The Report Of C++ Programming AS3 For EEE102 Module

Yifan.Wei(1612635)

May 7, 2018

1 Introduction

This report is about the process of realize a simple C++ Monopoly. And this report would follow the software development process (SDP) structure to introduce the realization of such project.

2 Problem Statement

This problem is to realize a Monoply game by C++ with following features:

- This game is played by 2 players (You and the computer)
- Every player must set up an account first with starting deposit 10000. This means that you need to set up a data base (a file) which records the players' information, for example, name, gender and account balance etc. and the program is supposed to be able to track the balance changes as the game is going.
- Game play on a game board which have several squares (80 for example) and price tag for them (price randomly from 10-500$). Moreover, the map need a starting point at the corner. The player's balance will increase 200 when pass through the starting point.
- In each round player take turns to roll dice (1-6) then go head. Get the no owner block, player could buy it. If the block belongs to the player himself/herself the block can be invest to a higher level (max level 4, cost half price of the block itself).
- If the player enters opponent's block, the player would be fine. You will be fined by 10% of the square price if this square is occupied by your opponent and the adjacent squares are unoccupied or occupied by you. This fine will be increased to 15% if one of the adjacent squares is also occupied by your opponent (which means you opponent has purchased 2 consecutives squares) and further to 20% if both of the adjacent squares are also occupied by your opponent (which means you opponent has purchased 3 consecutives squares). The fine is topped at 20% of the square price even if more than 3 consecutive squares have been occupied by your opponent. The fine for each square can be further increased by 5% if the owner decides to invest on the square he/she has just bought off.
- The game ends when either one of the players declares bankruptcy (the balance <=0). or you have chosen to quit the game. You should design and implement at least 3 classes (objects).
- Bonus points: your program can resume a game which was played half way through last time and saved to the database.
- Note: you need to make your coding comments as you go

3 Analysis

- The player can input the name and operation in the game
- Data related to player include name, balance in the account.

- The AI could run by itself
- The game would display the map during time goes
- The map would include different block with different price. Each block has the serial number, price, owner name, investment level.
- The game need to display the player situation during the time goes
- The game could output the key information to outer file so that realize the save game module.
- When a player run out of all the money, He/she will be the loser and the game come to the end.

4 Design

4.1 Game rule set and change

To get better experience, I changed some of the game rules, the basic structure is similar to the origin one.

(1) The price range of each block adjust to 100-500 because the price below 100 is too low.

(2) The starting point is at the left upper corner to fit the custom

(3) The block number adjust to 20 because 80 block would make the game spend long time.

(4) The cost calculate system: **cost= map[n].getPrice() * (0.1+0.05 * checkneighbor(n)+0.05*map[n].getInvest()**; Remove the upper limit of the cost, for a block, cost 10%, each near opponent block and investment will increase it 5%.

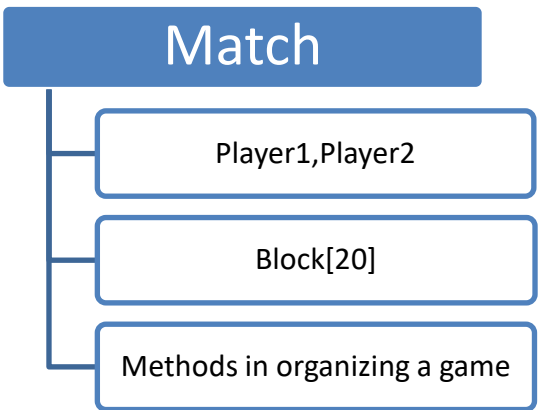
4.2 Structure of the game project

The game is designed into 3 classes.

Player class used to store the deposit and name of the player and operation about them.

Block class used to save the information of the block, such as the price, the investment level, the owner name. Moreover it contain the functions and variables about the starting point the variable property is use to describe the block is starting point or not, the starting point cannot be bought and display start during the game and player go through it can get bonus.

Match class used to package the game. Initialize a match class is to initialize a new game, which include an array of 20 which include 20 blocks in the game, 2 players, the methods of operation about the game such as each round, starting menu and save, load modules.



