Project 1

<Battleship - Abridged and Virtual>

CSC5-48101

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Date: 11/11/16

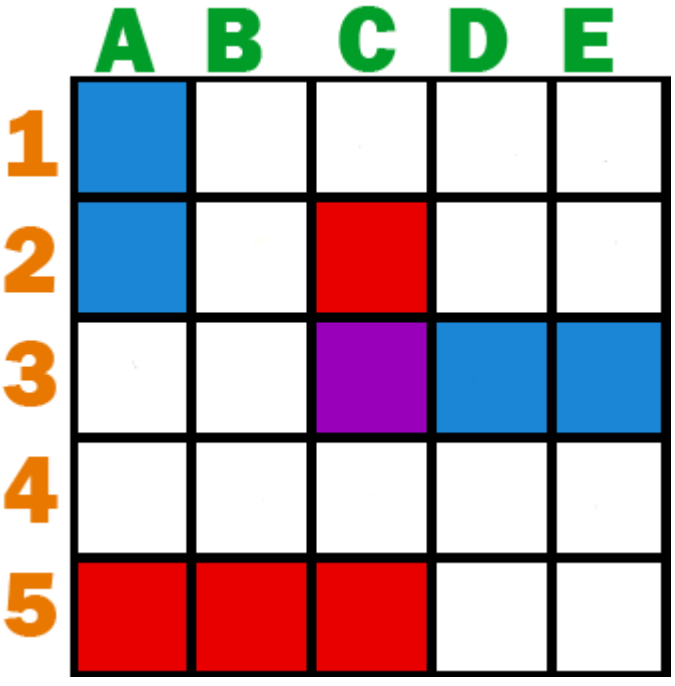
Introduction:

Title: Battleship - Abridged and Virtual

Just like the popular board game, this Battleship program emulates the original board game with a few differences. The three differences are: instead of the board being a 10x10, it is cut in half to a 5x5 virtual board; the ships are affected as well, instead of the 5+ ship configuration in the original, I've simplified it to only 2 ships to avoid too much confusion from a lack of visuals (a 1x2 ship and a 1x3 ship); lastly, the player may choose where and how to place the first ship, but the second one is randomized to avoid accidental overlapping.

The guesses in the game come in two parts, the column and row guess. They are either entered one at a time (A -> return -> 1), or together (A1). However the letters are case sensitive, so I've added input validation to insure that the user enters a proper value.

Before the game begins a coin toss is done to find out who will be taking the first turn. After that is decided the game will alternate between players as they take their turns. The turns are kept track of and as the last ship is sunk the game will end by breaking out of the loop and finishing out the program



*Visual example

Development Summary:

Project size: about 550 Lines
Number of variables: about 40

This project started off very smooth and most of the ground work didn't take much longer than a day. However after having a working program with one ship, I had to completely rework the code to make the second ship. It took deep thinking to figure out how to make the two ships not intersect each other, while still remaining inside the 5x5 grid. The solution came to me while adjusting the random outputs and testing out nesting. From this project I learned more about how the data types interact with each other (ex. char and int), and new ways to make logical operators work.

Along with the data types, I also used a small function I created to calculate the computer turn without having repost code (comAtk seen underneath main). The most used construct in my program is loops. They might consist of 80% of the code, and I have used do-while loops like in line 93-112, as well as if-else (if-if else) loops given in lines 123-139 for example.

