Battleship

Project2

CSC- 5 – 46023 Intro C++

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Content

1. Introduction

Rules and Gameplay

There are 2 10x10 tables shown on the screen. One is for player, the other is for AI. Both of them have 5 ships which are 1 5-unit ship, 1 4-unit ship,1 3-unit ship, and 2 2-unit ships. After the player enter the coordinate to place the ship, the table will be refresh and use 2 to 5 to label the ships. The coordinates of AI's ships will be place randomly. Player needs to hit all the ships to win the game. In the game, X means hit and O means miss. Every time after check the validation, the program will scan the table to check whether there is any numbers which is ships on the table. If there isn't any numbers on the table, the game ends.

Thoughts after Program

The game seems very simple, but the AI's fire part is very complicated because it is very difficult to make an AI act like a human player. I want the AI check the coordinates around the hit coordinate, and keep fire when he gets the second hit. If one side is "O" or the side of the table, the AI needs to check the other side too. This needs many Boolean variables. Also, the AI table shown to the player isn't the real table, it is a clear table and after the player fire, the program will compare the coordinate to the real table. Then record and show "O", "X", or invalid input. The validation part costs me a lot of time too because I use string as an input type and input in A1 form to let the player input the coordinates. This can check the length easily, but I need to use ascii code to translate after check the length. It is possible to make the Ai smarter which is divided the table into several sections and randomly fire each of the section to increase the accuracy, but it needs more codes and better logic.

2. Development

Approach Strategy

The battleship needs three 10x10 tables, it is too difficult to use one-dimension arrays. It is easier to use 2-dimension arrays. Also, I use A-J to label the rows and 0-9 to label the columns. It makes the players enter the coordinates clearly and prevent them get confused. I have tried to let the player to choose which ship they want to place first, but there are 2 2-unit ships, so I need to use a Boolean to remember the first 2-unit ship. However, there are many bugs and I couldn't fix it. Therefore, I let the player place the 5-unit ship, then 4-unit ship, and so on. After the player's place ship part, I need to random the AI ships' coordinates. Because I use an array to store the ship units, so I can avoid the oversize by subtract the units such as srand()%10-5. After generate the coordinate, the program will random to place it horizontally or vertically. If the ship overlaps, it will try to place it in other way. If it is still invalid, the program will random the coordinates again.

After the preparing, I use a switch to separate the player's fire turn and AI's fire turn. If the game isn't over, the program to go to AI's turn and so on. If the game ends in player's turn, the program will jump to other case same as AIs. Also, I put a do-while loop outside the switch and repeat until the game is over.

For the AI's fire part, I let the AI to fire randomly until it hits. After AI hits, the program will record the coordinate and check the four coordinates beside it until it gets second hit. After a second hit, AI will fire that direction until it get miss, touch the side, or overlap. Then, it will

fire the opposite side until miss, oversize, overlap again. After it finishes these steps, it will go back to random fire mode.

3. Variables list

Type	Variable Name	Description	Line
int	COLS=10	Global const	19
	COL=3	Global const	20
	ROWS=10	const	34
	XY=4	const	34
	ROW=100	const	34
	unit[5] ={5,4,3,2,2}	unit of ship	38
	x1,y1,x2,y2	coordinate to place ship	39
	hx=10, hy=10	first hit coordinates	43
	ax,ay	ai fire coordinate	61
	hplan	hit plan after first hit (corss)	64
	oppcombo=0	the other side	46
	turn	switch turn	48
	count	use space check validation	494
	max, min	replace the coordinates to place ship	495
float	phit=0, pmiss=0	player hit miss counter	53
	aihit=0, aimiss=0	ai hit miss counter	54
char	p[ROWS][COLS]	player table	35
	ai[ROWS][COLS]	ai fake table	36
	real[ROWS][COLS]	real ai table	37
	pvect[ROW][COL]	player vector array to do sorting	58
	aivect[ROW][COL]	ai vector array to do sorting	59
	cax,cay	ai fire display in A0 form to player	62
	row=i+65	display A-J	471
	temp	temporary memory	736

string	place	x,y to place ship start and end coordinates	496
	fire	player fire	645
bool	goback=ture	invalid back to random	40
	valid	check validation	41
	hit	hit to skip random fire	44
	finish=true	finish one ship back to random	45
	over	game over	47
	oneend=false	one side miss/overalp/overside go to opposite direction	49
	cross[XY]={true,true,true,true}	cross 4 boxes around hit	50
	crossdone=true	if true back to random	51
	combohit	keep fire the same direction	52
	done	finish fire	60
	swap	sorting swap	735
vector<int>	prow,pcol,airow,aicol	player/ai hit/miss coordinates	56
vector<char>	pr, air	player/ai hit/miss result	57
ofstream	output		55
time_t	start, end	delay display ai fire	485

4. Topic Covered (Checklist)

Chapter	type	code	line
2.1 Variables	int	int x1,y1,x2,y2;	39
2.2 Input Output	cin	cin>>place;	506
	cout	cout<<"Hit!!!\n";	672
	endl	cout<<endl;	723
2.3 data types	char	char cax,cay;	431
	float	float phit=0, pmiss=0;	53
	bool	bool hit;	44
	string	string place;	496
2.4 condition	=	int hx=10, hy=10;	43
	==	if(y1==y2){	524

	++	count++;	543
2.5 style	comment	//player table y,x	35
3.1 boolean expression	>=, &&, <=	if(real[y1][x1]>='2' && real[y1][x1]<='5'){	671
	<, >, ||	if(ay<0 || ay>9 || ax<0 || ax>9){	157
3.2 multiway branches	switch	switch(turn){	89
	if	if(fire.length()!=2){	655
	else	else{	677
	else if	else if(p[ay][ax]=='X' || p[ay][ax]=='O'){	161
	nested	for(int q=0;q<5;q++){	498
		do{	499
	break	break;	94
3.3 type of loop	for	for(int i=0;i<4;i++){	101
	do-while	do{}while(valid==false);	110,118
4.2 predefined function	srand, time	srand(static_cast<unsigned int>(time(0)));	67
	rand	y1=rand()%(10-unit[q]);	610
5.1 void function	void	void intro();	22
5.2 call-by-reference		void aiplace(char [][COLS], char [][COLS], int &, int &, bool &, int []);	25
6.1 streams and basic	ofsream declare	ofstream output;	55
	output	output.open("stat.dat")	433
	close	output.close();	454
7.1 array	int array	int unit[5]={5,4,3,2,2};	38
	bool aray	bool cross[XY]={true,true,true,true};	50
7.2 array in function	pass 2d array to function	void table(char [][COLS],char [][COLS], char [][COLS]);	23
7.3 soritng	sorting		734-817
7.4 mutli-dim array	2D	char p[ROWS][COLS];	35
8.3 vector	int	vector<int> prow,pcol,airow,aicol;	56
	char	vector<char> pr, air;	57
	pass vector to function by ref	void sort(char [][COL], char [][COL], vector<char>, vector<char>);	29
difftime		}while(difftime(end,start)<1);	490