4.3 Code procedure

The procedure would follow the game structure.

First, finish the player class variable and the methods about changing of them during the game such buy, invest, spend money on opponent's block.

Second, finish the block class with the methods of change the variables used in the game such as buy, invest, get bonus at the starting point.

Thirdly, combination the two classes element then get a new class called match which include all the elements and menu methods including the interaction parts such dis play the map, ask the player to buy or invest the block, ask the player to save game, display the change of money.

Finally, write the main function to generate game object to run the game.

4.4 Class Player

There are 3 variable in player class, name (record player name), money(money on the account) and location (player's location in the map).

Methods about player can divide into 4 types: Basic functions (constructor and destructor), Get value functions (get the private variable of the class), game operation functions such as go(int a) which can receive dice value from game then change the location of player, moneyChange(int a) which can be used in money change during game to add the player's money value a.

Player.h

AS3

```cpp
//#define _Player

#include <iomanip>      // use for setting field width
#include <time.h>       // use for generating random factor
#include <iostream>
#include <string>
class Player
{
public:
    //==================================================================
    //Basic functions
    ~Player();//distructor
    Player();//defult construct
    Player(std::string a);//generate player with input name
    //==================================================================
    //Get value functions
    int getmoney();//get the money of the player
    int getlocation();//get the location of player
    std::string getname();//get the player name

    //==================================================================
    //Game operation functions
    void getbonus();//get bonus when pass the starting point
    void moneyChange(int a);//change the money in the account
    void go(int a);//player walk in the map
    bool defeat();//judeg the player defeat or not return 1 for death

    //==================================================================
    //set value functions used in loading
    void setLocation(int a);
    void setMoney(int a);
    void setName(std::string a);

    //==================================================================
    //data
    int location;//record the location of player

private:

    //==================================================================
    //data
    int money; // money in account
    std::string name;
};

//#endif
```

4.5 Class Block

There are 7 variables in the class, the use of them could be seen in the following picture.

Methods can also divide into 4 types like the class player. Constructor would randomly give the block a price. Get functions just return the value packaged in the class. Operate functions include set start point which change the property so that it cannot be buy and show start. Moreover, it has investigated function used to add investment level. InvestgateJudge is used to limit the max level of the investment. Functions used to load the game include the set function of every variable needed which would be used in loading.

Block.h Player.h

AS3 (全局范

```
class Block
{
public:
    //==================================================================
    //Basic function
    Block::Block();             //defult constructor
    Block(int a);               //genarate new block with serial number
    ~Block();                   //Defult distructor

    //==================================================================
    //Get value function
    int getPrice();             //get the price of block
    int getInvest();            //get the investment situation
    bool getPro();              //get the property of the block
    std::string getowner();     //return owner

    //==================================================================
    //Oprational function
    void setStartPoint(bool a); //set property of starting point
    void setStartPoint();       //set the start point property to 1
    void bonuss(Player p);      //give player bonus when pass the starting point
    void buy(Player a);         //set new owner of the block
    void investigate(Player a); //investigate the block
    bool investJudge();         //judge whether the location can be invest because the upper limit of investment
    void changeOwner(std::string a);//change the owner when buy the block
    int getblocknumber();       //get the block number

    //==================================================================
    //function used to load game
    void loadBlock(int bn, int pr, int in, bool pro, std::string o);//used by loading module
    void setBlocknumber(int a); //set the block number of this block
    void setPrice(int a);       //set the price of this block
    void setInvestment(int a);  //set the investment level of this block
    void setProperty(bool a);   //set the property of this block
    void setOwner(std::string a);//set the owner of this block

private:
    int blocknumber;            //save the number of block
    int price;                  //save the price of block
    int investment;             // save the investment time
    bool property;              //property to distinguish start block(with out price) and normal block
    int priceRrange = 500;      // set the range of block price
    int investmentUL = 4;       // set the upper limit of investment
    std::string owner="NA";     //inicialize the owner, this used to save the owner name
};

//#endif
```

4.6 Class Match

Match is a class packaging the game.