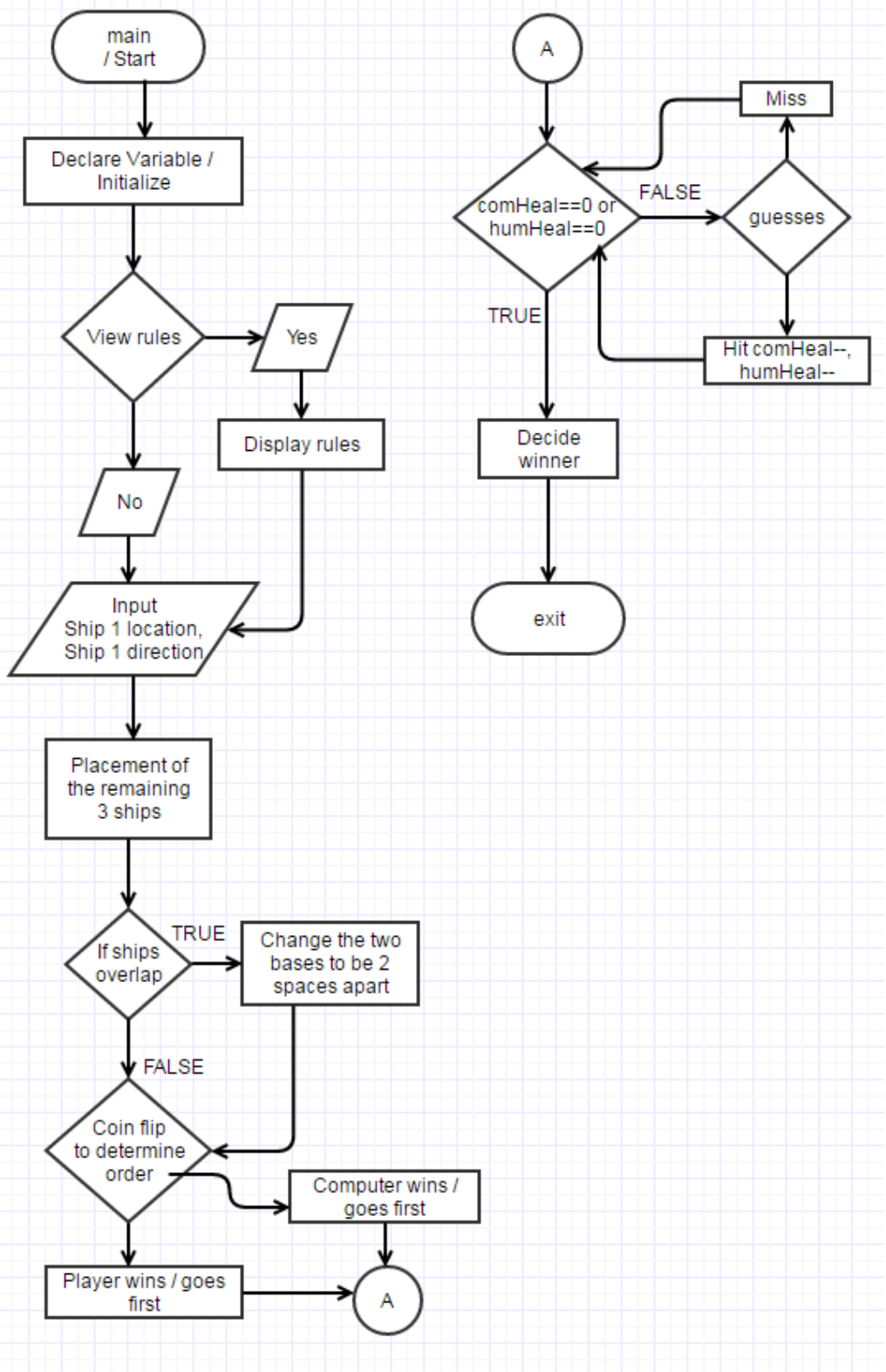
There is randomized computer placement and guesses so no 2 games will be alike. Also the Player may set a name that will be used throughout the game.

Chapter Concepts:

Textbook	Chap.Sec	Concept	Code Location
Savitch 9th	1.3	#include	Lines 9-13
Savitch 9th	1.3	namespace	Line 14
Savitch 9th	1.3	return	Lines 543,557
Savitch 9th	2.1	variable	Lines 30-62
Savitch 9th	2.1	variable assignments	Lines 40-42
Savitch 9th	2.1	identifiers	Lines 30-62
Savitch 9th	2.2	output/cout	Line 66
Savitch 9th	2.2	input/cin	Line 72
Savitch 9th	2.2	escape sequence	Line 67 (endl)
Savitch 9th	2.3	int data types	Lines 35, 258
Savitch 9th	2.3	char data types	Lines 33, 360
Savitch 9th	2.3	bool data types	Lines 522,525
Savitch 9th	2.3	strings	Lines 43, 81
Savitch 9th	2.3	math expressions	Line 286
Savitch 9th	2.4	if-else branching	Lines 99, 104
Savitch 9th	2.4	operators	Lines 89, 93
Savitch 9th	2.4	while loop	N/A

