Project 2

<Blackjack Game>

CIS-5 – 44188
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Introduction

Blackjack

The game of Blackjack is a popular casino game where a player is faced against a dealer, who deals cards from a deck, and compete to see who can get the closest to 21, without going over it. The goal of the game is to see who can get the closest, and thus, the winner is decided based on who has the higher total score, so long as neither player goes over 21. If either the player or the dealer go over 21, the one who went over it will lose the game. This game is a comparative kind of game, where final scores are compared to one another to see who has the higher value within the range of 21, and whoever has the higher value will win the game.

The game itself implements strategy as well as luck, given that random cards are dealt each time, and there is no way to know which card will be dealt next. In the course of the game, the player will initially be given 2 cards, who may then decide whether to "hit" or "stand" based on the value of his cards. The game works in that the total value of all the cards in one's hand is added and based on that, the player must decide whether to ask for another card to be added to his hand, also known as "hit," or decide to keep his current hand, also known as "stand," and end his turn for the dealer to play. With each successive card a player decides to add to his hand, his risk of losing the game by going over 21 increases. However, if the player's total value in hand is a low number in the range of 21, then he may also lose against the dealer's hand. Once the player ends his turn, the dealer will then play as he, too, decides whether to "hit" or "stand" based on his score. Whoever gets the closest to 21, without going over it, at the end of both turns wins the game, and in the occasion that both the player and the dealer get the same score at the end, the dealer wins the game.

I decided to program this game because I have previously played the game of Blackjack before and have enjoyed the strategic side of the game, as well as the random assigning of cards that person is given. Due to that, I set out to program this game, thinking that it would be a moderately easy task. However, once having started it, I realized there were more obstacles than I had previously anticipated, and thus, the difficult I found in programming this game increased.

Summary

Project Size: About 600 lines

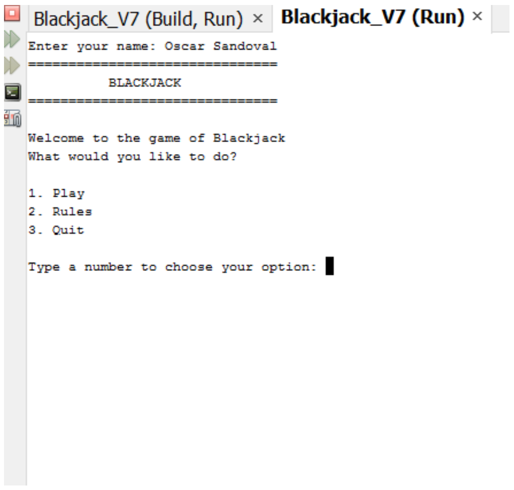
Number of variables: More than 15

Number of Methods: 12

In this new revision of my previous game, I managed to include a lot of new concepts that we learned in class that make my game run more smooth as well as provide a better gaming experience than before. I implemented the ability to gamble as well as reading from and writing to files, in addition to a variety of other things. Overall, I faced many challenges in trying to improve my game and had to search for a few new concepts that would help me in creating the game I wanted to create. For example, I learned to convert strings into integers and those back to strings. In addition, I gained a better understanding of all the concepts covered in class and I am now able overcome more obstacles through the higher understanding of programming that I have acquired since the first project.

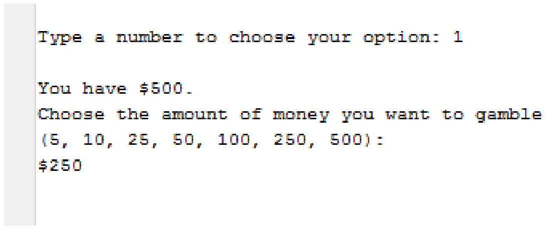
Screenshots

Menu



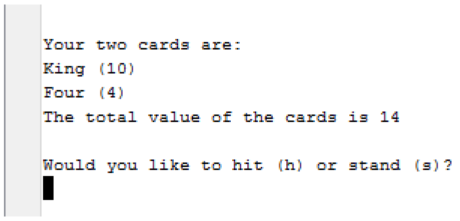
```
Enter your name: Oscar Sandoval
===============================
          BLACKJACK
===============================

Welcome to the game of Blackjack
What would you like to do?

1. Play
2. Rules
3. Quit

Type a number to choose your option:
```

