Project 2
<Blackjack>
Card Game

Name: Samuel Anderson
Date: 5/28/2024
Class: CIS-5
43720

Table of Contents

Introduction and How to Play

Welcome to the game of Blackjack! It is a fun and enjoyable game for all. The rules are pretty simple as well, so you can pick it up in no time. Blackjack originated in France around the 1700s and is now enjoyed by people all around the world. It is a popular game in casinos nowadays due to the luck involved in winning, but there are still ways to improve your odds, such as card counting. Hope you enjoy the game!

How to Play

Title: Blackjack

Setup: The player and the dealer get 2 cards. The dealer shows one card while the other is face down.

Objective: Beat the Dealer!! Get as close as possible to 21 points without going over, if the dealer gets closer to 21 than you lose.

Gameplay: Cards each have their own value

-2-10: are each worth their face value

-Jack, King, and Queen: 10 points

-Ace: 1 or 11 points, it point worth is up to the dealer

After the setup: player goes first and has the option to stay or draw a card. The dealer has to hit untill he has atleast a 17. If the dealer is at 17 or above he has to "stay" If the player wins they win the amount they bet. If they lose their entire bet is gone. If both sides have the same number of points the result is a tie.

Blackjack: If you are dealt a "Black Jack" you win automatically. Blackjack wins are paid 3 to 2 of the bet. If both players have a "blackjack" the game results in a "push". If the dealer gets a blackjack the player looses.

Double down: After the first two cards have been delt you have the option to double down on the original bet. 2x the amount you bet and the player will only be allowed to draw exactly one card more for this game.

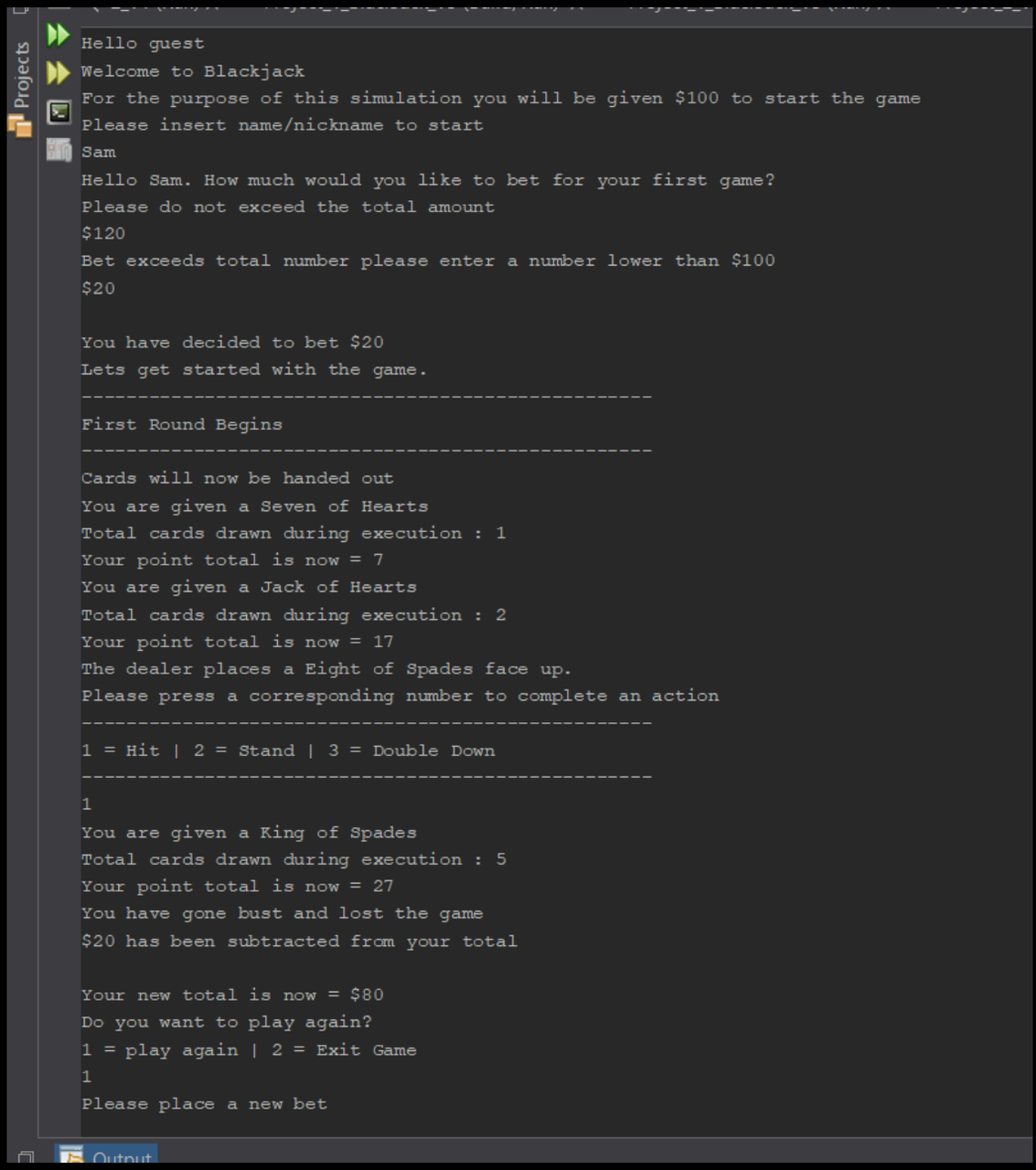
Split: If the first 2 cards you recieve are the same you have the option to slit them into two different decks that can be played sepearetly. They decks are not relient on each other and have the option to loose and win on their own. The same amount bet on the first deck must also be placed on the second deck. If a slplit of two aces occurs the player may only draw one card for each deck.

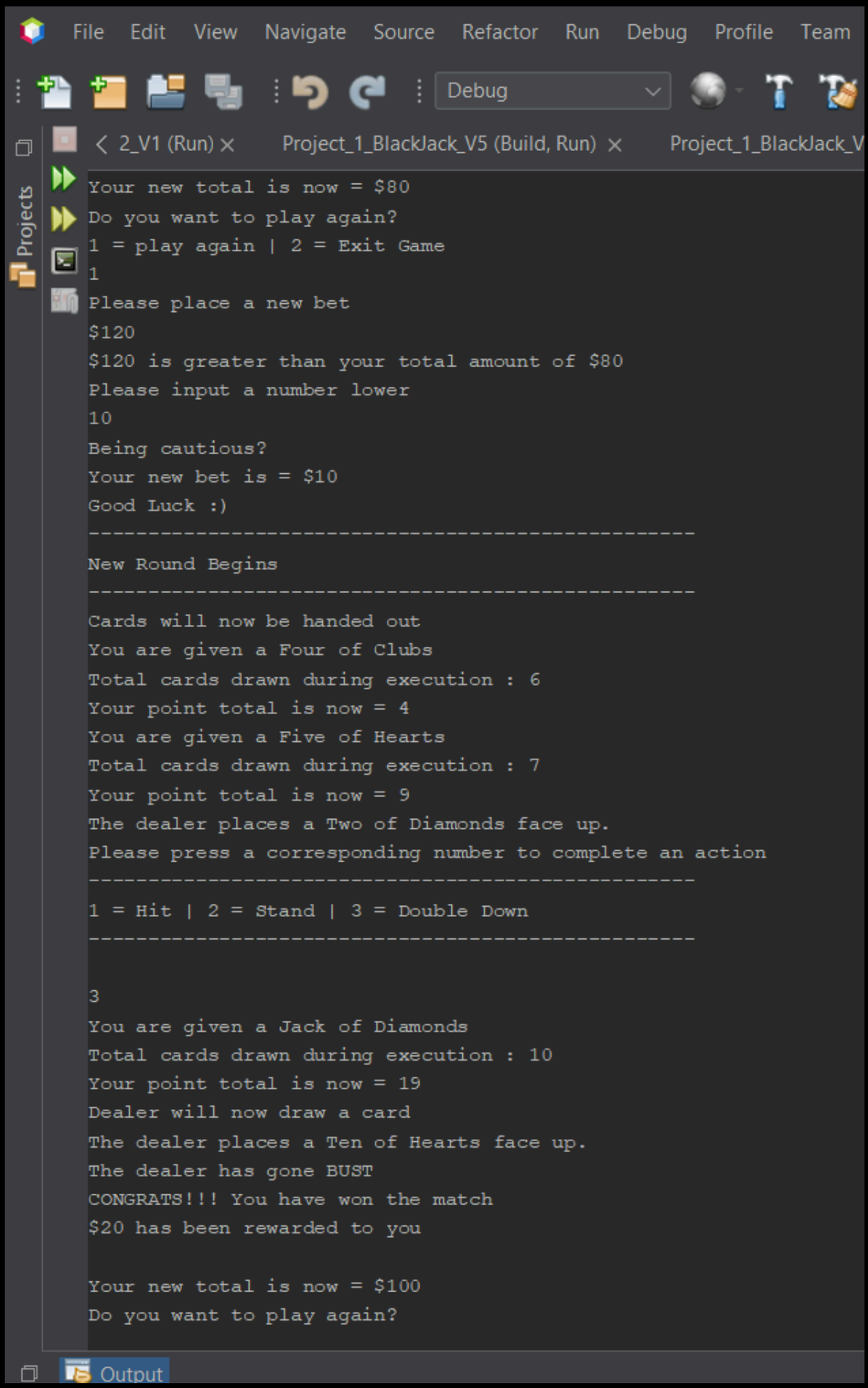
Insurance: When the dealers face up card is an ace, the players can add bets of up to half the original bet into "insurance". If at the end of the round the dealer has a "blackjack". The players who have bets in insurance get apayout of 2:1.

