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COP 3331

Final Project Report

Develop a computer Casino program that has three games: Slot Machine, Blackjack, and Texas Hold'em. Also indicate where the required components are implemented.

Required Components:

- **Operator Overloading**
  - Slot Machine : Machine class has overloaded stream extraction operator

  - Blackjack: BJCard class has overloaded assignment operator, BJPlayer class has overloaded stream extraction operator

  - Texas Hold'em: Card class has overloaded assignment operator, Player class has overloaded boolean operators > and ==

- **Inheritance**
  - Slot Machine: Reel, Reel2, and Reel3 classes use inheritance from base class Symbols

  - Blackjack: BJDeck class inherits from base class Hand, Gambler and Dealer classes inherit from base class BJPlayer

- **Polymorphism**
  - Slot Machine: Abstract base class Symbols contains a pure virtual member function

  - Blackjack: Abstract base class BJPlayer contains pure virtual and virtual member functions

- **Template**
  - Used in the Main.cpp file to check if user input is of the desired type

- **Vector**
    - Slot Machine: Machine class implements a vector of base class pointers of the Symbols class

    - Blackjack: Hand class implements a vector of BJCard class objects, BJPlayer class implements a vector of pointers of the Hand class, Gambler class implements a vector of unsigned integers, BJGame class implements a vector of base class pointers of the BJPlayer class

    - Texas Hold’em: Deck class implements a vector Card class objects
- **Const and Static**
    - Slot Machine: Static const array is a private data member of the Symbols class

    - Blackjack: Two static const arrays are private data members of the BJCard class

    - Texas Hold’em: Static const array is private data member of the Card class
- **New and Delete**
    - Slot Machine: Machine class features use of new and delete on base class pointers of class Symbols

    - Blackjack: BJPlayer class features use of new and delete on pointers of class Hand, BJGame features use of new and delete on base class pointers of the class BJPlayer

Program Structure:

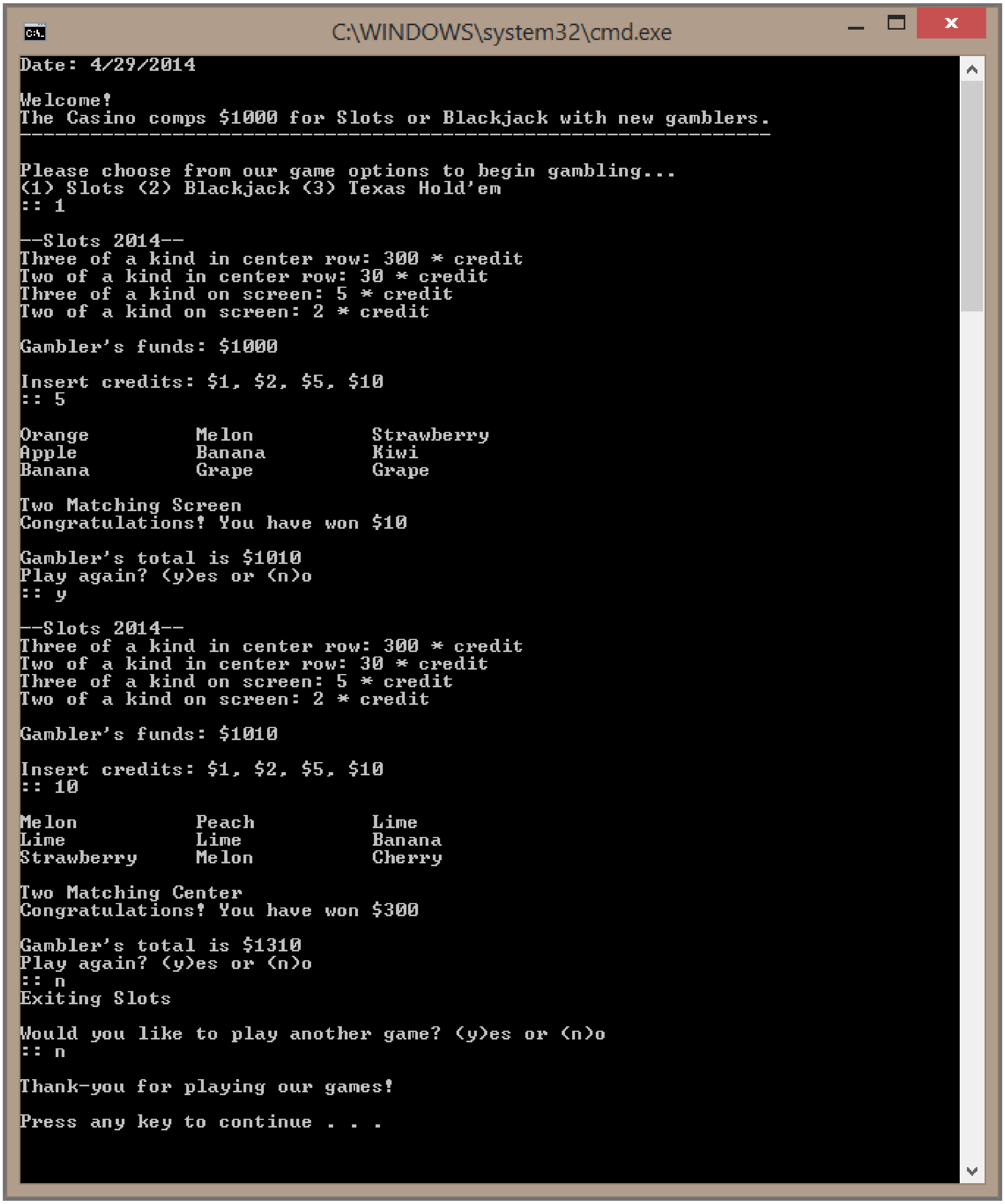
Upon execution of the groups Casino program the user is first shown the current system date and a brief welcome message that informs the user of a $1000 starting balance if he/she decides to select either the Slot Machine or Blackjack games. A simple prompt allows the user to choose from any of the three games required by the project. Once the user has given input to the computer corresponding to a valid game, the user’s selection will be sent as the argument for a three case switch statement. Each case of the switch statement contains the relevant functions and objects associated with a specific game nested inside a try-catch block that will evaluate “invalid_arguments” thrown during run-time. The inclusion of do-while structure allows for continuous processing of a game’s functions and objects if the user agrees to the conditional parameter of the “while”. A general do-while structure encompasses the whole of the switch statement and is meant to offer the user a chance to choose another game from any of the three games available.

