Battleship

Project2

CSC- 17A – 48130

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Content

1. Introduction

Rules and Gameplay

The players can choose the size of the table which 8x8 to 10x10. After the player choose the size, two tables created . 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 acts like a human player. I want the AI check the coordinates around the hit coordinate, and keep fire when it 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 it records and shows "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 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. It is possible the tables which are larger than 10x10, but there are only 0-9 for digits, and it is not a good idea to use low case characters with digits because it is confusing. 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()%num-5(num is the size of the table). 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	num	size of 2d dynamic array	main	40
	turn=1	menu turns	main	41
	n	function getN return var	main	103
	count		main	212
	max, min		main	213
	turn	in function aifire return var	main	429
	hplan	hit plan after first hit (cross)	main	431
	unit[5]	units of the ships in an array	Player	15
	x1, x2, y1, y2	2 coordinates to place ship	Player	16
	hx, hy, x, y	current, pre fire coordinates	AI	19
	oppcombo	opposite side combo	AI	21
	combo		AI	22
float	pttl=0, aittl=0	both total number of fire	main	743
	pac, aiac	accuracy	main	744
	hit	player hit counter	Player	20
	miss	player miss counter	Player	21
	hit, miss	ai hit miss counter	AI	29
char	temp		main	115
	row		main	187
	**pt	player table	Player	12
	**fake, **real	ai fake real tales	AI	11
	cx, cy	ai coordinates in char	AI	23
string	temp		main	95

	place	player place input type	main	214
	fire	player fire input type	main	372
bool	invalid=false	num validation	main	104
	valid	string validation	main	215
	digit	isdidit validation	main	216
	valid	ai place validation	main	329
	over=true	game over Boolean	main	373
	valid	player fire validation	main	374
	valid	ai fire validation	main	430
	over	ai over boolean	AI	14
	done	finish fire	AI	15
	cross[4]	cross 4 boxes around hit	AI	16
	crossdone	if true back to random	AI	17
	goback	invalid back to random	AI	18
	finish	combo finish Boolean	AI	20
	hit	hit Boolean	AI	24
	oneend	one side finish	AI	25
	combohit	keep fire the same direction	AI	26
fstream	io	i/o file in function intro	main	93
	io	i/o file in function init	main	114
	io	i/o file in function gestates	main	742
time_t	start, end	delay display ai fire	main	760
PlayerT	pT	Player table	main	42
PlayerG	pG	Player game data	main	43
PlayerS	*ps	Player States	main	44
AIT	ait	AI table	main	45
AIG	ai	AI game data	main	46
AIS	*as	AI game states	main	47

4. Topic Covered (Checklist)

Chapter	type	code	cpp	line
Memory Allocation	char**	pT.pt = new char*[num];	main	147
		for(int i=0;i<num;i++){	main	150
		pT.pt[i] = new char[num];	main	151
		}	main	154
delete 2d dynamic arr		for (int i=0;i<num;i++){	main	80
		delete[] pT.pt[i];	main	81
		}	main	84
		delete[] pT.pt;	main	85
function with struct		void init(PlayerT &, AIT &, int, PlayerG &, PlayerS &, AIG &, AIS &);	main	30
		void table(char **, char **, char **, int);	main	31
pointer notation		if(*(*(pt+pG.y1)+k)==' '){	main	267
structure pointer	PlayerS	PlayerS *ps	main	44
delete struct pointer		delete ps, as;	main	88
cctype	isdigit	if(isdigit(place[1]) && isdigit(place[3])){	main	234
input binary	input	io.open("unit.txt", ios::in | ios::binary);	main	116
	ouput	io.open("rank.txt", ios::out | ios::binary);	main	749
struct		struct PlayerT	Player	14
	array	int unit[5];	Player	15
difftime		}while(difftime(end,start)<1);	main	772

5. Libraries included

- <cstdlib>
- <iostream>
- <ctime>
- <fstream>
- <iomanip>
- <cctype>
- Player.h
- AI.h

6. Pseudo Code

Ask the size of the table

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 fire)

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, turn=5

case 4

Player lose, turn=5

if(turn<5) keep looping the case

scan player and ai table

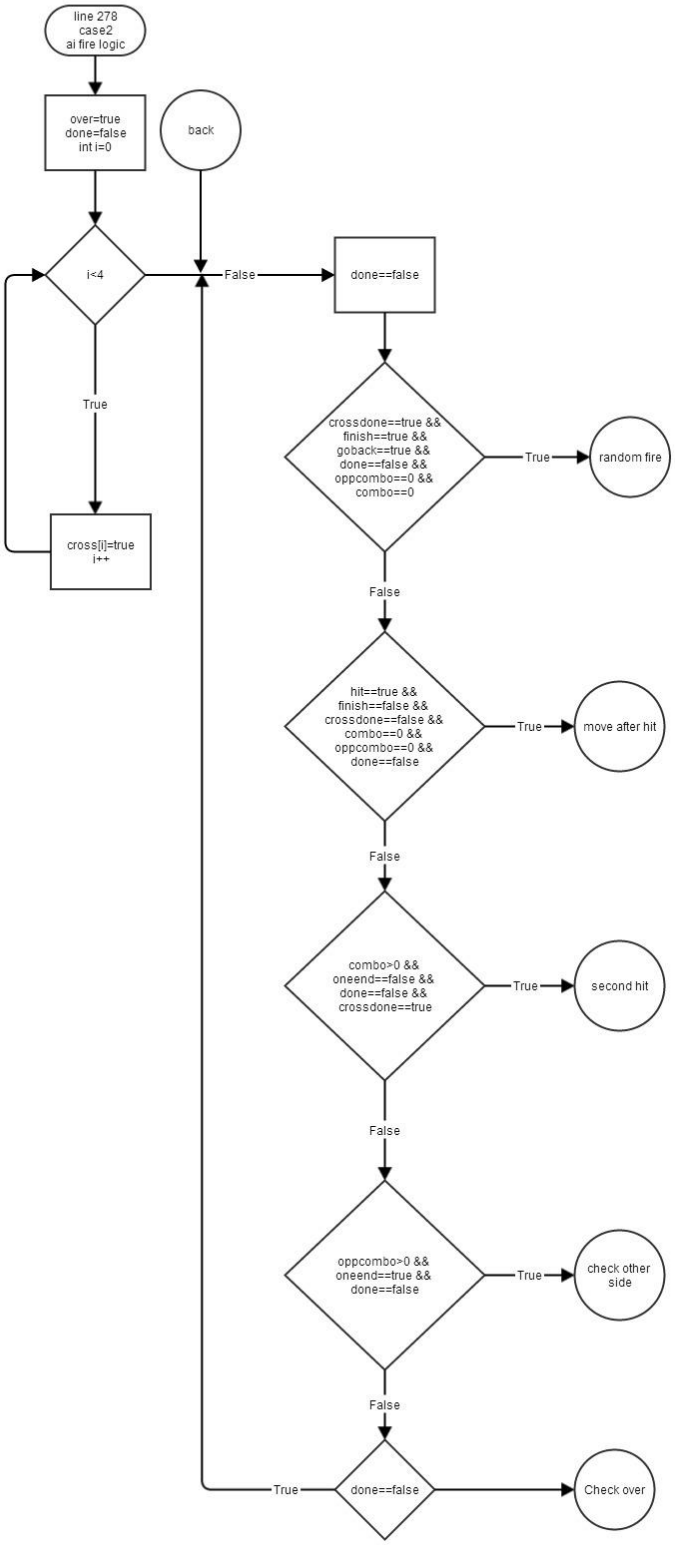
calculate accuracy hit/(hit+miss)