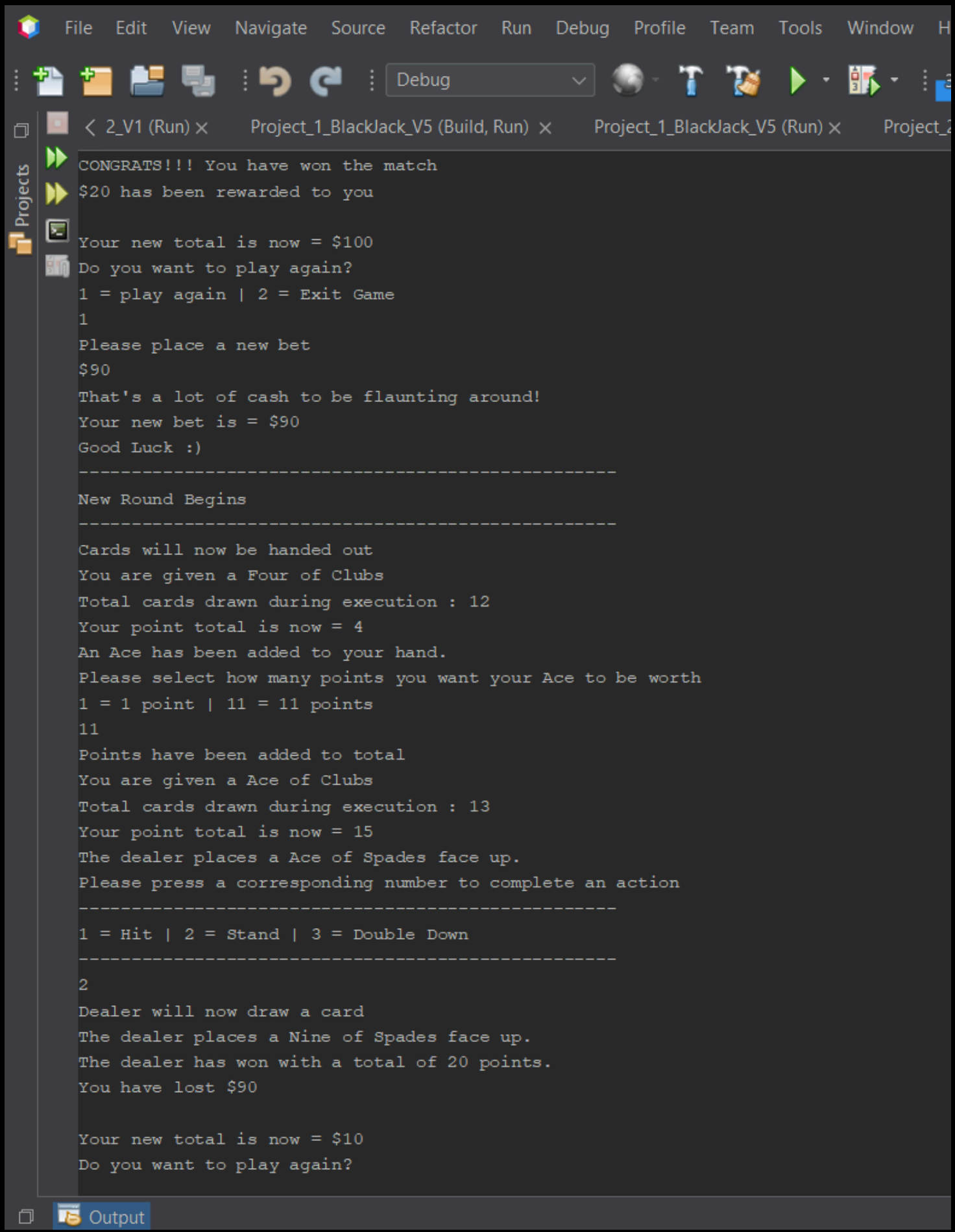
Similarities
dealer has mechanics to try and have a better chance at winning
Double Down
Money is used as currency

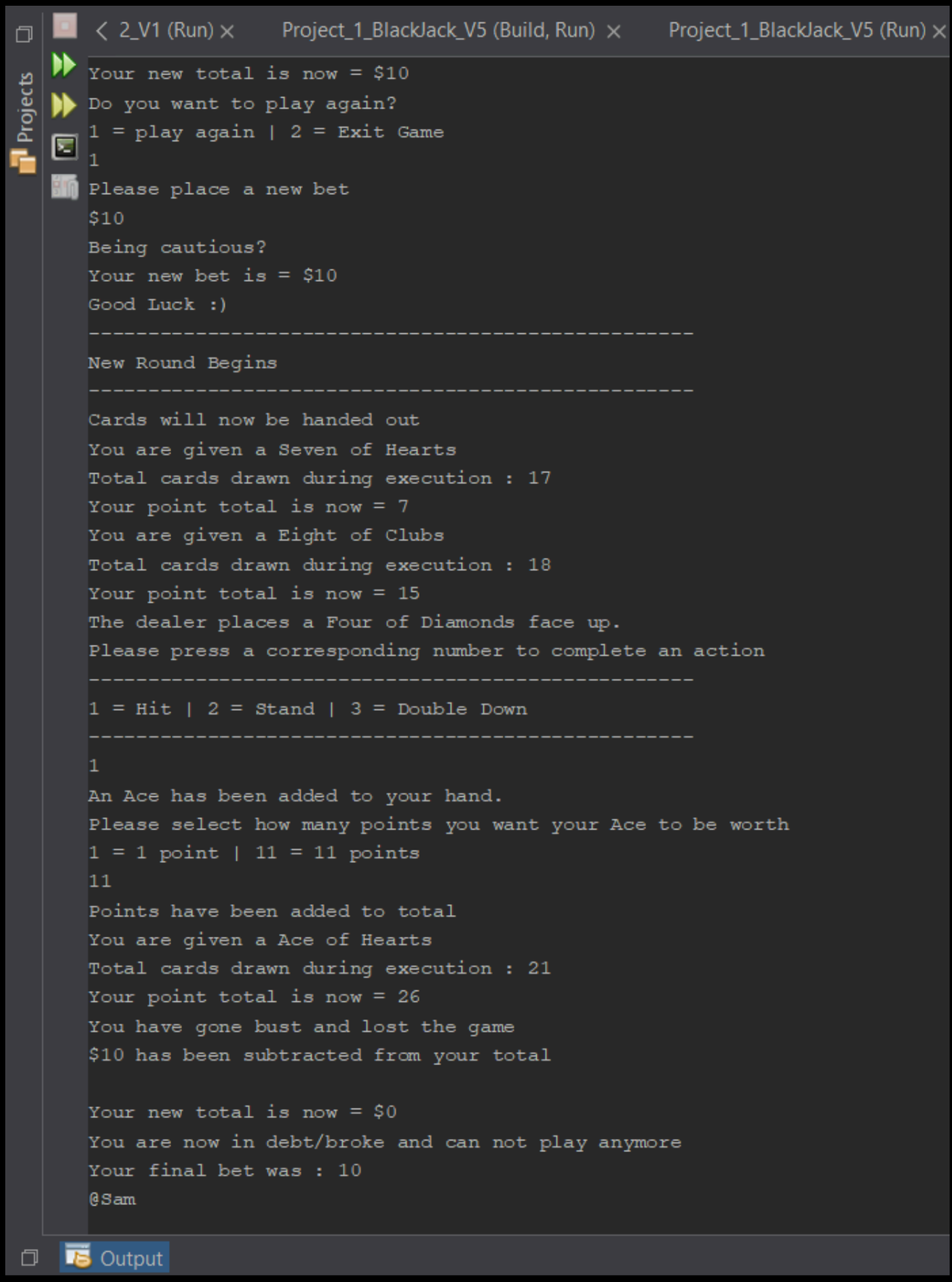
Differences
Dealer is a bot
Limited amount of players
You can lose real money