The Slot Machine program contains five classes of which there is the Symbols class, an abstract base class that provides the derived classes Reel, Reel2, and Reel3 with the necessary member functions to randomly instantiate each derived classes own array of type string. The included static const data member array Fruits has ten predefined string literals and serves as a collection to populate an array of strings randomly.

The Machine class has member functions and data members that mimic the functionality of a real slot machine. For instance the vector of base class pointers instantiates three derived objects using the “new” operator, this would be the three reels of a slot machine. A two dimensional array of size 3 x 3 holds strings representing the three rows of symbols displayed on screen at any time. The member function pullHandle() populates the two dimensional array based of a randomly generated number given by another member function.

The key to this program is the use of polymorphism to dynamically create three derived objects that each include an individually randomized array of strings.

An example of the Slot Machine program:



```
Date: 4/29/2014

Welcome!
The Casino comps $1000 for Slots or Blackjack with new gamblers.
----------------------------------------------------------------

Please choose from our game options to begin gambling...
(1) Slots (2) Blackjack (3) Texas Hold'em
:: 1

--Slots 2014--
Three of a kind in center row: 300 * credit
Two of a kind in center row: 30 * credit
Three of a kind on screen: 5 * credit
Two of a kind on screen: 2 * credit

Gambler's funds: $1000

Insert credits: $1, $2, $5, $10
:: 5

Orange          Melon           Strawberry
Apple           Banana          Kiwi
Banana          Grape           Grape

Two Matching Screen
Congratulations! You have won $10

Gambler's total is $1010
Play again? (y)es or (n)o
:: y

--Slots 2014--
Three of a kind in center row: 300 * credit
Two of a kind in center row: 30 * credit
Three of a kind on screen: 5 * credit
Two of a kind on screen: 2 * credit

Gambler's funds: $1010

Insert credits: $1, $2, $5, $10
:: 10

Melon           Peach           Lime
Lime            Lime            Banana
Strawberry      Melon           Cherry

Two Matching Center
Congratulations! You have won $300

Gambler's total is $1310
Play again? (y)es or (n)o
:: n
Exiting Slots

Would you like to play another game? (y)es or (n)o
:: n

Thank-you for playing our games!

Press any key to continue . . .
```

The Blackjack program contains seven classes of which two are derived classes from an abstract base class called BJPlayer. The BJPlayer class provides all the functionality of a real gambler and dealer for a game of Blackjack. BJPlayer provides the necessary virtual functions to the derived classes for redefinition depending on the derived object's type.

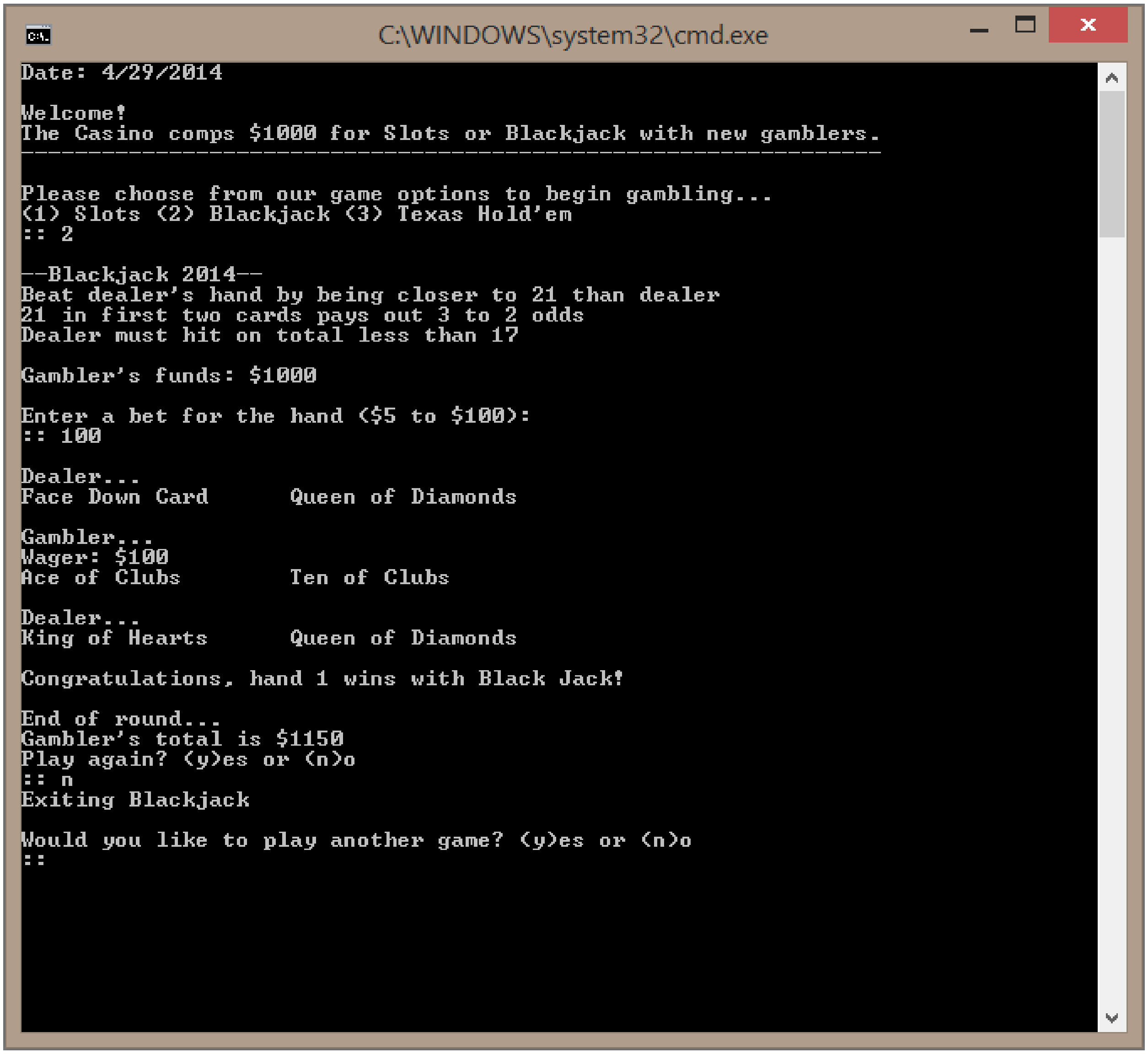
Due to the dangerous nature of "downcasting" or dynamic casting there needed to be a method for determining which derived object a base class pointer was referencing. This was accomplished through the inclusion of an enumeration called Type that contains definitions representing a derived class's name where protected data member "object_id" of type "Type" is used to store the identifier for a derived class. Essentially when a derived class object is instantiated through the use of the "new" operator the derived class object overrides a pure virtual member function of the base class in its constructor and stores the derived objects "Type" in the protected data member "object_id" located in the base class. The base class provides a non-virtual member function to return the protected data member "object_id" . This functionality is extremely useful when the programmer does not know the order in which derived class objects are stored in a container, such as a vector. A simple if-else structure could be used to ensure that only certain derived objects of a certain type are acted upon in some manner elsewhere in the program thus creating a level of abstraction inherent to polymorphism.