display player rank

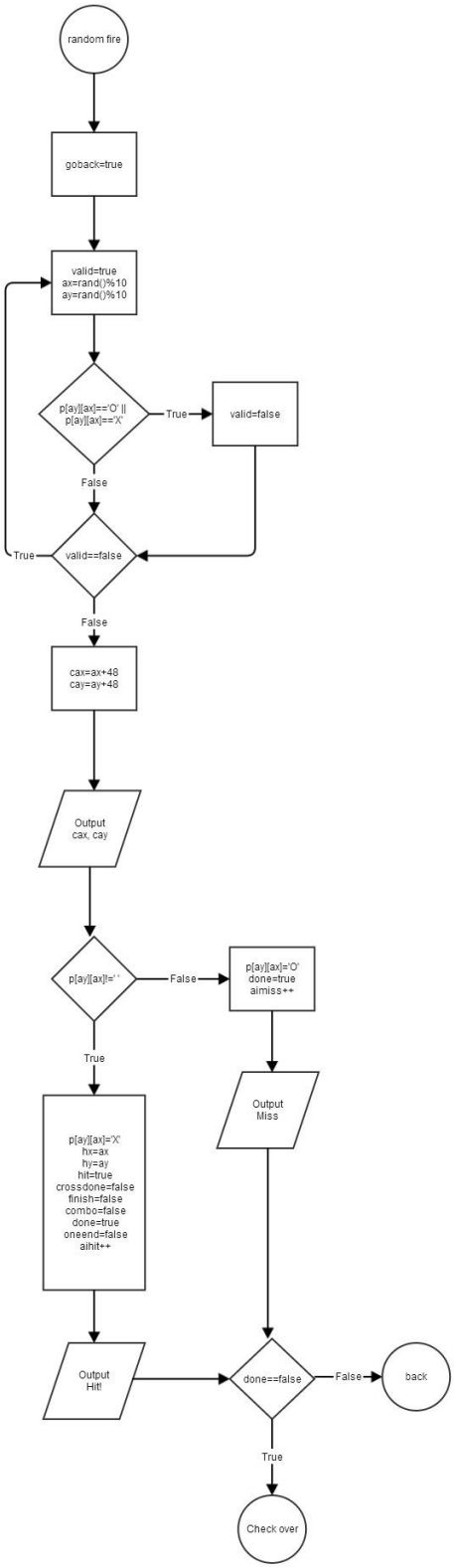
output to rank.txt

7. Flowchart

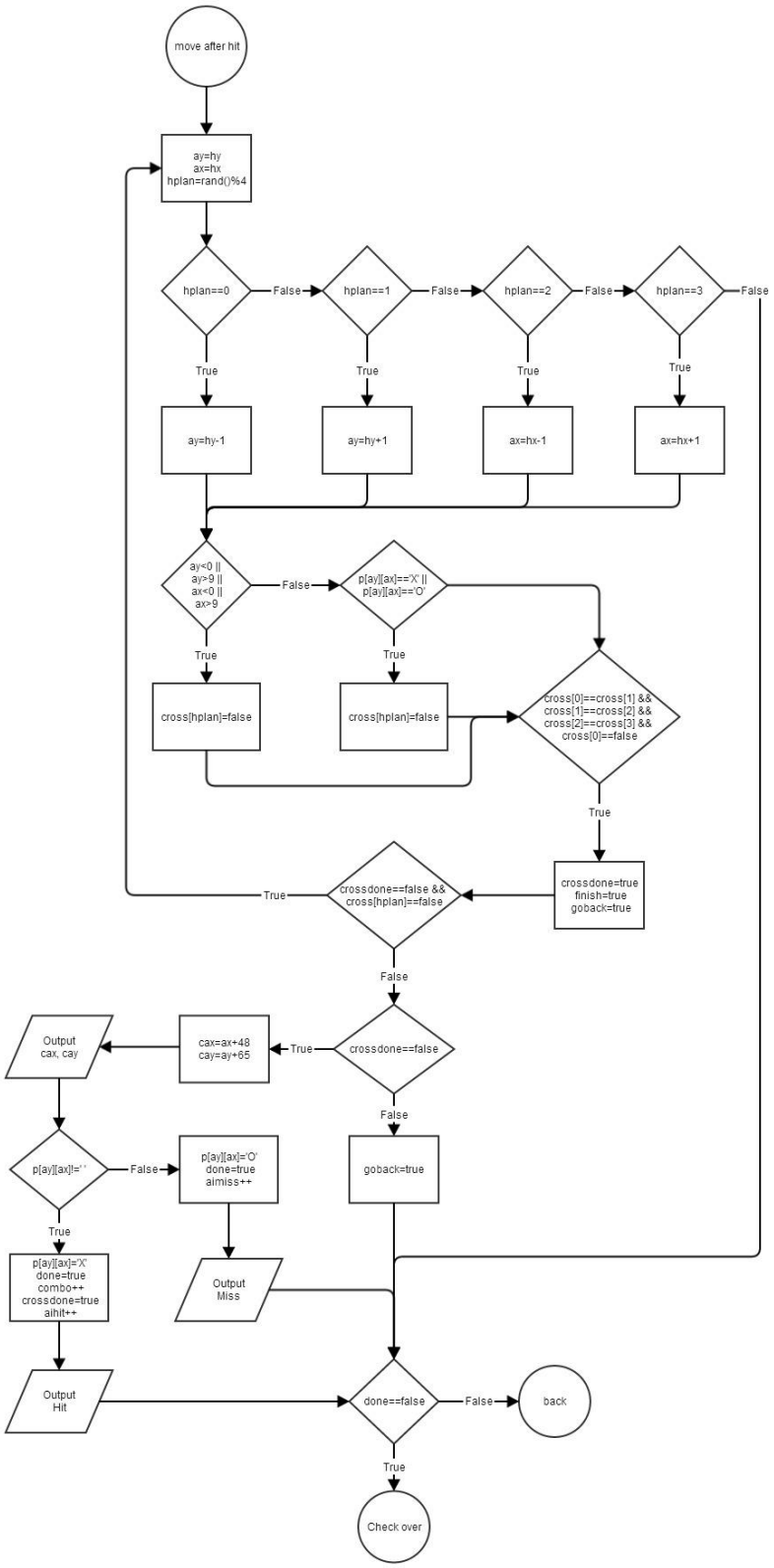
AI fire turn(case2)



