Project 2

Title of Project

Alex's New Blackjack Game

Course

CIS-17C 42475

Date Due

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Created By

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1 Introduction

For this project I decided to challenge myself with making a card game based off of the game 21, or also known as Blackjack. I always enjoyed playing cards games with my family and friends and when I had this opportunity I wanted to do a card game and choosed Blackjack. The mental battle of a card game is always fun to play and I wanted to share that. It may not be as elaborate as poker, but it was still fun to create.

The alternation of this program was created to see how much I learned regarding classes, inheritance, the STL library, recursive sorts, hashing, trees, and more.

2 Game Play and Rules

The program begins by displaying the introduction to the project which displays the choices of learning more about Blackjack, starting the game, or quiting the game.

After the introduction, the rules are then displayed to the player which state that Blackjack is played with one or more standard 52-card decks, with each card assigned a point value. The cards 2 through 10 are worth their face value. Kings, queens, and jacks are each worth 10, and aces may be used as either 1 or 11. The object for the player is to draw cards totaling closer to 21, without going over, than the dealer's cards. After the game, the player can then choose to play again and/or change their name for another player.

3 Project Development Summary

Total Lines of Code	**1482**
Lines of Code	**1113**
Pure Comment Lines	**150**
Pure Blank Lines	**219**
Total Lines of Source File	**94**
Number of Classes	**6**
Number of variables (Minus repeating ones)	**56**

Project Aspects

This C++ project is an application which is contained in eleven different files, my main file, my BlackjackGame.h with holds my classes and libraries, GeneralHashFunctions.h which holds general hashes for hashing, HashTable.h which makes a class to for the .cpp to hash a string,

and Tree.h which creates the tree class so an AVL tree can be used. There are also the six .cpp files minus main: presentation, Card, and Deck, tree, hashtable, GeneralHashFunctions,. All these display usage of structures, strings, char arrays, static variables, classes, inheritance, polymorphism, the STL library with queues, algorithms, iterators, binary search, recursive sorts, hashing, trees, and sets. The programming was done using NetBeans 8.2 and outside help was originally needed for inserting an internal clock. The development of my second project took around a total work time of around 7 hours of brainstorming and actual coding.

Project Difficulty

The overall difficulty of this project was not too high and out of my level but I decided to go with Blackjack since I can set up the base and add other concepts after. The first main issue that I ran across while trying to create my project was creating the base for the game and following the rules for a game of Blackjack. Making sure the ace cards work as intended by always being an eleven first and act as a one if the total went over 21. However the first major issue was with the way my cards were being dealt. Originally I modeled my deck and hands to have a numeric value that would track how many cards have been dealt however when the dealer was given his hand he would constantly get the same card of the Ace of Spades. I had to change around the way the hands were dealt to fix it.

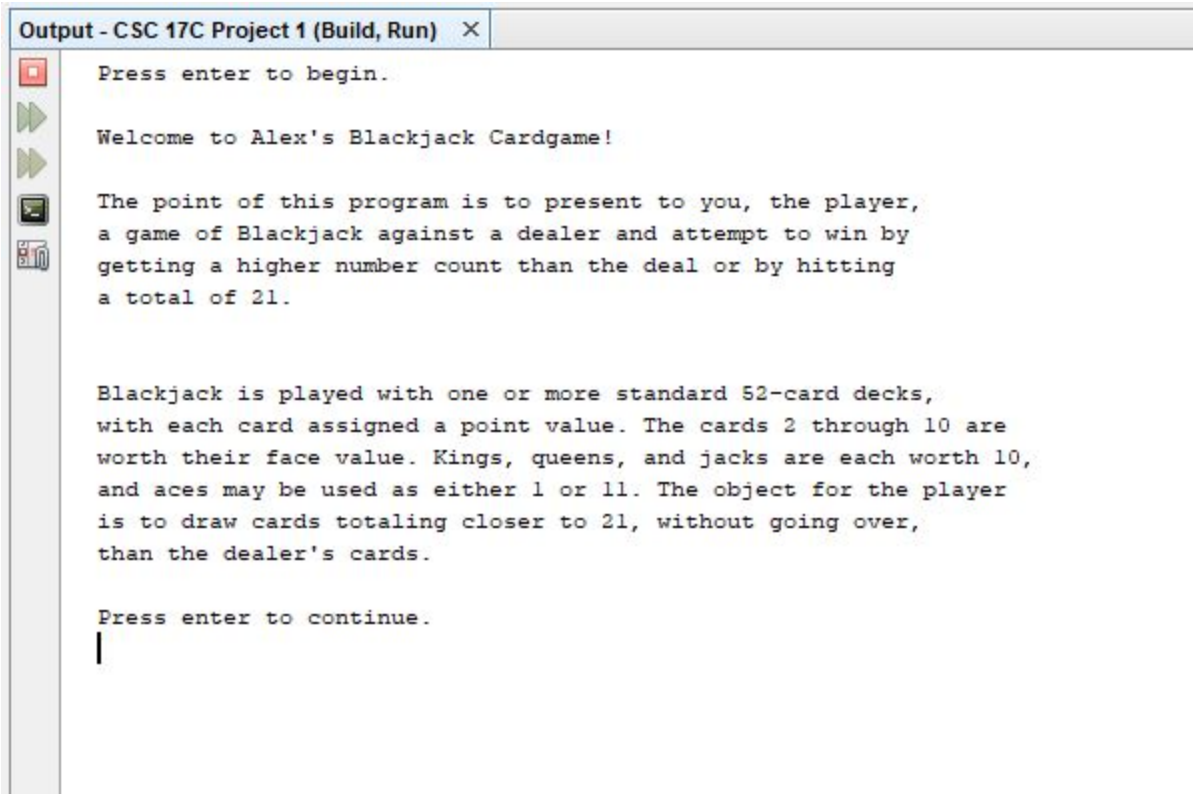
Project Missed Opportunities

Sadly being a straightforward game as it is, it was difficult to expand upon the game as it was. I had other ideas like making the game multiplayer with three other players or possibility implementing a betting system that could keep track of your cash over time which could definitely help with implementing other things I missed like graphs and maps. It was difficult to try to find a way I could incorporate a graph into the game without seeming unnecessary.

4 Project Description

Sample Inputs/Outputs

Since I created a game that uses random numbers for the cards, the inputs are more centered around being visually oriented and using one's judgement skills as opposed to being data-centric with input and output. The beginning of the program asks the user to press enter to display the introduction and rules. After reading the user then presses enter again to enter their name.