However, the Blackjack program only instantiates a single Dealer and Gambler derived class object. Therefore the programmer can simply refer to the two objects using the member functions front() and back() of the vector class, as is the case with this program.

Another workaround in the base class BJPlayer is the use of the overloaded stream extraction operator. Knowing that an abstract base class cannot have a function declared virtual and that function be a non-member, there needed to be another means of overloading the stream extraction operator as declaring it a friend function would not allow the derived class objects to override such function. Creating a pure virtual function in the base class that returns an ostream reference allows for a "free standing function", in this case an in-line function in the header of BJPlayer, to overload the stream extraction operator and call the pure virtual function in its return statement. This chaining of non-member and member functions grants access to derived classes the overloaded stream extraction operator such that each derived class can implement its own version of the ostream reference function.

Among the other classes in the Blackjack program there is the Hand class and it's inherited by the BJDeck class. A BJDeck class object stores fifty-two BJCard class objects using a vector of type BJCard in the Hand class. Derived class objects from base class BJPlayer also store a series of BJCard objects using a dynamically allocated Hand class object. The BJGame class includes the appropriate headers to provide all the general purpose functionality of a typical round of Blackjack.

Examples of the Blackjack program:



```
Date: 4/29/2014

Welcome!
The Casino comps $1000 for Slots or Blackjack with new gamblers.
----------------------------------------------------------------

Please choose from our game options to begin gambling...
(1) Slots (2) Blackjack (3) Texas Hold'em
:: 2