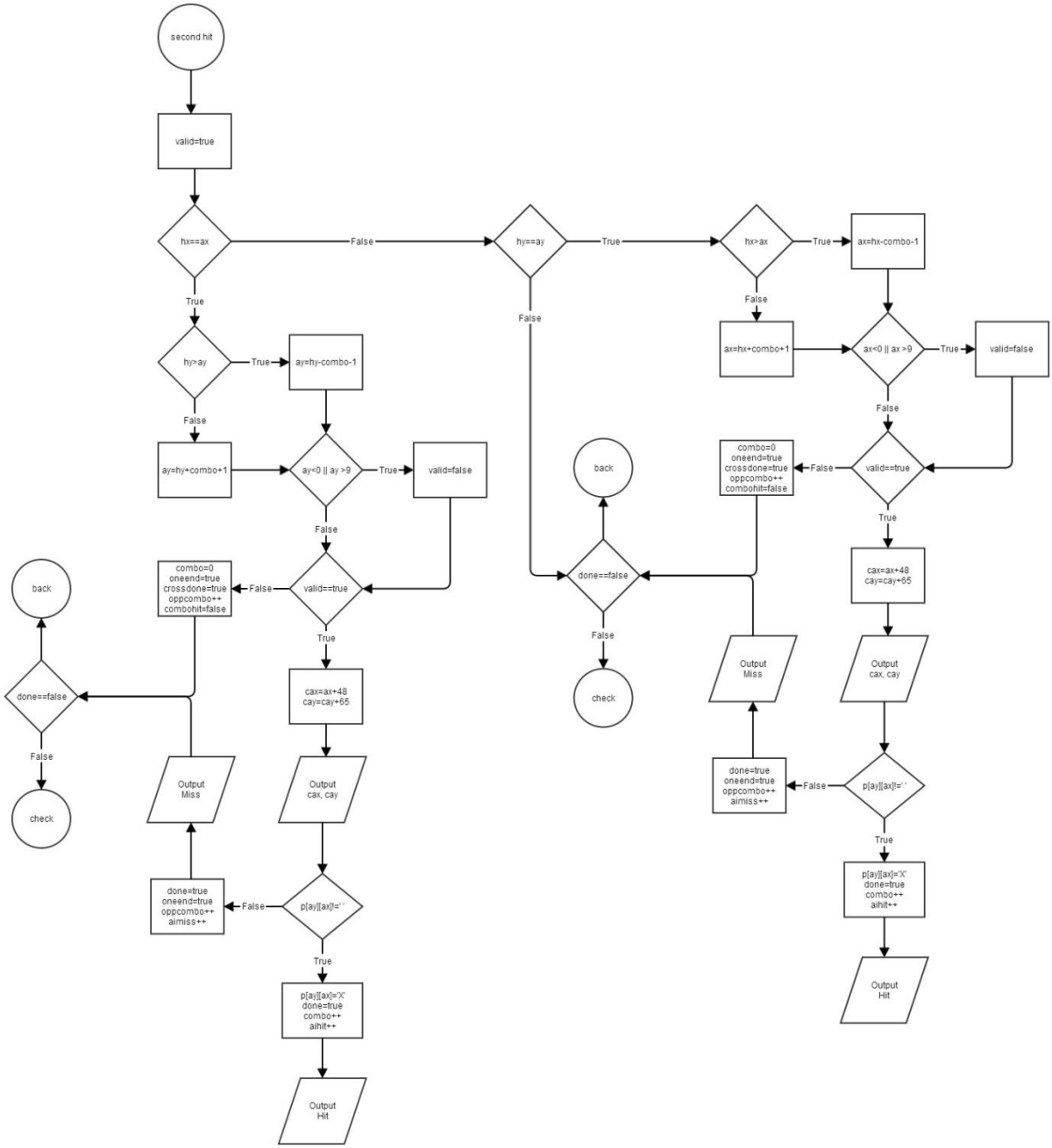
Random fire



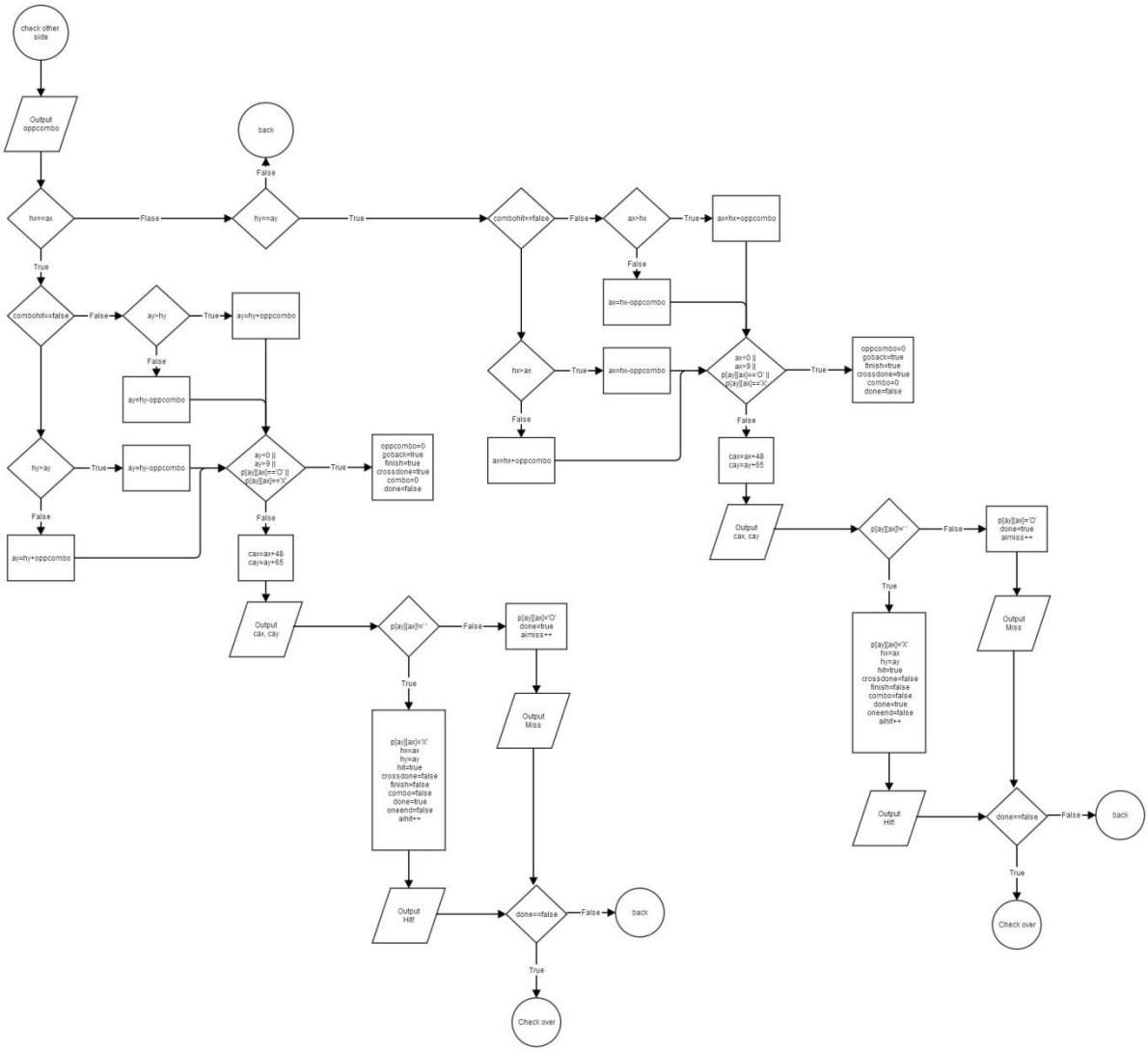
Move after hit



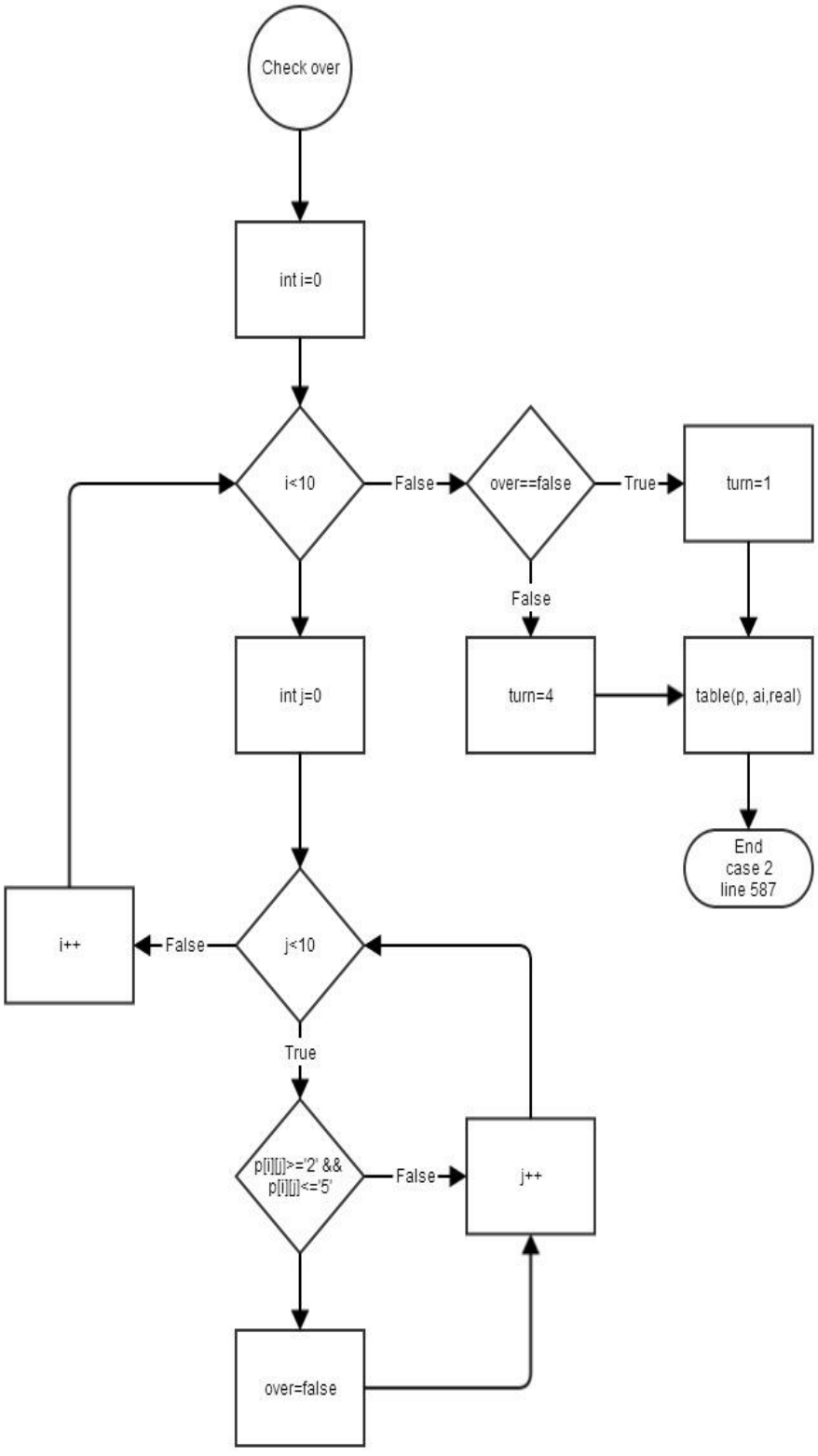
Move after second hit



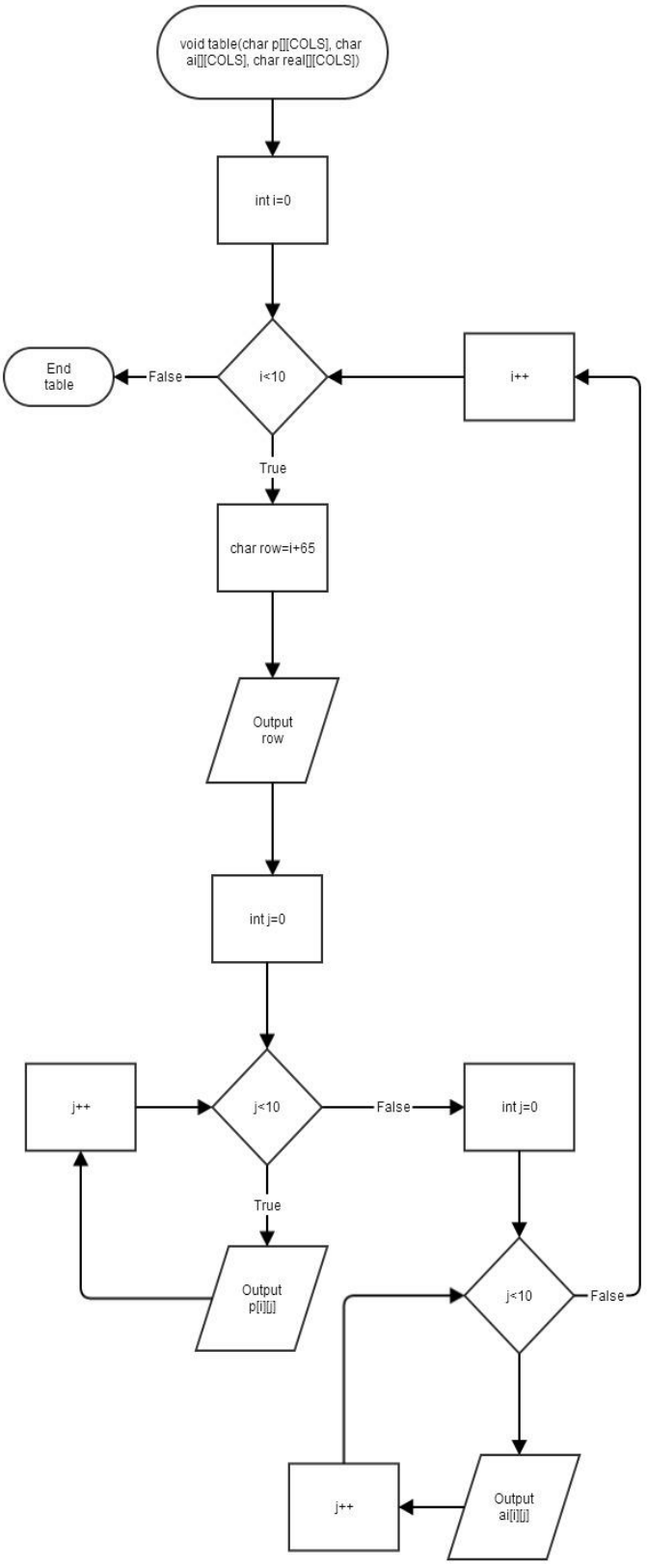
Check opposite side



Check over



table_function



8. Code - main

```
/*
 * File:   main.cpp
 * Author: Tsz, Kwan
 * Created on September 30, 2014, 10:33 AM
 * Purpose: CSC17A_Porj1_Battleship
 * 2D_Dynamic_array
 * Structure
 * cctype_binary
 */

//System libraries
#include <cstdlib>
#include <iostream>
#include <iomanip>
#include <ctime>
#include <fstream>
#include <cctype>
using namespace std;

//User Libraries
#include "Player.h"
#include "AI.h"

//Global Constant

//Function Prototypes
```

```
void intro();
int getN();
void pause();
void init(PlayerT &, AIT &,  int, PlayerG &, PlayerS *, AIG &, AIS *);
void table(char **, char **, char **, int);
void pplace(char **, char **, char **, PlayerG &, int);
void aiplace(char **, char **, char **, int [], int, int, int);
int pfire(char **, char **, char **, PlayerG &, PlayerS *, int);
int aifire(char **, char **, char **, AIG &, AIS *, int);
void getstates(PlayerS *);
//System Begins Here
int main(int argc, char** argv) {
    intro();
    int num=getN();
    int turn=1;
    PlayerT pT;
    PlayerG pG;
    PlayerS *ps = new PlayerS;
    AIT ait;
    AIG ai;
    AIS *as = new AIS;
    cout<<fixed<<showpoint<<setprecision(2);

    //reset
    srand(static_cast<unsigned int>(time(0)));
    init(pT, ait, num, pG, ps, ai, as);
    table(pT.pt, ait.fake, ait.real, num);
```

```
//player prepare
pplace(pT.pt, ait.fake, ait.real, pG, num);