Savitch 9th	2.4	do-while loop	Line 421-434
Savitch 9th	2.5	comments	Lines 79,84,86
Savitch 9th	2.5	indenting	Line 141
Savitch 9th	3.1	boolean expressions	Lines 89, 93
Savitch 9th	3.2	nested statements	Lines 116-133
Savitch 9th	3.2	multi if-else statements	Lines 140-159
Savitch 9th	3.2	switch statement	Lines 106-115
Savitch 9th	3.2	menu	N/A
Savitch 9th	3.2	blocks	Lines 140-142 (inside the if statement)
Savitch 9th	3.3	increment / decrement	Lines 136-137 (rand)
Savitch 9th	3.3	for loops	N/A
Savitch 9th	3.3	break in a loop	Line 471
Savitch 9th	3.4	nested loops	Line 421-434
Savitch 9th	4.2	predefined functions	Lines 136-137 (rand)
Savitch 9th	4.2	random number gen.	Line 139
Savitch 9th	4.2	type casting	Line 263 (testing char as an int)
Savitch 9th	4.3	function call	Line 75
Savitch 9th	4.3	function return	Line 557
Savitch 9th	4.5	global constants	N/A
Savitch 9th	4.6	function prototypes	Lines 21-22
Savitch 9th	5.1	void functions	Lines 22,75,565
Savitch 9th	5.2	reference parameters	Lines 21,475,552
Savitch 9th	6.1	file input / output	Lines 530-539 (not writing as it should)
Gaddis 8th	4.11	validating user input	Lines 427-434

Flowchart:


main
/ Start
Declare Variable /
Initialize
View rules
Yes
Display rules
No
Input
Ship 1 location,
Ship 1 direction
Placement of
the remaining
3 ships
If ships
overlap
TRUE
Change the two
bases to be 2
spaces apart
FALSE
Coin flip
to determine
order
Computer wins /
goes first
Player wins / goes
first
A
A
Miss
comHeal==0 or
humHeal==0
FALSE
guesses
TRUE
Hit comHeal--,
humHeal--
Decide
winner
exit

Pseudo Code:

Initialize

Ask if the user would like to view the rules

If the user wishes to show rules

    Show the rules

Else continue to the placement of the four ships

Prompt the user to set the 1x2 piece.

Randomize the placement of the second piece

    If the piece overlaps

        Shift the base two spaces apart

    Else begin setting the Comp pieces

Randomize the 1x2 Comp piece

Randomize the 1x3 Comp piece until no overlap

Coin flip calculation to see if Comp or Player goes first

If Comp wins

    Comp guess first

Else Player Wins

    Skip to Player's turn

Both continue to guess until all pieces of the ships on a single side have been guessed.

Calculate and display the winner.

Exit Program.

Variables:

Data Type	Name	Description
ifstream	in	Input file
ofstream	out	Output file
string	line	Place holder line
char	comptr	Basic character input from the computer
char	compCol	Computer's column guess
char	compRow	Computer's row guess
char	chosDir	The ship direction of a player's choice
int	shipDir	Ship direction, which will be randomized

char	human	Basic character input from the player
int	coin	The coin, which the value will equal heads or tails (1 or 2).
char	humCol	Player's column guess
char	humRow	Player's row guess
char	comHeal='5'	Total health for the computer
char	humHeal='5'	Total health for the human
int	turn=0	The turn counter, starts at zero
string	name	The name of the player
bool	winner	Winning player (0 - Computer, 1 - Player)
char	hsmlC1, hsmlR1	Column and row location for human small ship: part 1
char	hsmlC2, hsmlR2	Column and row location for human small ship: part 2
char	hsmlDr	Direction, horizontal or vertical for human small ship
char	csmlC1, csmlR1	Column and row location for computer small ship: part 1
char	csmlC2, csmlR2	Column and row location for computer small ship: part 2
char	csmlDr	Direction, horizontal or vertical for computer small ship
char	hmedC1, hmedR1	Column and row location for human medium ship: part 1
char	hmedC2, hmedR2	Column and row location for human medium ship: part 2
char	hmedC3, hmedR3	Column and row location for human medium ship: part 3
char	hmedDr	Direction, horizontal or vertical for human medium ship
char	cmedC1, cmedR1	Column and row location for computer medium ship: part 1
char	cmedC2, cmedR2	Column and row location for computer medium ship: part 2
char	cmedC3, cmedR3	Column and row location for computer medium ship: part 3
char	cmedDr	Direction, horizontal or vertical for computer medium ship