--Blackjack 2014--
Beat dealer's hand by being closer to 21 than dealer
21 in first two cards pays out 3 to 2 odds
Dealer must hit on total less than 17

Gambler's funds: $1000

Enter a bet for the hand ($5 to $100):
:: 100

Dealer...
Face Down Card      Queen of Diamonds

Gambler...
Wager: $100
Ace of Clubs        Ten of Clubs

Dealer...
King of Hearts      Queen of Diamonds

Congratulations, hand 1 wins with Black Jack!

End of round...
Gambler's total is $1150
Play again? (y)es or (n)o
:: n
Exiting Blackjack

Would you like to play another game? (y)es or (n)o
::
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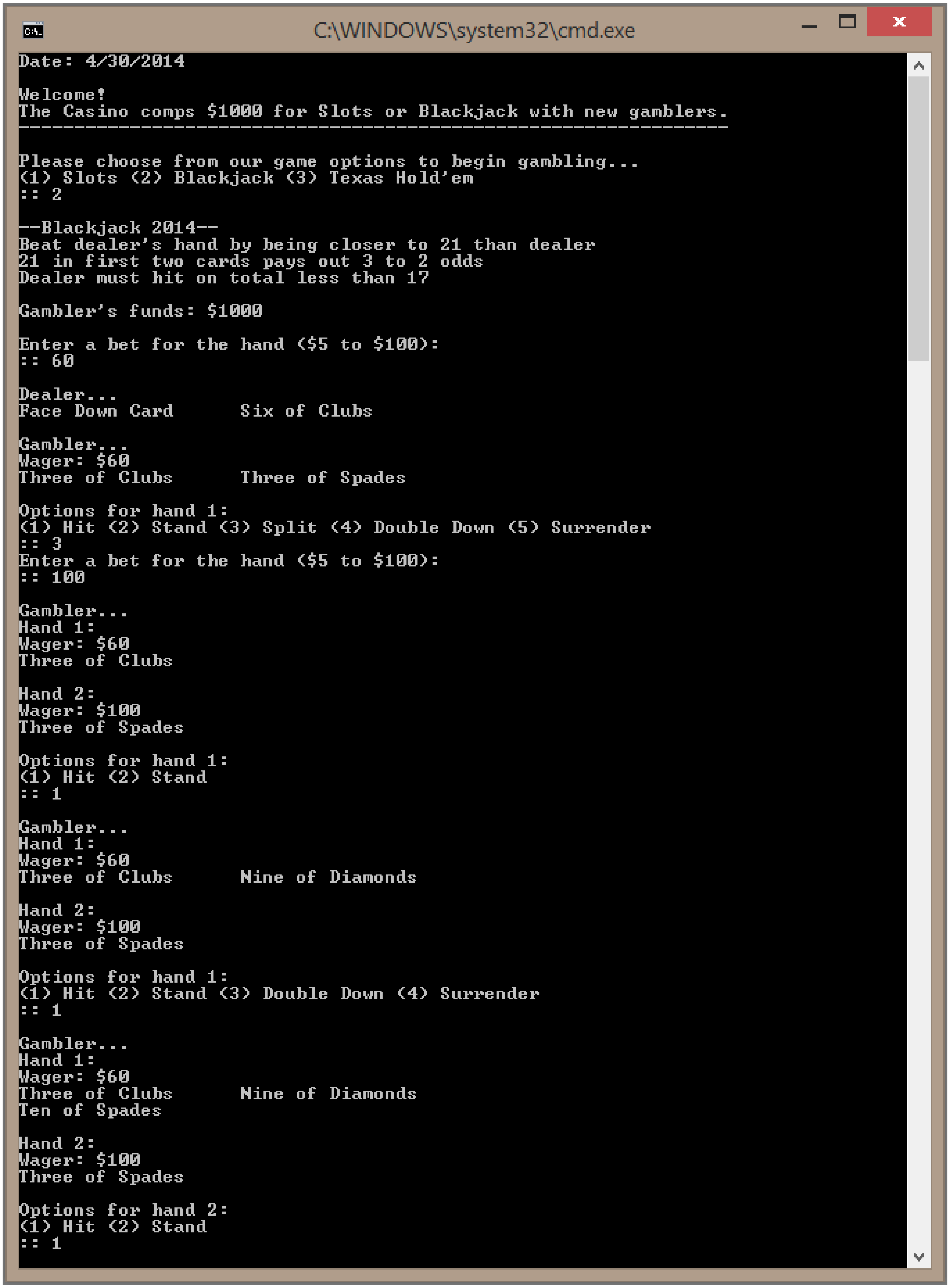

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Date: 4/30/2014

Welcome!
The Casino comps $1000 for Slots or Blackjack with new gamblers.
----------------------------------------------------------------

Please choose from our game options to begin gambling...
(1) Slots (2) Blackjack (3) Texas Hold'em
:: 2

--Blackjack 2014--
Beat dealer's hand by being closer to 21 than dealer
21 in first two cards pays out 3 to 2 odds
Dealer must hit on total less than 17

Gambler's funds: $1000

Enter a bet for the hand ($5 to $100):
:: 60

Dealer...
Face Down Card      Six of Clubs

Gambler...
Wager: $60
Three of Clubs      Three of Spades

Options for hand 1:
(1) Hit (2) Stand (3) Split (4) Double Down (5) Surrender
:: 3
Enter a bet for the hand ($5 to $100):
:: 100

Gambler...
Hand 1:
Wager: $60
Three of Clubs

Hand 2:
Wager: $100
Three of Spades

Options for hand 1:
(1) Hit (2) Stand
:: 1

Gambler...
Hand 1:
Wager: $60
Three of Clubs      Nine of Diamonds

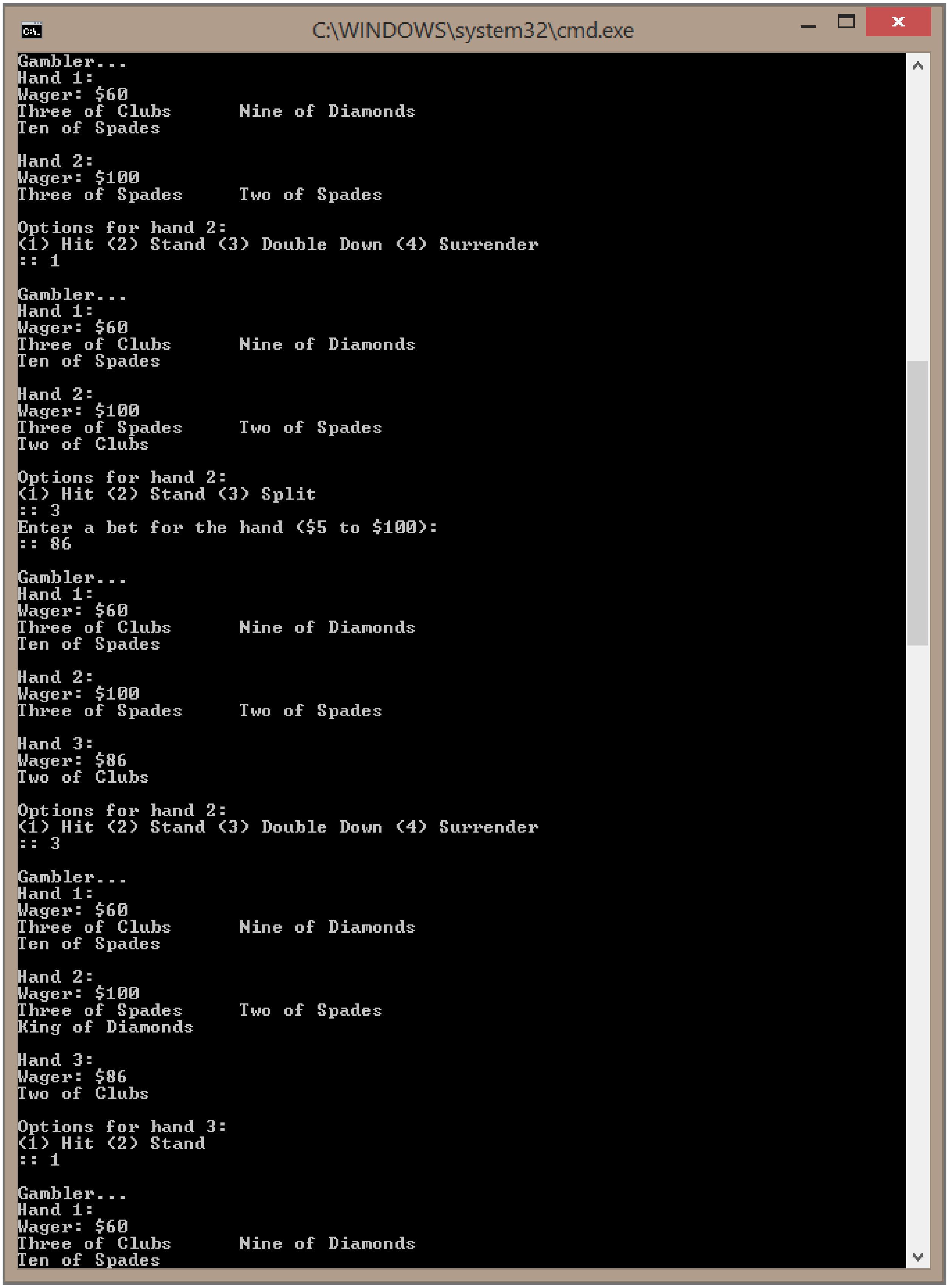
Hand 2:
Wager: $100
Three of Spades

Options for hand 1:
(1) Hit (2) Stand (3) Double Down (4) Surrender
:: 1

Gambler...
Hand 1:
Wager: $60
Three of Clubs      Nine of Diamonds
Ten of Spades

Hand 2:
Wager: $100
Three of Spades

Options for hand 2:
(1) Hit (2) Stand
:: 1
```