aiplace(pT.pt, ait.fake, ait.real, pG.unit, pG.x1, pG.y1, num);
//game start
do{
   switch(turn){
      case 1:{
         turn=pfire(pT.pt, ait.fake, ait.real, pG, ps, num);
         break;
      }
      case 2:{
         turn=aifire(pT.pt, ait.fake, ait.real, ai, as, num);
         break;
      }
      case 3:{
         cout<<"You win!\n\n";turn=5;
         break;
      }
      case 4:{
         cout<<"You lose!\n\n";turn=5;
         break;
      }
   }
}while(turn<5);
getstates(ps);
//free memory
for (int i=0;i<num;i++){
```

```
        delete[] pT.pt[i];
        delete[] ait.real[i];
        delete[] ait.fake[i];
    }
    delete[] pT.pt;
    delete[] ait.real;
    delete[] ait.fake;
    delete ps, as;
    return 0;
}

void intro(){
    fstream io;
    io.open("intro.txt", ios::in);
    if(io.is_open()){
        string temp;
        while(getline(io, temp))
            cout<<temp<<endl;
        io.close();
    }
}
int getN(){
    int n;
    bool invalid=false;
    do{
        cout<<"Please choose the size of the table (8-10) :";
        cin>>n;
```

```
        if(n<8 || n>10)
            invalid=true;
    }while(invalid);
    return n;
}
void init(PlayerT &pT,AIT &ait, int num, PlayerG &pG, PlayerS *ps, AIG &ai, AIS *as){
    fstream io;
    char temp;
    io.open("unit.txt", ios::in | ios::binary);
    if(io.is_open()){
        for(int i=0;i<5;i++){
            io.read(&temp, sizeof(temp));
            pG.unit[i]=temp-48;
        }
        io.close();
    }
    //init by default
    else{
        cout<<"Default\n";
        for(int i=0;i<4;i++)
            pG.unit[i]=5-i;
        pG.unit[4]=2;
    }
    for(int i=0;i<4;i++)
        ai.cross[i]=true;