This class include many game setting variable such as dice (to set the dice range), blocknum (to set the amount of block), bonus(set the bonus when pass through the starting point).

Other variables are the 2 players and the array map with 20 blocks in it.

The constructor could initialize the variables of player and block into the value at the game start. StartMenu function is used to open a new game. Round is a game round and it will loop until a player lose the game. GameSave is run in every round to ask the player save or not ant it could save the crucial information about player and block into a txt file. gameLoad could set up a new game then load from txt finally set the value into the game object which could realize the load function.

There are some display function used to display the situation of the game, such as display the map, display the player's situation which would used in the interaction between computer and player. The standerString function is used to make all the string show in the map be length of 3 in order to avoid the overflow of map square.

Block.cpp Player.cpp Match.cpp Match.h Block.h

AS3 (全局范围)

```cpp
#include "Block.h"
//#include < vector>
#include "Match.h"
#include <string>                //Support the output of string
#include <fstream>

class Match
{
public:
    //=================================================================
    //Basic function
    Match();//The cunstructor
    ~Match();//The distructor
    //=================================================================
    //Menu function
    void startMenu();            //start menu
    void round();                //Round of the player and the AI which will loop during the game
    void saveOrnot();            //ask the user to save the game
    void gameLoad();             //Load game from file
    void gameSave();             //Save game to file
    //=================================================================
    //Dis play function used in menu
    void display();              //display the situation of player
    void mapdisplay();           //display the game map
    void mapdisplay2();
    std::string standerString(std::string a);// used to change the string into needed length
    void displayBlock(int a);        //Display the situation of the block
    //=================================================================
    //Calculate function used in menu
    int checkneighbor(int n);   //check the neighbor number
    int calculateCost(int n);   //calculate the cost in this block
    //=================================================================
    //Varibles
    int dice = 6;
    int blocknumm=20;            //set the block number of the game
    int bouns = 200;             //set the bonus get at the start block
private:
    //=================================================================
    //Varibles
    Player player;               //The player class to save player
    Player AI;                   //The player class to save AI
    Block map[20];               //Use array to save the blocks in the game
    //=================================================================
    //learning note
    //std::vector <Block> map;
    //Match &match;                //Why this can not use->(Can not inincialize it self)
};
```

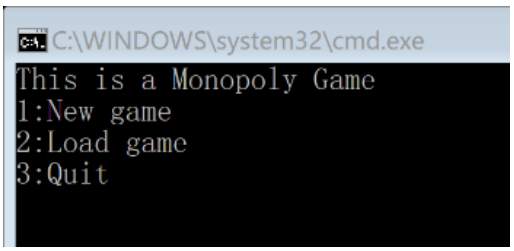
5 Implementation

- AS3 project file solve the problem.
- AS3.cpp include main function of the game outer menu.
- Match.h and Match.cpp are the header and the source of match class which packaging the inner menu and related function of the game.
- Block.h and Block.cpp are the header and the source of Block class which used to save the imformation and related operations of blocks in the game.
- Player.h and Player.cpp are the header and the source of Player class which used to save the data and operation of each player in the game.

6 Testing

First test the run of the game

Start menu



New game (press 1)

```
C:\WINDOWS\system32\cmd.exe
Please Input your name
```

Start a new game

Player can see the map with block owner, block price and block serier number. The ditail of player and AI are showed in the right side of the map

```
C:\WINDOWS\system32\cmd.exe
|-------------------------------|   KSK
|STA|NA |NA |NA |NA |NA |NA |NA |
|141|167|434|200|469|224|378|258|
|000|001|002|003|004|005|006|007|   Money:10000
|-------------------------------|
|NA |                       |NA |   Location:0
|336|                       |262|
|019|        Monopoly       |008|
|---|                       |---|
|NA |                       |NA |
|127|                       |164|
|018|                       |009|   AI
|---|                       |---|
|NA |NA |NA |NA |NA |NA |NA |NA |   Money:10000
|442|295|191|461|127|181|245|205|
|017|016|015|014|013|012|011|010|
|-------------------------------|   Location:0
press Enter to roll the dice.
请按任意键继续. . .
KSK go head 2 step and get 2 .
|-----------------------|
|Block Information:     |
|-----------------------|
|Number: 2
|Owner: NA
|Price: 434
|Invest Level: 0
|-----------------------|
This block belongs to NA
 Investigate: 0
```