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Gambler...
Hand 1:
Wager: $60
Three of Clubs      Nine of Diamonds
Ten of Spades

Hand 2:
Wager: $100
Three of Spades     Two of Spades

Options for hand 2:
(1) Hit (2) Stand (3) Double Down (4) Surrender
:: 1

Gambler...
Hand 1:
Wager: $60
Three of Clubs      Nine of Diamonds
Ten of Spades

Hand 2:
Wager: $100
Three of Spades     Two of Spades
Two of Clubs

Options for hand 2:
(1) Hit (2) Stand (3) Split
:: 3
Enter a bet for the hand ($5 to $100):
:: 86

Gambler...
Hand 1:
Wager: $60
Three of Clubs      Nine of Diamonds
Ten of Spades

Hand 2:
Wager: $100
Three of Spades     Two of Spades

Hand 3:
Wager: $86
Two of Clubs

Options for hand 2:
(1) Hit (2) Stand (3) Double Down (4) Surrender
:: 3

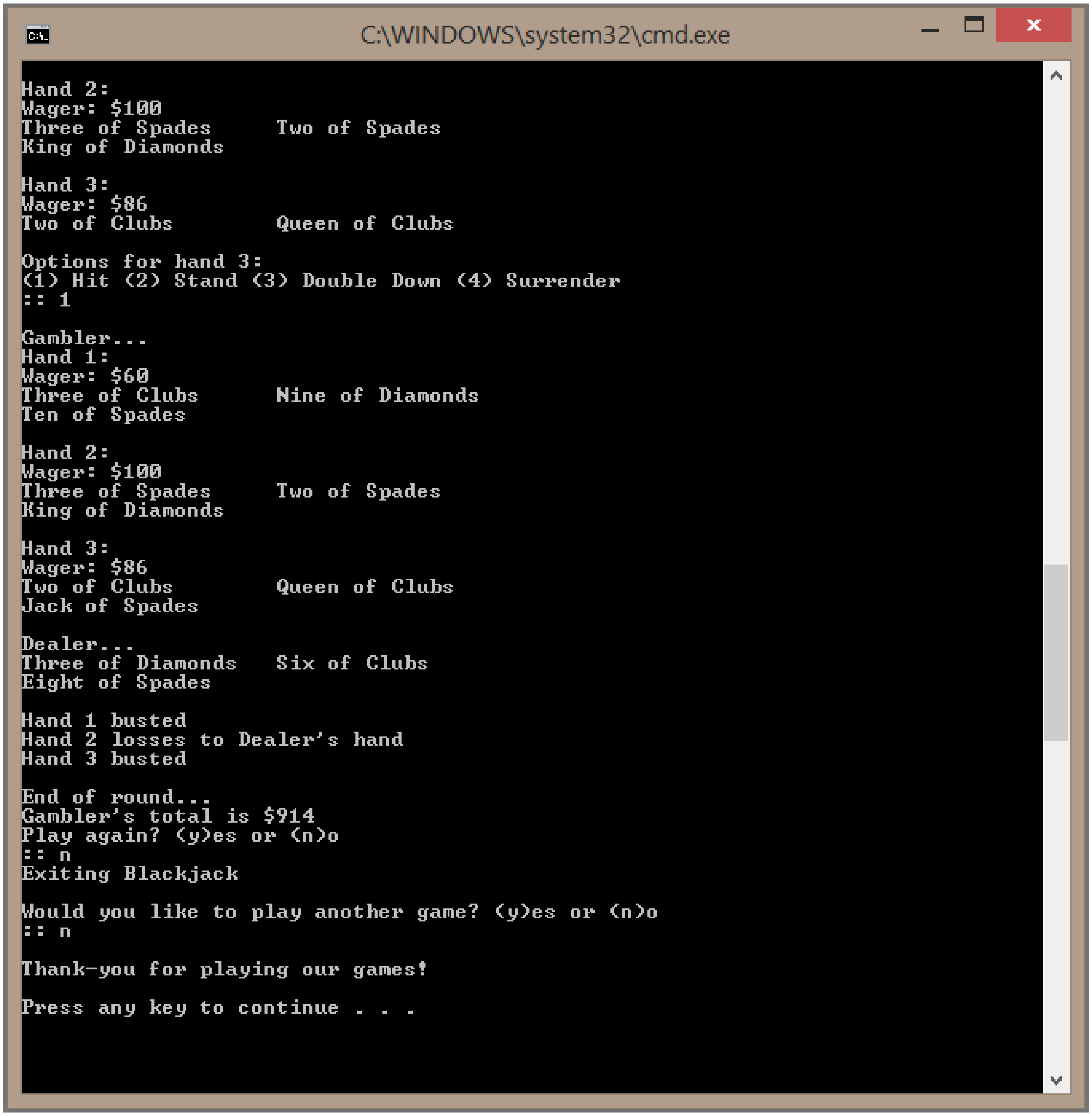
Gambler...
Hand 1:
Wager: $60
Three of Clubs      Nine of Diamonds
Ten of Spades