Game In Action

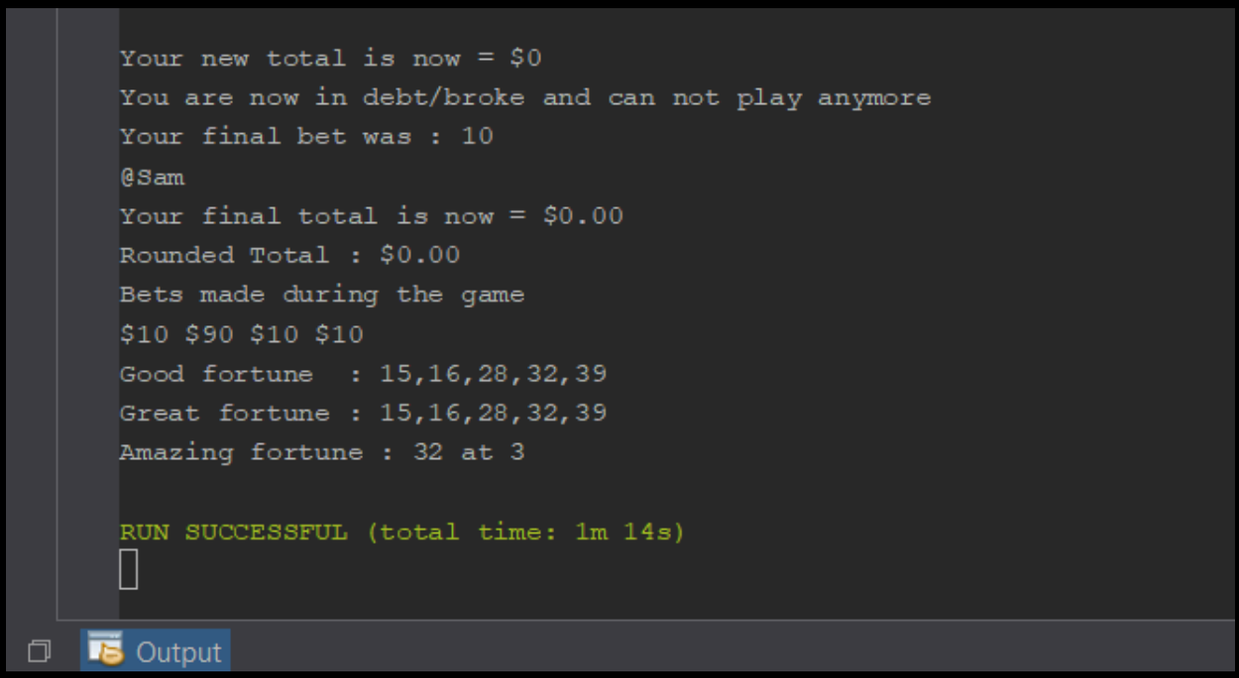



File Edit View Navigate Source Refactor Run Debug Profile Team
Debug
2_V1 (Run)
Project_1_BlackJack_V5 (Build, Run)
Project_1_BlackJack_V
Projects
Your new total is now = $80
Do you want to play again?
1 = play again | 2 = Exit Game
1
Please place a new bet
$120
$120 is greater than your total amount of $80
Please input a number lower
10
Being cautious?
Your new bet is = $10
Good Luck :)
New Round Begins
Cards will now be handed out
You are given a Four of Clubs
Total cards drawn during execution : 6
Your point total is now = 4
You are given a Five of Hearts
Total cards drawn during execution : 7
Your point total is now = 9
The dealer places a Two of Diamonds face up.
Please press a corresponding number to complete an action
1 = Hit | 2 = Stand | 3 = Double Down
3
You are given a Jack of Diamonds
Total cards drawn during execution : 10
Your point total is now = 19
Dealer will now draw a card
The dealer places a Ten of Hearts face up.
The dealer has gone BUST
CONGRATS!!! You have won the match
$20 has been rewarded to you
Your new total is now = $100
Do you want to play again?
Output

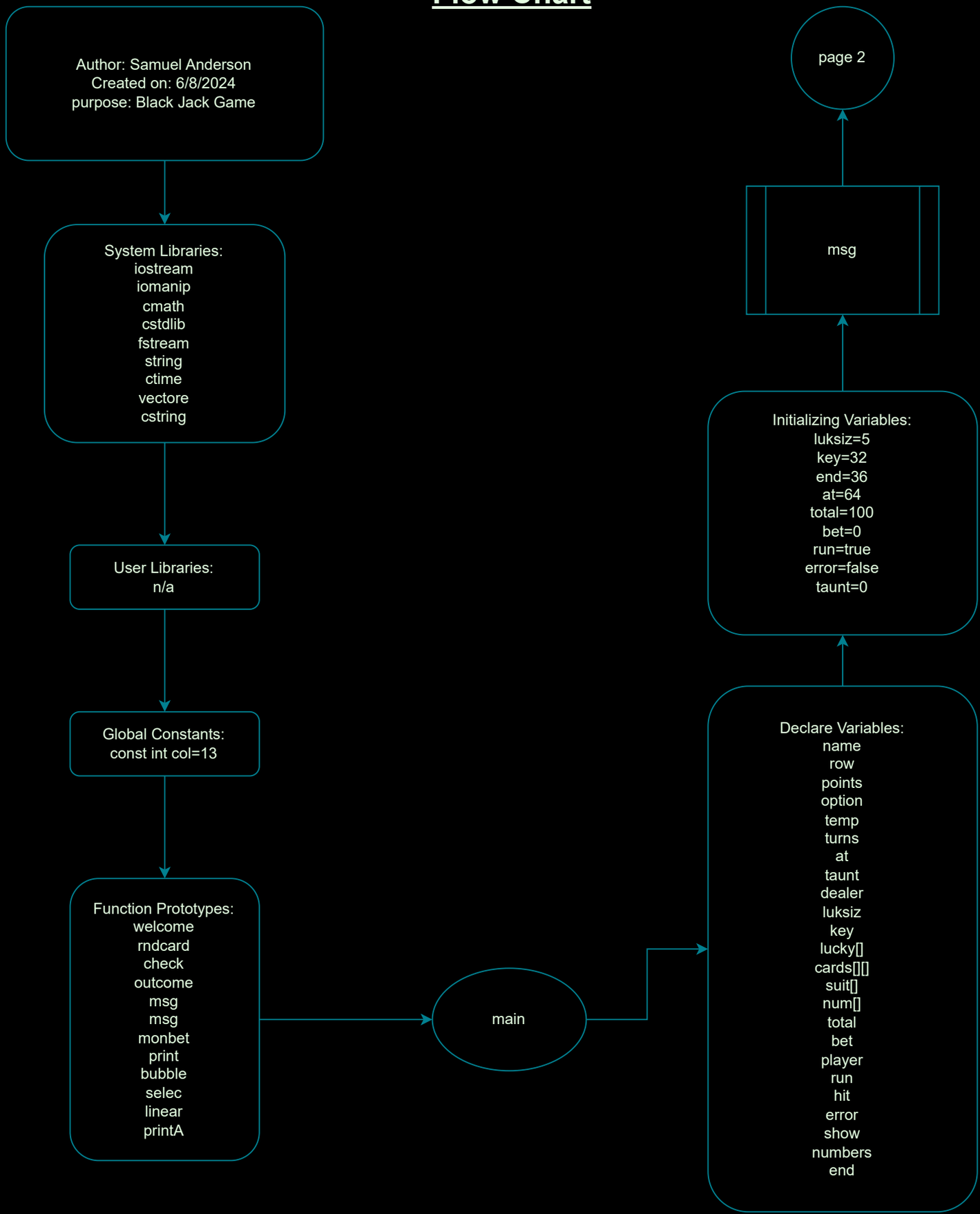

File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window
Debug
2_V1 (Run)
Project_1_BlackJack_V5 (Build, Run)
Project_1_BlackJack_V5 (Run)
Projects
CONGRATS!!! You have won the match
$20 has been rewarded to you
Your new total is now = $100
Do you want to play again?
1 = play again | 2 = Exit Game
1
Please place a new bet
$90
That's a lot of cash to be flaunting around!
Your new bet is = $90
Good Luck :)
New Round Begins
Cards will now be handed out
You are given a Four of Clubs
Total cards drawn during execution : 12
Your point total is now = 4
An Ace has been added to your hand.
Please select how many points you want your Ace to be worth
1 = 1 point | 11 = 11 points
11
Points have been added to total
You are given a Ace of Clubs
Total cards drawn during execution : 13
Your point total is now = 15
The dealer places a Ace of Spades face up.
Please press a corresponding number to complete an action
1 = Hit | 2 = Stand | 3 = Double Down
2
Dealer will now draw a card
The dealer places a Nine of Spades face up.
The dealer has won with a total of 20 points.
You have lost $90
Your new total is now = $10
Do you want to play again?
Output

