CS205 C/ C++ Programming - Assignment3

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Question1- Analysis

Quesiton describtion:

The question gives us the initial **position** of the bulets and the **direction vector** of the bullets, we need to calculate the **safe points** left in the screen.

Solution:

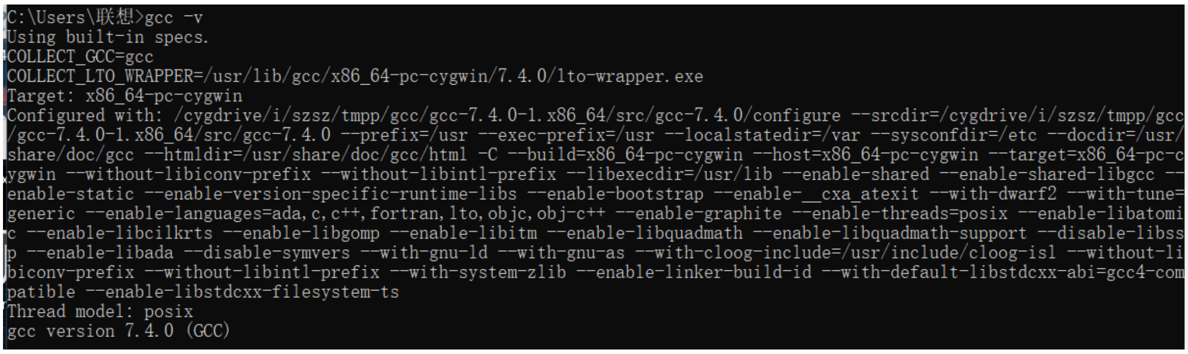
1. Read the arguments and initial a boolean array, where false denote a safe point since at first every point is safe and boolean array is all false.
2. Read the information about the bullets,including x,y,direction vector and define a check function to update the state of the point.

   The implementation of check() function: for each start point(x0,y0) of a bullet, it will make all points whose coordinate satisfy**(x0+*ide1,y0+*jde2)**,so each time, update the state of this points.
3. Traverse the array to get the answer.

Question1- Code

My tool: VSCode

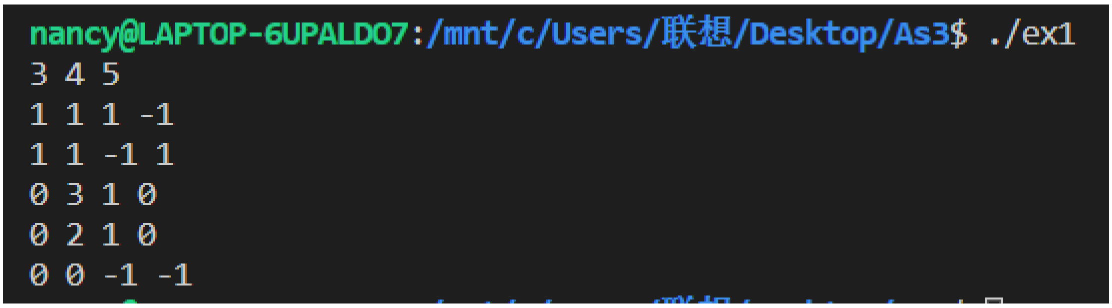
My develop environment is:



