Lab 5: Vegas Blackjack

Assigned: March 3, 2017   *Due: March 17, 2017*

In this lab we will be writing a text-based computer game based upon a card game, casino blackjack.

Description and Rules of Blackjack

You can find many descriptions of blackjack online. There are several variants of the game. The rules we will use are similar to those used in most American casinos. Your program must adhere to the rules as described below.

Your program will have only a single player (the person running the program) and the dealer, whose actions will be determined by the program. The player is playing against the dealer. Blackjack is played in rounds. The cards held by the player during a round are called the player's hand. The player's objective in each round is to obtain a hand value higher than the dealer's hand value, without exceeding 21. The value of each card is as follows:

Card	2	3	4	5	6	7	8	9	10	Jack	Queen	King	Ace
Value	2	3	4	5	6	7	8	9	10	10	10	10	11 or 1

(Cards also have 'suits': Spades, Clubs, Hearts, or Diamonds, but this is irrelevant to this game.)

The hand value is the sum of the card values in the hand. For example, if the player has a hand consisting of a 6 and a Queen, the player's hand value is 16. An Ace can have a value of 11 or 1, depending on which value is better for the person holding the hand. For example, if the player or dealer has a hand consisting of a 7 and an Ace, the hand value is 18. However, if the player or dealer has a hand consisting of a 7, an Ace, and a 6, the hand value is 14, because if the Ace's value were 11 the hand value would exceed 21, which is undesirable.

A round of blackjack is played as follows. Two cards are given (dealt) to the player and two cards to the dealer. The player is shown all of the cards in their hand, but only shown one of the dealer's cards. If the player's hand value at this point equals 21, the player has blackjack, and the player automatically wins the round unless the dealer also has blackjack, which results in a tie (known as a push). If the player does not have blackjack, the player may choose to 'hit' or 'stand'. Choosing to hit means one card is added to the player's hand. The player may continue to hit as many times as they wish, as long as their hand value does not equal or exceed 21. If the player's hand value exceeds 21, the player has busted, and automatically loses the round regardless of the dealer's hand. When the player no longer wishes to hit, or has a hand value equal to 21, the player stands, which transfers play to the dealer.

From this point forward, the player is shown all of the dealer's cards. The dealer's hand is similar to the player's, but the dealer has no choices to make. If the dealer's hand value is 21 with only two cards, the dealer has blackjack, and the player loses (unless the player also has blackjack, as described above). If the dealer does not have blackjack, the dealer must continue to hit as long as the dealer's hand value is less than 17, and must stand if the dealer's hand value is equal to or greater than 17. The dealer's Aces are always taken to have a value of 11 unless doing so would cause the dealer's hand value to exceed 21 (in casino lingo, we require the dealer to stand on a soft 17). If the dealer's hand value exceeds 21, the dealer has busted, and the player wins unless the player has also busted (in which case the player loses).

After both player and dealer are done, the hand values are compared. The winning hand has the highest value without exceeding 21. If the hand values are equal, the player and dealer push (tie). As described above, a blackjack (a hand value of 21 with only two cards in the hand) beats any other hand, including a hand with more than two cards whose value is 21.

The player places a monetary bet before each round of blackjack. If the player wins the round with a blackjack, they receive money equal to 1.5 times their bet. If the player wins the round with any hand other than a blackjack, they receive money equal to their bet. If the player pushes with the dealer, no money is received or lost. If the player loses the round, they lose money equal to their bet. For this program, the player will start with 300 dollars, and will be allowed to bet and play rounds until they run out of money or quit the game. Quitting the game will be indicated by the player placing a bet of 0 dollars. Players should not be allowed to place a bet larger than the amount of money they have!

We will assume that the hands are dealt from an infinite deck of cards, so that any card is equally likely to be dealt at any time. (In the real world, some players use 'card counting' and exploit the finite size of the deck to determine the relative probability of certain cards being dealt. Casinos often ban players suspected of doing this.) When adding a card to a hand, your program should randomly select a number from 1 to 13, and add the card corresponding to the number selected.