After enter a name the player is sent a prompt to choose a number 1-4, which will present the options to learned more about a hit and/or stand, start the game, or quit.

```
Press enter to continue.

Please enter the name of the player:
Alex

This is name: Alex


Choice #1: What does it mean to 'Hit'?
Choice #2: What does it mean to 'Stand'?
Choice #3: Start the game.
Choice #4: Stop the game

Please enter a number to choose what you want:
```

Choosing any of the first two options gives the player a detailed explanation of what a “hit” and “stand” is in Blackjack if some where not sure about it, like my brother when I asked him to test out the game.

```
Please enter a number to choose what you want: 1

If you hit, you must take another card or cards in hopes of getting
closer to 21. If the player's total exceeds 21 after hitting, the
player is said to 'bust' and loses the game against the dealer.

Would you like to go back to the menu or quit? (Y for menu or N for quit): Y


Would you like to change your name? (Y or N): N




Choice #1: What does it mean to 'Hit'?
Choice #2: What does it mean to 'Stand'?
Choice #3: Start the game.
Choice #4: Stop the game

Please enter a number to choose what you want: 2

If you decide to stand then you are unable to hit and accept more
cards. Your current total will be compared to the dealer's and
a winner will be decided.
```

When the game begins you get to see what your hand is with the first value indicating the face value you have, 1-10, J, Q, K, A and the second being the suit card. You are told what your total

is and are given the option to hit or pass. Hitting grants another card but if the total goes over 21 than the player busts and loses.

```
Please enter a number to choose what you want: 3

Your hand is: 6C KS

This is your total drawn Alex: 16

Would you like to hit or pass? (H for hit, P for pass)? H
Your hand is: 6D


This is your total drawn Alex: 22
Your hand has exceed the value of 21, thus you have
busted your hand. Sorry try again!

Press enter to continue.
```

If the player decides to pass then his total gets compared with the dealer's and whoever's total is the highest gets to win the game. (However I think if the player passes the dealer can hit however I wasn't sure and can definitely implement it next time.)

```
Please enter a number to choose what you want: 3

Your hand is: KS 10C

This is your total drawn Alex: 20

Would you like to hit or pass? (H for hit, P for pass)? P
Your hand total is 20

The dealer's hand total is 9
Congratulations! Your hand total is more than the dealer's, so
you win out this round.

Would you like to go back to the menu or quit? (Y for menu or N for quit):
```

Pseudocode

Version 1

This pseudocode was made during the brainstorming aspect of the project and was a way to think about how I wanted the project to

```
Display info:
    Present the introduction, rules, and menu

Choose Option:
    Send menu function
    Switch function for player choice, call function for input
```

```
    accept user input

Send card:
      call function that player requested
      pull randomly generated face and suit twice
      display cards to user


Add points to the player's score:
    if (face card == number)
            Ptotal += value of card;
    Repeat once more

Add points to the dealer's score
      if (face card == number)
            Ptotal += value of card;
    Repeat once more

Decide to hit or pass
      if(hit)
            Add one more card to user
            If (total > 21)
                  End game due to bust
            Else
                  Ask to hit again, do while loop if hit is true, set hit to
                  Pass
      if(pass)
            Compare score from player and dealer

Stop the game:
    if (Dealer > Player && Dealer <= 21)
            Say the dealer won out
    else if (Dealer = Pplayer)
            No one wins
    else if (Dealer < Player)
            Player wins
    else
            Dealer busts out and player wins
    Ask player if they want to go back to menu
          if (player chooses yes)
             display the subject menu
          If (player chooses no
             End the program
```

Variables

main.cpp

```
string player;        //Name of the player
char play = 'N';      //Character to hold player voice to replay
int inN;              //Holds player choice
Intro start;          //start variable for the intro class to present info
BlkJk game;           //Variable to access the game
```

```
Card.cpp
int _card
int n                    //Number of cards
auto f = lower_bound(vect.begin(), vect.end(), "10")       //Returns the first occurrence of 10
auto l = upper_bound(vect.begin(), vect.end(), "J")        //Returns the last occurrence of J
set <string, greater <string> > pcard1                     //empty set container
set <string, greater <string> > :: iterator itr
string num
queue <string> cQue;

Deck.cpp
int randnum = rand() % 52                    //Random numbers

BlackjackGame.h
Class Card
private:
      int card                               // range 0 to 51

      static const string CARD_FACES[];      //Face values of cards
      static const string CARD_SUITS[];      //Suits of cards

class Deck
private:
   Card cards[52];                           //Array of cards in deck
   int nxtCrdIndex;                          //Next card in index

class Intro
protected:
   string name                               //Name of the player

class BlkJk : public Intro
public:
struct Num     //Structure containing the elements for the first addition level
{
   int num1;                                 //First number to be created
   int num2;                                 //Second number to be created and added to num1
   int num3;                                 //Third number to be created and added if needed
   int num4;                                 //Fourth number to be created and added if needed
   int num5;                                 //Fifth number to be created and added if needed
   int num6;                                 //Sixth number to be created and added if needed
}

Presentation.cpp

   int inN = 0 in Intro::getN()              //Value to choose menu option

Variables in BlkJk::Num BlkJk::BlkGame(string name)
   char HitPass                  //Choice to hit or pass
   char hitAgain                 //Choice to hit again
   int numOfCards = 2            // Input number for how many cards to deal.
   int Ptotal = 0                //Total of player hand
   int Dtotal = 0                //Total of dealer hand
   Deck deck                     //Deck variable to shuffle and deal
   Card car;                     //Card variable to test STL functions
```

```
    Card c = deck.dealOneCard()
    string suit = c.getSuit()
    string face = c.getFace()
    int hit = 1;                        //Access one card
```

HashTable.cpp

```
 uint hash = RSHash(key);
 uint index = hash % this->SIZE;
```

GeneralHashFunctions.cpp

```
unsigned int RSHash(const std::string& str)
{
  unsigned int b    = 378551;
  unsigned int a    = 63689;
  unsigned int hash = 0;
}
```

unsigned int hash = 1315423911; in JSHash

PJWHash

```
unsigned int BitsInUnsignedInt = (unsigned int)(sizeof(unsigned int) * 8);
 unsigned int ThreeQuarters     = (unsigned int)((BitsInUnsignedInt  * 3) / 4);
 unsigned int OneEighth         = (unsigned int)(BitsInUnsignedInt / 8);
 unsigned int HighBits          = (unsigned int)(0xFFFFFFFF) << (BitsInUnsignedInt - OneEighth);
 unsigned int hash              = 0;
 unsigned int test              = 0;
```