    ai.crossdone=true;
    ai.goback=true;
```

```
ai.hx=10;
ai.hy=10;
ai.finish=true;
ai.goback=true;
ai.oppcombo=0;
ai.combo=0;
ai.oneend=false;
as->hit=0;
as->miss=0;
ps->hit=0;
ps->miss=0;
//init table
pT.pt = new char*[num];
ait.fake = new char*[num];
ait.real = new char*[num];
for(int i=0;i<num;i++){
    pT.pt[i] = new char[num];
    ait.fake[i] = new char[num];
    ait.real[i] = new char[num];
}
for(int i=0;i<num;i++){
    for(int j=0;j<num;j++){
        pT.pt[i][j]=' ';
        ait.fake[i][j]=' ';
        ait.real[i][j]=' ';
    }
}
```

```
}
void table(char **pt, char **fake, char **real, int num){
    //table
    //space 38, 3
    cout<<"   PLAYER 1"<<setw(num*4+4)<<"A.I.\n";
    for(int i=0;i<num;i++){
        cout<<setw(4)<<i;
    }
    cout<<"       ";
    for(int i=0;i<num;i++){
        cout<<setw(4)<<i;
    }
    cout<<endl;
    //third line
    cout<<"  ";
    for(int i=0;i<num;i++){
        cout<<"____";
    }
    cout<<"      ";
    for(int i=0;i<num;i++){
        cout<<"____";
    }
    cout<<endl;
    //forth to num line
    for(int i=0;i<num;i++){
        char row=i+65;
        cout<<row<<"| ";
```

```
        for(int j=0;j<num;j++){
            cout<<pt[i][j];
            cout<<" "<<"| ";
        }
        cout<<"    "<<"| ";

        for(int k=0;k<num;k++){
            cout<<fake[i][k];
            cout<<" "<<"| ";
        }
        cout<<endl;
        cout<<"  ";
        for(int l=0;l<num;l++){
          cout<<"----";
        }
        cout<<"      ";
        for(int m=0;m<num;m++){
          cout<<"----";
        }
        cout<<endl;
    }
}
void pplace(char **pt, char **fake, char **real, PlayerG &pG, int num){
