 6 6 4 5 5 2 3 5 1 1 3 2 6 3 2 4 2 5 1
Player 1 did not win this round.
Player 2 Hand: 6 1
Deck contains: 3 6 6 4 5 5 2 3 5 1 1 3 2 6 3 2 4 2 5 1 6
Player 2 did not win this round.
Player 3 Hand: 3 4
Deck contains: 6 6 4 5 5 2 3 5 1 1 3 2 6 3 2 4 2 5 1 6 3
Player 3 did not win this round.
Player 1 Hand: 6 4
Deck contains: 6 4 5 5 2 3 5 1 1 3 2 6 3 2 4 2 5 1 6 3 6
Player 1 did not win this round.
Player 2 Hand: 6 1
Deck contains: 4 5 5 2 3 5 1 1 3 2 6 3 2 4 2 5 1 6 3 6 6
Player 2 did not win this round.
Player 3 Hand: 4 4
Player 3 has won this round!
Deck contains: 5 5 2 3 5 1 1 3 2 6 3 2 4 2 5 1 6 3 6 6
```

Round 3:

Time for round 3
Dealer: deck shuffled.
Deck contains: 5 3 4 6 5 1 1 2 2 3 3 4 3 6 6 5 4 1 1 5 2 4 6 2
Let the game begin player 3 is first.
Deck contains: 6 5 1 1 2 2 3 3 4 3 6 6 5 4 1 1 5 2 4 6 2
Player 3 Hand: 5 6
Deck contains: 5 1 1 2 2 3 3 4 3 6 6 5 4 1 1 5 2 4 6 2 5
Player 3 did not win this round.
Player 1 Hand: 3 5
Deck contains: 1 1 2 2 3 3 4 3 6 6 5 4 1 1 5 2 4 6 2 5 3
Player 1 did not win this round.
Player 2 Hand: 4 1
Deck contains: 1 2 2 3 3 4 3 6 6 5 4 1 1 5 2 4 6 2 5 3 4
Player 2 did not win this round.
Player 3 Hand: 1 6
Deck contains: 2 2 3 3 4 3 6 6 5 4 1 1 5 2 4 6 2 5 3 4 1
Player 3 did not win this round.
Player 1 Hand: 2 5
Deck contains: 2 3 3 4 3 6 6 5 4 1 1 5 2 4 6 2 5 3 4 1 2
Player 1 did not win this round.
Player 2 Hand: 2 1
Deck contains: 3 3 4 3 6 6 5 4 1 1 5 2 4 6 2 5 3 4 1 2 2
Player 2 did not win this round.
Player 3 Hand: 3 6
Deck contains: 3 4 3 6 6 5 4 1 1 5 2 4 6 2 5 3 4 1 2 2 3
Player 3 did not win this round.
Player 1 Hand: 3 5
Deck contains: 4 3 6 6 5 4 1 1 5 2 4 6 2 5 3 4 1 2 2 3 3
Player 1 did not win this round.
Player 2 Hand: 4 1
Deck contains: 3 6 6 5 4 1 1 5 2 4 6 2 5 3 4 1 2 2 3 3 4
Player 2 did not win this round.
Player 3 Hand: 3 6
Deck contains: 6 6 5 4 1 1 5 2 4 6 2 5 3 4 1 2 2 3 3 4 3
Player 3 did not win this round.
Player 1 Hand: 6 5
Deck contains: 6 5 4 1 1 5 2 4 6 2 5 3 4 1 2 2 3 3 4 3 6
Player 1 did not win this round.
Player 2 Hand: 6 1
Deck contains: 5 4 1 1 5 2 4 6 2 5 3 4 1 2 2 3 3 4 3 6 6
Player 2 did not win this round.
Player 3 Hand: 5 6
Deck contains: 4 1 1 5 2 4 6 2 5 3 4 1 2 2 3 3 4 3 6 6 5
Player 3 did not win this round.
Player 1 Hand: 4 5
Deck contains: 1 1 5 2 4 6 2 5 3 4 1 2 2 3 3 4 3 6 6 5 4

```
Player 1 Hand: 4 5
Deck contains: 1 1 5 2 4 6 2 5 3 4 1 2 2 3 3 4 3 6 6 5 4
Player 1 did not win this round.
Player 2 Hand: 1 1
Player 2 has won this round!
Deck contains: 1 5 2 4 6 2 5 3 4 1 2 2 3 3 4 3 6 6 5 4
Dealer: The game is over.