ELFHash

```
unsigned int hash = 0;
unsigned int x    = 0;
```

BKDRHash

```
unsigned int seed = 131; // 31 131 1313 13131 131313 etc..
 unsigned int hash = 0;
```

DJBHash

```
unsigned int hash = 5381;
```

DKEHash

```
unsigned int hash = static_cast<unsigned int>(str.length());
```

FNVHash

```
const unsigned int fnv_prime = 0x811C9DC5;
```

APHash

unsigned int hash = 0xAAAAAAAA;

Concepts Used

- ~~Arrays~~ (Lines 29,30 BlackjackGame.h)(Lines 11,13,35,46,51,72 Card.cpp) (Lines 16,29,41 Deck.cpp)
- ~~String arrays~~ (Lines 29,30 BlackjackGame.h) (Line 72 Vector string array Card.cpp)
- ~~String objects~~ (Line 72 Vector string array Card.cpp)
- ~~Structures~~ (Lines 76-84 BlackjackGame.h)s
- ~~Classes~~ (Lines 24,42,54,73 BlackjackGame.h, Lines 16-55 Tree.h, Lines 22-35 HashTable.h)
- ~~Constructors~~ (Lines 16-19 Card.cpp Lines 10-14 Tree.cpp)
- ~~Static Members~~ (Lines 29,30 BlackjackGame.h)
- ~~Copy Constructors~~ (Lines 23-26 Card.cpp)
- ~~Aggregation~~ (Lines 78-83,86 BlackjackGame.h)
- ~~Inheritance~~ (Line 73 BlackjackGame.h)
- ~~Protected Members~~ (Line 56-57 BlackjackGame.h)
- ~~Polymorphism~~ (Lines 118,124-126,173-175,233-235 Presentation.cpp)
- ~~Virtual Member Functions~~ (Line 68 BlackjackGame.h)
- ~~Error Handling~~ (Line 28 Deck.cpp)
- ~~STL Library~~ (49-82, 87.152, 157-163, 168-181 Card.cpp)(Lines 112-114 Presentation.cpp)
- ~~Recursive sort~~ (Lines 184-207 Card.cpp)
- ~~Hashing~~ (GeneralHashFunctions.cpp/.h Lines 63-67 main.cpp
- ~~Trees~~ (Trees.cpp/.h)

References

Google Searched Sites

In points in this project where I needed guidance in what to do, when implementing some STL library, I looked through the book.
For usage of a queue I looked through page 640 of the STL book to find examples of a queue.

```
“#include <iostream>
#include <queue>
#include <string>
using namespace std;
int main()
{
queue<string> q;
// insert three elements into the queue
q.push("These ");
q.push("are ");
```

```
q.push("more than ");
// read and print two elements from the queue
cout << q.front();
q.pop();
cout << q.front();
q.pop();
// insert two new elements
q.push("four ");
q.push("words!");
// skip one element
q.pop();
// read and print two elements
cout << q.front();
```

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```
q.pop();
cout << q.front() << endl;
q.pop();
// print number of elements in the queue
cout << "number of elements in the queue: " << q.size()
<< endl;
}
```

Nicolai M. Josuttis-The C++ Standard Library_ A Tutorial and Reference-Addison-Wesley (2012)

I also used the hash functions from earlier assignments, the .h and .cpp

```
typedef unsigned int (*HashFunction)(const std::string&);


unsigned int RSHash  (const std::string& str);
unsigned int JSHash  (const std::string& str);
unsigned int PJWHash (const std::string& str);
unsigned int ELFHash (const std::string& str);
unsigned int BKDRHash(const std::string& str);
unsigned int SDBMHash(const std::string& str);
unsigned int DJBHash (const std::string& str);
unsigned int DEKHash (const std::string& str);
unsigned int BPHash  (const std::string& str);
unsigned int FNVHash (const std::string& str);
unsigned int APHash  (const std::string& str);
```

http://www.partow.net/programming/hashfunctions/index.html

5 Program Listing

```
/*
 * File:   main.cpp
 * Author: Alex
 *
 * Created on June 3, 2018, 1:00 PM
 */

#include "BlackjackGame.h"
#include "GeneralHashFunctions.h"

//Function Prototypes
//    None

using namespace std;


int main(int argc, char** argv)
{
    //Variables for the player and game
    string player;         //Name of the player
    string passwrd;        //Player's password
    string repeat;         //Repeat password
    string inputPass;      //User input password
    string msage;          //Message for hash
    string hash1;          //Hash of message
    string hash2;          //Hash of password
    string test2;          //Hash of test password
    int Hash;              //Hash of hash1 and hash2
    int Test;              //Hash result of test
    char play = 'N';       //Character to hold player voice to replay
    int inN;               //Holds player choice
    Intro start;           //start variable for the intro class to present info
    BlkJk game;            //Variable to access the game

    //Initialize the random number seed
    srand(static_cast<unsigned int>(time(0)));

    cout << "Press enter to begin.\n";
    cin.get();

    start.Introduction();
    start.Rules();

    cout << "Press enter to continue.\n";
    cin.ignore(1,'\n');         //Pause screen
    cout << "Please enter the name of the player: " << endl;
    getline(cin,player);       //Enter name
    cout << "\nThis is name: " << player << endl;
    start.setName(player);     //Send name to class
    cout << "Enter a Password: ";
    cin >> passwrd;
    cout << "Repeat your password: ";
    cin >> repeat;

    //If two input didn't match, ask for reenter
    if (repeat != passwrd)
    {
            cout << "\n Error! Your repeat password different with your password!" << endl;
            cout << " Press enter information again." << endl;
            cin.ignore();
    }
```

```
    //Hash message
    msage = "This program is awesome!";
    hash1 = to_string(RSHash(msage));
    hash2 = to_string(BPHash(passwrd));
    Hash = ELFHash(hash1 + hash2);

    do
    {
        player = start.difName(play, player);

        cout << endl << endl;
        start.Menu();         //Display menu

        inN = start.getN();     //Accept user input for challenge choice

        switch(inN)          //Switch for deciding challenges or if misinput
        {
          case 1:   start.Hit();break;
          case 2:   start.Stand();break;
          case 3:   game.BlkGame(player);break;
          case 4:   break;
          default:  start.getN();
        }

        cout << "Would you like to go back to the menu or quit? (Y for menu or N for quit): ";
//Ask to play again
        cin >> play;               //User input for replay
        cout << endl << endl;
    }while (play == 'Y' || play == 'y');

