

Project 1

Title:

Blackjack

Course:

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Rules

The objective of the card game “Blackjack” or “21” is to get the highest total value without going over twenty one. In this version of 21, there is one human player and one computer player that acts as the dealer. Therefore, the objective in this case is to beat the dealer. If the human player has a value over twenty one, it is called a “bust” and it is an automatic loss. This is true even if the dealer also “busts.” In the case that the player and dealer have the same value of cards, it counts as a draw and is called a “push.” In this version, the player’s original bet is returned.

To determine the value of a player’s hand, each card is given a specific value and the summation of all cards is the player’s hand. The numbered cards are worth their face value. The Jack, King, and Queen are worth ten points each. The Ace has a variety of values in this version of 21. The ace counted as either eleven or one. The Joker card is not used in this game.

The game 21 is started with the dealer dealing the player two cards, and then dealing him/herself two cards also. The player is able to see what cards he/she has but the dealer only reveals one of his/her cards. In this version of 21, the player then has a choice to “hit,” “stay,” “surrender,” “double down,” “split pairs,” or buy “insurance.” If the player chooses to surrender, the player forfeits his/her cards and is given half of the original bet back. If the player chooses to double down, the player has an additional bet up to the value of the original bet and receives one and only one additional card. If the player chooses to split pairs, the pair of cards is split into two separate hands and the player has to have another bet of equal size for the new hand. If the Dealer shows an Ace, the player can buy insurance up to half the original amount of the bet. If the dealer has Blackjack, the player gets double the insurance bet but losses the original bet. If

the player chooses to hit, the dealer deals the player an additional card and the value of this card is added to the player's total value of his/her hand. The player can continue to hit as long as his/her total value does not go over 21. When the player does not wish to hit, the player can stay and keep his/her current hand. After the player's turn has ended, as long as the player did not bust, the dealer reveals his/her cards. The dealer is required to hit until the dealer's total value of cards remains under seventeen. Sometimes the dealer hits at seventeen and this is called a "soft 17." In this version of 21, this is not the case.

Some additional rules are that if player has an Ace and a ten value card (Blackjack), the player's payout is 1:1. If the player or the dealer has Blackjack, they win, unless they both have Blackjack and in this case it is a push. The player can only split his/her pair once and there is no double down after a split.

Stats

Using Basic Strategy:

Overall Player Win Percentage = 48%

Overall Dealer Win Percentage = 52%

Player Blackjack Probability = 1 out of 21 hands

Player Bust Percentage = 16%

Dealer Bust Percentage = 28%

Summary

This project is based on the card game “21” or “Blackjack.” This version of the game is for one human player and one computer player that is also the dealer. There is a betting system and the player starts with \$50 and the minimum bet is \$5. There is only one player not counting the dealer, ties are counted as a push and the player gets his/her money back, and Aces are valued as high or low.

In the game 21, the statistics are in the dealer’s favor because not only does the human player go first, but statistically, the player only has a forty-eight percent chance of winning. The player also only has a one in twenty-one chance to get “blackjack,” and the player has a sixteen percent chance to bust and automatically lose the game.

This version of the game was designed to be user friendly by setting default decisions and validating the user’s input. This game also outputs what steps are happening and it always tells the user the most recent card or cards that are dealt and calculates the total value of the user’s hand. Once the user is done playing, he/she can open the results file and see the total wins, losses, and win percentage. The player’s score, or money, is also shown on the leaderboard if he/she has one of the top ten scores.

Overall, this project uses a large majority of the concepts learned so far and satisfies all of the requirements. Some future improvements for this project include but are not limited to having more than one player, split pairs as many times as possible, and provide even more additional blackjack rules and options.

Sample Inputs and Outputs

Player's Initials:

Input – “AB” or “ABCD”

Output – “You can only enter three characters”

Player's Cards:

Output – “Card 1 = Ace”, “Card 2 = 3”, “The total value of your cards is 14”

Dealer's Cards:

Output – “Card 1 = Jack”, “Card 2 = ?”

Hit Option:

Input – “H” for hit

Output – “You Draw an additional card”, “Card = 2”, “The total value of your cards is 16”

Determining Winner:

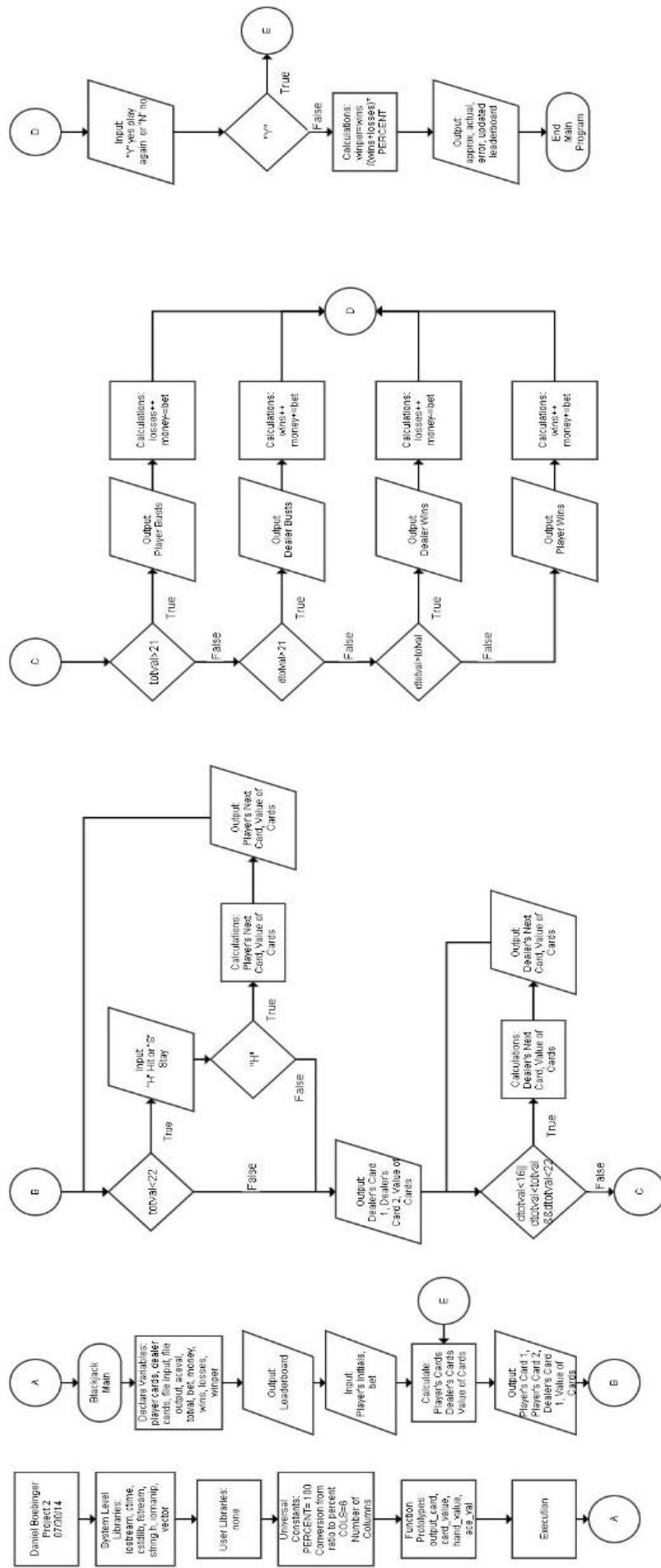
Output – “You Bust”, “Dealer Busts”, “Dealer Wins”, or “You Win”

Results.txt:

Output – “Wins = 7 Losses = 9 Win Percentage = 43.75%”

Flowchart

Project2



Pseudocode

Execution Starts Here!

Declare and Initialize Variables

Inputs and Constants

Input from file

Number

Leader Board with initials and scores from file

Size set to 4 for the 3 initials and null terminator

Initials of User

Outputs

User's Money (Buy-in at \$50)