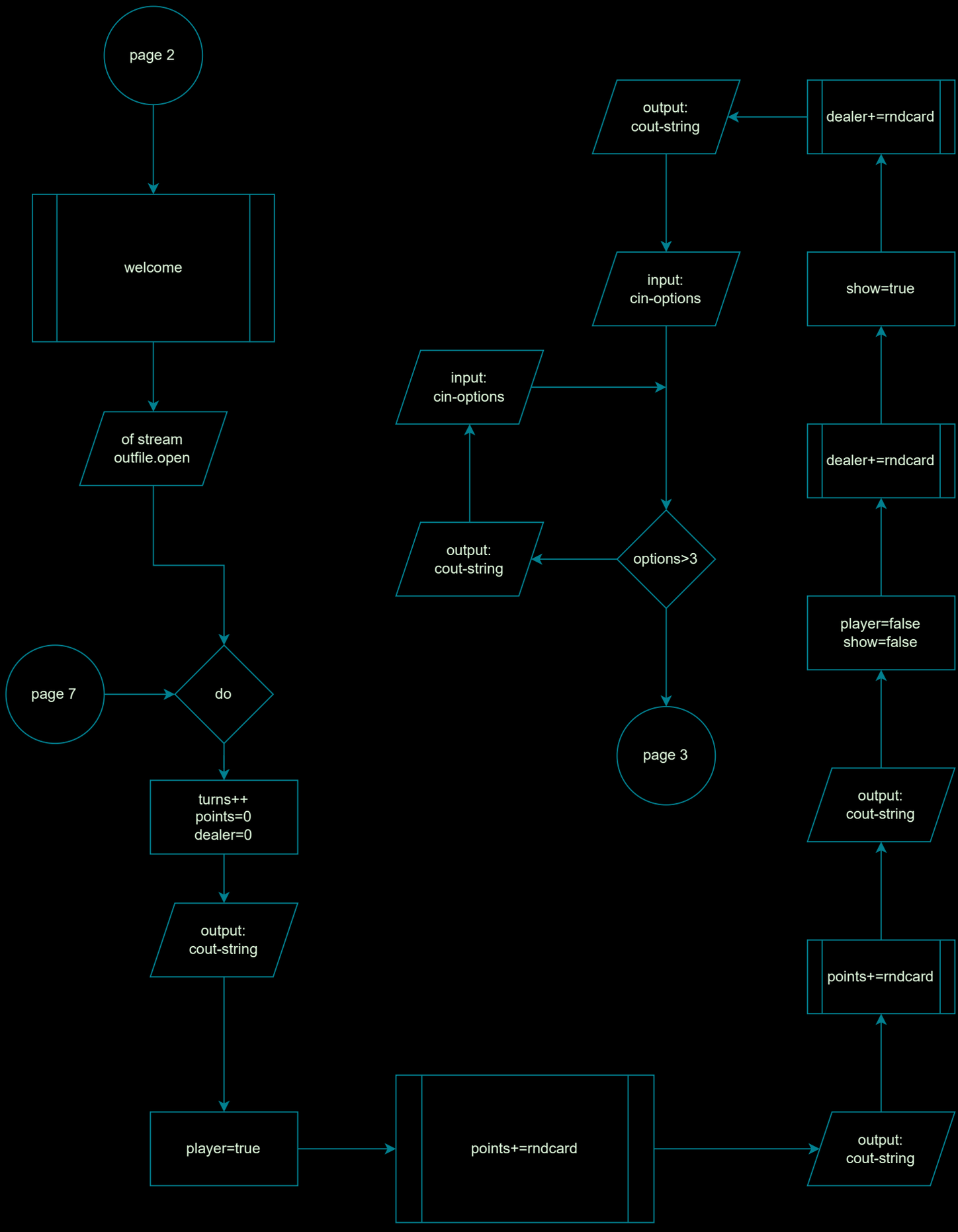


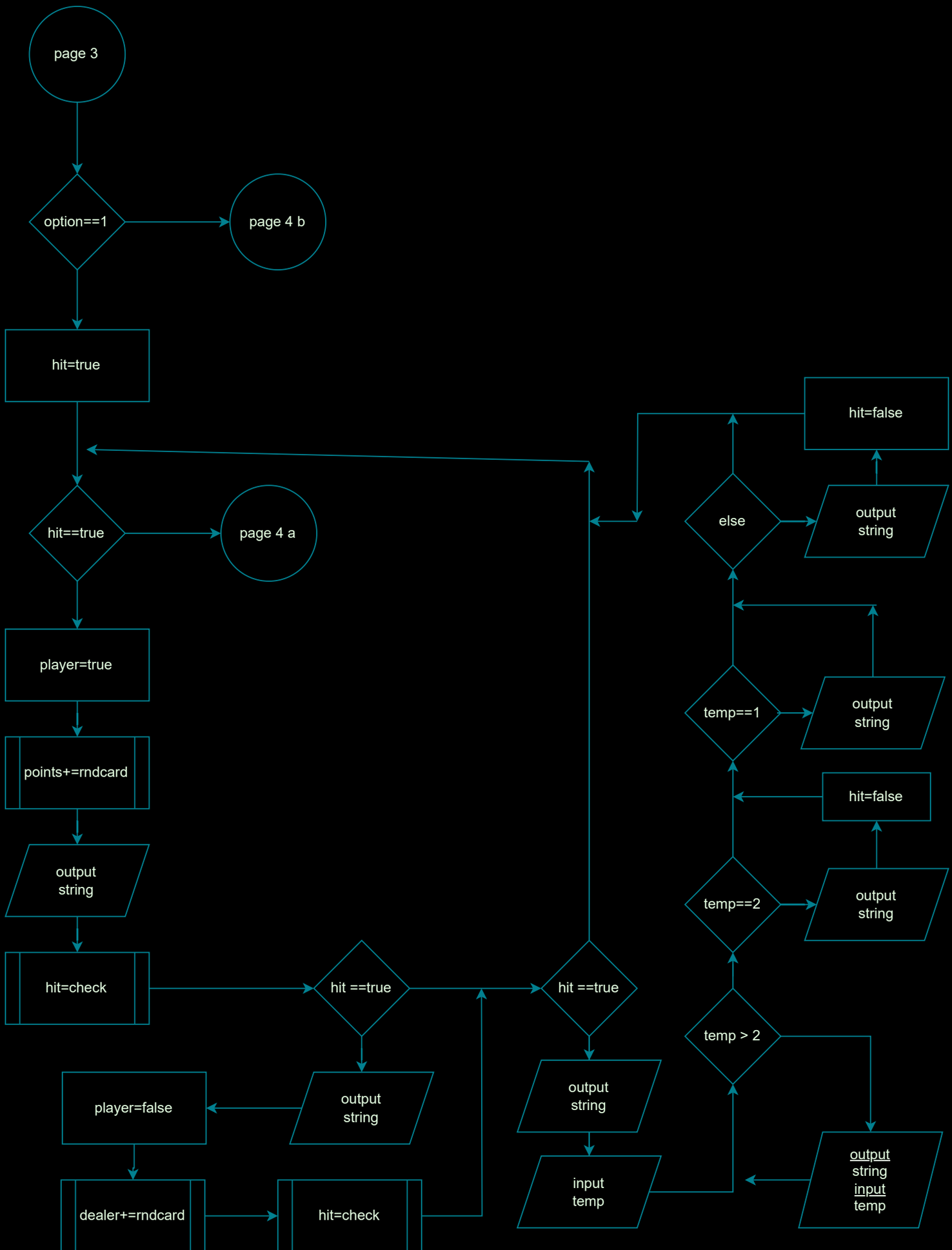

```
Your new total is now = $10
Do you want to play again?
1 = play again | 2 = Exit Game
1
Please place a new bet
$10
Being cautious?
Your new bet is = $10
Good Luck :)
--------------------------------------------------
New Round Begins
--------------------------------------------------
Cards will now be handed out
You are given a Seven of Hearts
Total cards drawn during execution : 17
Your point total is now = 7
You are given a Eight of Clubs
Total cards drawn during execution : 18
Your point total is now = 15
The dealer places a Four of Diamonds face up.
Please press a corresponding number to complete an action
--------------------------------------------------
1 = Hit | 2 = Stand | 3 = Double Down
--------------------------------------------------
1
An Ace has been added to your hand.
Please select how many points you want your Ace to be worth
1 = 1 point | 11 = 11 points
11
Points have been added to total
You are given a Ace of Hearts
Total cards drawn during execution : 21
Your point total is now = 26
You have gone bust and lost the game
$10 has been subtracted from your total

Your new total is now = $0
You are now in debt/broke and can not play anymore
Your final bet was : 10
@Sam
```