Gamble

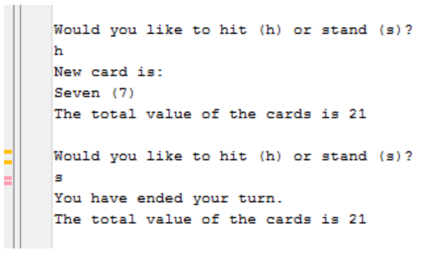


```
Type a number to choose your option: 1

You have $500.
Choose the amount of money you want to gamble
(5, 10, 25, 50, 100, 250, 500):
$250
```

Hit or Stand

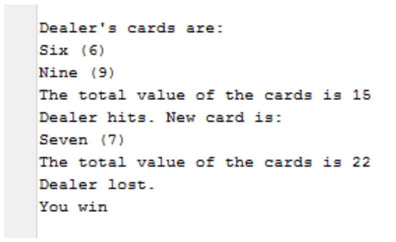


```
Your two cards are:
King (10)
Four (4)
The total value of the cards is 14

Would you like to hit (h) or stand (s)?
```



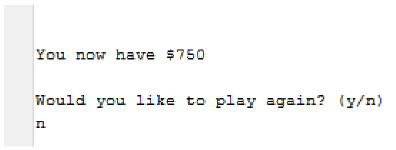
```
Would you like to hit (h) or stand (s)?
h
New card is:
Seven (7)
The total value of the cards is 21

Would you like to hit (h) or stand (s)?
s
You have ended your turn.
The total value of the cards is 21
```

Dealer’s Turn



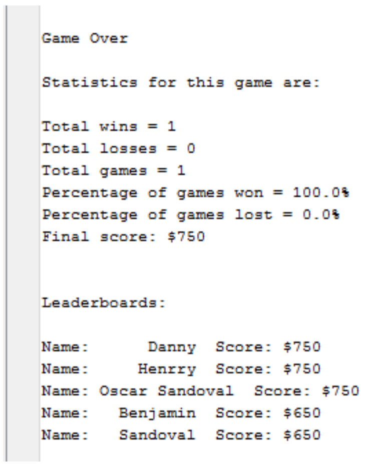
```
Dealer's cards are:
Six (6)
Nine (9)
The total value of the cards is 15
Dealer hits. New card is:
Seven (7)
The total value of the cards is 22
Dealer lost.
You win
```

Play Again?



```

You now have $750

Would you like to play again? (y/n)
n
```

Game Over



```
Game Over

Statistics for this game are:

Total wins = 1
Total losses = 0
Total games = 1
Percentage of games won = 100.0%
Percentage of games lost = 0.0%
Final score: $750


Leaderboards:

Name:      Danny  Score: $750
Name:     Henrry  Score: $750
Name: Oscar Sandoval  Score: $750
Name:   Benjamin  Score: $650
Name:   Sandoval  Score: $650
```