5. Libraries included

- <cstdlib>
- <iostream>
- <ctime>
- <fstream>
- <vector>
- <iomanip>

6. Pseudo Code

Initialize

Reset table

Output table

do{

    Input 2 coordinates to place ship

}while (invalid)

place other ship and check validation

do{

    AI random ship coordinates

}while (invalid)

case1

Player enter coordinate to frie

check validation

check hit/miss and add count

display table again

check game over (no number s on the table)

if(true) case3

else case2

case2 (AI fire)

do{

    if (not hit/combo) random hit

    if (hit) check cross 4

if(all invalid) go back to random

if(hit) combo++, add count

else add count

if (cross 4 coordinates hit) continue fire that direction

if(invalid) jump to next statement, oppcombo++, combo=0

if(miss) oppcombo++, combo=0, add count

if(hit) combo++, add count

if(oppcombo>0) check the opposite side

if(invalid) go back to random

if(miss) oppcombo=0, add count

if(hit) oppcombo+1

}while (not fire)

check game over

if (true) go to case 4

else go to case1

case3

Player win

case 4

Player lose

if(not case 3 && not case4) keep looping the case

scan player and ai table

push back X and O coordinates

copy to player and ai 2d array

sorting

array like A0 X

X(hit) first, O(miss) after

sort with first column

sort with second column

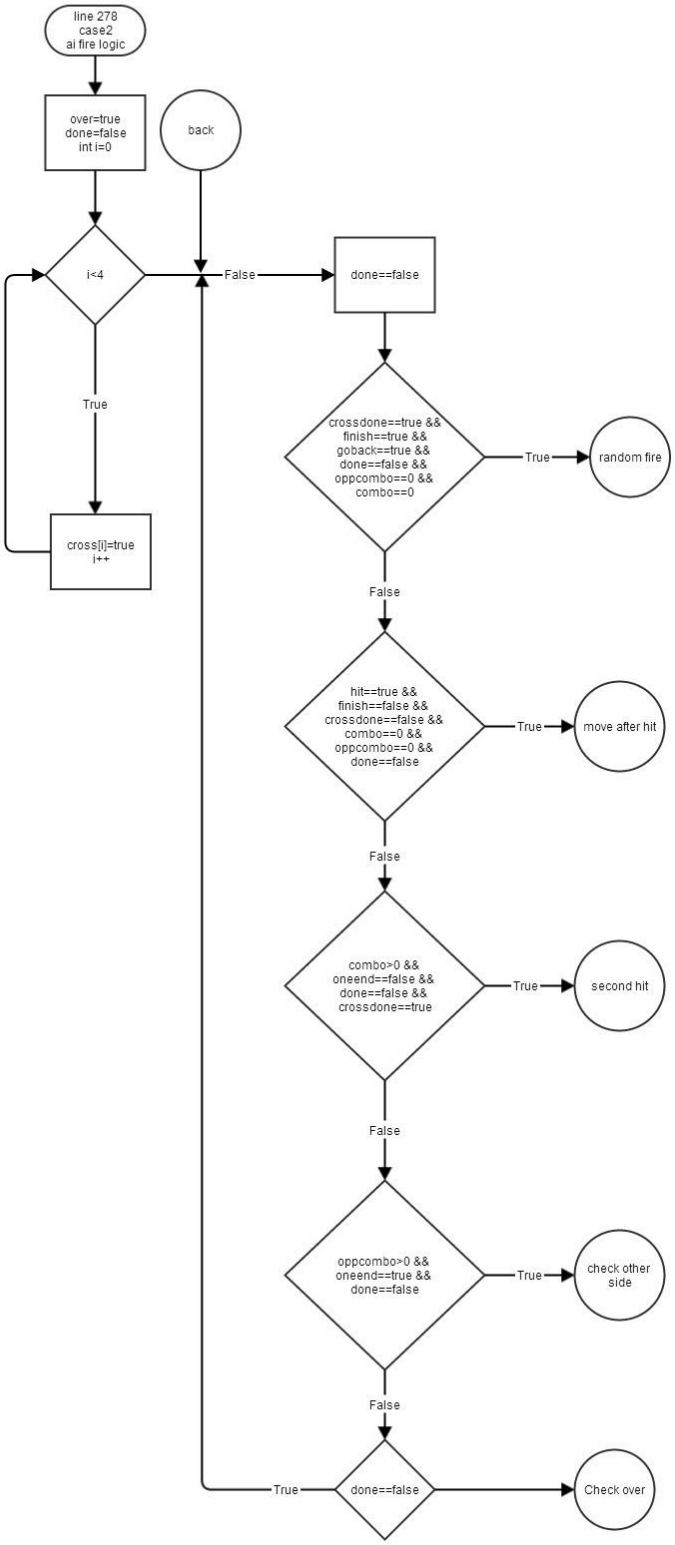
calculate accuracy hit/(hit+miss)

display accuracy rate

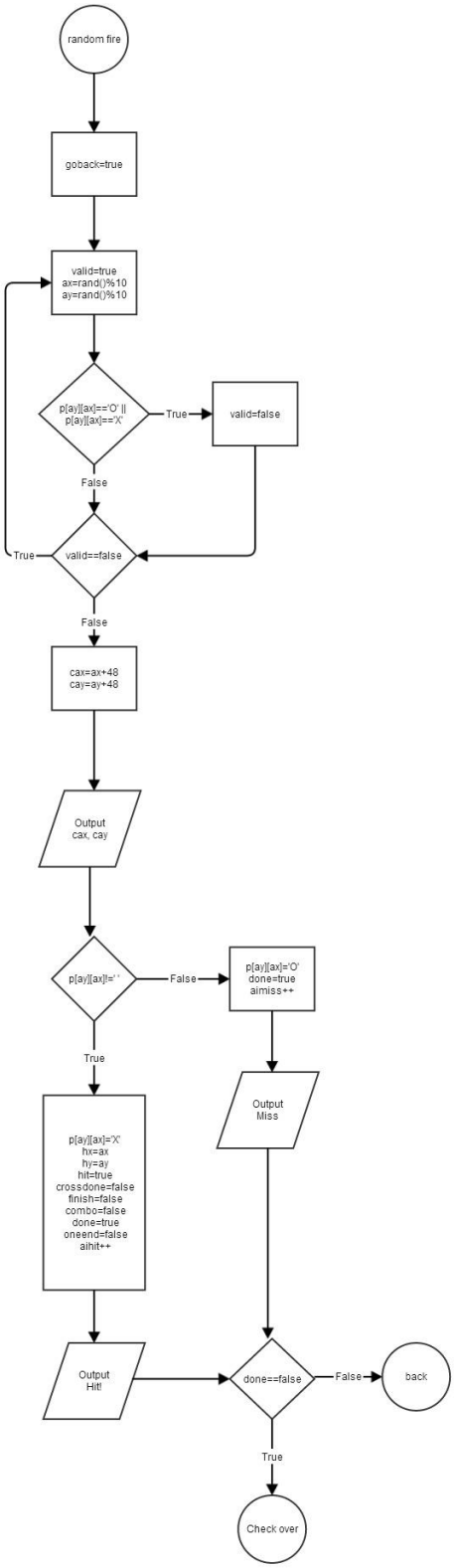
ouput sorted array and accuracy to stat.dat