Functions:

Type Name	Purpose	Inputs	Outputs
char comAtk	Randomizes computer guess	compCol, compRow	compCol, compRow
void disRule	Displays the rules	None	None

Reference:

1. Textbook (Savitch 9th Edition).
2. Mark Lehr GitHub repository.
3. Official Battleship board game.

Program (main):

```
//Set random number seed
   srand(static_cast<unsigned int>(time(0)));

   //Declaration of Variables
   ifstream in;          //Input file
   ofstream out;         //Output file
   string line;          //Place holder line
   char comptr;          //Computer Inputs
   char compCol, compRow; //Computer Attack
   int shipDir;          //Ship direction for random
   char chosDir;         //Ship direction
   int coin;             //Coin flip for heads or tails
   char human;           //Player inputs
   char humCol, humRow;   //Player's Attack
   char comHeal='5';     //Total computer health
   char humHeal='5';     //Total player health
   int turn=0;           //Tracks turn count
   string name;          //Player's Name
   bool winner;          //Winning player (0 - Computer, 1 - Player)
   //Small ship Human
   char hsmlC1, hsmlR1;   //1x2 Base
   char hsmlC2, hsmlR2;   //1x2 Tail
   char hsmlDr;          //Direction
   //Small ship Comp
   char csmlC1, csmlR1;   //1x2 Base
   char csmlC2, csmlR2;   //1x2 Tail
   char csmlDr;          //Direction
   //Medium ship Human
   char hmedC1, hmedR1;   //1x3 Base
   char hmedC2, hmedR2;   //1x3 Tail
   char hmedC3, hmedR3;   //1x3 Tail
   char hmedDr;          //Direction
   //Medium ship Comp
   char cmedC1, cmedR1;   //1x3 Base
   char cmedC2, cmedR2;   //1x3 Tail
   char cmedC3, cmedR3;   //1x3 Tail
   char cmedDr;          //Direction


   //Initialize
   cout<<"Welcome to the program that emulates a abridged version of "
         "the classic board game, Battleship."<<endl;
```

```
//Rules
cout<<"---------------------------Rules---------------------------"<<endl;
cout<<"Would you like to view the rules? (Y/N)"<<endl;
cin>>human;
switch(human){
   case 'y':
   case 'Y': disRule();break;
}
cout<<"-----------------------------------------------------------"<<endl;

//Game Setup
cout<<"What is your desired name? (no spaces)"<<endl;
cin>>name; //Input Name
cout<<"Alright then "<<name<<". Get ready for a game of Battleship!"<<endl;

//Player's Small Ship
cout<<"Okay, now choose the placement of the smaller ship. (1x2)"<<endl;
do{    //Validate Input
   cout<<"Choose a column (A-E, case sensitive):"<<endl;
   cin>>hsmlC1;
}while(hsmlC1<65||hsmlC1>69);
do{    //Validate Input
   cout<<"Choose a row (1-5):"<<endl;
   cin>>hsmlR1;
}while(hsmlR1<49||hsmlR1>53);
//Direction of Player's Small Ship
cout<<"Now choose either Vertical (V) or Horizontal (H)."<<endl;
//Validate Input
do{
   cin>>chosDir;
   if(chosDir=='h'||chosDir=='H'||chosDir=='v'||chosDir=='V'){

   }
   else{
      cout<<"Pick Vertical (V) or Horizontal (H):"<<endl;
   }
}while(chosDir!='h'&&chosDir!='H'&&chosDir!='v'&&chosDir!='V');
switch(chosDir){
   case 'h':
   case 'H': {
      cout<<"You picked Horizontal."<<endl;
      hsmlDr='H';};break;
   case 'v':
   case 'V': {
```

```
      cout<<"You picked Vertical."<<endl;
      hsmlDr='V';};break;
}
if(hsmlDr=='V'){    //Vertical
   hsmlC2=hsmlC1;
   if(hsmlR1+1>53){  //Keep the ship inside the board