Pseudocode

```
/*
 * File:   main.cpp
 * Author: Oscar Sandoval
 * Created on June 3rd, 2017, 7:27 PM
 * Purpose: Game of Blackjack Version 7
 */

//System Libraries
//Input - Output Library
//Needed to use strings
//For rand and srand
//Time for rand
//Format the output
//For I/O Files
//The STL Vector -> Dynamic Array
//For parsing strings

//Name-space under which system libraries exist

//User Libraries

//Global Constants

//Function Prototypes

//Execution begins here

    //Array for each card name

    //Array for value of each card

    //Array for total number of each card value in deck

    //Array for player's hand

    //Array for dealer's hand

    //Declare variables

    //Input number to choose option menu
    //Total score of player based on his hand's total value
    //Total score of dealer based on his hand's total value
    //Initialize to 0 each time program loops
    //Initialize to 0 each time program loops
    //Loops again as long as boolean is false
    //Counts the wins of the player
    //Counts the losses of the player
    //Money given to player to gamble
    //Money player wants to gamble
    //Choice input by user to gamble
    //Number of rows in data array
    //2-D Array used to print leaderboards

    //For leaderboard

    //Declare and initialize array for names
```

```
   //Ask user to enter his or her name and save to char array name

   //Enter player's name into last spot of string array names

      //Loop will reset all of the card values in array for player
      //and dealer back to zero at the start of each new game

         //Resets hand of player back to 0
         //Resets hand of dealer back to 0

         //Resets all cards of each value back to 4

      //Resets boolean back to false each time the program loops
      //Resets player's index each time program loops for array to start at the beginning
      //Resets dealer's index each time program loops for array to start at the beginning


      //Display the main menu

      //Choose an option

            //Check to see if player meets minimum bet requirements. If not,
            //player is not allowed to continue playing and game ends.

               //Output the game statistics to screen

               // Call function to output statistics to file

               //Call function to make leaderboards

            //Ask player for amount of money to gamble

               //Convert variable back into integer

            //Total score of player's hand returned from player function will be assigned to pScore

            //If player's score is less than 21, the game continues to dealer's turn

               //Total score of dealer's hand returned from dealer function will be assigned to dScore

               // Call function to compare player and dealer's scores

            //If player's score is greater than 21, the game ends with a loss for the player

            //If player's score is equal to 21, player wins

            //Display rules of Blackjack
------------------------------------------
// Create menu for game

   //Option 1 plays the game
   //Option 2 displays the rules of the game
   //Option 3 exits the program
------------------------------------------
// Function for player's turn

   //Set boolean statement to false to continue loop
```

```
    //Total sum of player's cards' values
    //Choose whether to hit or stand

    //Deal the first two cards

    //First card dealt will go into first space of array
    //Second card dealt will go into second space of array

    //Sum of player's hand returned from sum function will be assigned to pTotal

        //Loop the question to hit or stand until player stands,
        //or wins or loses the game by hitting 21 or over 21

            //Reset pTotal back to 0 to give correct sum each time a new card is dealt

            //Player inputs choice

            //If chosen to hit, another card will be dealt

                //Card will go into next space in array

                //New sum will be calculated

                //Check to see if player has won or lost the game, else continue asking to hit or stand.

                    //Player has lost. Break out of loop and display a loss

                //Loop will continue as long as player chooses to hit

                  //If chosen to stand, player will end his turn

                //Display sum of player's current hand
                //Break out of question loop to continue the game

                //If option is invalid, continue to ask question until valid option is input

        //Loop will continue as long as askAgain is true

    //Returns player's total score back to main
----------------------------------------
// Function for dealer's turn

    //Total sum of dealer's cards' values

    //Deal the first two cards

    //First card dealt will go into first space of array
    //Second card dealt will go into second space of array

    //Sum of dealer's hand returned from sum function will be assigned to dTotal

        //If total is less than 17, dealer has to hit.

            //Reset dTotal back to 0 to give correct sum

        //If total is greater than or equal to 17, dealer has to stand.

    //Loop as long as score is less than 17
```

```
   //Returns dealer's total score back to main
---------------------------------------------------------
// Deals cards to dealer and player and removes them from cards in deck

   //Card index used to create random cards and assign a name and value to each

   // NOTE: We wait 1000 milliseconds because fast CPUs
   // give the same number inside random.

   //Set the random number seed.

      //Gives out a random card

      //Removes the card from the deck.

   //Will continue to deal cards as long as there are still cards of that value
---------------------------------------------
// Sum for the value of all cards in your hand

   //Returns sum of all cards in hand to dealer and player functions
-----------------------------
// Rules of Blackjack
-----------------------------------------
//Ask player whether to play again or not

      //Input character to play again or not

      //If chosen not to play, the program will exit

         //Output the game statistics to screen

         // Call function to output statistics

         //Call function to make leaderboards

      //If chosen to play, the program will run again

      //If option is invalid, question will continue to be asked
------------------------------------------
   //Declare and initialize output file

   //Output the game statistics to file
--------------------------------------
//Output Statistics to screen
----------------
//Compare player and dealer's scores

   //Display the scores of the player and the dealer for comparison

        //If dealer's score is greater than 21, player wins

   //Player's score must be greater than dealer's score to win

   //If dealer's score is greater than player's score, and less than 21, player loses

--------------------------------------------
//Make Leaderboards
   //Declare and initialize leaderboards file
   //Save names temporarily into strings
   //Save scores temporarily into strings

      //Read names in file up to the comma and store in name
      //Read scores in file after comman and store in score
      //Save names into names array
      //Convert strings into integers and save to points array
      //Increase counter after each loop to completely fill arrays

   //Close the file

   //Assign player's score to last spot in array to be compared with previous scores

   //Call function to sort array for leaderboards

   //Declare and initialize output file

   //Open the file

   //Write the names and scores to file and output the leaderboards to screen

   //Close the file
------------------------------------
//Use bubble sort to sort array
   //Temporary variable needed to swap scores
   //Temporary variable to swap names along with scores

       //Set flag to break loop when everything is sorted

         //Sort parallel arrays in order from largest to smallest score

            //Sort score array in order from largest to smallest

            //Sort names of players along with their scores

            //Will continue to loop until everything is sorted

   //Convert integers to strings
```