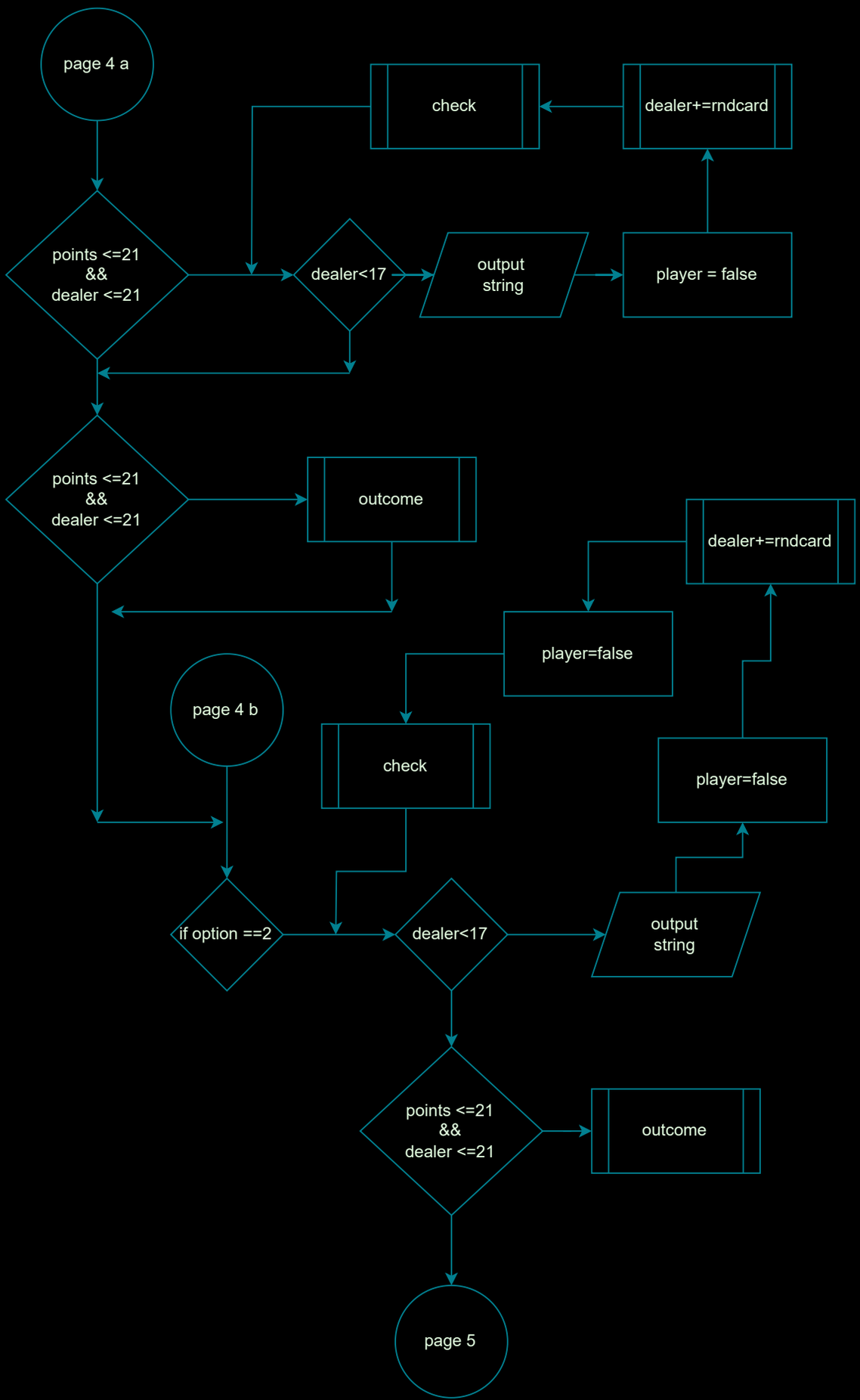

Your new total is now = $0
You are now in debt/broke and can not play anymore
Your final bet was : 10
@Sam
Your final total is now = $0.00
Rounded Total : $0.00
Bets made during the game
$10 $90 $10 $10
Good fortune : 15,16,28,32,39
Great fortune : 15,16,28,32,39
Amazing fortune : 32 at 3
RUN SUCCESSFUL (total time: 1m 14s)
Output