Process returned 0 (0x0)   execution time : 0.190 s
Press any key to continue.
```

Seed 4

Round 1:

```

Deck Contains: 3 6 6 5 5 3 4 2 4 1 2 5 3 1 2 1 1 2 4 5 3 6 6 4
Let the game begin player 1 is first.
Deck contains: 5 5 3 4 2 4 1 2 5 3 1 2 1 1 2 4 5 3 6 6 4
Player 1 Hand: 3 5
Deck contains: 5 3 4 2 4 1 2 5 3 1 2 1 1 2 4 5 3 6 6 4 5
Player 1 did not win this round.
Player 2 Hand: 6 5
Deck contains: 3 4 2 4 1 2 5 3 1 2 1 1 2 4 5 3 6 6 4 5 5
Player 2 did not win this round.
Player 3 Hand: 6 3
Deck contains: 4 2 4 1 2 5 3 1 2 1 1 2 4 5 3 6 6 4 5 5 3
Player 3 did not win this round.
Player 1 Hand: 3 4
Deck contains: 2 4 1 2 5 3 1 2 1 1 2 4 5 3 6 6 4 5 5 3 4
Player 1 did not win this round.
Player 2 Hand: 6 2
Deck contains: 4 1 2 5 3 1 2 1 1 2 4 5 3 6 6 4 5 5 3 4 2
Player 2 did not win this round.
Player 3 Hand: 6 4
Deck contains: 1 2 5 3 1 2 1 1 2 4 5 3 6 6 4 5 5 3 4 2 4
Player 3 did not win this round.
Player 1 Hand: 3 1
Deck contains: 2 5 3 1 2 1 1 2 4 5 3 6 6 4 5 5 3 4 2 4 1
Player 1 did not win this round.
Player 2 Hand: 6 2
Deck contains: 5 3 1 2 1 1 2 4 5 3 6 6 4 5 5 3 4 2 4 1 2
Player 2 did not win this round.
Player 3 Hand: 6 5
Deck contains: 3 1 2 1 1 2 4 5 3 6 6 4 5 5 3 4 2 4 1 2 5
Player 3 did not win this round.
Player 1 Hand: 3 3
Player 1 has won this round!
Deck contains: 1 2 1 1 2 4 5 3 6 6 4 5 5 3 4 2 4 1 2 5
Time for round 2

```

Round 2:

```

Time for round 2
Dealer: deck shuffled.
Deck contains: 3 4 2 6 2 2 6 5 1 3 1 1 3 4 5 5 1 2 6 6 5 3 4 4
Let the game begin player 2 is first.
Deck contains: 6 2 2 6 5 1 3 1 1 3 4 5 5 1 2 6 6 5 3 4 4
Player 3 Hand: 4 6
Deck contains: 2 2 6 5 1 3 1 1 3 4 5 5 1 2 6 6 5 3 4 4 6
Player 3 did not win this round.
Player 1 Hand: 2 2
Player 1 has won this round!
Deck contains: 2 6 5 1 3 1 1 3 4 5 5 1 2 6 6 5 3 4 4 6
Time for round 3

```

Round 3:

```
Time for round 3
Dealer: deck shuffled.
Deck contains: 5 4 2 1 5 3 4 5 3 4 1 2 6 6 6 6 5 3 4 1 1 2 2
Let the game begin player 3 is first.
Deck contains: 1 5 3 4 5 3 4 1 2 6 6 6 6 5 3 4 1 1 2 2
Player 3 Hand: 5 1
Deck contains: 5 3 4 5 3 4 1 2 6 6 6 6 5 3 4 1 1 2 2 1
Player 3 did not win this round.
Player 1 Hand: 4 0
Deck contains: 5 3 4 5 3 4 1 2 6 6 6 6 5 3 4 1 1 2 2 1
Player 1 did not win this round.
Player 2 Hand: 2 5
Deck contains: 3 4 5 3 4 1 2 6 6 6 6 5 3 4 1 1 2 2 1 5
Player 2 did not win this round.
Player 3 Hand: 5 3
Deck contains: 4 5 3 4 1 2 6 6 6 6 5 3 4 1 1 2 2 1 5 3
Player 3 did not win this round.
Player 1 Hand: 4 4
Player 1 has won this round!
Deck contains: 5 3 4 1 2 6 6 6 6 5 3 4 1 1 2 2 1 5 3
Dealer: The game is over.

Process returned 0 (0x0)   execution time : 1.210 s
Press any key to continue.
```