Program

```
/*
 * File:   main.cpp
 * Author: Oscar Sandoval
 * Created on June 3rd, 2017, 7:27 PM
 * Purpose: Game of Blackjack Version 7
 */

//System Libraries
#include <iostream> //Input - Output Library
#include <string>   //Needed to use strings
#include <cstdlib>  //For rand and srand
#include <ctime>    //Time for rand
#include <chrono>
#include <thread>
#include <iomanip>  //Format the output
#include <fstream>  //For I/O Files
#include <vector>   //The STL Vector -> Dynamic Array
#include <sstream>  //For parsing strings

using namespace std; //Name-space under which system libraries exist

//User Libraries

//Global Constants
const int COLS = 2;

//Function Prototypes
void menu();
int player(vector<int> &, int, short*, const string*, short*);
int dealer(vector<int> &, int, short*, const string*, short*);
void givCard(short*, const string*, short*, vector<int> &, int&);
int sum(vector<int> &);
void rules();
bool playAgn(int, int, bool, int&, int*, string*, string [][COLS], const int);
void oFile(int, int, int&);
void oScreen(int, int, int&);
void comScor(int, int, int&, int&, int&, int&);
void lderBrd(int*, int, string*, string [][COLS], const int);
void srtAray(int*, string*, string [][COLS], const int);

//Execution begins here
int main(int argc, char** argv) {
  //Array for each card name
  const string cards[13] = { "Ace", "Two", "Three", "Four", "Five", "Six", "Seven",
                             "Eight", "Nine", "Ten", "Jack", "Queen", "King" };

  //Array for value of each card
  short cardVal[13] = { 11, 2, 3, 4, 5, 6, 7, 8, 9, 10, 10, 10, 10 };

  //Array for total number of each card value in deck
```

```
short cardTot[13] = { 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4 };

//Array for player's hand
vector<int> pHand(1);

//Array for dealer's hand
vector<int> dHand(1);

//Declare variables
char choice; //Input number to choose option menu
int pScore; //Total score of player based on his hand's total value
int dScore; //Total score of dealer based on his hand's total value
int pIndex = 0; //Initialize to 0 each time program loops
int dIndex = 0; //Initialize to 0 each time program loops
bool askAgn = false; //Loops again as long as boolean is false
int win = 0; //Counts the wins of the player
int loss = 0; //Counts the losses of the player
int money = 500; //Money given to player to gamble
int gambled;     //Money player wants to gamble
string input;    //Choice input by user to gamble
const int ROW = 5; //Number of rows in data array
string data[ROW][COLS] = {}; //2-D Array used to print leaderboards

//For leaderboard
int points[6]; //Array
string names[6];

//Declare and initialize array for
const int SIZE = 20;
char name[SIZE];

//Ask user to enter his or her name and save to char array name
cout << "Enter your name: ";
cin.getline(name, SIZE);

//Enter player's name into last spot of string array names
names[5] = name;

do
{
    //Loop will reset all of the card values in array for player
    //and dealer back to zero at the start of each new game
    for (int i = 0; i < 11; i++)
    {
        pHand[i] = 0;   //Resets hand of player back to 0
        dHand[i] = 0;   //Resets hand of dealer back to 0
    }

    for (int i = 0; i < 13; i++)
        cardTot[i] = 4; //Resets all cards of each value back to 4

    askAgn = false; //Resets boolean back to false each time the program loops
    pIndex = 0; //Resets player's index each time program loops for array to start at the beginning
```

```
dIndex = 0; //Resets dealer's index each time program loops for array to start at the beginning


//Display the main menu
menu();

//Choose an option
cout << "Type a number to choose your option: ";
cin >> choice;

switch (choice)
{
  case '1':
    //Check to see if player meets minimum bet requirements. If not,
    //player is not allowed to continue playing and game ends.
    if (money < 5)
    {
      cout << "\n\nInsufficient funds. You cannot place the minimum bet." << endl;
      //Output the game statistics to screen
      oScreen(win, loss, money);

      // Call function to output statistics to file