Roll the dice then get a block, the screen will show the block fully information, when get a block without owner, the system will ask you to buy it.

```
C:\WINDOWS\system32\cmd.exe
|-------------------------------|   KSK
|STA|NA |NA |NA |NA |NA |NA |NA |
|141|167|434|200|469|224|378|258|
|000|001|002|003|004|005|006|007|   Money:10000
|-------------------------------|
|NA |                       |NA |   Location:2
|336|                       |262|
|019|        Monopoly       |008|
|---|                       |---|
|NA |                       |NA |
|127|                       |164|
|018|                       |009|   AI
|---|                       |---|
|NA |NA |NA |NA |NA |NA |NA |NA |   Money:10000
|442|295|191|461|127|181|245|205|
|017|016|015|014|013|012|011|010|
|-------------------------------|   Location:0
Would you like to buy block [2] (it will cost 434)?
y or n
```

Input y then get the block

```
Would you like to buy block [2] (it will cost 434)?
y or n
y
You buy 2 with 434
Your money remain 9566
请按任意键继续. . .
```

Next you will see the map change. Then, it's the AI's turn, AI buy block 5, the change of money and map will be applied in the next page.

```
C:\WINDOWS\system32\cmd.exe
|-------------------------------|    KSK
|STA|NA |KSK|NA |NA |NA |NA |NA |
|141|167|434|200|469|224|378|258|
|000|001|002|003|004|005|006|007|    Money:9566
|-------------------------------|
|NA |                           |NA |    Location:2
|336|                           |262|
|019|        Monopoly           |008|
|---|                           |---|
|NA |                           |NA |
|127|                           |164|
|018|                           |009|    AI
|---|                           |---|
|NA |NA |NA |NA |NA |NA |NA |NA |    Money:10000
|442|295|191|461|127|181|245|205|
|017|016|015|014|013|012|011|010|
|-------------------------------|    Location:0
AI go head 5 step and get 5 .
|-----------------------|
|Block Information:     |
|-----------------------|
|Number: 5
|Owner: NA
|Price: 224
|Invest Level: 0
|-----------------------|
AI buy 5 with 224
AI money remain 9776
请按任意键继续. . .
```