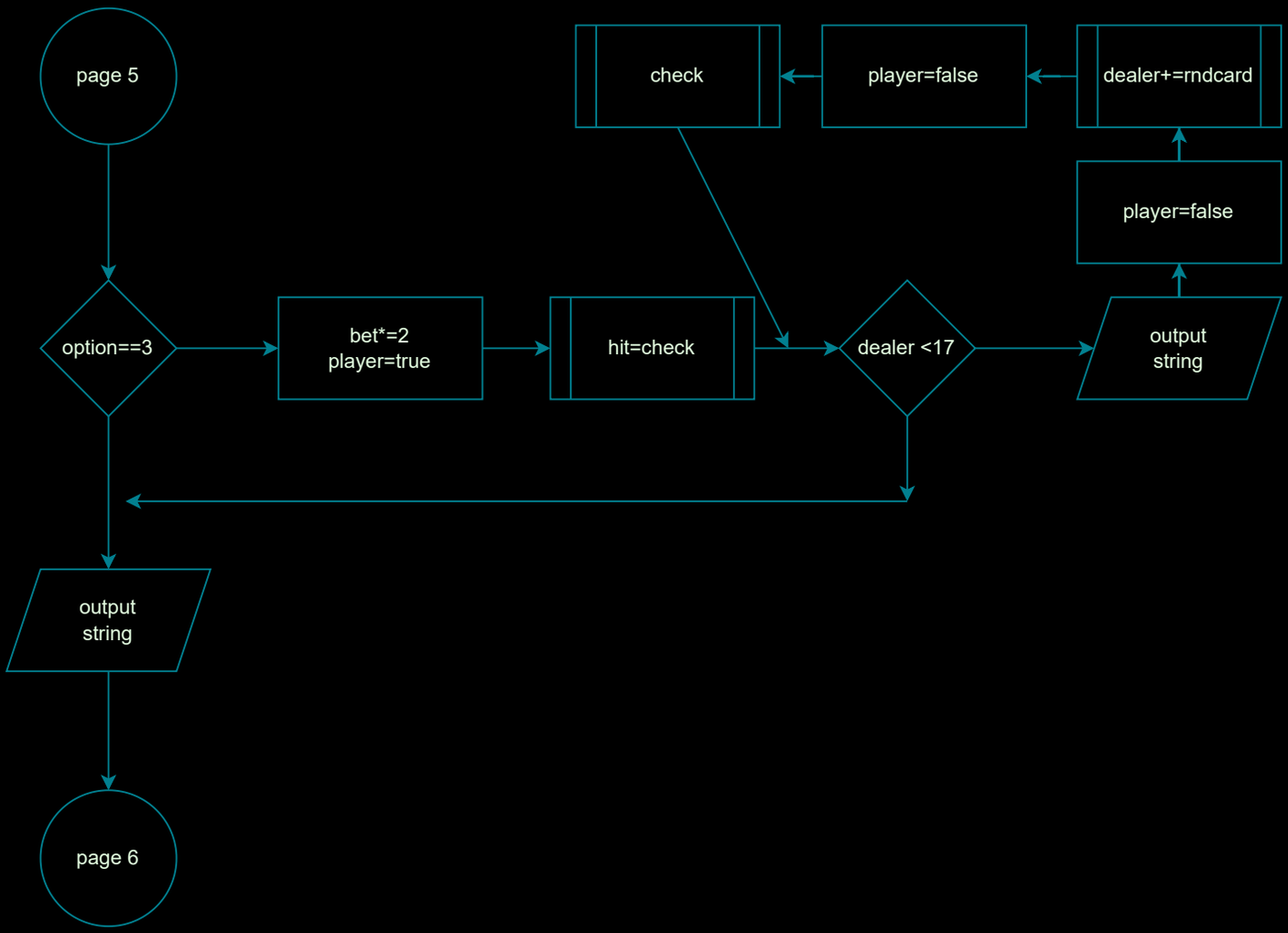
Flow Chart

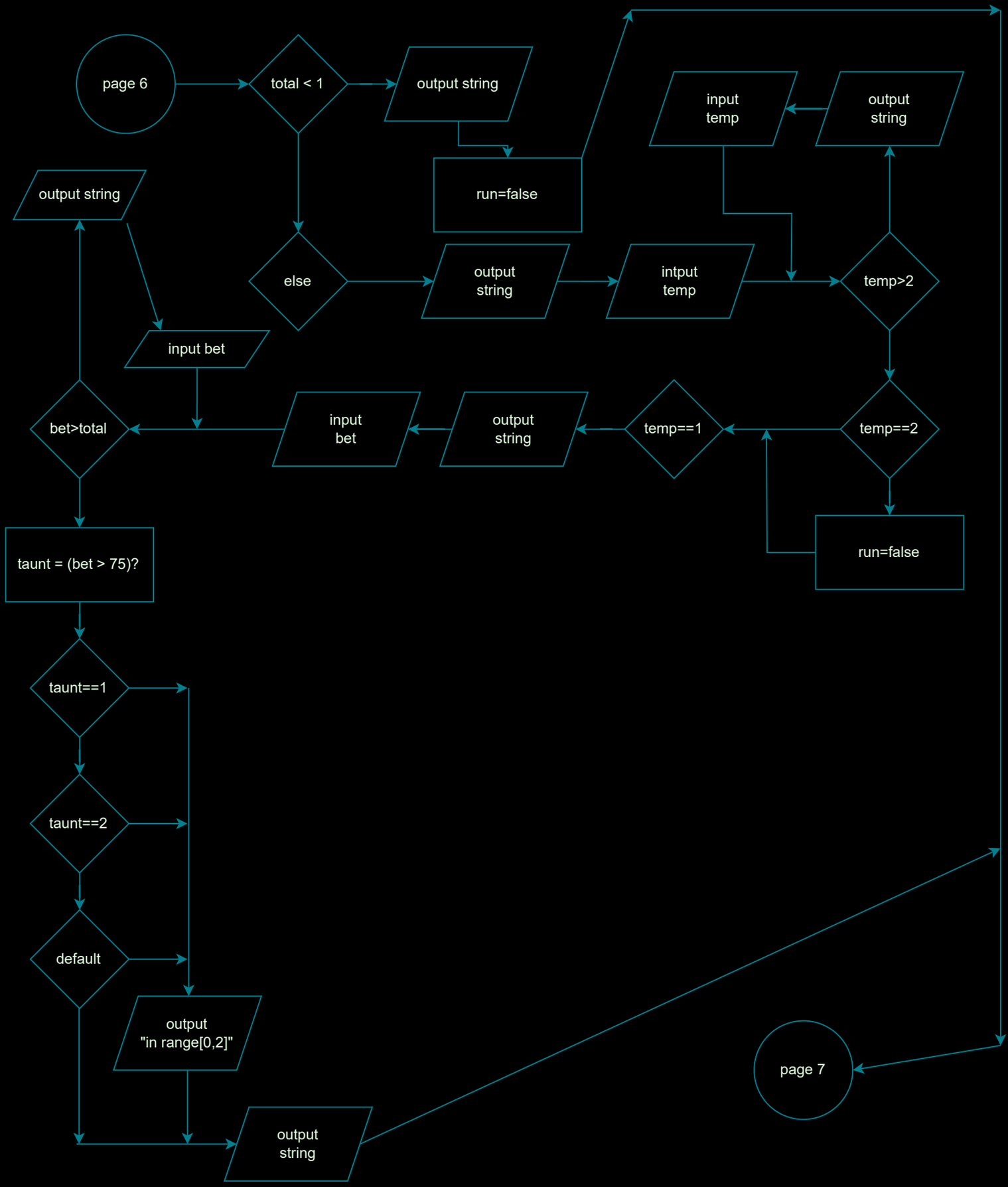

Author: Samuel Anderson
Created on: 6/8/2024
purpose: Black Jack Game
System Libraries:
iostream
iomanip
cmath
cstdlib
fstream
string
ctime
vectore
cstring
User Libraries:
n/a
Global Constants:
const int col=13
Function Prototypes:
welcome
rndcard
check
outcome
msg
msg
monbet
print
bubble
selec
linear
printA
main
Declare Variables:
name
row
points
option
temp
turns
at
taunt
dealer
luksiz
key
lucky[]
cards[][]
suit[]
num[]
total
bet
player
run
hit
error
show
numbers
end
Initializing Variables:
luksiz=5
key=32
end=36
at=64
total=100
bet=0
run=true
error=false
taunt=0
msg
page 2

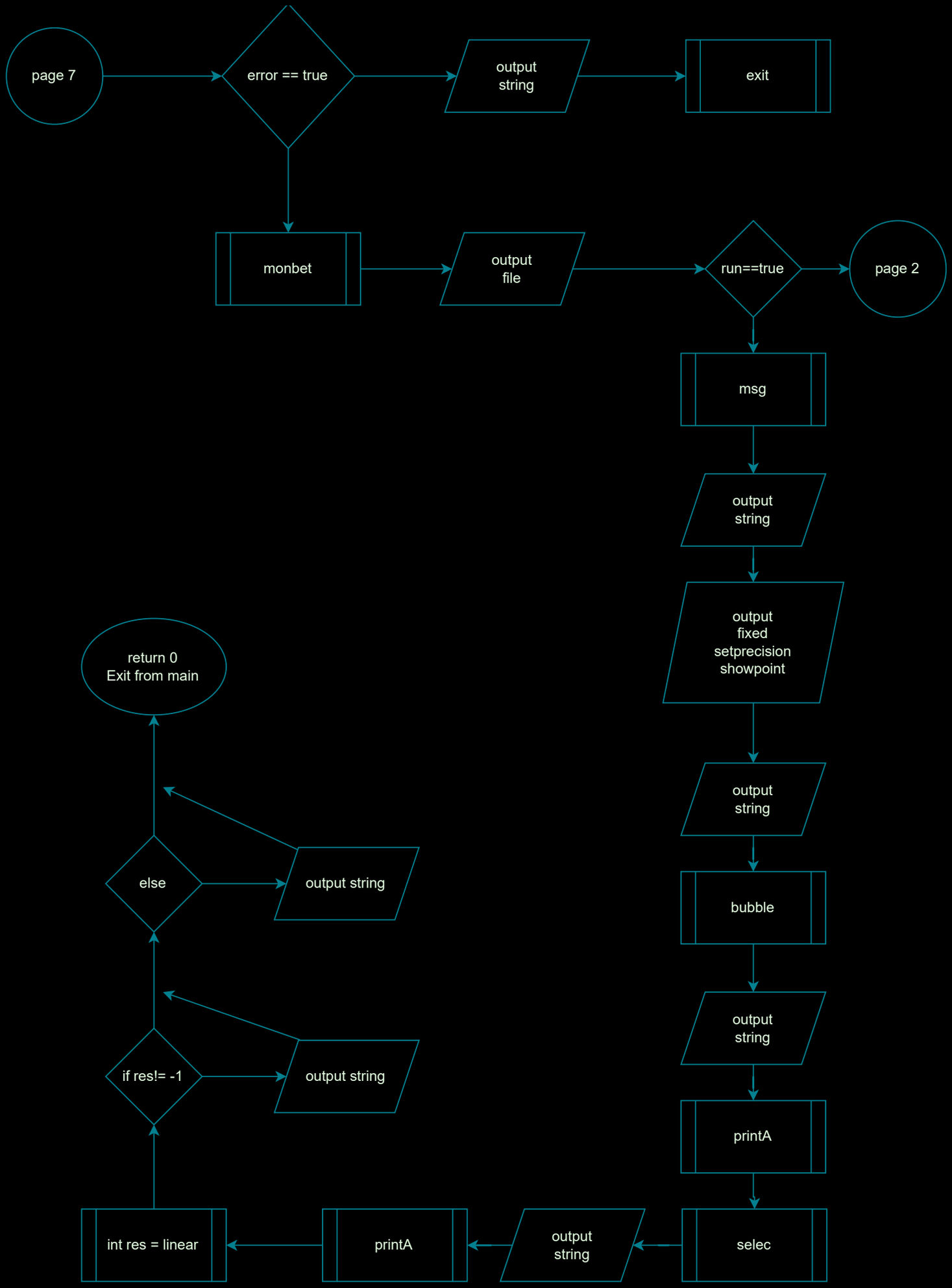

page 2
welcome
of stream
outfile.open
page 7
do
turns++
points=0
dealer=0
output:
cout-string
player=true
points+=rndcard
output:
cout-string
input:
cin-options
options>3
output:
cout-string
input:
cin-options
page 3
output:
cout-string
dealer+=rndcard
show=true
dealer+=rndcard
player=false
show=false
output:
cout-string
points+=rndcard
output:
cout-string


page 3
option==1
page 4 b
hit=true
hit==true
page 4 a
player=true
points+=rndcard
output string
hit=check
hit ==true
player=false
output string
dealer+=rndcard
hit=check
hit ==true
output string
input temp
temp > 2
output string input temp
temp==2
output string
hit=false
temp==1
output string
else
output string
hit=false


page 4 a
check
dealer+=rndcard
points <=21
&&
dealer <=21
dealer<17
output
string
player = false
points <=21
&&
dealer <=21
outcome
dealer+=rndcard
player=false
page 4 b
check
player=false
if option ==2
dealer<17
output
string
points <=21
&&
dealer <=21
outcome
page 5


page 5
check
player=false
dealer+=rndcard
player=false
option==3
bet*=2
player=true
hit=check
dealer <17
output
string
output
string
page 6


page 6
total < 1
output string
run=false
input temp
output string
output string
else
output string
intput temp
temp>2
input bet
bet>total
input bet
output string
temp==1
temp==2
run=false
taunt = (bet > 75)?
taunt==1
taunt==2
default
output "in range[0,2]"
output string
page 7


page 7
error == true
output string
exit
monbet
output file
run==true
page 2
msg
output string
output fixed setprecision showpoint
output string
bubble
output string
printA
selec
output string
printA
int res = linear
if res!= -1
output string
else
output string
return 0
Exit from main