7. Flowchart

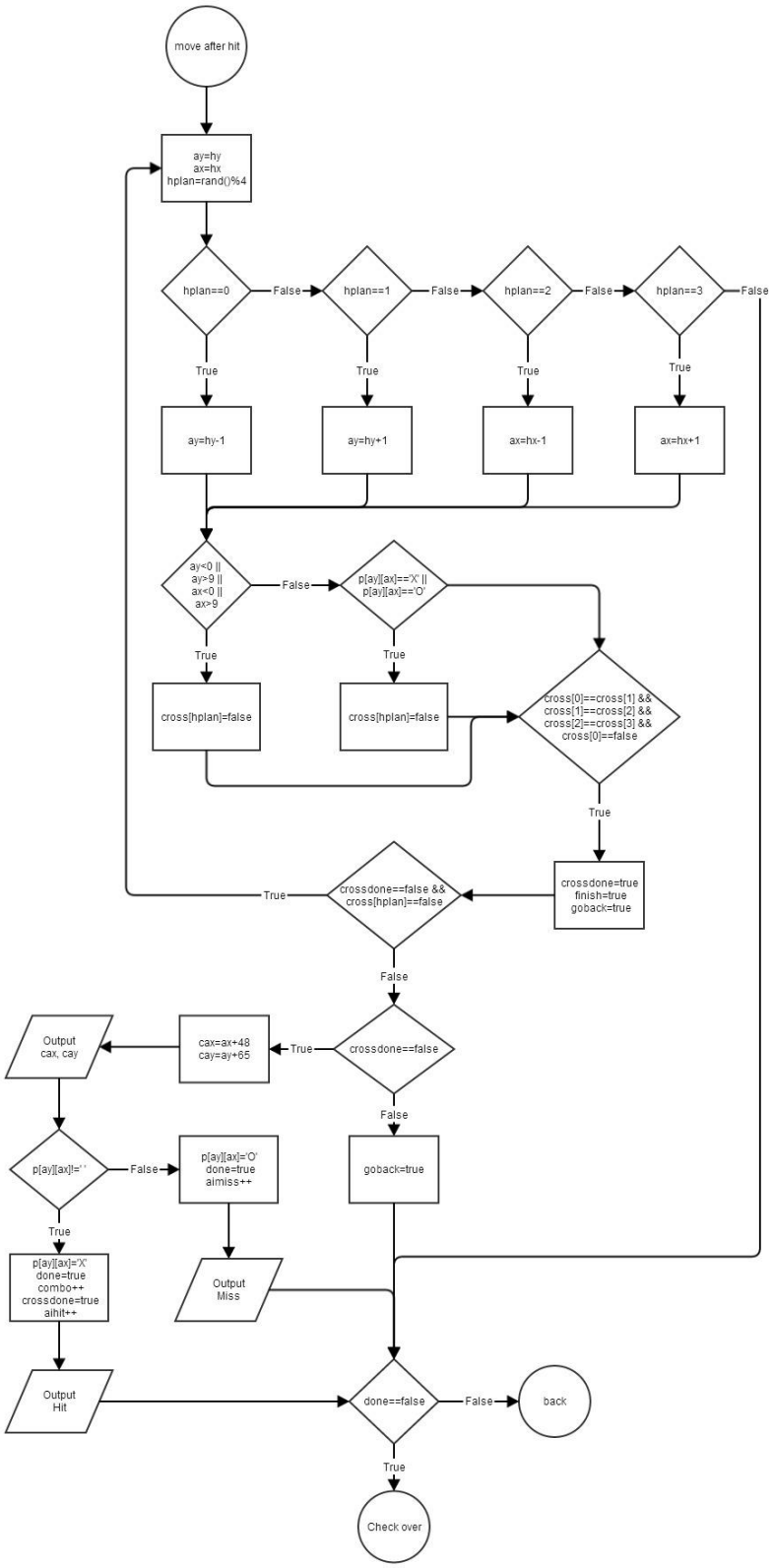
AI fire turn(case2)