      oFile(win, loss, money);

      //Call function to make leaderboards
      lderBrd(points, money, names, data, ROW);

      exit(0);
    }

    bool gamble;
    //Ask player for amount of money to gamble
    do
    {
      gamble = false;
      cout << "\nYou have $" << money << ".\nChoose the amount of money "
              "you want to gamble \n(5, 10, 25, 50, 100, 250, 500):\n$";
      cin >> input;
      if(input != "5" && input != "10" && input != "25" && input != "50" &&
        input != "100" && input != "250" && input != "500")
      {
        cout << "\nInvalid input. Choose one of the available amounts." << endl;
        gamble = true;
      }
      gambled = atoi(input.c_str()); //Convert variable back into integer
      if(gambled > money)
      {
        cout << "\nYou do not have enough funds to place this bet.\n"
                "Choose an amount that you can afford." << endl;
        gamble = true;
      }
    } while(gamble);
```

```
            //gambled = atoi(input.c_str());

            //Total score of player's hand returned from player function will be assigned to pScore
            pScore = player(pHand, pIndex, cardTot, cards, cardVal);

            //If player's score is less than 21, the game continues to dealer's turn
            if (pScore < 21)
            {
               //Total score of dealer's hand returned from dealer function will be assigned to dScore
               dScore = dealer(dHand, dIndex, cardTot, cards, cardVal);

               // Call function to compare player and dealer's scores
               comScor(pScore, dScore, win, loss, money, gambled);
            }
            //If player's score is greater than 21, the game ends with a loss for the player
            else if (pScore > 21)
            {
               cout << "\nYou lose.\n\n" << endl;
               loss++;
               money -= gambled;
            }
            //If player's score is equal to 21, player wins
            else
            {
               dScore = dealer(dHand, dIndex, cardTot, cards, cardVal);
                  cout << "You win\n\n" << endl;
                  win++;
                  money += gambled;
            }
            playAgn(win, loss, askAgn, money, points, names, data, ROW);
            break;
         case '2':
            rules(); //Display rules of Blackjack
            break;
         case '3':
            cout << "Exit the program." << endl;
            break;
         default:
            cout << "Not a valid option." << endl;
      }
   }while (choice != '3');

   return 0;
}

// Create menu for game
void menu()
{
   cout << "==============================" << endl;
   cout << "         BLACKJACK           " << endl;
   cout << "==============================" << endl << endl;
   cout << "Welcome to the game of Blackjack" << endl;
   cout << "What would you like to do?" << endl << endl;
```

```cpp
    cout << "1. Play" << endl; //Option 1 plays the game
    cout << "2. Rules" << endl; //Option 2 displays the rules of the game
    cout << "3. Quit" << endl << endl; //Option 3 exits the program
}

// Function for player's turn
int player(vector<int> &pHand, int pIndex, short* cardTot, const string* cards, short* cardVal)
{
    bool askAgn = false; //Set boolean statement to false to continue loop
    int pTotal = 0; //Total sum of player's cards' values
    char choose;    //Choose whether to hit or stand
    int hIndex = 0;

    //Deal the first two cards
    cout << "\n\nYour two cards are:" << endl;
    givCard(cardTot, cards, cardVal, pHand, hIndex);  //First card dealt will go into first space of array
    givCard(cardTot, cards, cardVal, pHand, hIndex);  //Second card dealt will go into second space of array

    pTotal = sum(pHand); //Sum of player's hand returned from sum function will be assigned to pTotal

    if (pTotal < 21)
    {
        //Loop the question to hit or stand until player stands,
        //or wins or loses the game by hitting 21 or over 21
        do
        {
            pTotal = 0; //Reset pTotal back to 0 to give correct sum each time a new card is dealt