Player's Cards

Player's Second hand if splitting cards

Dealer's Cards

Size of vector for player's cards

Size of vector for player's second hand

Size of vector for dealer's cards

User's Bet in dollars

An additional Bet if needed

Insurance Bet if needed

Player's Total value of all cards

Player's Total value of all cards for second hand

Dealer's total value of all cards

Player's Decision

Number of wins

Number of losses

Winning percentage

Output to file

Set the Random Seed

Input Values

Open the Leader Board file

Test File For Open Failures

Input Leader Board

Output Game Title

Output Current Leader Board

Input Player's Initials

Output Pre-Game Instructions

Set loop=true

Do: Game Loop

Output Start of New Game Information

Input Player's Bet

Initialize Hands and Values

Determine Values for Card 1 and 2 for Player

Calculate Size of Vector for Player's Cards

Output Player's Cards

Determine Value of Player's Cards

Determine Values for Card 1 and 2 for Dealer

Calculate Size of Vector for Dealer's Cards Minus One

Output Dealer's Card 1

Output Dealer's Card 2 as Unknown

Calculate Actual Size of Vector for Dealer's Cards

Calculate total value of Player's cards

Determine Best Ace Value for Player's Cards

Ask Player for First Decision

Evaluate Player's Decision and Change Bet Value If Needed

Player Hit Loop For First Hand

While Total Value of Player's Card is Less than 22 and Player Chooses Hit

Determine Value of Card for Player

Calculate Size of Vector for Player's Cards

Output Player's Cards

Determine Value of Player's Cards

Calculate total value of Player's cards

Determine Best Ace Value for Player's Cards

Output Value of Player's Cards

If Total Value of Player's Cards is less than 22

Player Hit Loop For Second Hand if Needed

While Total Value of Player's Card is Less than 22 and Player Chooses Hit

Determine Value of Card for Player

Calculate Size of Vector for Player's Cards

Output Player's Cards

Determine Value of Player's Cards

Calculate total value of Player's cards

Determine Best Ace Value for Player's Cards

Output Value of Player's Cards

If Total Value of Player's Cards is less than 22

Else

Exit Hit Loop

Calculate Total Value of Dealer's Cards

If Both Cards are Valued as 10

Total Value of Dealer's Cards is 20

Else if Both Cards are valued as 11

Total Value of Dealer's Cards is 12

Else if One Card is Ace and The Other is Valued as 10 and Ace Value is High or Either

Total Value of Dealer's Cards is 21

Else if Card 1 is Valued at 10

Total Value of Dealer's Cards is 10 plus Card Number

Else if Card 2 is Valued at 10

Total Value of Dealer's Cards is 10 plus Card Number

Else

Total Value of Dealer's Cards is Card 1 Number plus Card 2 Number

Dealer's Turn in relation to Player's First Hand

If Player Cards has Blackjack

```

    output Blackjack
If Dealer Cards has Blackjack
    output Blackjack
    If dealer has same value as player
        Output Push
    If Dealer's cards are greater than player's cards
}else if (dtotval>totval&&dtotval>16){
    Output Dealer as Winner
    if Total Value of Dealer's Cards is Less than Total Value of Player's Cards and Both are
Less than 22
        Dealer Hit Loop
        While Total Value of Dealer's Cards is less than Total Value of Player's Cards or 16,
and Less than 22
            while ((dtotval<totval||dtotval<=16)&&dtotval<22){
                Determine Value of Dealer's Card

                Calculate Size of Vector for Dealer's Cards

                Output Dealer's Cards

                Determine Value of Dealer's Cards

                Calculate total value of Dealer's cards

                Determine Best Ace Value for Dealer's Cards

                Output Total Value of Dealer's Cards

                Determine winner in accordance to first hand
                If the hands Tie
                    Output Push"<<endl;
                If Total Value of Dealer's Cards is Over 21
                    Output That Dealer Busts and Player Wins
                if Total Value of Dealer's Cards is Over Total Value of Player's Cards
                    Output That Dealer Wins
                Else
                    Output That Player Wins
                Else
                    Output That Player Busts

Repeat for Player's Second Hand if there is a second hand

If player chose to Surrender
    Output Surrender

End of Game Loop

```

If player does not have enough money
Output You do not have enough money to play again!
Else
Ask to Play Again
If Player Chooses Yes Continue Game Loop
Default End Game Loop

While: Player Wants to Play and has enough money

Calculate Win Percentage

Update Leader Board
Enter User's Name and Score to Leader Board
Enter Name to Leader Board
Enter Score to Leader Board

Search and Sort Leader Board

Output Sorted Leader Board to file

Output the results to file
Output Total Wins
Output Total Losses
Output Win Percentage
Inform Player Results were Outputted to File

Exit Stage Right!
Close Files

Concept Checklist

Used in Code	Concept	Example in Code
X	cout	Line 67
X	cin	Line 90
X	endl	Line 67
X	#include	Line 8
X	short	Line 54
X	int	Line 44
X	float	Line 56
X	char	Line 36
X	character strings	Line 38
X	bool	Line 106
X	Math Expressions	Line 698
X	Type Casting	Line 698
X	Naming Constants	Line 20
X	Combined Assignment	Line 91
	Format Input	NONE
X	Format Output	Line 782
X	File Input	Line 64
X	File Output	Line 771
X	Relational Operators	Line 70
X	if	Line 170
X	if/else	Line 66
X	if/else if	Line 116

X	switch	Line 682
X	Menus	Line 177
X	Logical Operators	Line 122
X	Validating User Input	Line 88
X	String Function	Line 91
X	Increment and Decrement Operators	Line 70
X	while	Line 338
X	do-while	Line 88
X	for	Line 70
X	1-D Array or Vector	Line 41
X	2-D Array	Line 36
X	Passing 1-D Array or vector between functions	Line 25
X	Passing 2-D Array between functions	Line 28
X	Pass by value for a function	Line 24
X	Pass by reference for a function	Line 27
X	Defaulted parameters for a function	Line 26
X	Return primitive data types for a function	Line 26
X	Sorting	Line 731
X	Searching	Line 731

Future Improvements

- Multiple players
- Split as many pairs as possible
- Additional blackjack rules and options
- Shorten overall code length

References

Dr. Mark Lehr

Savitch, Walter. *Problem Solving With C++*. 8th Edition. 2012 Pearson Education, Inc.

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