      hsmlC2=hsmlC1-1;
   }
   else{
      hsmlR2=hsmlR1+1;
   }
}
else if(hsmlDr=='H'){  //Horizontal
   if(hsmlC1+1>69){
      hsmlC2=hsmlC1-1;
   }
   else{
      hsmlC2=hsmlC1+1;
   }
   hsmlR2=hsmlR1;
}

//Computer's Small Ship
csmlC1=rand()%5+65;      //Calls random function, then modifies to A-E
csmlR1=rand()%5+49;      //Calls random function, then modifies to 1-5
//Direction of Computer's Small Ship
shipDir=rand()%10+1;
if(shipDir<=5){    //Vertical
   csmlDr='V';
   csmlC2=csmlC1;
   if(csmlR1+1>53){
      csmlR2=csmlR1-1;
   }
   else{
      csmlR2=csmlR1+1;
   }
}
else if(shipDir>5){  //Horizontal
   csmlDr='H';
   if(csmlC1+1>69){  //Keep the ship inside the board
      csmlC2=csmlC1-1;
   }
   else{
      csmlC2=csmlC1+1;
```

```
   }
   csmlR2=csmlR1;
}
//Computer's Medium Ship
do{
   cmedC1=rand()%5+65;      //Calls random function, then modifies to A-E
   cmedR1=rand()%5+49;      //Calls random function, then modifies to 1-5
}while(cmedC1==csmlC1||cmedR1==csmlR1);
//Direction of Computer's Medium Ship
shipDir=rand()%10+1;
if(shipDir<=5){  //Vertical
   cmedDr='V';
   if(cmedDr==csmlDr){  //If the directions are the same
      if(csmlC1==cmedC1){
         if(cmedC1+1>69){  //Keep the ship inside the board
            cmedC1=cmedC1-1;
         }
         else{
            cmedC1=cmedC1+1;
         }
      }
      if(cmedR1+2>53){  //Keep the ship inside the board
         cmedR2=cmedR1-1;
         cmedR3=cmedR2-1;
      }
      else{
         cmedR2=cmedR1+1;
         cmedR3=cmedR2+1;
      }
      cmedC2=cmedC1;
      cmedC3=cmedC1;
   }
   else{
      if(csmlC1+2>69){  //Keep the ship inside the board
         cmedC1=csmlC1-2;
      }
      else{
         cmedC1=csmlC1+2;
      }
      if(cmedR1+2>53){  //Keep the ship inside the board
         cmedR2=cmedR1-1;
         cmedR3=cmedR2-1;
      }
      else{
```

```
        cmedR2=cmedR1+1;
        cmedR3=cmedR2+1;
      }
      cmedC2=cmedC1;
      cmedC3=cmedC1;
    }
  }
  else if(shipDir>5){  //Horizontal
    cmedDr='H';
    if(cmedDr==csmlDr){  //If the directions are the same
      if(csmlR1==cmedR1){
        if(cmedR1+1>53){  //Keep the ship inside the board
          cmedR1=cmedR1-1;
        }
        else{
          cmedR1=cmedR1+1;
        }
      }
      if(cmedC1+2>69){  //Keep the ship inside the board
        cmedC2=cmedC1-1;
        cmedC3=cmedC2-1;
      }
      else{
        cmedC2=cmedC1+1;
        cmedC3=cmedC2+1;
      }
      cmedR2=cmedR1;
      cmedR3=cmedR1;
    }
    else{
      if(csmlR1+2>53){  //Keep the ship inside the board
        cmedR1=csmlR1-2;
      }
      else{
        cmedR1=csmlR1+2;
      }
      if(cmedC1+2>69){  //Keep the ship inside the board
        cmedC2=cmedC1-1;
        cmedC3=cmedC2-1;
      }
      else{
        cmedC2=cmedC1+1;
        cmedC3=cmedC2+1;
      }
```

```
      cmedR2=cmedR1;
      cmedR3=cmedR1;
   }
}

//Player's Medium Ship
cout<<"Okay, now the placement of the second ship will be random to prevent"
      " overlapping of pieces."<<endl;
 do{
   hmedC1=rand()%5+65;      //Calls random function, then modifies to A-E
   hmedR1=rand()%5+49;      //Calls random function, then modifies to 1-5
}while(hmedC1==hsmlC1||hmedR1==hsmlR1);
//Direction of Computer's Medium Ship