            cout << "\nWould you like to hit (h) or stand (s)?" << endl;
            cin >> choose; //Player inputs choice

            if (choose == 'h' || choose == 'H') //If chosen to hit, another card will be dealt
            {
                cout << "New card is:" << endl;
                givCard(cardTot, cards, cardVal, pHand, hIndex); //Card will go into next space in array

                pTotal = sum(pHand); //New sum will be calculated

                //Check to see if player has won or lost the game, else continue asking to hit or stand.
                if (pTotal > 21)
                {
                    cout << "Your total is greater than 21." << endl;
                    break; //Player has lost. Break out of loop and display a loss
                }
                askAgn = true; //Loop will continue as long as player chooses to hit
            }
            else if (choose == 's' || choose == 'S') //If chosen to stand, player will end his turn
            {
                cout << "You have ended your turn." << endl;
                pTotal = sum(pHand); //Display sum of player's current hand
                askAgn = false; //Break out of question loop to continue the game
            }
            else
            {
                cout << "Invalid option." << endl;
                askAgn = true; //If option is invalid, continue to ask question until valid option is input
            }

        } while (askAgn); //Loop will continue as long as askAgain is true
    }
    else if (pTotal == 21)
    {
        cout << "Blackjack." << endl;
    }

    return pTotal; //Returns player's total score back to main
}

// Function for dealer's turn
int dealer(vector<int> &dHand, int dIndex, short* cardTot, const string* cards, short* cardVal)
{
    int dTotal = 0; //Total sum of dealer's cards' values
    int hIndex = 0;

    //Deal the first two cards
    cout << "\n\nDealer's cards are:" << endl;
    givCard(cardTot, cards, cardVal, dHand, hIndex);  //First card dealt will go into first space of array
    givCard(cardTot, cards, cardVal, dHand, hIndex);  //Second card dealt will go into second space of array

    dTotal = sum(dHand); //Sum of dealer's hand returned from sum function will be assigned to dTotal

    do
    {
        if (dTotal < 17) //If total is less than 17, dealer has to hit.
        {
            dTotal = 0; //Reset dTotal back to 0 to give correct sum

            cout << "Dealer hits. New card is: " << endl;
            givCard(cardTot, cards, cardVal, dHand, hIndex);
            dTotal = sum(dHand);

            if (dTotal > 21)
            {
                cout << "Dealer lost." << endl;
            }
        }
        else if (dTotal >= 17) //If total is greater than or equal to 17, dealer has to stand.
        {
            cout << "The dealer stands." << endl;
        }
    } while (dTotal < 17); //Loop as long as score is less than 17
    return dTotal; //Returns dealer's total score back to main
}

// Deals cards to dealer and player and removes them from cards in deck
void givCard(short* cardTot, const string* cards, short* cardVal, vector<int> &hand, int& hIndex)
```

```
{
   int cIndex; //Card index used to create random cards and assign a name and value to each
   bool givOther = false;

   // NOTE: We wait 1000 milliseconds because fast CPUs
   // give the same number inside random.
   this_thread::sleep_for(chrono::milliseconds(1000));

   //Set the random number seed.
   std::srand(static_cast<unsigned int>(time(0)));

   do
   {
      givOther = false;

      //Gives out a random card
      cIndex = rand() % 13;

      hand[hIndex] = cardVal[cIndex];
      if(hand[hIndex] == hand[hIndex - 1])
      {
         givOther = true;
      }

      //Removes the card from the deck.
      cardTot[cIndex] -= 1;

   } while (cardTot[cIndex] == -1 || givOther == true);

   //Will continue to deal cards as long as there are still cards of that value
      cout << cards[cIndex] << " (" << cardVal[cIndex] << ")" << endl;

   hIndex++;
}

// Sum for the value of all cards in your hand
int sum(vector<int> &hand)
{