Next page

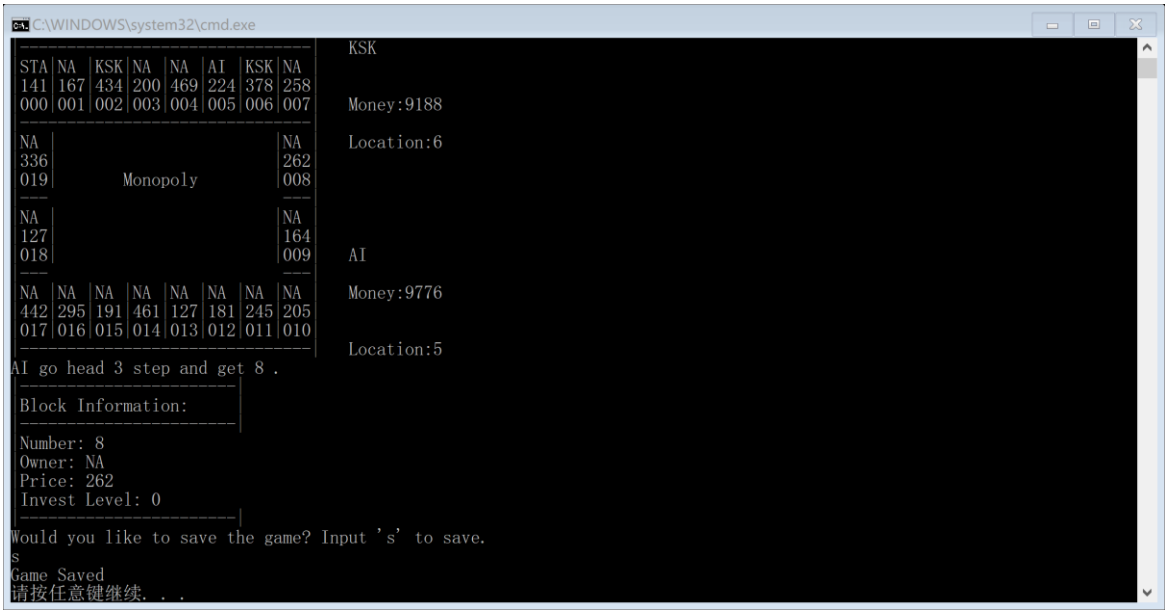
```
C:\WINDOWS\system32\cmd.exe
|-------------------------------|    KSK
|STA|NA |KSK|NA |NA |AI |NA |NA |
|141|167|434|200|469|224|378|258|
|000|001|002|003|004|005|006|007|    Money:9566
|-------------------------------|
|NA |                           |NA |    Location:2
|336|                           |262|
|019|        Monopoly           |008|
|---|                           |---|
|NA |                           |NA |
|127|                           |164|
|018|                           |009|    AI
|---|                           |---|
|NA |NA |NA |NA |NA |NA |NA |NA |    Money:9776
|442|295|191|461|127|181|245|205|
|017|016|015|014|013|012|011|010|
|-------------------------------|    Location:5
press Enter to roll the dice.
请按任意键继续. . .
```

You can see the map and number refresh

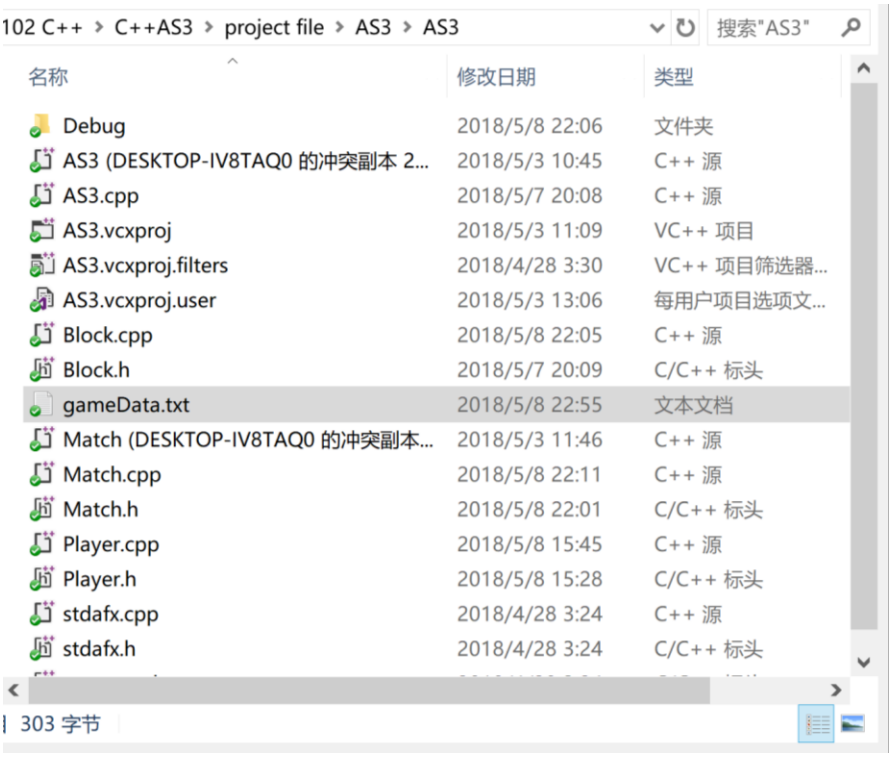
In the end of each round the system would ask you to save the game

```
C:\WINDOWS\system32\cmd.exe
|-------------------------------|    KSK
|STA|NA |KSK|NA |NA |AI |KSK|NA |
|141|167|434|200|469|224|378|258|
|000|001|002|003|004|005|006|007|    Money:9188
|-------------------------------|
|NA |                           |NA |    Location:6
|336|                           |262|
|019|        Monopoly           |008|
|---|                           |---|
|NA |                           |NA |
|127|                           |164|
|018|                           |009|    AI
|---|                           |---|
|NA |NA |NA |NA |NA |NA |NA |NA |    Money:9776
|442|295|191|461|127|181|245|205|
|017|016|015|014|013|012|011|010|
|-------------------------------|    Location:5
AI go head 3 step and get 8 .
|-----------------------|
|Block Information:     |
|-----------------------|
|Number: 8
|Owner: NA
|Price: 262
|Invest Level: 0
|-----------------------|
Would you like to save the game? Input 's' to save.
```