    //Exit stage right
    return 0;
}


/*
 * File:   BlackjackGame.h
 * Author: Alex
 *
 * Created on June 3, 2018, 1:00 PM
 */

#ifndef BLACKJACKGAME_H
#define BLACKJACKGAME_H

#include <iostream>                        //To accept user input
#include <cstdlib>                         //For randomized numbers
#include <ctime>                           //For randomized numbers
#include <string>                          //For user inputed name
#include <cassert>                         //Help with error handeling
#include <algorithm>                       //Use of binary search
#include <iterator>                        //For iterators
#include <vector>                          //Use of STL library
#include <set>                             //Use of showing off a set
#include <queue>                           //Use of showing off a queue

using namespace std;

class Card
{
    private:
        int card;  // range 0 to 51

        static const string CARD_FACES[];
        static const string CARD_SUITS[];
    public:
```

```
        Card();
        Card(int card);
        void SearchCard();
        void SetCard();
        void QueueCard();
        void ShowQue(queue <string>);
        void recSort(string [], int);
        void prtSort(string [], int);
        string getSuit() const;
        string getFace() const;
};

class Deck
{
private:
    Card cards[52];
    int nxtCrdIndex;

    public:
        Deck();
        Card dealOneCard();
        void shuffle();
};

class Intro
{
protected:
    string name;         //Name of the player

public:
    Intro()               //Default constructor
        {name;}
    Intro(string);       //Constructor declaration
    void Introduction(); //Introduces the program and its usage to the player
    void Rules();        //Introduces the rules to the player
    void Menu();         //Presents the menu selection to the user
    void Hit();          //Presents meaning of a 'Hit' in Blackjack
    void Stand();        //Presents meaning of 'Stand' in Blackjack
    virtual void setName(string); //Set the player's name to the protected name string
    string difName(char, string); //Asks if the user wants to change their name
    int getN();          //Asks the user which challenge they want to partake in
};

class BlkJk : public Intro
{
public:
struct Num     //Structure containing the elements for the first addition level
{
    int num1;         //First number to be created
    int num2;         //Second number to be created and added to num1
    int num3;         //Third number to be created and added if needed
    int num4;         //Fourth number to be created and added if needed
    int num5;         //Fifth number to be created and added if needed
    int num6;         //Sixth number to be created and added if needed
};

Num BlkGame (string);
};

#endif /* BLACKJACKGAME_H */




/*
 * File:   Card.cpp
```

```
 * Author: Alex
 *
 * Created on June 3, 2018, 1:00 PM
 */

#include "BlackjackGame.h"

// Static Constants
const string Card::CARD_FACES[] =  {"A", "2", "3", "4", "5", "6", "7"
                                    , "8", "9", "10", "J", "Q", "K"};
const string Card::CARD_SUITS[] = {"S", "H", "C", "D"};

//Constructor
Card::Card()
{
    card = 0;         // Should initialize to a Joker.
}


// Constructor
Card::Card(int _card)
{
    card = _card;
}


//getFace
//Returns face value of card.
//and a string representing card face

string Card::getFace() const
{
    return CARD_FACES[card%13];
}


//getSuit
//Returns suit of a card value.
// a string "S" (Spades), "H", (Hearts),
// "C" (Clubs), or "D" (Diamonds).

string Card::getSuit() const
{
    return CARD_SUITS[card/13];
}

void Card::SearchCard()
{
    int n = sizeof(CARD_FACES)/sizeof(CARD_FACES[0]);     //Number of cards
    vector<string> vect(CARD_FACES, CARD_FACES+n);

    // Sort the array to make sure that lower_bound()
    // and upper_bound() work.
    sort(vect.begin(), vect.end());

    // Returns the first occurrence of 10
    auto f = lower_bound(vect.begin(), vect.end(), "10");

    // Returns the last occurrence of J
    auto l = upper_bound(vect.begin(), vect.end(), "J");

    cout << "The lower bound is at position: ";
    cout << f-vect.begin() << endl;

    cout << "The upper bound is at position: ";
    cout << l-vect.begin() << endl;
```

```
    //Show begin() return the beginning position of the container.
    //and end() used to return the end position of the container.
    vector<string> ar = {"A", "2", "3", "4", "5", "6", "7",
                         "8", "9", "10", "J", "Q", "K"};

    // Declaring iterator to a vector
    vector<string>::iterator ptr;

    // Displaying vector elements using begin() and end()
    cout << "The vector elements are : ";
    for (ptr = ar.begin(); ptr < ar.end(); ptr++)
        cout << *ptr << " ";
}

void Card::SetCard()
{
    // empty set container
    set <string, greater <string> > pcard1;

    // insert elements in random order
    pcard1.insert("2");
    pcard1.insert("7");
    pcard1.insert("5");
    pcard1.insert("1");
    pcard1.insert("3");
    pcard1.insert("2");        // only one 2 should be added to the set
    pcard1.insert("4");
    pcard1.insert("6");
    pcard1.insert("10");
    pcard1.insert("8");
    pcard1.insert("9");

    // printing set pcard1
    set <string, greater <string> > :: iterator itr;
    cout << "\nThe set pcard1 is : ";
    for (itr = pcard1.begin(); itr != pcard1.end(); ++itr)
    {
        cout << '\t' << *itr;
    }
    cout << endl;

    // assigning the elements from pcard1 to pcard2
    set <string> pcard2(pcard1.begin(), pcard1.end());

    // print all elements of the set gquiz2
    cout << "\nThe set pcard2 after assign from pcard1 is : ";
    for (itr = pcard2.begin(); itr != pcard2.end(); ++itr)
    {
        cout << '\t' << *itr;
    }
    cout << endl;

    // remove all elements up to 30 in pcard2
    cout << "\npcard2 after removal of elements less than '5' : ";
    pcard2.erase(pcard2.begin(), pcard2.find("5"));
    for (itr = pcard2.begin(); itr != pcard2.end(); ++itr)
    {
        cout << '\t' << *itr;
    }

    // remove all elements with value 50 in pcard2
    string num;
    num = pcard2.erase ("8");
    cout << "\npcard2.erase('8') : ";
    cout << num << " removed \t" ;
```

```
    for (itr = pcard2.begin(); itr != pcard2.end(); ++itr)
    {
        cout << '\t' << *itr;
    }

    cout << endl;