   int total = 0;

   for (int i = 0; i < 11; i++)
   {
      total += hand[i];

      if(total > 21)
      {
         for(int i = 0; i < 11; i++)
         {
            if(hand[i] == 11)
            {
               hand[i] = 1;
               total -= 10;
            }
            }
        }
    }
    cout << "The total value of the cards is " << total << endl;

    return total; //Returns sum of all cards in hand to dealer and player functions
}

// Rules of Blackjack
void rules()
{
    cout << "\n\nThe rules of this game are as follows:" << endl << endl;
    cout << "There are two players in this game, you and the dealer." << endl;
    cout << "Each player will initially get two cards from a deck of 52 "
            "cards. " << endl;
    cout << "After getting the cards, you will be given a choice to hit or "
            "stand." << endl;
    cout << "If chosen to hit, you will be given another card in addition to "
            "those you had." << endl;
    cout << "If chosen to stand, you will keep your current hand, and your "
            "turn will end." << endl;
    cout << "Each card has a value corresponding to the number that is shown "
            "on them.\nThe special face cards of Jack, Queen, and King, each have a "
            "value of 10, " << endl;
    cout << "whereas the Ace has a value of 1." << endl;
    cout << "The goal of the game is to see who can get the closest to "
            "the number 21, with any combination of cards you have. " << endl;
    cout << "However, if you were to pass the number 21 with the added value "
            "of all of your cards, you will lose the game." << endl;
    cout << "Whoever gets the closest to 21 without going over it, will win "
            "the game." << endl;
    cout << "In the occasion that both players get the same score in the end, "
            "the dealer wins the game.\n\n" << endl;

}

bool playAgn(int win, int loss, bool askAgn, int& money, int* points, string* names, string data[][COLS], const int
ROW)
{
    do //Ask player whether to play again or not
    {
        char again; //Input character to play again or not

        cout << "You now have $" << money << endl << endl;

        cout << "Would you like to play again? (y/n)" << endl;
        cin >> again;

        if (again == 'n' || again == 'N') //If chosen not to play, the program will exit
        {
            //Output the game statistics to screen
            oScreen(win, loss, money);
            // Call function to output statistics
            oFile(win, loss, money);

            //Call function to make leaderboards
            lderBrd(points, money, names, data, ROW);

            exit(0);
        }
        else if (again == 'y' || again == 'Y') //If chosen to play, the program will run again
            break;
        else //If option is invalid, question will continue to be asked
        {
            cout << "Invalid option." << endl;
            askAgn = true;
        }
    } while (askAgn);
    return askAgn;
}

void oFile(int win, int loss, int& money)
{
    //Declare and initialize output file
    ofstream out;
    char outName[] = "GameStats.dat";
    out.open(outName);

    //Output the game statistics to file
    out << fixed << setprecision(1) << showpoint;
    out << "Statistics for last game were:" << endl << endl;
    out << "Total wins = " << win << endl;
    out << "Total losses = " << loss << endl;
    out << "Total games = " << win + loss << endl;
    out << "Percentage of games won = " << static_cast<float>(win) /
            (win + loss) * 100 << "%" << endl;
    out << "Percentage of games lost = " << static_cast<float>(loss) /
            (win + loss) * 100 << "%" << endl;
    out << "Final Score: S" << money << endl;

    out.close();
}

void oScreen(int win, int loss, int& money)
{
    cout << fixed << setprecision(1) << showpoint;
    cout << "\nGame Over" << endl << endl;
    cout << "Statistics for this game are:" << endl << endl;
    cout << "Total wins = " << win << endl;
    cout << "Total losses = " << loss << endl;
    cout << "Total games = " << win + loss << endl;