Hand 2:
Wager: $100
Three of Spades     Two of Spades
King of Diamonds

Hand 3:
Wager: $86
Two of Clubs

Options for hand 3:
(1) Hit (2) Stand
:: 1

Gambler...
Hand 1:
Wager: $60
Three of Clubs      Nine of Diamonds
Ten of Spades
```



```
Hand 2:
Wager: $100
Three of Spades     Two of Spades
King of Diamonds

Hand 3:
Wager: $86
Two of Clubs        Queen of Clubs

Options for hand 3:
(1) Hit (2) Stand (3) Double Down (4) Surrender
:: 1

Gambler...
Hand 1:
Wager: $60
Three of Clubs      Nine of Diamonds
Ten of Spades

Hand 2:
Wager: $100
Three of Spades     Two of Spades
King of Diamonds

Hand 3:
Wager: $86
Two of Clubs        Queen of Clubs
Jack of Spades

Dealer...
Three of Diamonds   Six of Clubs
Eight of Spades

Hand 1 busted
Hand 2 losses to Dealer's hand
Hand 3 busted

End of round...
Gambler's total is $914
Play again? (y)es or (n)o
:: n
Exiting Blackjack

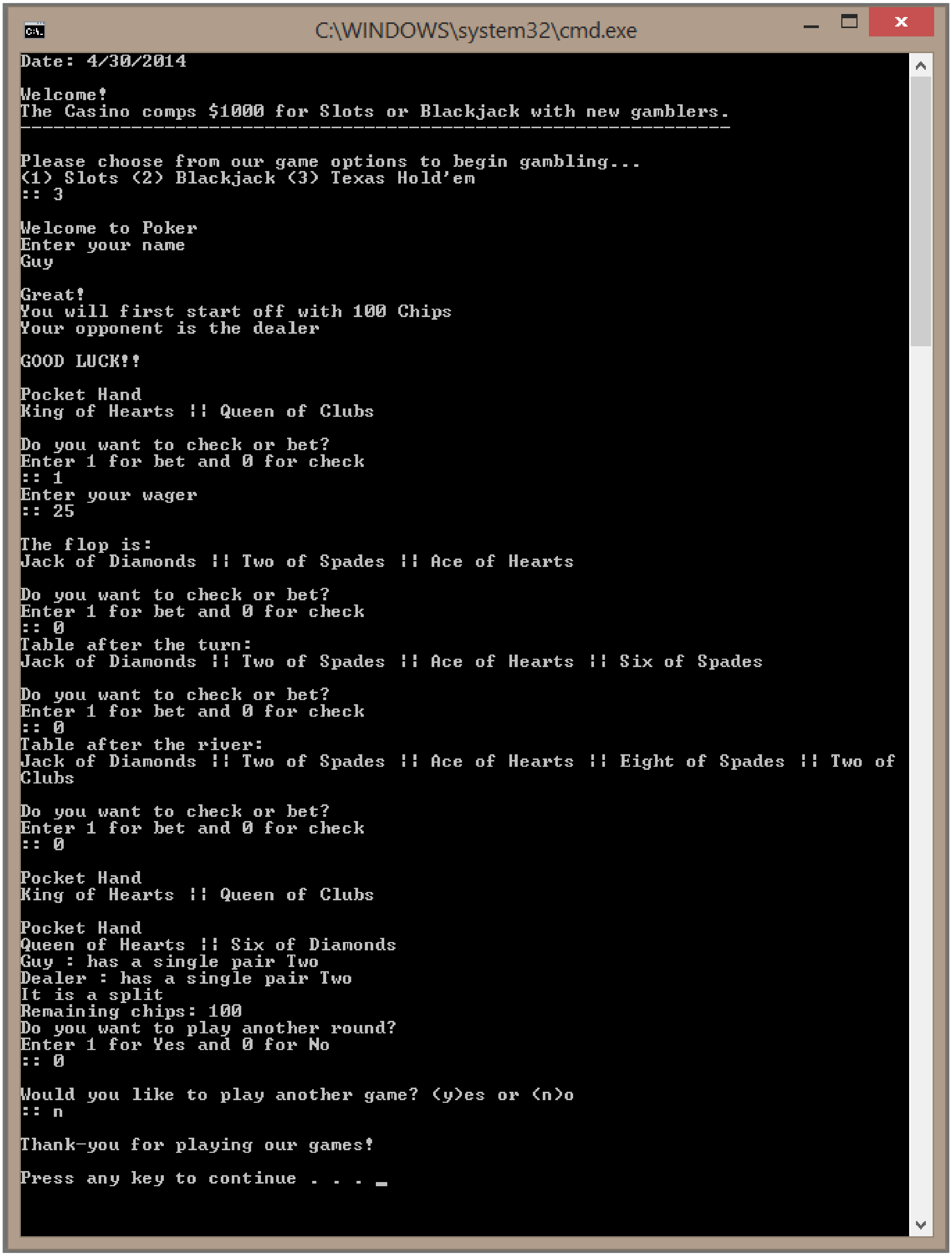
Would you like to play another game? (y)es or (n)o
:: n

Thank-you for playing our games!