    //lower bound and upper bound for set pcard1
    cout << "pcard1.lower_bound('7') : "
         << *pcard1.lower_bound("7") << endl;
    cout << "pcard1.upper_bound('7') : "
         << *pcard1.upper_bound("7") << endl;

    //lower bound and upper bound for set pcard2
    cout << "pcard2.lower_bound('7') : "
         << *pcard2.lower_bound("7") << endl;
    cout << "pcard2.upper_bound('7') : "
         << *pcard2.upper_bound("7") << endl;
}

void Card::ShowQue(queue <string> cardQ)
{
    queue <string> c = cardQ;
    while (!c.empty())
    {
        cout << '\t' << c.front();
        c.pop();
    }
    cout << '\n';
}

void Card::QueueCard()
{
    queue <string> cQue;
    cQue.push("A");
    cQue.push("B");

    cout << "The queue cQue is : ";
    ShowQue(cQue);

    cout << "\ncQue.size() : " << cQue.size();
    cout << "\ncQue.front() : " << cQue.front();
    cout << "\ncQue.back() : " << cQue.back();

    cout << "\ncQue.pop() : ";
    cQue.pop();
    ShowQue(cQue);
}

void Card::recSort(string ary[], int n)
{
    // Base case
    if (n == 1)
        return;

    // One pass of bubble sort. After
    // this pass, the largest element
    // is moved (or bubbled) to end.
    for (int index=0; index < n-1; index++)
        if (ary[index] > ary[index+1])
            swap(ary[index], ary[index+1]);

    // Largest element is fixed,
    // recur for remaining array
    recSort(ary, n-1);
}
```

```
//Function to print recursive sorted array
void Card::prtSort(string ary[], int n)
{
    for (int index=0; index < n; index++)
        cout << ary[index] << endl;
}


/*
 * File:   Deck.cpp
 * Author: Alex
 *
 * Created on June 3, 2018, 1:00 PM
 */

#include "BlackjackGame.h"

//Constructor
Deck::Deck()
{
    // Initialize the array to the nums 0-51
    for (int i=0; i < 52; i++)
    {
        cards[i] = Card(i);
    }
    shuffle();
    nxtCrdIndex = 0;  // index of next available card
}


//dealOneCard
//Returns random Card.

Card Deck::dealOneCard()
{
    assert(nxtCrdIndex >= 0 && nxtCrdIndex<52);
    return cards[nxtCrdIndex++];
}


//shuffle
//Shuffles the Deck.
void Deck::shuffle()
{
    // Shuffle by exchanging each element randomly
    for (int i=0; i<52; i++)
    {
        int randnum = rand() % 52;
        swap(cards[i], cards[randnum]);
    }
    nxtCrdIndex = 0;
}

/*
 ***************************************************************************
 *                                                                         *
 *          General Purpose Hash Function Algorithms Library               *
 *                                                                         *
 * Author: Arash Partow - 2002                                             *
 * URL: http://www.partow.net                                              *
 * URL: http://www.partow.net/programming/hashfunctions/index.html         *
 *                                                                         *
 * Copyright notice:                                                       *
 * Free use of the General Purpose Hash Function Algorithms Library is     *
 * permitted under the guidelines and in accordance with the most current *
```

```
 * version of the Common Public License.                                 *
 * http://www.opensource.org/licenses/cpl1.0.php                         *
 *                                                                       *
 *************************************************************************
*/


#ifndef INCLUDE_GENERALHASHFUNCTION_CPP_H
#define INCLUDE_GENERALHASHFUNCTION_CPP_H


#include <string>


typedef unsigned int (*HashFunction)(const std::string&);


unsigned int RSHash  (const std::string& str);
unsigned int JSHash  (const std::string& str);
unsigned int PJWHash (const std::string& str);
unsigned int ELFHash (const std::string& str);
unsigned int BKDRHash(const std::string& str);
unsigned int SDBMHash(const std::string& str);
unsigned int DJBHash (const std::string& str);
unsigned int DEKHash (const std::string& str);
unsigned int BPHash  (const std::string& str);
unsigned int FNVHash (const std::string& str);
unsigned int APHash  (const std::string& str);

#endif

#include "GeneralHashFunctions.h"

unsigned int RSHash(const std::string& str)
{
   unsigned int b    = 378551;
   unsigned int a    = 63689;
   unsigned int hash = 0;

   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash = hash * a + str[i];
      a    = a * b;
   }

   return hash;
}
/* End Of RS Hash Function */


unsigned int JSHash(const std::string& str)
{
   unsigned int hash = 1315423911;

   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash ^= ((hash << 5) + str[i] + (hash >> 2));
   }

   return hash;
}
/* End Of JS Hash Function */


unsigned int PJWHash(const std::string& str)
{
```

```
   unsigned int BitsInUnsignedInt = (unsigned int)(sizeof(unsigned int) * 8);
   unsigned int ThreeQuarters     = (unsigned int)((BitsInUnsignedInt  * 3) / 4);
   unsigned int OneEighth         = (unsigned int)(BitsInUnsignedInt / 8);
   unsigned int HighBits          = (unsigned int)(0xFFFFFFFF) << (BitsInUnsignedInt -
OneEighth);
   unsigned int hash              = 0;
   unsigned int test              = 0;

   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash = (hash << OneEighth) + str[i];

      if((test = hash & HighBits)  != 0)
      {
         hash = (( hash ^ (test >> ThreeQuarters)) & (~HighBits));
      }
   }

   return hash;
}
/* End Of  P. J. Weinberger Hash Function */


unsigned int ELFHash(const std::string& str)
{
   unsigned int hash = 0;
   unsigned int x    = 0;

   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash = (hash << 4) + str[i];
      if((x = hash & 0xF0000000L) != 0)
      {
         hash ^= (x >> 24);
      }
      hash &= ~x;
   }

   return hash;
}
/* End Of ELF Hash Function */


unsigned int BKDRHash(const std::string& str)
{
   unsigned int seed = 131; // 31 131 1313 13131 131313 etc..
   unsigned int hash = 0;

   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash = (hash * seed) + str[i];
   }

   return hash;
}
/* End Of BKDR Hash Function */


unsigned int SDBMHash(const std::string& str)
{
   unsigned int hash = 0;

   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash = str[i] + (hash << 6) + (hash << 16) - hash;
   }
```

```
   return hash;
}
/* End Of SDBM Hash Function */


unsigned int DJBHash(const std::string& str)
{
   unsigned int hash = 5381;