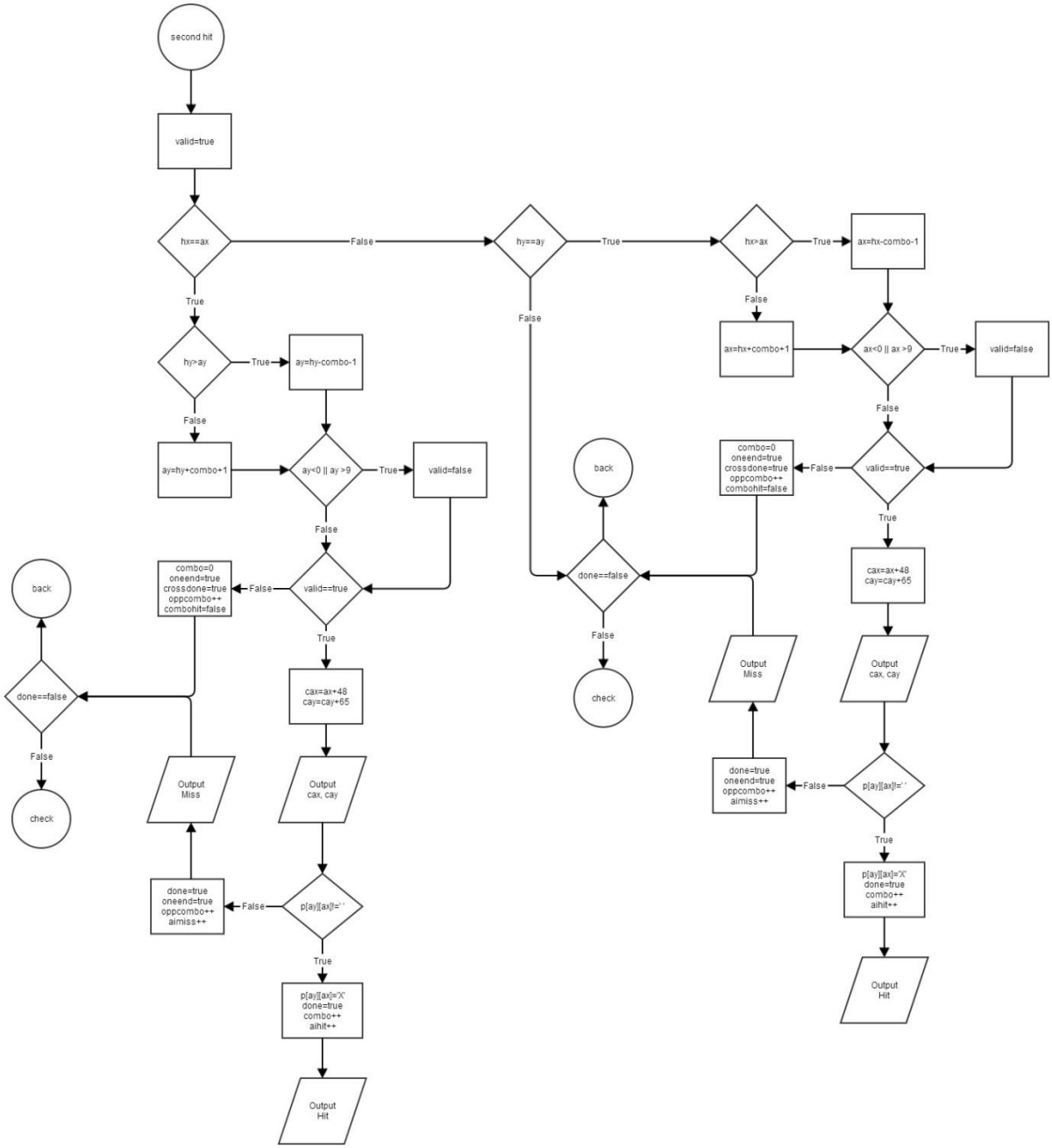
Random fire



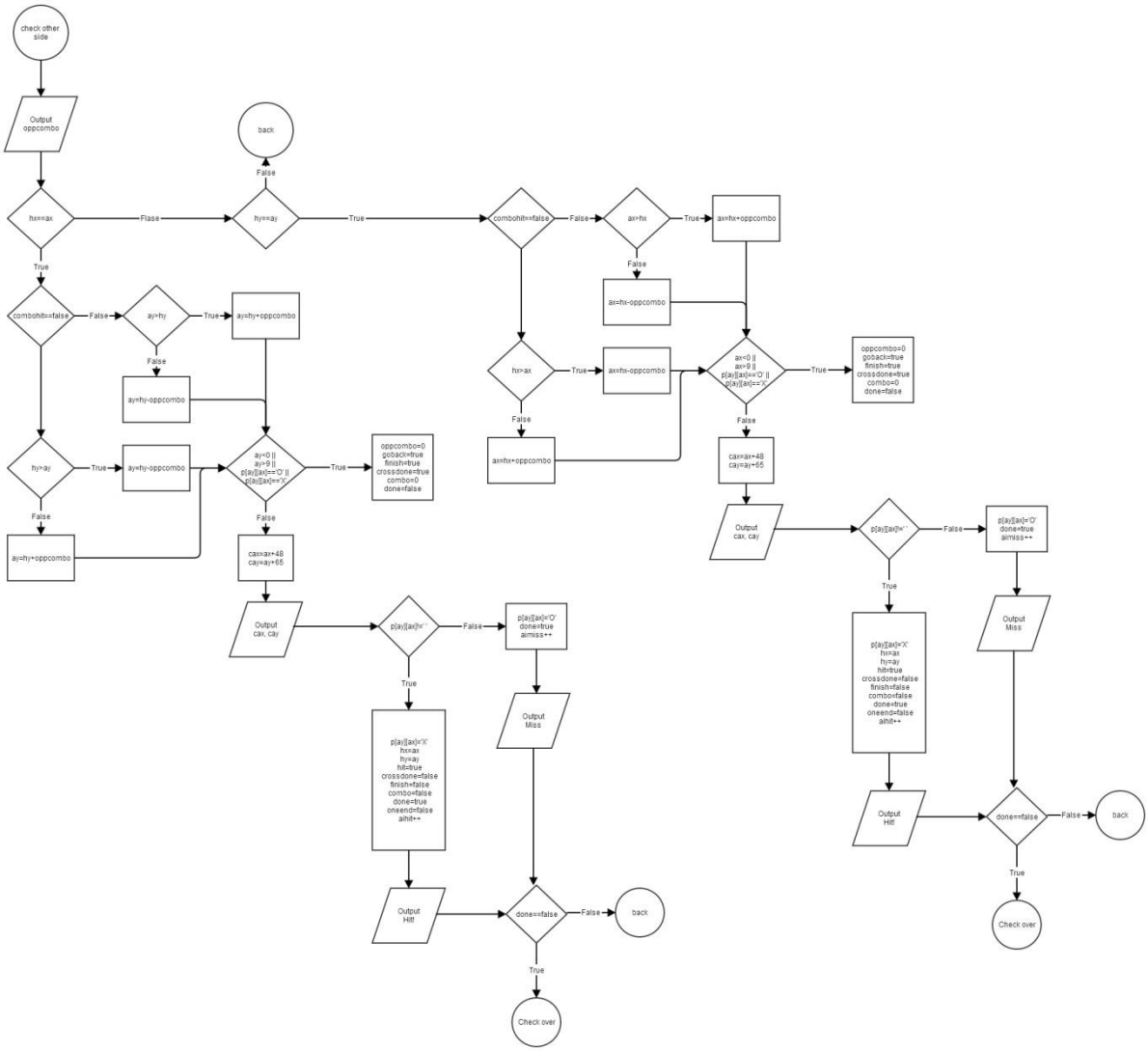
Move after hit



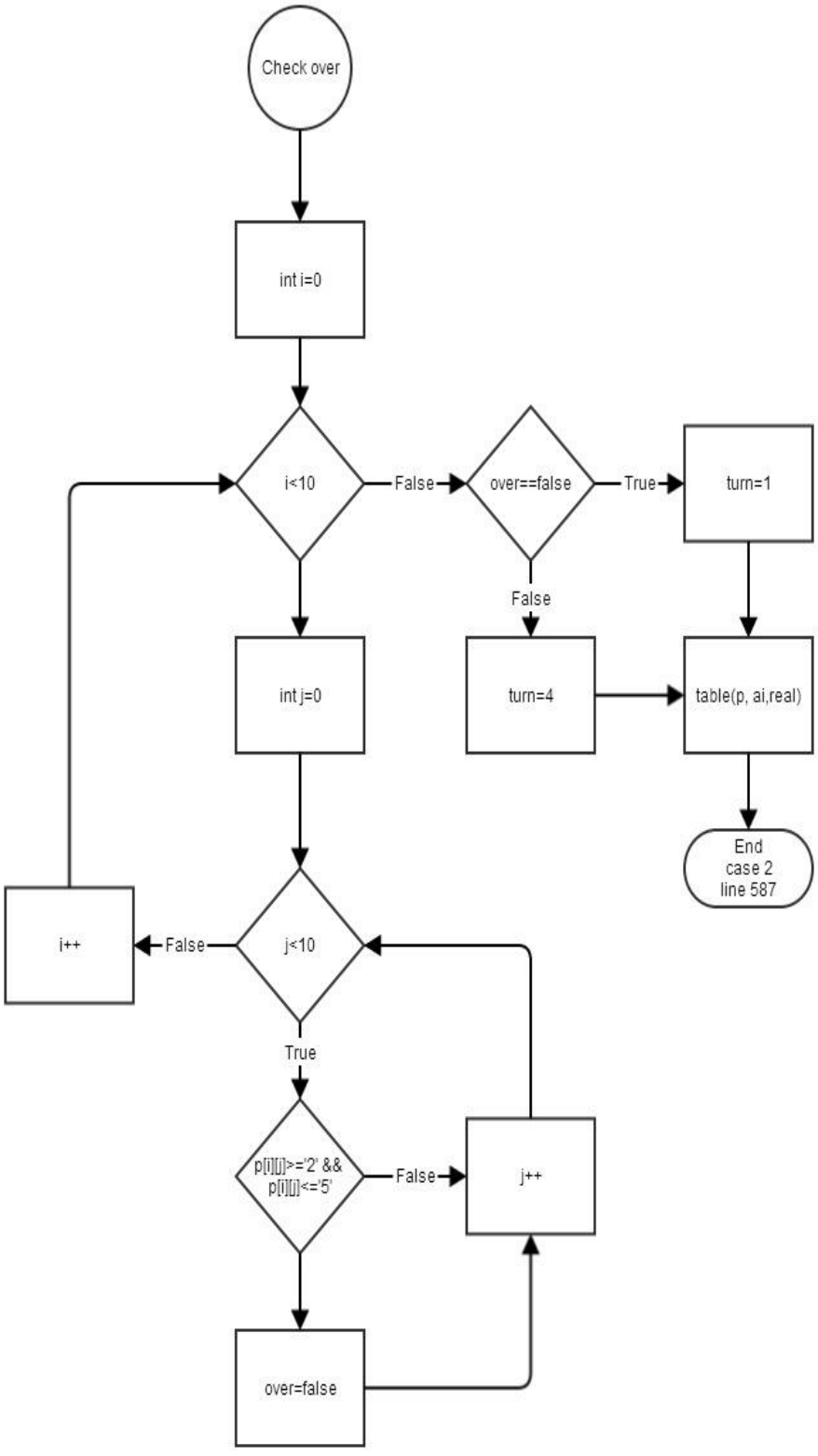
Move after second hit



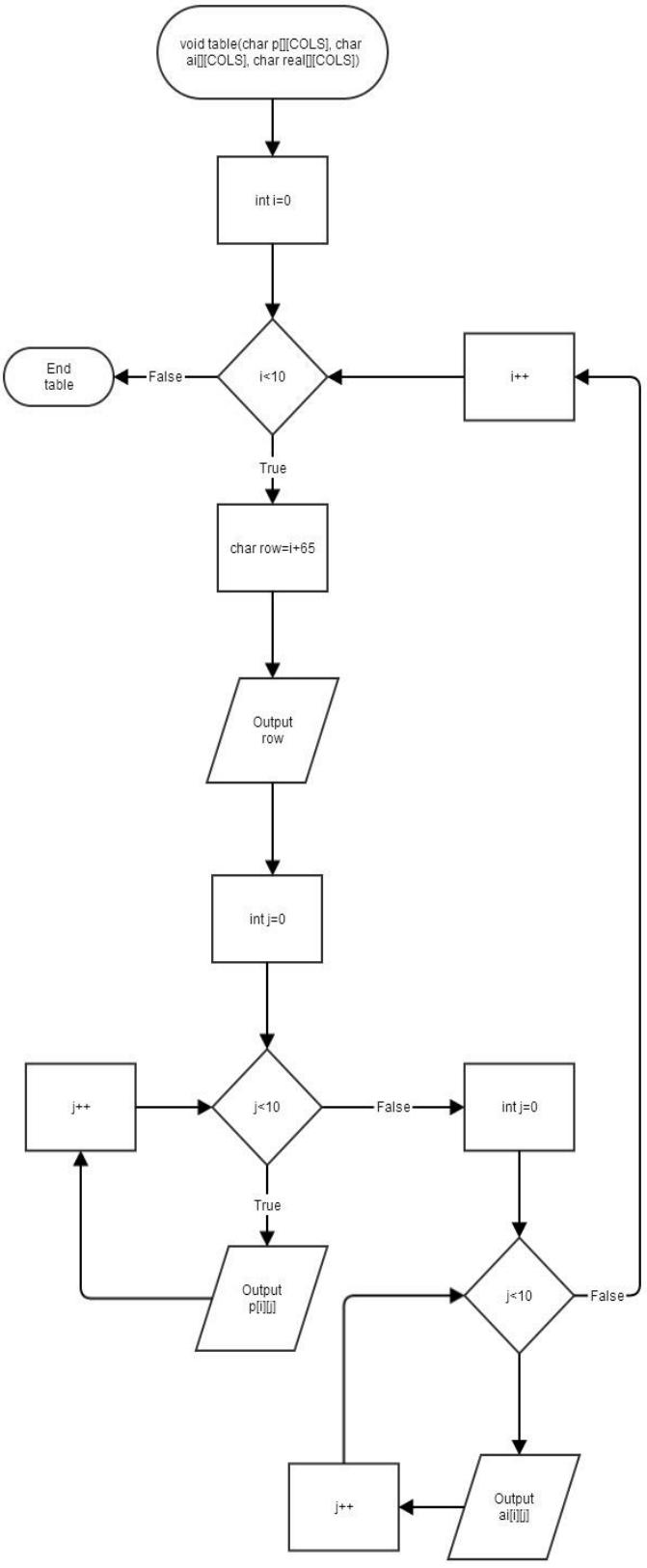
Check opposite side



Check over



table_function



8. Code

```
/*
 * File:   main.cpp
 * Author: Tsz, Kwan
 * Created on July 17, 2014, 5:05 PM
 * Purpose: Battleship for fun
 */

//System Libraries
#include <cstdlib>
#include <iostream>
#include <ctime>
#include <fstream>
#include <vector>
#include <iomanip>
using namespace std;
//User Libraries

//Global Constant
const int COLS=10;
const int COL=3;
//Function Prototypes
void intro();
void table(char [][COLS],char [][COLS], char [][COLS]);
void pplace(char [][COLS], char [][COLS], char [][COLS], bool &, int [], int &, int &, int &, int &);
void aiplace(char [][COLS], char [][COLS], int &, int &, bool &, int []);
```

```
void pause();

int pfire(char [][COLS], char [][COLS], char [][COLS], bool &, bool &, int &, int &, float &,
float &);

void getstat(vector<int> &, vector<int> &, vector<char> &, vector<int> &, vector<int> &,
vector<char> &, char [][COL], char [][COL], char [][COLS], char [][COLS]);

void sort(char [][COL], char [][COL], vector<char>, vector<char>);

//Execution Begins here

int main(int argc, char** argv) {


   //Declare variables

   const int ROWS=10, XY=4, ROW=100;

   char p[ROWS][COLS];              //player table y,x

   char ai[ROWS][COLS];             //ai table show to player

   char real[ROWS][COLS];           //real ai table

   int unit[5]={5,4,3,2,2};         //unit of ship

   int x1,y1,x2,y2;                 //coordinates to place ship

   bool goback=true;                //invalid back to random

   bool valid;                      //validation

   int count;                       //use space check validation

   int hx=10, hy=10;                //first hit coordinate

   bool hit;                        //hit to skip random fire

   bool finish=true;                //finish one ship back to random

   int combo=0, oppcombo=0;         //after second hit keep that direction

   bool over;                       //game over

   int turn;                        //switch turn

   bool oneend=false;               //one side miss/overlap/overside go to opposite direction

   bool cross[XY]={true,true,true,true}; //cross 4 boxes around hit

   bool crossdone=true;             //if true back to random
```

```
bool combohit;                    //keep fire the same direction
float phit=0, pmiss=0;            //player hit miss counter
float aihit=0, aimiss=0;          //ai hit miss counter
ofstream output;
vector<int> prow,pcol,airow,aicol;    //player/ai hit/miss coordinates
vector<char> pr, air;             //player/ai hit/miss result
char pvect[ROW][COL];             //player vector array to do sorting
char aivect[ROW][COL];            //ai vector array to do sorting
bool done;                        //finish fire
int ax,ay;                        //ai fire coordinate
char cax,cay;                     //ai fire display in A0 form to player
int hplan;                        //hit plan after first hit (corss)

cout<<fixed<<showpoint<<setprecision(2);
//reset
srand(static_cast<unsigned int>(time(0)));
for(int i=0;i<10;i++){        //y coordinates
   for(int j=0;j<10;j++){     //x coordinates
      p[i][j]=' ';          //reset
      ai[i][j]=' ';
      real[i][j]=' ';
   }
}
intro();
//table
table(p, ai, real);
```

```
//place ship
pplace(p, ai, real, valid, unit, x1, x2, y1, y2);

//ai part
aiplace(ai, real, x1, y1, valid, unit);
//table
table(p, ai, real);

turn=1;
do{
   switch(turn){
      //Player fire turn
      case 1:{
         turn=pfire(p, ai, real, over, valid, x1, y1, phit, pmiss);

         break;
      }
      //ai turn
      case 2:{
       pause();
      over=true;
      done=false;
      for(int i=0;i<4;i++){
         cross[i]=true;
      }
      do{
         done==false;
```

```
            if(crossdone==true && finish==true && goback==true && done==false &&
oppcombo==0 && combo==0){
                //random fire
//                cout<<"random fire\n";
                goback=true;
                do{
                   valid=true;
                   ax=rand()%10;
                   ay=rand()%10;
                   if(p[ay][ax]=='O' || p[ay][ax]=='X'){
                      valid=false;
//                      cout<<"overlap\n";
                   }
                }while(valid==false);
                cax=ax+48;
                cay=ay+65;
                cout<<"ai fire "<<cay<<cax<<"\n";
                if(p[ay][ax]!=' '){
                   p[ay][ax]='X';
                   cout<<"Hit!!!\n";
                   hx=ax;
                   hy=ay;
                   hit=true;
                   crossdone=false;
                   finish=false;