Press any key to continue . . .
```

Texas Hold'em was quite an accomplishment for a group who knew little of the fundamentals of Poker. The program features mostly object composition throughout but also makes use of friend classes to grant special access to private members of the Player class. While the use of friend functions/classes can be argued that it breaks the rule of encapsulation, it was deemed necessary to implement. There are also overloaded operator functions in the Player class to allow comparisons of the Player objects.

An example of the Texas Hold'em program:



```
Date: 4/30/2014

Welcome!
The Casino comps $1000 for Slots or Blackjack with new gamblers.
----------------------------------------------------------------

Please choose from our game options to begin gambling...
(1) Slots (2) Blackjack (3) Texas Hold'em
:: 3

Welcome to Poker
Enter your name
Guy

Great!
You will first start off with 100 Chips
Your opponent is the dealer

GOOD LUCK!!

Pocket Hand
King of Hearts || Queen of Clubs

Do you want to check or bet?
Enter 1 for bet and 0 for check
:: 1
Enter your wager
:: 25

The flop is:
Jack of Diamonds || Two of Spades || Ace of Hearts

Do you want to check or bet?
Enter 1 for bet and 0 for check
:: 0
Table after the turn:
Jack of Diamonds || Two of Spades || Ace of Hearts || Six of Spades

Do you want to check or bet?
Enter 1 for bet and 0 for check
:: 0
Table after the river:
Jack of Diamonds || Two of Spades || Ace of Hearts || Eight of Spades || Two of
Clubs

Do you want to check or bet?
Enter 1 for bet and 0 for check
:: 0

Pocket Hand
King of Hearts || Queen of Clubs

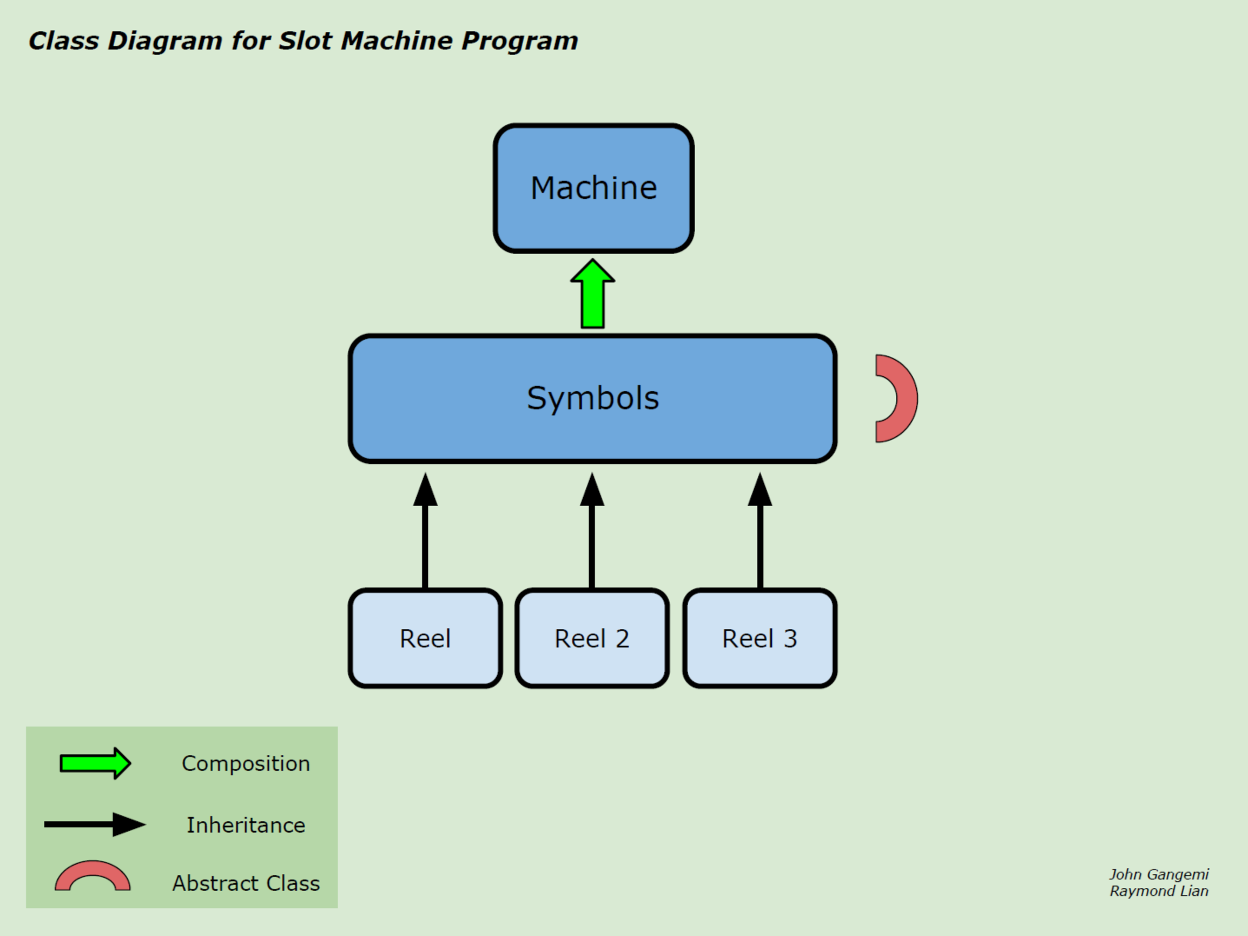
Pocket Hand
Queen of Hearts || Six of Diamonds
Guy : has a single pair Two
Dealer : has a single pair Two
It is a split
Remaining chips: 100
Do you want to play another round?
Enter 1 for Yes and 0 for No
:: 0