Press to save and system will show the massage



It will be saved in a txt file



The first and second line record the players name and the money. Next lines record the information of blocks.

gameData.txt - 记事本

文件(F) 编辑(E) 格式(O) 查看(V) 帮助(H)

```
6 9188 KSK
8 9776 AI
0 START 0 141 1
1 NA 0 167 0
2 KSK 0 434 0
3 NA 0 200 0
4 NA 0 469 0
5 AI 0 224 0
6 KSK 0 378 0
7 NA 0 258 0
8 NA 0 262 0
9 NA 0 164 0
10 NA 0 205 0
11 NA 0 245 0
12 NA 0 181 0
13 NA 0 127 0
14 NA 0 461 0
15 NA 0 191 0
16 NA 0 295 0
17 NA 0 442 0
18 NA 0 127 0
```

Close the game, then start the game, input 2 load game

C:\WINDOWS\system32\cmd.exe

```
This is a Monopoly Game
1:New game
2:Load game
3:Quit
2
Load Successful
请按任意键继续. . .
```

Then you can see the data will be back

C:\WINDOWS\system32\cmd.exe

```
|-------------------------------|   KSK
|STA|NA |KSK|NA |NA |AI |KSK|NA |
|141|167|434|200|469|224|378|258|
|000|001|002|003|004|005|006|007|   Money:9188
|-------------------------------|
|NA |                       |NA |   Location:6
|336|                       |262|
|019|        Monopoly       |008|
|---|                       |---|
|NA |                       |NA |
|127|                       |164|
|018|                       |009|   AI
|---|                       |---|
|NA |NA |NA |NA |NA |NA |NA |NA |   Money:9776
|442|295|191|461|127|181|245|205|
|017|016|015|014|013|012|011|010|
|-------------------------------|   Location:8
press Enter to roll the dice.
请按任意键继续. . .
```

Here add the procedure of testing the save/load module in the earlier version

Testing the save

```
C:\WINDOWS\system32\cmd.exe
-----------------------
ST|NA|KS|NA|NA|NA|NA|KS
00|01|02|03|04|05|06|07
-----------------------
NA                    NA
19      Monopoly      08
-----------------------
NA                    NA
18                    09
-----------------------
NA|NA|NA|NA|NA|NA|NA|NA
17|16|15|14|13|12|11|10
-----------------------

KSK

Money:9308

Location:7

AI

Money:9566

Location:2

AI go head 3 step and get 5 .
Would you like to save the game? Input 's' to save.
s
Game Saved
请按任意键继续. . .
```

```
gameData.txt - 记事本
文件(F) 编辑(E) 格式(O) 查看(V) 帮助(H)
7 9308 KSK
5 9566 AI
0 ST 0 141 1
1 NA 0 167 0
2 KSK 0 434 0
3 NA 0 200 0
4 NA 0 469 0
5 NA 0 224 0
6 NA 0 378 0
7 KSK 0 258 0
8 NA 0 262 0
9 NA 0 164 0
10 NA 0 205 0
11 NA 0 245 0
12 NA 0 181 0
13 NA 0 127 0
14 NA 0 461 0
15 NA 0 191 0
16 NA 0 295 0
17 NA 0 442 0
18 NA 0 127 0
```