   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash = ((hash << 5) + hash) + str[i];
   }

   return hash;
}
/* End Of DJB Hash Function */


unsigned int DEKHash(const std::string& str)
{
   unsigned int hash = static_cast<unsigned int>(str.length());

   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash = ((hash << 5) ^ (hash >> 27)) ^ str[i];
   }

   return hash;
}
/* End Of DEK Hash Function */


unsigned int BPHash(const std::string& str)
{
   unsigned int hash = 0;
   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash = hash << 7 ^ str[i];
   }

   return hash;
}
/* End Of BP Hash Function */


unsigned int FNVHash(const std::string& str)
{
   const unsigned int fnv_prime = 0x811C9DC5;
   unsigned int hash = 0;
   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash *= fnv_prime;
      hash ^= str[i];
   }

   return hash;
}
/* End Of FNV Hash Function */


unsigned int APHash(const std::string& str)
{
   unsigned int hash = 0xAAAAAAAA;
```

```
   for(std::size_t i = 0; i < str.length(); i++)
   {
      hash ^= ((i & 1) == 0) ? (  (hash <<  7) ^ str[i] * (hash >> 3)) :
                               (~((hash << 11) + (str[i] ^ (hash >> 5))));
   }

   return hash;
}
/* End Of AP Hash Function */

/*
 * File:   HashTable.h
 * Author: Alex
 *
 * Created on June 3, 2018, 1:00 PM
 */

#ifndef HASHTABLE_H
#define HASHTABLE_H

#include <string>
#include <cstdlib>
#include <list>

#include "GeneralHashFunctions.h"

using namespace std;

typedef unsigned int uint;


class HashTable
{
private:
       list<string> *table;
       int SIZE;
       uint hash(string key);
public:
       HashTable(int length);
       virtual ~HashTable();
       void put(string key, string val);
       string at(string key);
       bool hashMeet(string key);
       bool exists(string key);
};

#endif /* HASHTABLE_H */

/*
 * File:   HashTable.cpp
 * Author: Alex
 *
 * Created on June 3, 2018, 1:00 PM
 */

#include <string>
#include <cstdlib>
#include <list>

#include "HashTable.h"

using namespace std;

HashTable::HashTable(int length)
{
       this->table = new list<string>[length];
```

```
        this->SIZE = length;
}


HashTable::~HashTable( )
{
        delete [] this->table;
}


uint HashTable::hash(string key)
{
    uint hash = RSHash(key);
    uint index = hash % this->SIZE;
    return index;
}


void HashTable::put(string key, string val)
{
    uint index = hash( key );
    //If true then we have a collision
    if(this->table[index].size() > 1)
    {
       this->table[index].push_back(val);
    }
    else
    {
       //If no value here, no collision
       this->table[index].push_back(val);
    }
}


string HashTable::at(string key)
{
    uint index = hash(key);

    if( this->table[index].size() > 0)
    {
       //If true return collision
       if(this->table[index].size() == 1)
            {
               return this->table[index].front();
            }
        else
            {
               return "collision";
            }
    }
    return "";
}


bool HashTable::hashMeet(string key)
{
    uint index = hash( key );

    if( this->table[index].size() > 1)
    {
       return true;
    }
    else
    {
       return false;
    }
```

```
}


bool HashTable::exists(string key)
{
    uint index = hash(key);

    if( this->table[index].size() > 0)
    {
        return true;
    }
    else
   {
        return false;
    }
}

/*
 * File:   Tree.h
 * Author: Alex
 *
 * Created on June 4, 2018, 8:00 AM
 */

#ifndef TREE_H
#define TREE_H

#include <iostream>
using namespace std;

#include "BlackjackGame.h"

class Tree
{
private:

    struct Node
    {
        int value;
        struct Node *left;
        struct Node *right;
        int height;
    };
    Node *node;
    void insert(Node *&, Node *&);
    void delet(Node *&, int);
    int difference(Node *);
    void clean(Node *);
    int getHeight(Node *);
    int max(int, int);

    //Functions for printing
    void preOrder(Node *);
    void inOrder(Node *);
    void postOrder(Node *);
    void prntNode(Node *);


    void rotateRR(Node *&);
    void rotateLL(Node *&);
    void rotateRL(Node *&);
    void rotateLR(Node *&);

public:
    Tree();
    ~Tree();
```

```
    void insert(int);
    void delet(int);
    void prePrnt();
    void inPrnt();
    void postPrnt();
};
#endif /* TREE_H */

/*
 * File:   Tree.cpp
 * Author: Alex
 *
 * Created on June 4, 2018, 8:00 AM
 */

#include "Tree.h"

//Constructor
Tree::Tree()
{
    node = NULL;
}

//Destructor
Tree::~Tree()
{
    clean(node);
}

void Tree::clean(Node *node)
{
    if (node != NULL)
    {
        clean(node->left);
        clean(node->right);
        delete node;
    }
}

int Tree::getHeight(Node* n)
{
    if (n == NULL) return 0;
    return n->height;
}

void Tree::insert(int key)
{
    //Create a new node for insertion
    Node *newNode = new Node;
    newNode->value = key;
    newNode->left = NULL;
    newNode->right = NULL;
    newNode->height = 1;

    //Insert with recursion
    insert(node, newNode);
}

//Private insertion
void Tree::insert(Node *&node, Node *&newNode)
{
    if (node == NULL)
    {
        node = newNode;
    } else if (newNode->value <= node->value)
    {
```

```
        insert(node->left, newNode);
    } else
    {
        insert(node->right, newNode);
    }

    node->height = max(getHeight(node->left), getHeight(node->right)) + 1;

    //Right case
    if (difference(node)<-1)
    {
        if (newNode->value >= node->right->value)
        {
            rotateRR(node);
        } else
        {
            rotateRL(node);
        }
    }
    if (difference(node) > 1)
    {
        if (newNode->value <= node->left->value)
        {
            rotateLL(node);
        } else
        {
            rotateLR(node);
        }
    }
}

void Tree::prePrnt()
{
    preOrder(node);
}

void Tree::inPrnt()
{
    inOrder(node);
}

void Tree::postPrnt()
{
    postOrder(node);
}

int Tree::difference(Node *node)
{
    if (node == NULL) return 0;
    return getHeight(node->left) - getHeight(node->right);
}

void Tree::delet(int n)
{
    delet(node, n);
}

void Tree::rotateRR(Node *&parent)
{
    Node *node = parent->right;
    parent->right = node->left;
    node->left = parent;
    parent->height = max(getHeight(parent->left), getHeight(parent->right)) + 1;
    node->height = max(getHeight(node->left), getHeight(node->right)) + 1;