Would you like to play another game? (y)es or (n)o
:: n

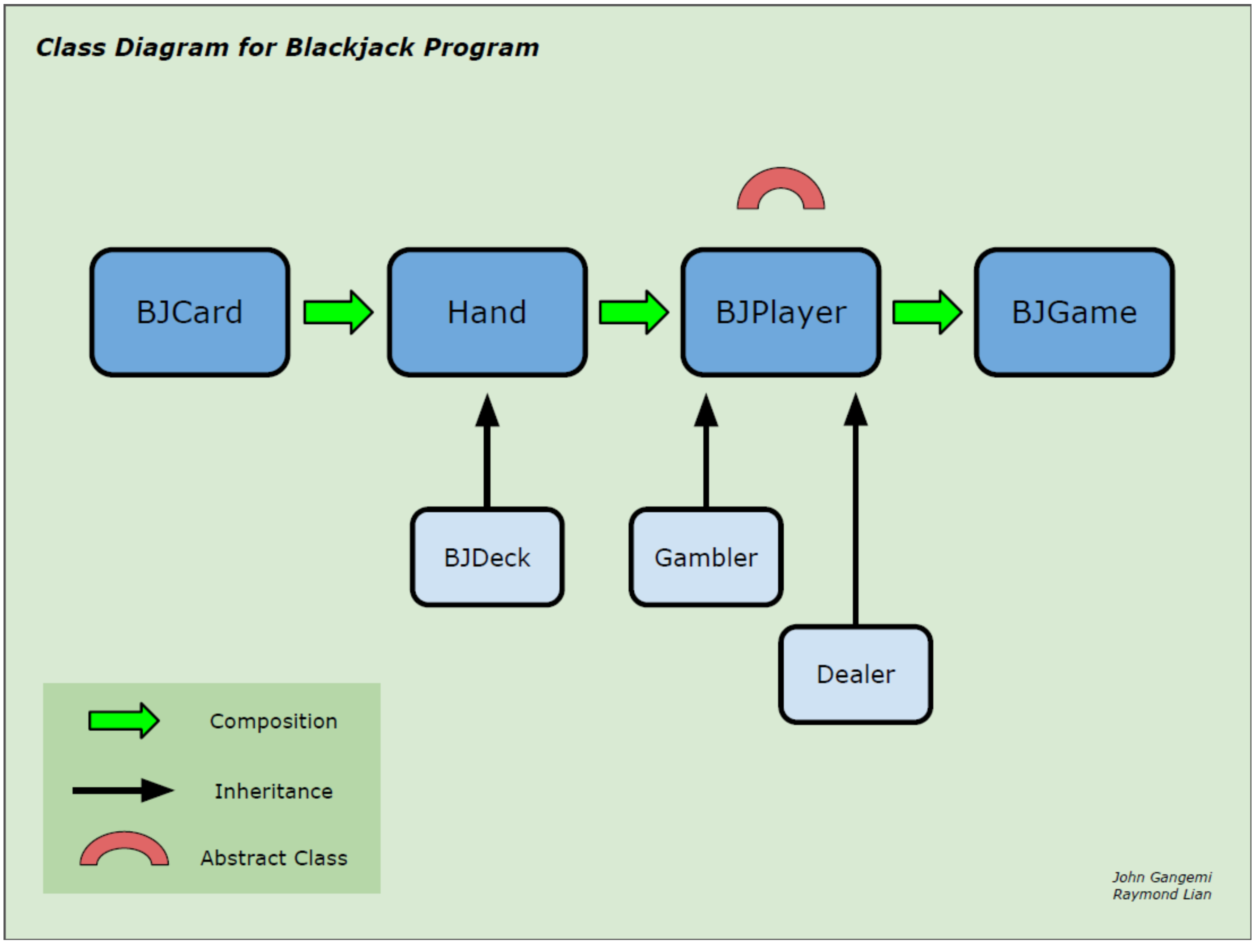
Thank-you for playing our games!

Press any key to continue . . . _
```

Class Diagrams:



Class Diagram for Blackjack Program



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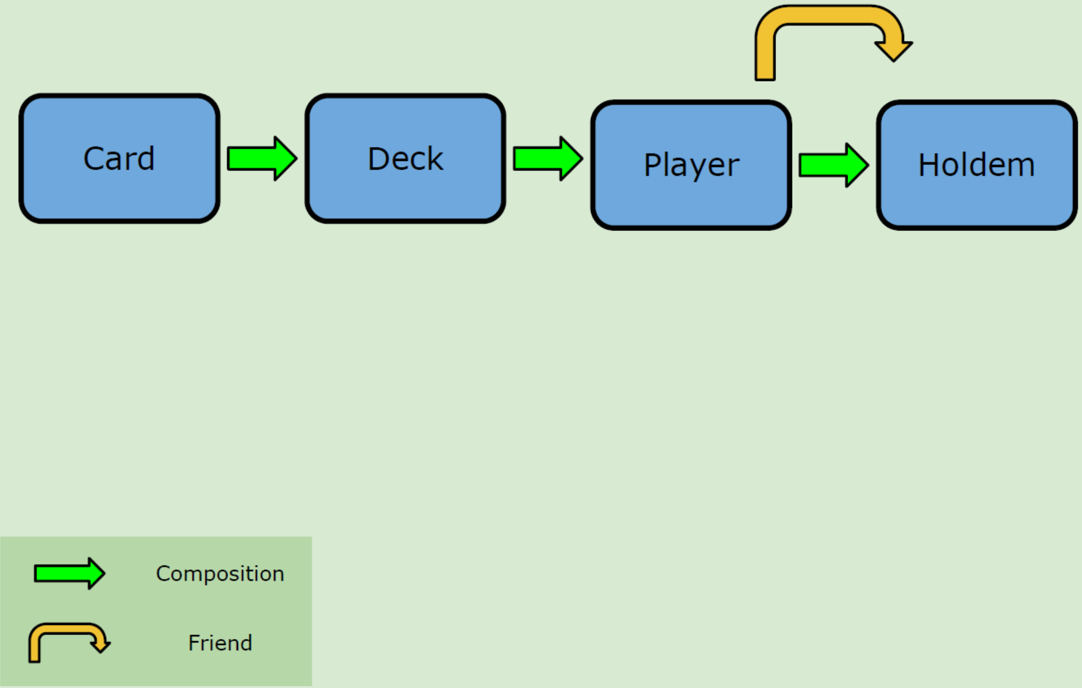
Class Diagram for Texas Hold'em Program



Card

Deck

Player

Holdem

Composition

Friend

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