Testing the load

First test the load function

```
std::ifstream fin;
fin.open("gameData.txt");//open the file
std::string a;
std::string b;
std::string c;
std::string c1;
std::string c2;
std::string c3;
std::string c4;
if (fin.is_open()) {
    //Code to test read
    fin >> a;
    fin >> b;
    fin >> c;
    fin >> c1;
    fin >> c2;
    fin >> c3;
    fin >> c4;
    std::cout << a << b << c << c1 << c2 << c3 << c4 <<std::endl;
}
else //no file finding
{
    std::cout << "no such file" << std::endl;
    return;
}
```

```
This is a Monopoly Game
1:New game
2:Load game
3:Quit
2
79308KSK59566AI0
请按任意键继续. . .
```

Load is word by word so set the load function, finally test it

```
This is a Monopoly Game
1:New game
2:Load game
3:Quit
2
Load Successful
请按任意键继续. . .
```

```
-----------------------
ST|NA|KS|NA|NA|NA|NA|KS
00|01|02|03|04|05|06|07
-----------------------
NA                    NA
19      Monopoly      08
-----------------------
NA                    NA
18                    09
-----------------------
NA|NA|NA|NA|NA|NA|NA|NA
17|16|15|14|13|12|11|10
-----------------------

KSK

Money:9308

Location:7

AI

Money:9566

Location:5

press Enter to roll the dice.
请按任意键继续. . .
```

The load without wrong

Then test the invest:
When player got the player's block

```
C:\WINDOWS\system32\cmd.exe
STA NA  KSK KSK AI  AI  KSK NA
141 167 434 200 469 224 378 258
000 001 002 003 004 005 006 007     Money:7651
-------------------------------
NA                          KSK     Location:3
336                         262
019         Monopoly        008
---                         ---
AI                          NA
127                         164
018                         009     AI
---                         ---
KSK NA  KSK KSK AI  KSK NA  NA      Money:9210
442 295 191 461 127 181 245 205
017 016 015 014 013 012 011 010
-------------------------------     Location:7
press Enter to roll the dice.
请按任意键继续. . .
KSK go head 5 step and get 8 .
----------------------
Block Information:
----------------------
Number: 8
Owner: KSK
Price: 262
Invest Level: 0
----------------------
This block belongs to KSK
 Investigate: 0
请按任意键继续. . .
```

The system will ask you to invest.

```
C:\WINDOWS\system32\cmd.exe
-------------------------------     KSK
STA NA  KSK KSK AI  AI  KSK NA
141 167 434 200 469 224 378 258
000 001 002 003 004 005 006 007     Money:7651
-------------------------------
NA                          KSK     Location:8
336                         262
019         Monopoly        008
---                         ---
AI                          NA
127                         164
018                         009     AI
---                         ---
KSK NA  KSK KSK AI  KSK NA  NA      Money:9210
442 295 191 461 127 181 245 205
017 016 015 014 013 012 011 010
-------------------------------     Location:7
Would you like to investigate (it will cost 131)?
y or n
y
```

After investing, the block would level up

```
Would you like to investigate (it will cost 95)?
y or n
y
You investigate 15 with 95 and it level up to 1
Your money remain 6831
请按任意键继续. . .
```