shipDir=rand()%10+1;
if(shipDir<=5){  //Vertical
   hmedDr='V';
   if(hmedDr==hsmlDr){  //If the directions are the same
      if(hsmlC1==hmedC1){
         if(hmedC1+1>69){  //Keep the ship inside the board
            hmedC1=hmedC1-1;
         }
         else{
            hmedC1=hmedC1+1;
         }
      }
      if(hmedR1+2>53){
         hmedR2=hmedR1-1;
         hmedR3=hmedR2-1;
      }
      else{
         hmedR2=hmedR1+1;
         hmedR3=hmedR2+1;
      }
      hmedC2=hmedC1;
      hmedC3=hmedC1;
   }
   else{
      if(hsmlC1+2>69){  //Keep the ship inside the board
         hmedC1=hsmlC1-2;
      }
      else{
         hmedC1=hsmlC1+2;
      }
      if(hmedR1+2>53){  //Keep the ship inside the board
```

```
            hmedR2=hmedR1-1;
            hmedR3=hmedR2-1;
        }
        else{
            hmedR2=hmedR1+1;
            hmedR3=hmedR2+1;
        }
        hmedC2=hmedC1;
        hmedC3=hmedC1;
    }
}
else if(shipDir>5){  //Horizontal
    hmedDr='H';
    if(hmedDr==hsmlDr){  //If the directions are the same
        if(hsmlR1==hmedR1){
            if(hmedR1+1>53){
                hmedR1=hmedR1-1;
            }
            else{
                hmedR1=hmedR1+1;
            }
        }
        if(hmedC1+2>69){  //Keep the ship inside the board
            hmedC2=hmedC1-1;
            hmedC3=hmedC2-1;
        }
        else{
            hmedC2=hmedC1+1;
            hmedC3=hmedC2+1;
        }
        hmedR2=hmedR1;
        hmedR3=hmedR1;
    }
    else{
        if(hsmlR1+2>53){  //Keep the ship inside the board
            hmedR1=hsmlR1-2;
        }
        else{
            hmedR1=hsmlR1+2;
        }
        if(hmedC1+2>69){  //Keep the ship inside the board
            hmedC2=hmedC1-1;
            hmedC3=hmedC2-1;
        }
```

```
      else{
         hmedC2=hmedC1+1;
         hmedC3=hmedC2+1;
      }
      hmedR2=hmedR1;
      hmedR3=hmedR1;
   }
}
cout<<name<<", your ship locations are:"<<endl;
cout<<"Small: "<<hsmlC1<<hsmlR1<<" "<<hsmlC2<<hsmlR2<<endl;
cout<<"Medium: "<<hmedC1<<hmedR1<<" "<<hmedC2<<hmedR2<<" "
      <<hmedC3<<hmedR3<<endl;

//Game Start!
cout<<"Coin Flip to find out who goes first."<<endl;
cout<<"Pick Heads(H) or Tails(T):"<<endl;
do{  //Validate Input
   cin>>human;
   if(human=='h'||human=='H'||human=='t'||human=='T'){
   }else{
      cout<<"Pick Heads(H) or Tails(T):"<<endl;
   }
}while(human!='h'&&human!='H'&&human!='t'&&human!='T');
switch(human){
   case 'h':
   case 'H': {
      cout<<"You picked Heads, the Computer picks Tails."<<endl;
      comptr='T';
      human='H';};break;
   case 't':
   case 'T': {
      cout<<"You picked Tails, the Computer picks Heads."<<endl;
      comptr='H';
      human='T';};break;
}
coin=rand()%2+1;
if(coin==1){
   cout<<"The coin landed on Heads"<<endl;
   if(human=='H')
      cout<<name<<" will go first."<<endl;
   else{
      cout<<"Computer will go first."<<endl;
      turn++;
      cout<<"                Turn #"<<turn<<endl;
```

```
      comAtk(compCol, compRow);
      if(compCol==hsmlC1&&compRow==hsmlR1){
         cout<<"HIT!"<<endl;
         humHeal--;
         hsmlC1='0';
         hsmlR1='0';
      }
      else if(compCol==hsmlC2&&compRow==hsmlR2){
         cout<<"HIT!"<<endl;
         humHeal--;
         hsmlC2='0';
         hsmlR2='0';