    parent = node;
```

```
}

void Tree::rotateLL(Node *&parent)
{
    Node *node = parent->left;
    parent->left = node->right;
    node->right = parent;
    parent->height = max(getHeight(parent->left), getHeight(parent->right)) + 1;
    node->height = max(getHeight(node->left), getHeight(node->right)) + 1;
    parent = node;
}

void Tree::rotateRL(Node *&z)
{
    rotateLL(z->right);
    rotateRR(z);
}

void Tree::rotateLR(Node *&z)
{
    rotateRR(z->left);
    rotateLL(z);
}

void Tree::delet(Node *&node, int key)
{
    if (node == NULL) return;
    if (key < node->value)
    {
        delet(node->left, key);
    }
    else if (key > node->value)
    {
        delet(node->right, key);
    }
    else
    {
        //If less than one child
        if ((node->left == NULL) || (node->right == NULL))
        {
            //If 0 child
            if ((node->left == NULL) && (node->right == NULL))
            {
                Node *temp = node;
                node = NULL;
                delete temp;
            }
            //If 1 child
            else
            {
                Node *temp = node->left ? node->left : node->right;
                Node *temp2 = node;
                node = temp;
                delete temp2;
            }
        }
        //If 2 children
        else
        {
            Node *temp = node->left;
            if (temp != NULL)
            {
                while (temp->right != NULL)
                {
                    temp = temp->right;
                }
```

```
            }
            node->value = temp->value;
            delet(node->left, node->value);
        }
    }
    if (node == NULL) return;
    node->height = max(getHeight(node->left), getHeight(node->right)) + 1;

    //Balance tree
    if (difference(node)<-1)
    {
        if (difference(node->right) < 0)
        {
            rotateRR(node);
        }
        else
        {
            rotateRL(node);
        }
    }
    if (difference(node) > 1)
    {
        if (difference(node->left) > 0)
        {
            rotateLL(node);
        }
        else
        {
            rotateLR(node);
        }
    }
}

void Tree::prntNode(Node *node)
{
    cout << node->value << " ";
}

void Tree::preOrder(Node *node)
{
    if (node != NULL)
    {
        prntNode(node);
        preOrder(node->left);
        preOrder(node->right);
    }
}

void Tree::inOrder(Node *node)
{
    if (node != NULL)
    {
        inOrder(node->left);
        prntNode(node);
        inOrder(node->right);
    }
}

void Tree::postOrder(Node *node)
{

    if (node != NULL)
    {
        postOrder(node->left);
        postOrder(node->right);
        prntNode(node);
```

```
    }
}

int Tree::max(int a, int b)
{
    return a >= b ? a : b;
}


/*
 * File:   Presentation.cpp
 * Author: Alex
 *
 * Created on June 3, 2018, 1:00 PM
 */

#include "BlackjackGame.h"
#include "Tree.h"

//Constructor that sets the name to the protected variable
Intro::Intro(string player)
{
    player = name;

}

//Sets the user inputed name to the protected name variable
void Intro::setName(string player)
{
    name = player;
}

//Presents introduction for when the player boots up program
void Intro::Introduction()
{
    cout << "Welcome to Alex's Blackjack Cardgame!\n" << endl;
    cout << "The point of this program is to present to you, the player,\n";
    cout << "a game of Blackjack against a dealer and attempt to win by\n";
    cout << "getting a higher number count than the deal or by hitting\n";
    cout << "a total of 21.\n\n";
}

//Presents rules for a game of blackjack
void Intro::Rules()
{
    cout << "\nBlackjack is played with one or more standard 52-card decks,\n";
    cout << "with each card assigned a point value. The cards 2 through 10 are\n";
    cout << "worth their face value. Kings, queens, and jacks are each worth 10,\n";
    cout << "and aces may be used as either 1 or 11. The object for the player\n";
    cout << "is to draw cards totaling closer to 21, without going over, \n";
    cout << "than the dealer's cards.\n\n";
}

//Presents the menu for the player to look more into a hit or stand move
void Intro::Menu()
{
    cout << "Choice #1: What does it mean to 'Hit'?\n";
    cout << "Choice #2: What does it mean to 'Stand'?\n";
    cout << "Choice #3: Start the game.\n";
    cout << "Choice #4: Stop the game\n\n";
}

//Presents meaning of a 'Hit' in Blackjack
void Intro::Hit()
{
   cout << "If you hit, you must take another card or cards in hopes of getting\n";
```

```
   cout << "closer to 21. If the player's total exceeds 21 after hitting, the\n";
   cout << "player is said to 'bust' and loses the game against the dealer.\n\n";
}

//Presents meaning of 'Stand' in Blackjack
void Intro::Stand()
{
    cout << "If you decide to stand then you are unable to hit and accept more\n";
    cout << "cards. Your current total will be compared to the dealer's and\n";
    cout << "a winner will be decided.\n\n";
}

//Function if the user wants to change their name after finishing a challenge
string Intro::difName(char change, string player)
{
    if (change == 'Y' || change == 'y') //Only activates on replay
        {
            cout << "Would you like to change your name? (Y or N): ";
            cin >> change;     //Character to hold player choice of name change
            cout << endl << endl;

            if (change == 'Y' || change == 'y') //If name wants to be changed
            {
                cin.ignore(1000,'\n');      //Prevent skipping of name on retry
                cout << "Please enter the name of the player: ";
                getline(cin,player);        //Enter new name
                Intro::setName(player);
                cout << endl << endl;
            }
        }
    return player;
}

//Get the user variable for the player choice
int Intro::getN()
{
    int inN = 0;
    cout << "Please enter a number to choose what you want: ";
    cin >> inN;
    cout << endl;
    return inN;
}


BlkJk::Num BlkJk::BlkGame(string name)
{
    char HitPass;              //Choice to hit or pass
    char hitAgain;             //Choice to hit again
    int numOfCards = 2;        // Input number for how many cards to deal.
    int Ptotal = 0;            //Total of player hand
    int Dtotal = 0;            //Total of dealer hand
    srand(time(0));            // Initializes random "seed".
    Deck deck;                 //Deck variable to shuffle and deal
    Card card;                 //Card variable to test STL functions
    Tree tree;                 //AVL tree to display

//    card.SearchCard();       //Binary search algorithm test
//    card.SetCard();          //Set test for the program
//    card.QueueCard()         //Queue test for program

    if (numOfCards == 2)
    {
        deck.shuffle();