Program

```
/*
 * File:   main.cpp
 * Author: Samuel Anderson
 * Created on June 4, 2024, 12:16 PM
 * Purpose:  Black jack Game Project 2 V4
 */

//System Libraries

#include <iostream>
#include <iomanip>
#include <cmath>
#include <cstdlib>
#include <fstream>
#include <string>
#include <ctime>
#include <vector>
#include <cstring>
using namespace std;

//User Libraries

//Global Constants - Math/Science/Conversions only
const int col=13;
//Function Prototypes
void welcome(string &name, float &bet, float &total); //starts / welcomes player to the game

int  rndcard(int cards[][col], string suit[], string num[], bool player,bool show);//grabs a random number for reference

bool check(int points,float &total, float bet,bool player);//checks to see if someone goes bust

void outcome(int points, int dealer, float bet, float &total, string name); //compares scores and outputs the outcome and changes the total score

void msg(string name = "guest"); // greets player
void msg(int x);//tell player bye
void monbet(vector<float> &numbers,float bet);//tacks bets made by player and outs into
int print(vector<float> &numbers, int turns);//prints and organizes vector

void bubble(int arr[], int size);//bubble sort
void selec(int arr[], int size);//section sort
int linear(int arr[], int size, int key);//linear search
void printA(int arr[], int size);//print sort

//Execution Begins Here
int main(int argc, char** argv) {
    //Set random seed
    srand(static_cast<unsigned int>(time(0)));
    //Declare Variables

    string name;//name/nickname the player, decided at start of game
    int row=2,//amount of rows in 2d array
        points,//total points from cards
        option,// allows the player to pick from 3 options
        temp,//temp var
        turns,// counts the amount of turns played during a run
        at,//@converter
        taunt,//option for taunting player
        dealer,//dealers points
        key;    //key for lucky number
    int luksiz = 5;
    int lucky[luksiz]={28,16,39,32,15};  //lucky numbers
    //                          card                suit
    int cards[row][col]={{1,2,3,4,5,6,7,8,9,10,11,12},{1,2,3,4}};

    string suit[4]={"Spades","Diamonds","Clubs","Hearts"};//suit names
    string num[13]={"Ace", "Two", "Three", "Four", "Five", "Six", "Seven", "Eight", "Nine", "Ten", "Jack", "Queen", "King"}; //card names



        float total, //total amount of money player has
          bet;   //amount user wants to bet
```

```
    bool player,  //checks player or dealer turn
    run, //checks if code should run
    hit, //checks if player wants to keep on hitting
    error, //checks for error
    show;  //checks if it should show the dealers card drawn

vector<float> numbers(0);//vector to put amount bet each game

char end;//sign



//Initialize Variables

key = 32;
end=36;//outputs "$"
at=64;//@converter
total=100;
bet=0;
run=true;
error = false;
taunt=0;
msg();
welcome(name, bet, total);
// Open a file to log results
ofstream outFile;
outFile.open("game_results.txt", ios::app);  // Opens file

//The Process -> Map Inputs to Outputs
do {
   //init points
   turns++; //add a turn every cycle
   points=0;
   dealer=0;
   cout<<"Cards will now be handed out"<<endl;
   //player turn
   player = true;
   //pull a first card
   points+=rndcard(cards,suit,num,player,show);
   //tell player their points
   cout<<"Your point total is now = "<<points<<endl;
   //pull a second card
   points+=rndcard(cards,suit,num,player,show);
   //tell player their points
   cout<<"Your point total is now = "<<points<<endl;
   //dealer draws a card
   player=false;
   show=false;
   //draw the dealers card
   dealer+=rndcard(cards,suit,num,player,show);
   //dealer draws a second card face up
   show=true;
   dealer+=rndcard(cards,suit,num,player,show);
   //Ask the user for a decision
   cout<<"Please press a corresponding number to complete an action\n";
   cout<<"-----------------------------------------------------"<<endl;
   cout<<"1 = Hit | 2 = Stand | 3 = Double Down\n";
   cout<<"-----------------------------------------------------"<<endl;
   cin>>option;
   //if user hits the wrong option
   while(option>3){
      cout<<"please input a correct number\n1 = Hit | 2 = Stand | 3 = Double Down\n";
      cin>>option;
   }
   //user decides to hit
   if (option == 1){
      hit=true;
      while(hit==true){
         //draw the card for player
         player=true;


          points+=rndcard(cards,suit,num,player,show);
         //tell them their points
         cout<<"Your point total is now = "<<points<<endl;
         //check if player goes over
         hitcheck(points,total,bet,player);
```

```
        hit=check(points, total, bet, player);
        //dealers turn if player under 21 & if dealer under 22

            if(hit==true){
            cout<<"Dealer will now draw a card"<<endl;
            //draw card for dealer
            player=false;
            dealer+=rndcard(cards,suit,num,player,show);
            //check if dealer goes bust
            hit=check(dealer, total, bet, player);
        }
        //checks if both players are under 21 and gives player an option
        if(hit==true){
            cout<<"The turn has not ended, nobody has gone bust"<<endl;
            cout<<"\nPlease pick pick an option"<<endl;
            cout<<"-----------------------------------------------------"<<endl;
            cout<<"1 = Hit | 2 = Stand"<<endl;
            cout<<"-----------------------------------------------------"<<endl;
            cin>>temp;
            //if player picks an option that's not available
            while(temp>2){
                cout<<"Please pick a valid option"<<endl;
                cout<<"-----------------------------------------------------"<<endl;
                cout<<"1 = Hit | 2 = Stand"<<endl;
                cout<<"-----------------------------------------------------"<<endl;
                cin>>temp;
            }
            //if user stands
            if(temp==2){
                cout<<"You have chosen to Stand\nmatch will now continue"<<endl;
                hit=false;
            }else if(temp==1){
                //if user hits start up the loop again
                cout<<"You have chosen to Hit"<<endl;
            }else{
                // Exit the loop if either the player or dealer goes bust
                cout<<"ERROR"<<endl;
                hit=false;
            }
        }
    }
    //player hit is done checking if dealer has a score higher than 17
    if(points <= 21 && dealer <= 21){
        while(dealer<17){
            cout<<"Dealer will now draw a card"<<endl;
            //draw card for dealer
            player=false;
            dealer+=rndcard(cards,suit,num,player,show);
            //check if dealer goes bust
            check(dealer, total, bet, player);
        }
    }
    //After the player stand and the dealer is at 17 or over
    //Check both scores and see who wins
    if(points <= 21 && dealer <= 21){
        outcome(points,dealer,bet,total,name);
    }

}
//user stands
if (option == 2){
    //check if dealer is under 17 then draw
    while(dealer<17){
        cout<<"Dealer will now draw a card"<<endl;
        //draw card for dealer
        player=false;
        dealer+=rndcard(cards,suit,num,player,show);
        //check if dealer goes bust
        player = false;
        check(dealer, total, bet, player);
    }
    //After the player stand and the dealer is at 17 or over
    //Check both scores and see who wins
    if(points <= 21 && dealer <= 21){
        outcome(points,dealer,bet,total,name);
    }
}
```

```
,
//user doubles down
if (option == 3){

    //double the bet by 2
    bet*=2;
    //draw a card for the player
    //draw the card for player
    player=true;
    points+=rndcard(cards,suit,num,player,show);
    //tell them their points
    cout<<"Your point total is now = "<<points<<endl;
    //check if player goes over
    hit=check(points, total, bet, player);
    //player cant draw anymore
    //draw cards for dealer till 17+
    while(dealer<17){
        cout<<"Dealer will now draw a card"<<endl;
        //draw card for dealer
        player=false;
        dealer+=rndcard(cards,suit,num,player,show);
        //check if dealer goes bust
        player = false;
        check(dealer, total, bet, player);
    }
    //After the player stand and the dealer is at 17 or over
    //Check both scores and see who wins
    if(points <= 21 && dealer <= 21){
        outcome(points,dealer,bet,total,name);
    }
}
//final parr
//Tell player their new total
cout<<"\nYour new total is now = $"<<total<<endl;
//check if player is negative
if (total < 1){
    cout<<"You are now in debt/broke and can not play anymore\n";
    run=false;
}else {