                   combo=false;
                   done=true;
                   oneend=false;
```

```
                aihit++;
            }
            else{
                p[ay][ax]='O';
                cout<<"Miss...\n";
                done=true;
                aimiss++;
            }
        }

        //move after hit
        if(hit==true && finish==false && crossdone==false && combo==0 &&
oppcombo==0 && done==false){
            do{
//                cout<<"random cross\n";
                ay=hy;
                ax=hx;
                //check cross rand
                hplan=rand()%4;
                if(hplan==0) ay=hy-1;
                if(hplan==1) ay=hy+1;
                if(hplan==2) ax=hx-1;
                if(hplan==3) ax=hx+1;
//                cout<<"hplan = "<<hplan<<endl;
                //check over size
                if(ay<0 || ay>9 || ax<0 || ax>9){
//                    cout<<"Out table\n";
                   cross[hplan]=false;
```

```
                    }
                    else if(p[ay][ax]=='X' || p[ay][ax]=='O'){
//                        cout<<"overlap\n";
                       cross[hplan]=false;
                    }
                    if(cross[0]==cross[1] && cross[1]==cross[2] && cross[2]==cross[3] &&
cross[0]==false){
//                        cout<<"test all 4 but invalid\n";
                       crossdone=true;
                       finish=true;
                       goback=true;
                    }
                }while(crossdone==false && cross[hplan]==false);



                //valid
                if(crossdone==false){
//                    cout<<"check hit or miss by cross rand xy\n";
                    cax=ax+48;
                    cay=ay+65;
                    cout<<"ai fire "<<cay<<cax<<"\n";
                    if(p[ay][ax]!=' '){
                       p[ay][ax]='X';
                       cout<<"Hit!!!\n";
                       done=true;
                       combo++;
                       crossdone=true;
                       aihit++;
```

```
                }
                else{
                    p[ay][ax]='O';
                    cout<<"Miss...\n";
                    done=true;
                    aimiss++;
                }
            }
            else{
//                  cout<<"crossdone=true, go back to rand \n";
                goback=true;
            }
        }
        else if(combo>0 && oneend==false && done==false &&
crossdone==true){   //continue check
//              cout<<"second hit\n";
            valid=true;
            if(hx==ax){
//                  cout<<"same x\n";
                if(hy>ay) ay=hy-combo-1;
                else ay=hy+combo+1;
                if(ay<0 || ay >9){
                    valid=false;
                }
                if(valid==true){
                    if(p[ay][ax]=='X' || p[ay][ax]=='O'){
                        valid=false;
                    }
```

```
    if(p[ay][ax]=='O'){
        finish=true;
        goback=true;
        crossdone=true;
        combo=0;
    }
    if(valid==true){
        cax=ax+48;
        cay=ay+65;
        cout<<"ai fire "<<cay<<cax<<"\n";
        if(p[ay][ax]!=' '){
            p[ay][ax]='X';
            cout<<"Hit!!!\n";
            done=true;
            combo++;
            aihit++;
        }
        else{
            p[ay][ax]='O';
            cout<<"Miss...\n";
            done=true;
            oneend=true;
            oppcombo++;
            aimiss++;
        }
    }
}
```

```
                else{     //check ->GO TO OPPCOMBO
//                    cout<<"next xy invalid change to opposite side\n";
                    combo=0;
                    oneend=true;
                    crossdone=true;
                    oppcombo++;
                    combohit=false;
                }
            }
            if(hy==ay){
//                  cout<<"same y\n";
                if(hx>ax) ax=hx-combo-1;
                else ax=hx+combo+1;
                if(ax<0 || ax >9){
                valid=false;
                combo=0;
                goback=true;
                finish=true;
                }
                if(valid==true){
                    if(p[ay][ax]=='X' || p[ay][ax]=='O'){
                        valid=false;
                        finish=true;
                        goback=true;
                    }
                    if(valid==true){
                        cax=ax+48;
```

```
                cay=ay+65;
                cout<<"ai fire "<<cay<<cax<<"\n";
                if(p[ay][ax]!=' '){
                    p[ay][ax]='X';
                    combo++;
                    done=true;
                    aihit++;
                }
                else{
                    p[ay][ax]='O';
                    cout<<"Miss...\n";
                    done=true;