    int count;
    int max, min;
    string place;
    bool valid;
```

```
bool digit;
//place ship
for(int q=0;q<5;q++){
   do{
      do{
         do{
            count=0;
            digit=false;
            valid=true;   //reset
            cout<<"Choose the coordinates to place the ";
            cout<<pG.unit[q]<<"-unit ship with A1A5 form : ";
            cin>>place;
            if(place.size()!=4){        //check size
               cout<<"size\n";
               valid=false;
            }
            digit=false;
            if(isdigit(place[1]) && isdigit(place[3])){
               digit=true;
            }
            if(place[0]<'A' || place[0]>'J' || place[2]<'A' || place[2]>'J'){
               valid=false;
            }
            if(valid==false || digit==false){
               cout<<"Invalid input\n";
            }
         }while(valid==false || digit==false);
```

```
cout<<place[0]-65<<place[1]-48<<place[2]-65<<place[3]-48<<endl;
pG.y1=place[0]-65;
pG.y2=place[2]-65;
pG.x1=place[1]-48;
pG.x2=place[3]-48;
cout<<pG.y1<<pG.x1<<pG.y2<<pG.x2<<endl;
if(pG.y1==pG.y2){     //x is same
   if(abs(pG.x1-pG.x2)!=pG.unit[q]-1){   //check unit invalid
      cout<<"x unit\n";
      valid=false;
   }
   else{                  //valid
      if(pG.x1>pG.x2){          //check which larger
         max=pG.x1;
         min=pG.x2;
      }
      else{
         max=pG.x2;
         min=pG.x1;
      }
      cout<<"max="<<max<<endl;
      cout<<"min="<<min<<endl;
      cout<<"p"<<pG.y1<<endl;
      for(int k=min;k<=max;k++){         //check overlap
         if(*(*(pt+pG.y1)+k)==' '){
            count++;
         }
```