Extra credit

5 points of extra credit will be awarded for correctly implementing 'double down'. Doubling down is a choice a player may make which is similar to asking for a hit, but with the following conditions:

- doubling down can only be done when the player's hand has only two cards (right after dealing and checking for blackjacks)
- the player's bet on the round is doubled
- a single card is added to the player's hand and then the player is required to stand (the player is not allowed to hit more than once after doubling down).
- http://www.youtube.com/watch?v=dxlbeqeGkQ8

You may choose to implement a more realistic finite-sized card deck from which the hands are dealt. However, you will not receive extra credit for doing so.

Detailed Lab Programming Requirements

Your code must use the classes 'Card', 'Hand', and 'Blackjack' described in Card.h, Hand.h and Blackjack.h files provided by the instructor. The instructor will also provide the main.cpp file. Download these files from t-square.

There are additional requirements described in the comments of these files. Your final code must use all of the above files with no modifications whatsoever, with one exception: you may make additions to Blackjack.h in order to accomplish the extra credit task, if you choose to do it. However, you are welcome to modify these files if desired during the coding and debugging process. You must write three files: Card.cpp, Hand.cpp, and Blackjack.cpp, which will contain all of the member function implementations that you've written.

My suggestion is that you perform tasks in the following order:

1. Write implementations for the Card member functions, and write a small main-card.cpp file to test this class alone. Do not proceed to step 2 until Card class is working.
2. Write implementations for the Hand member functions, and write a small main-hand.cpp file to test class Hand and Card.
3. Finally, write implementations for the Blackjack member functions.

Turnin Procedures

You have the choice to use any ONE of the following submission methods for this lab:

1. You may upload your source code to the deepthought cluster and submit it using the turnin script, as you did for Lab 0. You MUST ensure that your code compiles and runs properly on deepthought if you choose this method.

Depending on your section, from your home directory enter one of the following at the command prompt.

turnin-ece2036a Lab5

or

turnin-ece2036b Lab5

This automatically copies everything in your Lab5 directory to a place that we can access (and grade) it.

2. You may bring your laptop to the TA's office hours before the due date and time and demonstrate your code. The TA will check your source code in addition to checking that your code compiles and runs properly. The demonstrations will be conducted on a first-come, first-served basis during the TA's posted office hours. If the TA's office hours end while you are still waiting in line, you must either attend another TA office hour before the due date/time to try again, or use submission method 1.

Grading Rubric

If a student's program runs correctly and produces the desired output, the student has the potential to get a 100 on his or her lab; however, TA's will randomly look through this set of "perfect-output" programs to look for other elements of meeting the lab requirements. The table below shows typical deductions that could occur.

In addition, if a student's code does not compile, then he or she will have an automatic 30% deduction on the lab. Code that compiles, but does not match the sample output can incur a deduction from 10% to 30% depending on how poorly the output matches the output specified by the lab. This is in addition to the other deductions listed below or due to the student not attempting the entire assignment.

AUTOMATIC GRADING POINT DEDUCTIONS

Element	Percentage Deduction	Details
Does Not Compile	30%	Program does not compile on deepthought cluster
Does Not Match Output	10%-30%	The program compiles but doesn't match all output exactly

ADDITIONAL GRADING POINT DEDUCTIONS FOR RANDOMLY SELECTED PROGRAMS

Element	Percentage Deduction	Details
Implement all Card member functions	10%	Does not fully implement all Card member functions described in the provided Card.h file.
Implement all Hand member functions and operator overloads	10%	Does not fully implement all member functions and operator overloads described in the provided Hand.h file.

Element	Percentage Deduction	Details
Implement all Blackjack member functions	10%	Does fully implement all member functions described in the provided Blackjack.h file.
Dynamic allocation	10%	Does not dynamically allocate and delete new Cards correctly.
Clear Self-Documenting Coding Styles	5%-15%	This can include incorrect indentation, using unclear variable names, unclear comments, or compiling with warnings.