                    oneend=true;
                    oppcombo++;
                    combo=0;
                    combohit=false;
//                      cout<<"oneend==true\n";
//                      cout<<"done==true\n";
                    aimiss++;
                }
            }
        }
        if(valid==false){     //GO TO OPPCOMBO
//          cout<<"next xy inlvalid change to other side\n";
            combo=0;
            oneend=true;
            crossdone=true;
```

```
                oppcombo++;
                combohit=false;
            }
        }
    }
    else if(oppcombo>0 && oneend==true && done==false){  //check other side
//          cout<<"one side end check other side\n";
//          cout<<"oppcombo = "<<oppcombo<<endl;
        if(hx==ax){
//          cout<<"same X\n";
            if(combohit==false){
                if(hy>ay) ay=hy+oppcombo;
                else ay=hy-oppcombo;
            }
            else{
                if(ay>hy) ay=hy+oppcombo;
                else ay=hy-oppcombo;
            }
//          cout<<ay<<ax<<endl;
            if(ay<0 || ay>9 || p[ay][ax]=='O' || p[ay][ax]=='X'){
                oppcombo=0;
                goback=true;
                finish=true;
                crossdone=true;
                combo=0;
                done=false;
//              cout<<"overlap or oversize\n";
```

```
    }
    else{
        cax=ax+48;
        cay=ay+65;
        cout<<"ai fire "<<cay<<cax<<"\n";
        if(p[ay][ax]!=' '){
            p[ay][ax]='X';
            cout<<"Hit!!!\n";
            done=true;
            oppcombo+=1;
            combohit=true;
            aihit++;
        }
        else{
            p[ay][ax]='O';
            cout<<"Miss...\n";
            done=true;
            combo=0;
            oppcombo=0;
            finish=true;
            goback=true;
            crossdone=true;
            aimiss++;
        }
    }
}
else if(hy==ay){
```

```
//                  cout<<"same y\n";
                  if(combohit==false){
                     if(hx>ax) ax=hx+oppcombo;
                     else ax=hx-oppcombo;
                  }
                  else{
                     if(ax>hx) ax=hx+oppcombo;
                     else ax=hx-oppcombo;
                  }
//                  cout<<ay<<ax<<endl;
                  if(ax<0 || ax>9 || p[ay][ax]=='O' || p[ay][ax]=='X'){
                     oppcombo=0;
                     goback=true;
                     finish=true;
                     crossdone=true;
                     combo=0;
                     done=false;
//                     cout<<"overlap or oversize\n";
                  }
                  else{
                     cax=ax+48;
                     cay=ay+65;
                     cout<<"ai fire "<<cay<<cax<<"\n";
                     if(p[ay][ax]!=' '){
                        p[ay][ax]='X';
                        cout<<"Hit!!!\n";
                        done=true;
```

```
                oppcombo+=1;
                combohit=true;
                aihit++;
            }
            else{
                p[ay][ax]='O';
                cout<<"Miss...\n";
                done=true;
                combo=0;
                oppcombo=0;
                finish=true;
                goback=true;
                crossdone=true;
                aimiss++;
            }
        }
    }
}while(done==false);

for(int i=0;i<10;i++){    //check over
    for(int j=0;j<10;j++){
        if(p[i][j]>='2' && p[i][j]<='5')
            over=false;
    }
}
if(over==false) turn=1;
```

```
        else turn=4;
        //table
        table(p, ai, real);
           break;
        }
        case 3:{
           cout<<"You win \n";
           turn=5;
           break;
        }
        case 4:{
           cout<<"You lose \n";
           turn=5;
           break;
        }
     }
}while(turn<5);

getstat(prow, pcol, pr, airow, aicol, air, pvect, aivect, p, ai);
sort( pvect, aivect, pr, air);

cout<<"Your accuracy is ";
cout<<100*phit/(phit+pmiss);
cout<<"%\n";
cout<<"AI accuracy is ";
cout<<100*aihit/(aihit+aimiss);
```

```
cout<<"%\n\n";
    cout<<endl;

output.open("stat.dat");
if(output.fail()){
    cout<<"Output file opening failed.\n";
}
output<<"Your accuracy is ";
output<<100*phit/(phit+pmiss);
output<<"%\n";
output<<"AI accuracy is ";
output<<100*aihit/(aihit+aimiss);
output<<"%\n\n";
for(int i=0;i<air.size();i++){
    output<<pvect[i][0]<<pvect[i][1];
    output<<" ";
    output<<pvect[i][2];
    output<<"           ";
    output<<aivect[i][0]<<aivect[i][1];
    output<<" ";
    output<<aivect[i][2];
    output<<endl;
}

output.close();

return 0;
```

```
}

void intro(){
    cout<<"Battleship!\n";
    cout<<"You have 5 ship to place\n";
    cout<<"5 units ship*1 55555, 4 units ship*1 4444\n";
    cout<<"3 units ship*1 333, 2 units ships*2 22, 22\n";