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

```
                cout<<"min="<<min<<endl;
                cout<<"p"<<pG.y1<<endl;
                for(int k=min;k<=max;k++){
                    if(*(*(pt+k)+pG.x1)==' '){
                        count++;
                    }
                }
                if(count!=pG.unit[q]){
                    valid=false;
                    cout<<"overlap\n";
                }
                if(valid==true){
                    for(int k=min;k<=max;k++){
                        *(*(pt+k)+pG.x1)=pG.unit[q]+48;
                    }
                }
            }
        }
        if(pG.x1!=pG.x2 && pG.y1!=pG.y2){
            valid=false;
            cout<<"horizontal/vertical\n";
        }
    }while(valid==false);
    cout<<count<<endl;
}while(valid==false);
cout<<"\n\n\n\n\n\n\n\n\n";
//table
```

```
    table(pt, fake, real, num);
    }
}
void aiplace(char **pt, char **fake, char **real, int unit[], int x1,int y1, int num){
    int count, pos;
    bool valid;
    for(int q=0;q<5;q++){
        do{
            valid=true;
            count=0;
            //random coordinates
            y1=rand()%(num-unit[q]);     //won't over size
            x1=rand()%(num-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 **pt, char **fake, char **real, PlayerG &pG, PlayerS *ps, int num){
  string fire;                  //player fire;
  bool over=true;
  bool valid;
  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";
    }
    //fire[1]<'0' || fire[1]>'9' ||
    if(fire[0]<'A' || fire[0]>'J' || fire[1]<'0' || fire[1]>num+48-1){
        valid=false;
        cout<<"x/y\n";
    }
    pG.y1=fire[0]-65;
    pG.x1=fire[1]-48;
    if(real[pG.y1][pG.x1]=='O' || real[pG.y1][pG.x1]=='X'){
        valid=false;
        cout<<"overlap\n";
    }
}while(valid==false);
//hit
if(real[pG.y1][pG.x1]>='2' && real[pG.y1][pG.x1]<='5'){
    cout<<"Hit!!!\n";
    real[pG.y1][pG.x1]='X';
    fake[pG.y1][pG.x1]='X';
    ps->hit++;
}
else{
    cout<<"Miss....\n";
    real[pG.y1][pG.x1]='O';
```

```
            fake[pG.y1][pG.x1]='O';
            ps->miss++;
        }
        //table
        table(pt, fake, real, num);
        for(int i=0;i<num;i++){
            for(int j=0;j<num;j++){
                if(real[i][j]>='2' && real[i][j]<='5')
                    over=false;
            }
        }
        if(over==true){
//          cout<<"3\n";
            return 3;
        }
        else{
//          cout<<"2\n";
            return 2;
        }
    }
    int aifire(char **pt, char **fake, char **real, AIG &ai, AIS *as, int num){
        srand(static_cast<unsigned int>(time(0)));
        cout<<"aifire\n";
        pause();
        int turn;
        bool valid;
        int hplan;
```

```
    ai.over=true;
    ai.done=false;
    for(int i=0;i<4;i++){
        ai.cross[i]=true;
    }
    do{
        ai.done=false;
        if(ai.crossdone==true && ai.finish==true && ai.goback==true && ai.done==false &&
ai.oppcombo==0 && ai.combo==0){
            //random fire
//            cout<<"random fire\n";
            ai.goback=true;
            do{
                valid=true;
                ai.x=rand()%num;
                ai.y=rand()%num;
                if(pt[ai.y][ai.x]=='O' || pt[ai.y][ai.x]=='X'){
                    valid=false;
                    cout<<"overlap\n";
                }
            }while(valid==false);
            ai.cx=ai.x+48;
            ai.cy=ai.y+65;
            cout<<"ai fire "<<ai.cy<<ai.cx<<"\n";
            if(pt[ai.y][ai.x]!=' '){
                pt[ai.y][ai.x]='X';
                cout<<"Hit!!!\n";
                ai.hx=ai.x;
```

```
            ai.hy=ai.y;
            ai.hit=true;
            ai.crossdone=false;
            ai.finish=false;
            ai.combo=false;
            ai.done=true;
            ai.oneend=false;
            as->hit++;
        }
        else{
            pt[ai.y][ai.x]='O';
            cout<<"Miss...\n";
            ai.done=true;
            as->miss++;
        }
    }

    //move after hit
    if(ai.hit==true && ai.finish==false && ai.crossdone==false && ai.combo==0 &&
ai.oppcombo==0 && ai.done==false){
        do{
//            cout<<"random cross\n";
            ai.y=ai.hy;
            ai.x=ai.hx;
            //check cross rand
            hplan=rand()%4;
            if(hplan==0) ai.y=ai.hy-1;
            if(hplan==1) ai.y=ai.hy+1;
```

```
            if(hplan==2) ai.x=ai.hx-1;
            if(hplan==3) ai.x=ai.hx+1;
            cout<<"hplan = "<<hplan<<endl;
            //check over size
            if(ai.y<0 || ai.y>num-1 || ai.x<0 || ai.x>num-1){
//                cout<<"Out table\n";
               ai.cross[hplan]=false;
            }
            else if(pt[ai.y][ai.x]=='X' || pt[ai.y][ai.x]=='O'){
//                cout<<"overlap\n";
               ai.cross[hplan]=false;
            }
            if(ai.cross[0]==ai.cross[1] && ai.cross[1]==ai.cross[2] && ai.cross[2]==ai.cross[3]
&& ai.cross[0]==false){
//                cout<<"test all 4 but invalid\n";
               ai.crossdone=true;
               ai.finish=true;
               ai.goback=true;
            }
         }while(ai.crossdone==false && ai.cross[hplan]==false);



         //valid
         if(ai.crossdone==false){
//             cout<<"check hit or miss by cross rand xy\n";
            ai.cx=ai.x+48;
            ai.cy=ai.y+65;
            cout<<"ai fire "<<ai.cy<<ai.cx<<"\n";
```

```
            if(pt[ai.y][ai.x]!=' '){
                pt[ai.y][ai.x]='X';
                cout<<"Hit!!!\n";
                ai.done=true;
                ai.combo++;
                ai.crossdone=true;
                as->hit++;
            }
            else{
                pt[ai.y][ai.x]='O';
                cout<<"Miss...\n";
                ai.done=true;
                as->miss++;
            }
        }
        else{
//              cout<<"crossdone=true, go back to rand \n";
            ai.goback=true;
        }
    }
    else if(ai.combo>0 && ai.oneend==false && ai.done==false &&
ai.crossdone==true){   //continue check
//          cout<<"second hit\n";
        valid=true;
        if(ai.hx==ai.x){
//              cout<<"same x\n";
            if(ai.hy>ai.y) ai.y=ai.hy-ai.combo-1;
            else          ai.y=ai.hy+ai.combo+1;
```

```
if(ai.y<0 || ai.y >9){
    valid=false;
}
if(valid==true){
    if(pt[ai.y][ai.x]=='X' || pt[ai.y][ai.x]=='O'){
        valid=false;
    }
    if(pt[ai.y][ai.x]=='O'){
        ai.finish=true;
        ai.goback=true;
        ai.crossdone=true;
        ai.combo=0;
    }
    if(valid==true){
        ai.cx=ai.x+48;
        ai.cy=ai.y+65;
        cout<<"ai fire "<<ai.cy<<ai.cx<<"\n";
        if(pt[ai.y][ai.x]!=' '){
            pt[ai.y][ai.x]='X';
            cout<<"Hit!!!\n";
            ai.done=true;
            ai.combo++;
            as->hit++;
        }
        else{
            pt[ai.y][ai.x]='O';
            cout<<"Miss...\n";
```

```
                    ai.done=true;
                    ai.oneend=true;