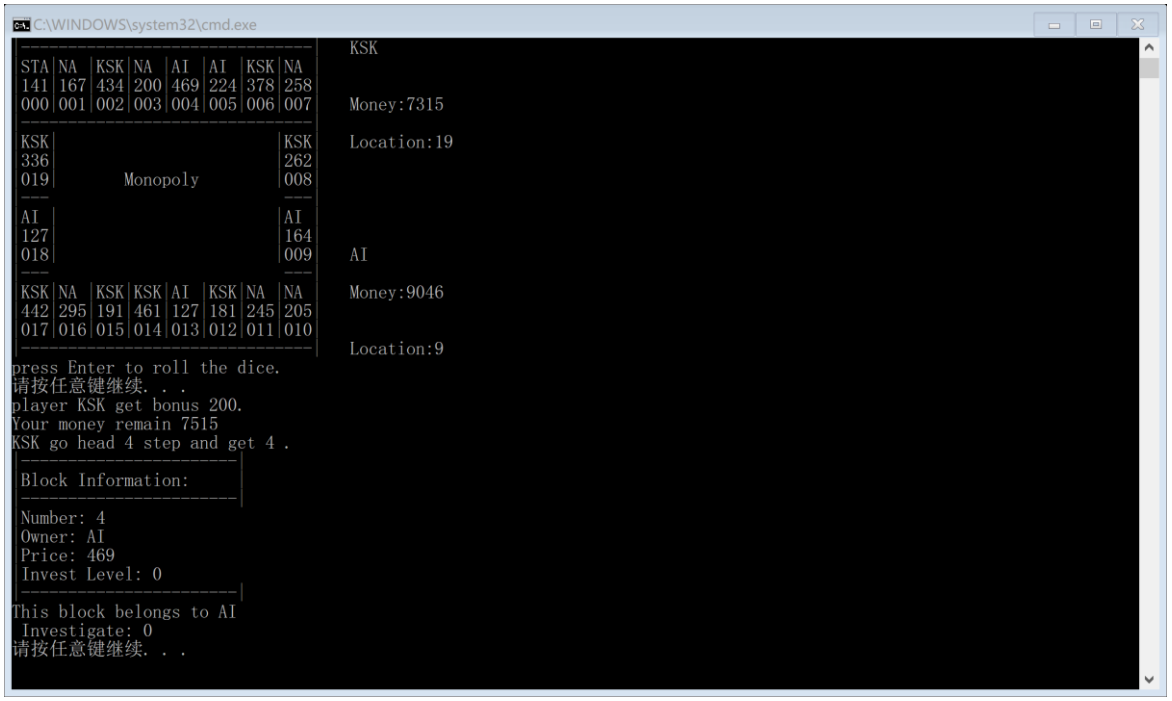
```
C:\WINDOWS\system32\cmd.exe
|141|167|434|200|469|224|378|258|
|000|001|002|003|004|005|006|007|    Money:6926
|-----------------------------|
|KSK|                         |KSK|    Location:11
|336|                         |262|
|019|        Monopoly         |008|
|---|                         |---|
|AI |                         |AI |
|127|                         |164|
|018|                         |009|    AI
|---|                         |---|
|KSK|NA |KSK|KSK|AI |KSK|KSK|NA |    Money:8959
|442|295|191|461|127|181|245|205|
|017|016|015|014|013|012|011|010|
|-----------------------------|    Location:18
player AI get bonus 200.
AI money remain 9159
请按任意键继续. . .
AI go head 5 step and get 4 .
|----------------------|
|Block Information:    |
|----------------------|
Number: 4
Owner: AI
Price: 469
Invest Level: 0
|----------------------|
AI investigate 4 with 234 and it level up to 1
AI money remain 9037
请按任意键继续. . .
```

AI could invest, too.

AI get bonus through the starting point.
AI spend money on the opponent's block.

```
C:\WINDOWS\system32\cmd.exe
|000|001|002|003|004|005|006|007|    Money:8093
|-----------------------------|
|NA |                         |KSK|    Location:15
|336|                         |262|
|019|        Monopoly         |008|
|---|                         |---|
|AI |                         |NA |
|127|                         |164|
|018|                         |009|    AI
|---|                         |---|
|NA |NA |KSK|KSK|AI |KSK|NA |NA |    Money:9522
|442|295|191|461|127|181|245|205|
|017|016|015|014|013|012|011|010|
|-----------------------------|    Location:18
player AI get bonus 200.
AI money remain 9722
请按任意键继续. . .
AI go head 3 step and get 2 .
|----------------------|
|Block Information:    |
|----------------------|
Number: 2
Owner: KSK
Price: 434
Invest Level: 0
|----------------------|
AI money remain 9679
请按任意键继续. . .
Would you like to save the game? Input 's' to save.
y
```

Player get bonus through the starting point.
Player spend money on opponent's block.



When a player spends out all the money, the other will win then game over.