      }
      else{
         cout<<"Miss..."<<endl;
      }
   }
}
else{
   cout<<"The coin landed on Tails"<<endl;
   if(human=='T')
      cout<<name<<" will go first."<<endl;
   else{
      cout<<"Computer will go first."<<endl;
      turn++;
      cout<<"                Turn #"<<turn<<endl;
      comAtk(compCol, compRow);
      if(compCol==hsmlC1&&compRow==hsmlR1){
         cout<<"HIT!"<<endl;
         humHeal--;
         hsmlC1='0';
         hsmlR1='0';
      }
      else if(compCol==hsmlC2&&compRow==hsmlR2){
         cout<<"HIT!"<<endl;
         humHeal--;
         hsmlC2='0';
         hsmlR2='0';
      }
      else{
         cout<<"Miss..."<<endl;
      }
   }
}
```

```
do{
   //Player's Turn
   turn++;
   cout<<"                Turn #"<<turn<<endl;
   cout<<"------------------"<<name<<"'s Turn------------------"<<endl;
   cout<<"Make your guess."<<endl;
   do{    //Validate Input
      cout<<"Choose a column (A-E, case sensitive):"<<endl;
      cin>>humCol;
   }while(humCol<65||humCol>69);
   do{    //Validate Input
      cout<<"Choose a row (1-5):"<<endl;
      cin>>humRow;
   }while(humRow<49||humRow>53);

   cout<<name<<" attacks "<<humCol<<"-"<<humRow<<"!"<<endl;

   if(humCol==csmlC1&&humRow==csmlR1){
      cout<<"HIT!"<<endl;
      comHeal--;
      csmlC1='0';
      csmlR1='0';
   }
   else if(humCol==csmlC2&&humRow==csmlR2){
      cout<<"HIT!"<<endl;
      comHeal--;
      csmlC2='0';
      csmlR2='0';
   }
   else if(humCol==cmedC1&&humRow==cmedR1){
      cout<<"HIT!"<<endl;
      comHeal--;
      cmedC1='0';
      cmedR1='0';
   }
   else if(humCol==cmedC2&&humRow==cmedR2){
      cout<<"HIT!"<<endl;
      comHeal--;
      cmedC2='0';
      cmedR2='0';
   }
   else if(humCol==cmedC3&&humRow==cmedR3){
      cout<<"HIT!"<<endl;
      comHeal--;
```

```
   cmedC3='0';
   cmedR3='0';
}
else{
   cout<<"Miss..."<<endl;
}
if(comHeal=='0')break;
//Computer Turn
turn++;
cout<<"                Turn #"<<turn<<endl;
comAtk(compCol, compRow);
if(compCol==hsmlC1&&compRow==hsmlR1){
   cout<<"HIT!"<<endl;
   humHeal--;
   hsmlC1='0';
   hsmlR1='0';
}
else if(compCol==hsmlC2&&compRow==hsmlR2){
   cout<<"HIT!"<<endl;
   humHeal--;
   hsmlC2='0';
   hsmlR2='0';
}
else if(compCol==hmedC1&&compRow==hmedR1){
   cout<<"HIT!"<<endl;
   humHeal--;
   hmedC1='0';
   hmedR1='0';
}
else if(compCol==hmedC2&&compRow==hmedR2){
   cout<<"HIT!"<<endl;
   humHeal--;
   hmedC2='0';
   hmedR2='0';
}
else if(compCol==hmedC3&&compRow==hmedR3){
   cout<<"HIT!"<<endl;
   humHeal--;
   hmedC3='0';
   hmedR3='0';
}
else{
cout<<"Miss..."<<endl;
}
```

```
    }while(comHeal>=49||humHeal>=49);

    //Post Game
    cout<<endl;
    if(comHeal=='0')
       cout<<"*****"<<name<<" Won!*****"<<endl;
       winner=1;
    if(humHeal=='0')
       cout<<"*****You Lose.*****"<<endl;
       winner=0;
    cout<<endl;

    //Store Winner
    if(winner==0){
       line='Comp';
    }
    if(winner==1){
       line=name;
    }

    //Results
    cout<<"Would you like to save the results to a file? (Y/N)"<<endl;
    cin>>human;
    switch(human){
       case 'y':
       case 'Y': {
          in.open("score.dat");
          in>>line>>turn;
          in.close();
       };break;
    }
    cout<<"Thanks for playing!"<<endl;

    //Exit Program
    return 0;
}
```