        //Player hand
        cout << "Your hand is: ";
```

```
        for (int cardNum = 0; cardNum < numOfCards; cardNum++)
        {
            Card c = deck.dealOneCard();
            string suit = c.getSuit();
            string face = c.getFace();
            cout << face << suit << " ";
            if (c.getFace() == "1")
            Ptotal+=1;
        else if (c.getFace() == "2")
            Ptotal+=2;
        else if (c.getFace() == "3")
            Ptotal+=3;
        else if (c.getFace() == "4")
            Ptotal+=4;
        else if (c.getFace() == "5")
            Ptotal+=5;
        else if (c.getFace() == "6")
           Ptotal+=6;
        else if (c.getFace() == "7")
            Ptotal+=7;
        else if (c.getFace() == "8")
            Ptotal+=8;
        else if (c.getFace() == "9")
            Ptotal+=9;
        else if (c.getFace() == "10")
            Ptotal+=10;
        else if (c.getFace() == "J")
            Ptotal+=10;
        else if (c.getFace() == "Q")
            Ptotal+=10;
        else if (c.getFace() == "K")
            Ptotal+=10;
        else if (c.getFace() == "A")
        {
            Ptotal+=11;
            if (Ptotal > 21)
            {
                Ptotal - 10;
            }
        }
        else
            Ptotal+=0;
        }
        cout << endl;
    }

    //Dealer hand
    if (numOfCards == 2)
    {
        for (int cardNum = 0; cardNum < numOfCards; cardNum++)
        {
            Card c = deck.dealOneCard();
            string suit = c.getSuit();
            string face = c.getFace();
            if (c.getFace() == "1")
            Dtotal+=1;
        else if (c.getFace() == "2")
            Dtotal+=2;
        else if (c.getFace() == "3")
            Dtotal+=3;
        else if (c.getFace() == "4")
            Dtotal+=4;
        else if (c.getFace() == "5")
            Dtotal+=5;
        else if (c.getFace() == "6")
            Dtotal+=6;
```

```
        else if (c.getFace() == "7")
            Dtotal+=7;
        else if (c.getFace() == "8")
            Dtotal+=8;
        else if (c.getFace() == "9")
            Dtotal+=9;
        else if (c.getFace() == "10")
            Dtotal+=10;
        else if (c.getFace() == "J")
            Dtotal+=10;
        else if (c.getFace() == "Q")
            Dtotal+=10;
        else if (c.getFace() == "K")
            Dtotal+=10;
        else if (c.getFace() == "A")
        {
            Dtotal+=11;
            if (Dtotal > 21)
            {
                Dtotal - 10;
            }
        }
        else
            Dtotal+=0;
        }
        cout << endl;
    }


    cout << "This is your total drawn " << name << ": "<< Ptotal << endl;

    cout << "\nWould you like to hit or pass? (H for hit, P for pass)? ";
    cin >> HitPass;

    if (HitPass == 'H' || HitPass == 'h')
    {
        do
        {
            int hit = 1;                //Access one card
            if (hit == 1)
            {
                //Player hand
                cout << "Your hand is: ";
                for (int cardNum = 0; cardNum < hit; cardNum++)
                    {
                        Card c = deck.dealOneCard();
                        string suit = c.getSuit();
                        string face = c.getFace();
                        cout << face << suit << " ";
                        int Ptotal2 = 0;
                        if (c.getFace() == "1")
                        {
                            Ptotal2+=1;
                            Ptotal = Ptotal + Ptotal2;
                        }
                        else if (c.getFace() == "2")
                        {
                            Ptotal2+=2;
                            Ptotal = Ptotal + Ptotal2;
                        }
                        else if (c.getFace() == "3")
                        {
                            Ptotal2+=3;
                            Ptotal = Ptotal + Ptotal2;
                        }
                        else if (c.getFace() == "4")
```

```
                {
                    Ptotal2+=4;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "5")
                {
                    Ptotal2+=5;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "6")
                {
                    Ptotal2+=6;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "7")
                {
                    Ptotal2+=7;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "8")
                {
                    Ptotal2+=8;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "9")
                {
                    Ptotal2+=9;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "10")
                {
                    Ptotal2+=10;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "J")
                {
                    Ptotal2+=10;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "Q")
                {
                    Ptotal2+=10;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "K")
                {
                    Ptotal2+=10;
                    Ptotal = Ptotal + Ptotal2;
                }
                else if (c.getFace() == "A")
                {
                    Ptotal2+=11;
                    if ((Ptotal + Ptotal2) > 21)
                        {
                            Ptotal += Ptotal2;
                            Ptotal = Ptotal - 10;
                        }
                }
                else
                    Ptotal2+=0;
            }
        cout << endl;
    }
    cout << endl << endl;

    cout << "This is your total drawn " << name << ": "<< Ptotal << endl;
```

```
            if (Ptotal > 21)
            {
                cout << "Your hand has exceed the value of 21, thus you have\n";
                cout << "busted your hand. Sorry try again!\n\n";
                cout << "Press enter to continue.\n";
                cin.get();
                cin.ignore(1);
                HitPass = '1';
                hitAgain = 'N';

            }
            else
            {
                cout << "Would you like to hit again? (H for Hit or P for Pass)? ";
                cin >> hitAgain;
                if (hitAgain == 'P' || hitAgain == 'p')
                {
                    HitPass = 'P';
                }
            }
        }while(hitAgain == 'H' || hitAgain == 'h');
    }

    if (HitPass == 'P' || HitPass == 'p')
    {
        cout << "Your hand total is " << Ptotal << endl;

        if (Dtotal > Ptotal && Dtotal <= 21)
        {
            cout << "\nThe dealer's hand total is " << Dtotal << endl;
            cout << "Sadly your hand total is less than the dealer's, so\n";
            cout << "you lose out this round.\n\n";
        }
        else if (Dtotal == Ptotal)
        {
            cout << "\nThe dealer's hand total is " << Dtotal << endl;
            cout << "Sadly your hand total is equal to the dealer's, so\n";
            cout << "nobody wins this round.\n\n";
        }
        else if (Dtotal < Ptotal)
        {
            cout << "\nThe dealer's hand total is " << Dtotal << endl;
            cout << "Congratulations! Your hand total is more than the dealer's, so\n";
            cout << "you win out this round.\n\n";
        }
        else
        {
            cout << "\nThe dealer's hand total is " << Dtotal << endl;
            cout << "Congratulations! Since the dealer busted out his hand,\n";
            cout << "you win out this round.\n\n";
        }
    }
}
```