}
void table(char p[][COLS], char ai[][COLS], char real[][COLS]){
    //table
    cout<<"   PLAYER 1                              A.I.\n";
    cout<<"   0   1   2   3   4   5   6   7   8   9       0   1   2   3   4   5   6   7   8   9\n";
    cout<<"  _____________________________________________
_____________________________________\n";
    for(int i=0;i<10;i++){
        char row=i+65;
        cout<<row<<"| ";
        for(int j=0;j<10;j++){
            cout<<p[i][j]<<" | ";
        }
        cout<<"   "<<row<<"| ";
        for(int j=0;j<10;j++){
            cout<<ai[i][j]<<" | ";
        }
        cout<<endl;
        cout<<"  ---------------------------------------      ---------------------------------------\n";
    }
}
```

```
void pause(){
    time_t start, end;


    start=time(0);
    do{
        end=time(0);
    }while(difftime(end,start)<1);
}


void pplace(char p[][COLS], char ai[][COLS], char real[][COLS], bool &valid, int unit[], int
&x1, int &x2, int &y1, int &y2){
    int count;
    int max, min;                    //replace the coordinates to place ship
    string place;                   //x,y to place ship start and end coordinates
    //place ship
    for(int q=0;q<5;q++){
        do{
            do{
                do{
                    count=0;
                    valid=true;   //reset
                    cout<<"Choose the coordinates to place the ";
                    cout<<unit[q]<<"-unit ship with A1A5 form : ";
                    cin>>place;
                    if(place.size()!=4){        //check size
                        cout<<"size\n";
                        valid=false;
                    }
```

```
    if(place[0]<'A' || place[0]>'J' || place[2]<'A' || place[2]>'J'){
        valid=false;
    }
    if(valid==false){
        cout<<"Invalid input\n";
    }
}while(valid==false);
cout<<place[0]-65<<place[1]-48<<place[2]-65<<place[3]-48<<endl;
y1=place[0]-65;
y2=place[2]-65;
x1=place[1]-48;
x2=place[3]-48;
cout<<y1<<x1<<y2<<x2<<endl;
if(y1==y2){     //x is same
    if(abs(x1-x2)!=unit[q]-1){   //check unit invalid
        cout<<"x unit\n";
        valid=false;
    }
    else{                   //valid
        if(x1>x2){          //check which larger
            max=x1;
            min=x2;
        }
        else{
            max=x2;
            min=x1;
        }
```

```
        cout<<"max="<<max<<endl;
        cout<<"min="<<min<<endl;
        cout<<"p"<<y1<<endl;
        for(int k=min;k<=max;k++){          //check overlap
           if(p[y1][k]==' '){
              count++;
           }
        }
        if(count!=unit[q]){
           valid=false;
           cout<<"overlap\n";
        }
        if(valid==true){
           for(int k=min;k<=max;k++){
              p[y1][k]=unit[q]+48;
           }
        }
     }
  }
  if(x1==x2){           //y is same
     if(abs(y1-y2)!=unit[q]-1){   //check unit
        cout<<"y unit\n";
        valid=false;
     }
     else{                //valid
        if(y1>y2){
           max=y1;
```

```
            min=y2;
        }
        else{
            max=y2;
            min=y1;
        }
        cout<<"max="<<max<<endl;
        cout<<"min="<<min<<endl;
        cout<<"p"<<y1<<endl;
        for(int k=min;k<=max;k++){
            if(p[k][x1]==' '){
                count++;
            }
        }
        if(count!=unit[q]){
            valid=false;
            cout<<"overlap\n";
        }
        if(valid==true){
            for(int k=min;k<=max;k++){
                p[k][x1]=unit[q]+48;
            }
        }
    }
}
if(x1!=x2 && y1!=y2){
    valid=false;
```

```
                cout<<"horizontal/vertical\n";
            }
        }while(valid==false);
        cout<<count<<endl;
    }while(valid==false);
  //table
  table(p, ai, real);
  }
}

void aiplace(char ai[][COLS], char real[][COLS], int &x1, int &y1, bool &valid, int unit[]){
  int count;
  int pos;                          //place horizontal/vertical(ai)
  for(int q=0;q<5;q++){
    do{
      valid=true;
      count=0;
      //random coordinates
      y1=rand()%(10-unit[q]);     //won't over size
      x1=rand()%(10-unit[q]);
      pos=rand()%2;
      if(pos==0){                 //0 horizontal
        for(int k=y1;k<y1+unit[q];k++){
          if(real[k][x1]==' '){
            count++;
          }
        }
```

```
            if(count!=unit[q]){
                valid=false;
            }
            if(valid==true){
                for(int k=y1;k<y1+unit[q];k++){
                    real[k][x1]=unit[q]+48;
                }
            }
        }
        else{                   //1 vertical
            for(int k=x1;k<x1+unit[q];k++){
                if(real[y1][k]==' '){
                    count++;
                }
            }
            if(count!=unit[q]){
                valid=false;
            }
            if(valid==true){