                    ai.oppcombo++;
                    as->miss++;
                }
            }
        }
        else{     //check ->GO TO OPPCOMBO
//                cout<<"next xy invalid change to opposite side\n";
            ai.combo=0;
            ai.oneend=true;
            ai.crossdone=true;
            ai.oppcombo++;
            ai.combohit=false;
        }
    }
    if(ai.hy==ai.y){
//            cout<<"same y\n";
        if(ai.hx>ai.x) ai.x=ai.hx-ai.combo-1;
        else ai.x=ai.hx+ai.combo+1;
        if(ai.x<0 || ai.x >9){
        valid=false;
        ai.combo=0;
        ai.goback=true;
        ai.finish=true;
        }
        if(valid==true){
```

```
                if(pt[ai.y][ai.x]=='X' || pt[ai.y][ai.x]=='O'){
                    valid=false;
                    ai.finish=true;
                    ai.goback=true;
                }
                if(valid==true){
                    ai.cx=ai.x+48;
                    ai.cy=ai.y+65;
                    cout<<"ai fire "<<ai.cy<<ai.cx<<"\n";
                    if(pt[ai.y][ai.x]!=' '){
                        pt[ai.y][ai.x]='X';
                        ai.combo++;
                        ai.done=true;
                        as->hit++;
                    }
                    else{
                        pt[ai.y][ai.x]='O';
                        cout<<"Miss...\n";
                        ai.done=true;
                        ai.oneend=true;
                        ai.oppcombo++;
                        ai.combo=0;
                        ai.combohit=false;
//                          cout<<"oneend==true\n";
//                          cout<<"done==true\n";
                        as->miss++;
                    }
```

```
                }
            }
            if(valid==false){     //GO TO OPPCOMBO
//                cout<<"next xy inlvalid change to other side\n";
                ai.combo=0;
                ai.oneend=true;
                ai.crossdone=true;
                ai.oppcombo++;
                ai.combohit=false;
            }
        }
    }
    else if(ai.oppcombo>0 && ai.oneend==true && ai.done==false){  //check other side
//          cout<<"one side end check other side\n";
//          cout<<"oppcombo = "<<ai.oppcombo<<endl;
        if(ai.hx==ai.x){
//              cout<<"same X\n";
            if(ai.combohit==false){
                if(ai.hy>ai.y) ai.y=ai.hy+ai.oppcombo;
                else ai.y=ai.hy-ai.oppcombo;
            }
            else{
                if(ai.y>ai.hy) ai.y=ai.hy+ai.oppcombo;
                else ai.y=ai.hy-ai.oppcombo;
            }
                cout<<ai.y<<ai.x<<endl;
            if(ai.y<0 || ai.y>num-1 || pt[ai.y][ai.x]=='O' || pt[ai.y][ai.x]=='X'){
```

```
                ai.oppcombo=0;
                ai.goback=true;
                ai.finish=true;
                ai.crossdone=true;
                ai.combo=0;
                ai.done=false;
//                cout<<"overlap or oversize\n";
            }
            else{
                ai.cx=ai.x+48;
                ai.cy=ai.y+65;
                cout<<"ai fire "<<ai.cy<<ai.cx<<"\n";
                if(pt[ai.y][ai.x]!=' '){
                    pt[ai.y][ai.x]='X';
                    cout<<"Hit!!!\n";
                    ai.done=true;
                    ai.oppcombo+=1;
                    ai.combohit=true;
                    as->hit++;
                }
                else{
                    pt[ai.y][ai.x]='O';
                    cout<<"Miss...\n";
                    ai.done=true;
                    ai.combo=0;
                    ai.oppcombo=0;
                    ai.finish=true;
```

```
                ai.goback=true;
                ai.crossdone=true;
                as->miss++;
            }
        }
    }
    else if(ai.hy==ai.y){
//          cout<<"same y\n";
        if(ai.combohit==false){
            if(ai.hx>ai.x) ai.x=ai.hx+ai.oppcombo;
            else ai.x=ai.hx-ai.oppcombo;
        }
        else{
            if(ai.x>ai.hx) ai.x=ai.hx+ai.oppcombo;
            else ai.x=ai.hx-ai.oppcombo;
        }
//          cout<<ai.y<<ai.x<<endl;
        if(ai.x<0 || ai.x>num-1 || pt[ai.y][ai.x]=='O' || pt[ai.y][ai.x]=='X'){
            ai.oppcombo=0;
            ai.goback=true;
            ai.finish=true;
            ai.crossdone=true;
            ai.combo=0;
            ai.done=false;
//              cout<<"overlap or oversize\n";
        }
        else{
```

```
            ai.cx=ai.x+48;
            ai.cy=ai.y+65;
            cout<<"ai fire "<<ai.cy<<ai.cx<<"\n";
            if(pt[ai.y][ai.x]!=' '){
               pt[ai.y][ai.x]='X';
               cout<<"Hit!!!\n";
               ai.done=true;
               ai.oppcombo+=1;
               ai.combohit=true;
               as->hit++;
            }
            else{
               pt[ai.y][ai.x]='O';
               cout<<"Miss...\n";
               ai.done=true;
               ai.combo=0;
               ai.oppcombo=0;
               ai.finish=true;
               ai.goback=true;
               ai.crossdone=true;
               as->miss++;
            }
         }
      }
   }
}while(ai.done==false);
```

```
    for(int i=0;i<num;i++){     //check over
        for(int j=0;j<num;j++){
            if(pt[i][j]>='2' && pt[i][j]<='5')
                ai.over=false;
        }
    }
    if(ai.over==false) turn=1;
    else turn=4;
    //table
    table(pt, fake, real, num);
    return turn;
}
void getstates(PlayerS *ps){
    fstream io;
    float pttl=0; //total fire
    float pac;     //accuracy
    char pr;       //player rank
    pttl=ps->hit+ps->miss;
    pac=(ps->hit)/pttl;
    if(pac>90) pr='S';
    else if(pac>80) pr='A';
    else if(pac>70) pr='B';
    else if(pac>60) pr='C';
    else if(pac>50) pr='D';
    else if(pac>40) pr='E';
    else pr='F';
    io.open("accuracy.txt", ios::out | ios::binary);
```

```
    if(io.fail())
        cout<<"Open fail\n";
    else{
        char m1[]={'R', 'a', 'n', 'k', '='};
        io.write(m1, sizeof(m1));
        io.write(&pr,sizeof(pac));
        io.close();
    }
}
//1s delay for ai turn
void pause(){
    time_t start, end;   //delay display ai fire

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

Code – Player.h

```
/*
 * File:   Player.h
 * Author: Tsz, Kwan
 *
 * Created on September 25, 2014, 11:49 AM
 */

#ifndef PLAYER_H
```

```
#definePLAYER_H

struct PlayerT{
    char **pt;
};
struct PlayerG{
    int unit[5];
    int x1, x2, y1, y2;
};
//Status
struct PlayerS{
    float hit;
    float miss;
};
#endif  /* PLAYER_H */
```

Code – AI.h

```
/*
 * File:    AI.h
 * Author: Tsz, Kwan
 *
 * Created on September 30, 2014, 10:34 AM
 */

#ifndef AI_H
#defineAI_H
struct AIT{
    char **fake, **real;
```

```
};
struct AIG{
    bool over;
    bool done;
    bool cross[4];
    bool crossdone;
    bool goback;
    int hx, hy, x, y;
    bool finish;
    int oppcombo;
    int combo;
    char cx, cy;
    bool hit;
    bool oneend;
    bool combohit;
};
struct AIS{
    float miss, hit;
};



#endif  /* AI_H */
```