    cout << "Percentage of games won = " << static_cast<float>(win) /
            (win + loss) * 100 << "%" << endl;
    cout << "Percentage of games lost = " << static_cast<float>(loss) /
            (win + loss) * 100 << "%" << endl;
    cout << "Final score: $" << money << endl;
}

void comScor(int pScore, int dScore, int& win, int& loss, int& money, int& gambled)
{
    //Display the scores of the player and the dealer for comparison
    cout << "\nPlayer = " << pScore << endl;
    cout << "Dealer = " << dScore << endl;

    if (dScore > 21) //If dealer's score is greater than 21, player wins
    {
        cout << "\nYou win.\n\n" << endl;
        win++;
        money += gambled;
    }

    //Player's score must be greater than dealer's score to win
    if (pScore > dScore)
    {
        cout << "\nYou win.\n\n" << endl;
        win++;
        money += gambled;
    }
    //If dealer's score is greater than player's score, and less than 21, player loses
    else if (dScore > pScore && dScore <= 21)
    {
        cout << "\nYou lose.\n\n" << endl;
        loss++;
        money -= gambled;
    }
    else if (pScore == dScore)
    {
        cout << "\nYou win.\n\n" << endl;
        win++;
        money += gambled;
    }
}

void lderBrd(int* points, int money, string* names, string data[][COLS], const int ROW)
{
    //Declare and initialize leaderboards file
    char scores[] = "Leaderboards.dat";
    int count = 0;

    string name;  //Save names temporarily into strings
    string score; //Save scores temporarily into strings
    string line;
    ifstream in("Leaderboards.dat");

    while(getline(in,line))
    {
        stringstream iss(line);
        getline(iss, name, ','); //Read names in file up to the comma and store in name
        getline(iss, score);     //Read scores in file after comman and store in score
        names[count] = name;     //Save names into names array
        points[count] = atoi(score.c_str()); //Convert strings into integers and save to points array
        count++; //Increase counter after each loop to completely fill arrays
    }

    //Close the file
    in.close();

    //Assign player's score to last spot in array to be compared with previous scores
    points[5] = money;

    //Call function to sort array for leaderboards
    srtAray(points, names, data, ROW);

    //Declare and initialize output file
    ofstream out;

    //Open the file
    out.open(scores);

    cout << "\n\nLeaderboards:" << endl << endl;
    //Write the names and scores to file and output the leaderboards to screen
    for(int i = 0 ; i < 5; i++)
    {
        cout << "Name: " << setw(10) << data[i][0] << "  Score: $" << data[i][1] << "\n";
        out  << data[i][0] << ", " << data[i][1] << "\n";
    }

    //Close the file
    out.close();
}

//Use bubble sort to sort array
void srtAray(int* points, string* names, string data[][COLS], const int ROW)
{
    bool swap;
    int temp; //Temporary variable needed to swap scores
    string sTemp; //Temporary variable to swap names along with scores
    string score[5] = {};

    do
    {
        swap = false; //Set flag to break loop when everything is sorted
        for(int count = 0; count < 5; count++)
        {
            //Sort parallel arrays in order from largest to smallest score
            if(points[count] < points[count + 1])
            {
                //Sort score array in order from largest to smallest
                temp = points[count];
                points[count] = points[count + 1];
                points[count + 1] = temp;
                //Sort names of players along with their scores
                sTemp = names[count];
                names[count] = names[count + 1];
                names[count + 1] = sTemp;

                //Will continue to loop until everything is sorted
                swap = true;
            }
        }
    } while(swap);

    //Convert integers to strings
    for(int i = 0; i < ROW; i++)
        score[i] = to_string(points[i]);

    for(int i = 0; i < ROW; i++)
    {
        data[i][0] = names[i];
        data[i][1] = score[i];
    }
}
```