    //checks to see if player wants to go again
    cout<<"Do you want to play again?"<<endl;
    cout<<"1 = play again | 2 = Exit Game"<<endl;
    cin>>temp;
    //if user inputs an invalid option
    while(temp>2){
        cout<<"INVALID INPUT PLEASE TRY AGAIN"<<endl;
        cout<<"1 = play again | 2 = Exit Game"<<endl;
        cin>>temp;
    }
    //if user exits game stop running game
    if(temp == 2){
        run=false;
    }
    //if user wants to continue with game
    if (temp == 1){
        cout<<"Please place a new bet"<<endl;
        cout<<"$";
        cin>>bet;
        while(bet>total){
            cout<<"$"<<bet<<" is greater than your total amount of $"<<total<<"\nPlease input a number lower\n";
            cin>>bet;
        }
        taunt = (bet > 75) ? 2 : 1;
        switch(taunt) {
            case 1:
              cout<<"Being cautious?"<<endl;// code block
              break;
            case 2:
              cout<<"That's a lot of cash to be flaunting around!"<<endl;// code block
              break;
            default:
                cout<<"error";
        }
        cout<<"Your new bet is = $"<<bet<<"\nGood Luck :)"<<endl;
        cout<<"-------------------------------------------------------"<<endl;
        cout<<"New Round Begins"<<endl;
        cout<<"-------------------------------------------------------"<<endl;
    }
```

```
            }
        }
        //stops running if error is detected

            if (error == true ){
            cout<<"ERROR PROGRAM IS BEING TERMINATED"<<endl;
            exit(EXIT_FAILURE);
        }
        //adds the amount bet by player into the vector
        monbet(numbers,bet);
        //Logs bets made
        outFile << "Bet made: " <<bet<< endl;
    }
    while(run==true);
    //Display Inputs/Outputs
    msg(bet);
    cout<<(char)at<<name<<endl;
    cout<<fixed<<setprecision(2)<<showpoint;
    cout<<"Your final total is now = "<<end<<total<<endl;
    //Stats
    cout<<"Rounded Total : $"<<round(total)<<endl;
    print(numbers,turns);
    //bubble sort
    bubble(lucky, luksiz);
    cout << "Good fortune  : ";
    printA(lucky, luksiz);
    // Selection Sort
    selec(lucky, luksiz);
    cout << "Great fortune : ";
    printA(lucky, luksiz);
    int res = linear(lucky, luksiz, key);
    if (res != -1) {
        cout<<"Amazing fortune : "<<key<<" at "<<res<<"\n";
    } else {
        cout<<"Amazing fortune : "<<key<<" not found\n";
    }
    //Exit the Program
    return 0;
}
void welcome(string &name, float &bet, float &total){
    cout<<"Welcome to Blackjack\nFor the purpose of this simulation you will be given $100 to start the game\n";
    cout<<"Please insert name/nickname to start\n";
    //prompts user to input name/nickname
    cin>>name;
    cout<<"Hello "<<name<<". How much would you like to bet for your first game?\nPlease do not exceed the total amount\n$";
    cin>>bet;
    //if bet is greater than total amount of money held by player ask for input again
    while(bet > total){
        cout<<"Bet exceeds total number please enter a number lower than $"<<total<<"\n$";
        cin>>bet;
    }
    cout<<"\nYou have decided to bet $"<<bet<<"\nLets get started with the game.\n";
    cout<<"-----------------------------------------------------"<<endl;
    cout<<"First Round Begins"<<endl;
    cout<<"-----------------------------------------------------"<<endl;
}

int rndcard(int cards[][col], string suit[], string num[], bool player, bool show) {
    int rand1 = rand() % 4; // random number for suit
    int rand2 = rand() % 13; // random number for card

    // Debug check
    //cout << "rand1: " << rand1 << endl;
    //cout << "rand2: " << rand2 << endl;

    // Init
    int pass1 = rand2;
    int pass2 = rand1;
    int points = 0;
    bool ace = true;
    // Static variable to count the number of card draws
    static int drawn = 0; // Initialized only once, it tells players how many cards they have drawn
    drawn++; // Incremented every time the function is called
    // Calculate points for player
    if(player == true) {
        if(pass1 == 0) { // Ace
            while(ace == true) {
```

```
            cout << "An Ace has been added to your hand.\nPlease select how many points you want your Ace to be worth\n";
            cout << "1 = 1 point | 11 = 11 points\n";
            cin >> points;

             if(points == 1 || points == 11) {
                cout << "Points have been added to total\n";
                ace = false;
            } else {
                cout << "Please input a correct number\n";
            }
          }
      } else if (pass1 >= 10) { // Face cards
          points = 10;
      } else {
          points = pass1 + 1; // Number cards
      }
      // Output the card gotten
      cout<<"You are given a "<<num[pass1]<<" of "<<suit[pass2]<<endl;
      cout<<"Total cards drawn during execution : "<<drawn<<endl;
   }
   // Calculate points for dealer
   if(player == false) {
      if(pass1 == 0) { // Ace
          while(ace == true){
          if(points>8){
              points=10;
              ace=false;
          }else{
              points=1;
              ace=false;
          }
      }
      } else if (pass1 >= 10) { // Face cards
          points = 10;
      } else {
          points = pass1 + 1; // Number cards
      }
      // Output the card gotten
      if(show==true){
          cout<<"The dealer places a "<<num[pass1]<<" of "<<suit[pass2]<<" face up."<<endl;
      }
   }

   return points;
}

bool check(int points,float &total, float bet,bool player){
   if (player==true) {
      if (points > 21) {
          // Output player bust information
          cout<<"You have gone bust and lost the game\n";
          cout<<"$"<<bet<<" has been subtracted from your total"<<endl;
          // Subtract bet from total
          total -= bet;
          // Return false to indicate the game should stop
          return false;
      }
   }else {
      if (points > 21) {
          // Output dealer bust information
          cout<<"The dealer has gone BUST\nCONGRATS!!! You have won the match"<<endl;
          cout<<"$"<<bet<<" has been rewarded to you"<<endl;
          // Add bet to total
          total += bet;
          // Return false to indicate the game should stop
          return false;
      }
   }
   // If no one has gone bust, continue the game
   return true;
}

void outcome(int points,int dealer ,float bet ,float &total , string name){
   if (dealer == points){
      //if dealer points are == to player points
      cout<<"A push has occurred\nNothing has been lost or gained"<<endl;
   }else if (dealer > points){
```

```
    }else if (dealer > points){
        //if dealer has more points than player
        cout<<"The dealer has won with a total of "<<dealer<<" points.\n";



         cout<<"You have lost $"<<bet<<endl;
        total = total-bet;
    }else if(dealer < points){
        //if player has more points than dealer
        cout<<"You have more points than the dealer and have won the match"<<endl;
        cout<<"-----------------------------------------------------"<<endl;
        cout<<name<<" point total = "<<points<<" > "<<dealer<<" = dealer point total"<<endl;
        cout<<"-----------------------------------------------------"<<endl;
        cout<<"Total of $"<<bet<<" has been added to total";
        total = total+bet;
    }else{
        //if an error occurs
        cout<<"an error has occurred"<<endl;
    }
}

void msg(string name){
    cout<<"Hello "<<name<<endl;
};
void msg(int bet){
    cout<<"Your final bet was : "<<bet<<endl;
}

void monbet(vector<float> &numbers,float bet){
    numbers.push_back(bet);
}
int print(vector<float> &numbers, int turns){
    //print it
    cout<<"Bets made during the game"<<endl;
    for(int number:numbers){
        cout<<"$"<<number<<" ";
    }
    cout<<endl;

}

void bubble(int arr[], int size) {
    for (int i = 0; i < size - 1; i++) {
        for (int j = 0; j < size - i - 1; j++) {
            if (arr[j] > arr[j + 1]) {
                swap(arr[j], arr[j + 1]);
            }
        }
    }
}

void selec(int arr[], int size) {
    for (int i = 0; i < size - 1; i++) {
        int minIdx = i;
        for (int j = i+1; j < size; j++) {
            if (arr[j] < arr[minIdx]) {
                minIdx = j;
            }
        }
        swap(arr[i], arr[minIdx]);
    }
}

int linear(int arr[], int size, int key) {
    for (int i = 0; i < size; i++) {
        if (arr[i] == key) {
            return i; // return the index of the key
        }
    }
    return -1; // key not found
}

void printA(int arr[], int size) {
    for (int i = 0; i < size; i++) {
        cout << arr[i];
        if (i < size - 1) {
```

```
            `cout << ",";´ `
        }
    }
    cout << endl;
}
```