                for(int k=x1;k<x1+unit[q];k++){
                    real[y1][k]=unit[q]+48;
                }
            }
        }
    }while(valid==false);
  }
}
```

```
int pfire(char p[][COLS], char ai[][COLS], char real[][COLS], bool &over, bool &valid, int &x1,
int &y1, float &phit, float &pmiss){


   string fire;                    //player fire;
   over=true;
   do{
      valid=true;
      cout<<"Your turn, please enter a coordinate to fire in A0 form :";
      cin>>fire;
      if(fire.length()!=2){
         valid=false;
         cout<<"size\n";
      }
      if(fire[0]<'A' || fire[0]>'J' || fire[1]<'0' || fire[1]>'9'){
         valid=false;
         cout<<"x/y\n";
      }
      y1=fire[0]-65;
      x1=fire[1]-48;
      if(real[y1][x1]=='O' || real[y1][x1]=='X'){
         valid=false;
         cout<<"overlap\n";
      }
   }while(valid==false);
   //hit
   if(real[y1][x1]>='2' && real[y1][x1]<='5'){
      cout<<"Hit!!!\n";
```

```
        real[y1][x1]='X';
        ai[y1][x1]='X';
        phit++;
    }
    else{
        cout<<"Miss....\n";
        real[y1][x1]='O';
        ai[y1][x1]='O';
        pmiss++;
    }
    //table
    table(p, ai, real);
    for(int i=0;i<10;i++){
        for(int j=0;j<10;j++){
            if(real[i][j]>='2' && real[i][j]<='5')
                over=false;
        }
    }
    if(over==true){
        return 3;
    }
    else return 2;
}


void getstat(vector<int> &prow, vector<int> &pcol, vector<char> &pr, vector<int> &airow,
vector<int> &aicol, vector<char> &air, char pvect[][COL], char aivect[][COL], char p[][COLS],
char ai[][COLS]){
    for(int i=0;i<10;i++){
```

```
    for(int j=0;j<10;j++){
        if(p[i][j]=='X'){
            prow.push_back(i);
            pcol.push_back(j);
            pr.push_back(p[i][j]);
        }
        if(ai[i][j]=='X'){
            airow.push_back(i);
            aicol.push_back(j);
            air.push_back(ai[i][j]);
        }
    }
    for(int j=0;j<10;j++){
        if(p[i][j]=='O'){
            prow.push_back(i);
            pcol.push_back(j);
            pr.push_back(p[i][j]);
        }
        if(ai[i][j]=='O'){
            airow.push_back(i);
            aicol.push_back(j);
            air.push_back(ai[i][j]);
        }
    }
}
for(int i=0;i<pr.size();i++){
    pvect[i][0]=prow[i]+65;
```

```
        pvect[i][1]=pcol[i]+48;
        pvect[i][2]=pr[i];
        aivect[i][0]=airow[i]+65;
        aivect[i][1]=aicol[i]+48;
        aivect[i][2]=air[i];
    }
}

void sort(char pvect[][COL], char aivect[][COL], vector<char> pr, vector<char> air){
    bool swap;                          //sorting swap
    char temp;

    do{
        swap=false;
        for(int i=0;i<pr.size()-1;i++){
            if(pvect[i][2]<pvect[i+1][2]){
                for(int k=0;k<3;k++){
                    temp=pvect[i][k];
                    pvect[i][k]=pvect[i+1][k];
                    pvect[i+1][k]=temp;
                    swap=true;
                }
            }
        }
    }while(swap);
    do{
        swap=false;
```

```
    for(int i=0;i<pr.size()-1;i++){
        if(pvect[i][0]>pvect[i+1][0] && pvect[i][2]==pvect[i+1][2]){
            for(int k=0;k<3;k++){
                temp=pvect[i][k];
                pvect[i][k]=pvect[i+1][k];
                pvect[i+1][k]=temp;
                swap=true;
            }
        }
    }
  }while(swap);
  do{
    swap=false;
    for(int i=0;i<pr.size()-1;i++){
        if(pvect[i][1]>pvect[i+1][1] && pvect[i][2]==pvect[i+1][2] &&
pvect[i][1]==pvect[i+1][1]){
            for(int k=0;k<3;k++){
                temp=pvect[i][k];
                pvect[i][k]=pvect[i+1][k];
                pvect[i+1][k]=temp;
                swap=true;
            }
        }
    }
  }while(swap);

  do{
    swap=false;
```

```
    for(int i=0;i<air.size()-1;i++){
        if(aivect[i][2]<aivect[i+1][2]){
            for(int k=0;k<3;k++){
                temp=aivect[i][k];
                aivect[i][k]=aivect[i+1][k];
                aivect[i+1][k]=temp;
                swap=true;
            }
        }
    }
}while(swap);
do{
    swap=false;
    for(int i=0;i<air.size()-1;i++){
        if(aivect[i][0]>aivect[i+1][0] && aivect[i][2]==aivect[i+1][2]){
            for(int k=0;k<3;k++){
                temp=aivect[i][k];
                aivect[i][k]=aivect[i+1][k];
                aivect[i+1][k]=temp;
                swap=true;
            }
        }
    }
}while(swap);
do{
    swap=false;
    for(int i=0;i<air.size()-1;i++){
```

```
        if(aivect[i][1]>aivect[i+1][1] && aivect[i][2]==aivect[i+1][2] &&
aivect[i][1]==aivect[i+1][1]){
            for(int k=0;k<3;k++){
                temp=aivect[i][k];
                aivect[i][k]=aivect[i+1][k];
                aivect[i+1][k]=temp;
                swap=true;
            }
        }
      }
   }while(swap);
}
```