LATE POLICY

Element	Percentage Deduction	Details
First Day	20%	By Monday after the due date
Each Additional Day	20% per day	The weekend (Sat/Sun) will count as one day

Sample output from completed code

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bash-3.2$ ./a.out

Player starts with 300 dollars


Round 1
Enter bet in dollars, 0 to quit: 20
Dealer's first card is: Queen

Player's hand is: Six  Jack
Player's hand value is 16
What would you like to do?  Enter (h)it or (s)tand: h

Player's hand is: Six  Jack  Four
Player's hand value is 20
What would you like to do?  Enter (h)it or (s)tand: s

Dealer's hand is: Queen  Five
Dealer's hand value is 15

Dealer's hand is: Queen  Five  Queen
Dealer's hand value is 25

Dealer's hand is bust.  Player wins!
Player has 320 dollars


Round 2
Enter bet in dollars, 0 to quit: 30
Dealer's first card is: Eight

Player's hand is: Six  Ten
Player's hand value is 16
What would you like to do?  Enter (h)it or (s)tand: h

Player's hand is: Six  Ten  Jack
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Player's hand value is 26

Dealer's hand is: Eight  Four
Dealer's hand value is 12

Dealer's hand is: Eight  Four  Jack
Dealer's hand value is 22

Player's hand is bust.
Player has 290 dollars


Round 3
Enter bet in dollars, 0 to quit: 300
You don't have that much money!  Enter a lower bet.


Enter bet in dollars, 0 to quit: 50
Dealer's first card is: Queen

Player's hand is: Nine  Ace
Player's hand value is 20
What would you like to do?  Enter (h)it or (s)tand: h

Player's hand is: Nine  Ace  Five
Player's hand value is 15
What would you like to do?  Enter (h)it or (s)tand: h

Player's hand is: Nine  Ace  Five  Seven
Player's hand value is 22

Dealer's hand is: Queen  Four
Dealer's hand value is 14

Dealer's hand is: Queen  Four  Queen
Dealer's hand value is 24

Player's hand is bust.
Player has 240 dollars


Round 4
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Enter bet in dollars, 0 to quit: 100
Dealer's first card is: Six

Player's hand is: Five  King
Player's hand value is 15
What would you like to do?  Enter (h)it or (s)tand: h

Player's hand is: Five  King  Five
Player's hand value is 20
What would you like to do?  Enter (h)it or (s)tand: s

Dealer's hand is: Six  Six
Dealer's hand value is 12

Dealer's hand is: Six  Six  King
Dealer's hand value is 22

Dealer's hand is bust.  Player wins!
Player has 340 dollars


Round 5
Enter bet in dollars, 0 to quit: 200
Dealer's first card is: King

Player's hand is: Queen  Seven
Player's hand value is 17
What would you like to do?  Enter (h)it or (s)tand: s

Dealer's hand is: King  Queen
Dealer's hand value is 20

Dealer wins.
Player has 140 dollars


Round 6
Enter bet in dollars, 0 to quit: 100
Dealer's first card is: Six

Player's hand is: Five  Eight
Player's hand value is 13
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What would you like to do?  Enter (h)it or (s)tand:
h

Player's hand is: Five  Eight  Queen
Player's hand value is 23

Dealer's hand is: Six  Nine
Dealer's hand value is 15

Dealer's hand is: Six  Nine  Four
Dealer's hand value is 19

Player's hand is bust.
Player has 40 dollars


Round 7
Enter bet in dollars, 0 to quit: 50
You don't have that much money!  Enter a lower bet.


Enter bet in dollars, 0 to quit: 20
Dealer's first card is: Six

Player's hand is: Four  Two
Player's hand value is 6
What would you like to do?  Enter (h)it or (s)tand: h

Player's hand is: Four  Two  Eight
Player's hand value is 14
What would you like to do?  Enter (h)it or (s)tand: h

Player's hand is: Four  Two  Eight  Queen
Player's hand value is 24

Dealer's hand is: Six  Three
Dealer's hand value is 9

Dealer's hand is: Six  Three  Four
Dealer's hand value is 13

Dealer's hand is: Six  Three  Four  Four
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Dealer's hand value is 17

Player's hand is bust.
Player has 20 dollars


Round 8
Enter bet in dollars, 0 to quit: 0
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