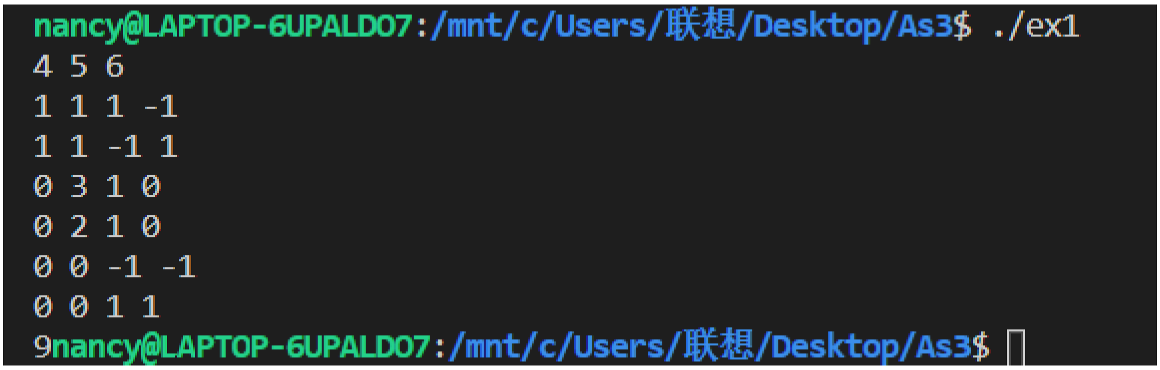
```
C:\Users\联想>gcc -v
Using built-in specs.
COLLECT_GCC=gcc
COLLECT_LTO_WRAPPER=/usr/lib/gcc/x86_64-pc-cygwin/7.4.0/lto-wrapper.exe
Target: x86_64-pc-cygwin
Configured with: /cygdrive/i/szsz/tmpp/gcc/gcc-7.4.0-1.x86_64/src/gcc-7.4.0/configure --srcdir=/cygdrive/i/szsz/tmpp/gcc
/gcc-7.4.0-1.x86_64/src/gcc-7.4.0 --prefix=/usr --exec-prefix=/usr --localstatedir=/var --sysconfdir=/etc --docdir=/usr/
share/doc/gcc --htmldir=/usr/share/doc/gcc/html -C --build=x86_64-pc-cygwin --host=x86_64-pc-cygwin --target=x86_64-pc-c
ygwin --without-libiconv-prefix --without-libintl-prefix --libexecdir=/usr/lib --enable-shared --enable-shared-libgcc --
enable-static --enable-version-specific-runtime-libs --enable-bootstrap --enable-__cxa_atexit --with-dwarf2 --with-tune=
generic --enable-languages=ada,c,c++,fortran,lto,objc,obj-c++ --enable-graphite --enable-threads=posix --enable-libatomi
c --enable-libcilkrts --enable-libgomp --enable-libitm --enable-libquadmath --enable-libquadmath-support --disable-libss
p --enable-libada --disable-symvers --with-gnu-ld --with-gnu-as --with-cloog-include=/usr/include/cloog-isl --without-li
biconv-prefix --without-libintl-prefix --with-system-zlib --enable-linker-build-id --with-default-libstdcxx-abi=gcc4-com
patible --enable-libstdcxx-filesystem-ts
Thread model: posix
gcc version 7.4.0 (GCC)
```

```cpp
#include<iostream>
using namespace std;

void check(bool** p,int n,int m,int x,int y,int de1,int de2)
{
    for (int i=0 ; x<n&&y<m; i++)
    {
        if (x<0||y<0)
        {
            return;
        }
        *(*(p+x)+y)=true;
        x+=de1;
        y+=de2;
    }

}
int main()
{
    int n,m,k,result=0;
    cin>>n;
    cin>>m;
    cin>>k;
    bool** a=new bool*[n];
    for (int i = 0; i < n; i++)
    {
        a[i]=new bool[m];
    }
    for (int i = 0; i < k; i++)
    {
        int x,y,de1,de2;
        cin>>x;
        cin>>y;
        cin>>de1;
        cin>>de2;
        if (x>=n||y>=m||x<0||y<0)
        {
            cout<<"The bullets are out of the screen !"<<endl;
            i--;
            continue;
        }


        check(a,n,m,x,y,de1,de2);
    }



    for (int i = 0; i < n; i++)
    {
        for (int j = 0; j < m; j++)
        {
            if (*(*(a+i)+j)==0)
            {
                result++;
            }
        }
    }
    cout<<result;
    delete(a);
    return 0;
}
```

Question1- Result & Verification

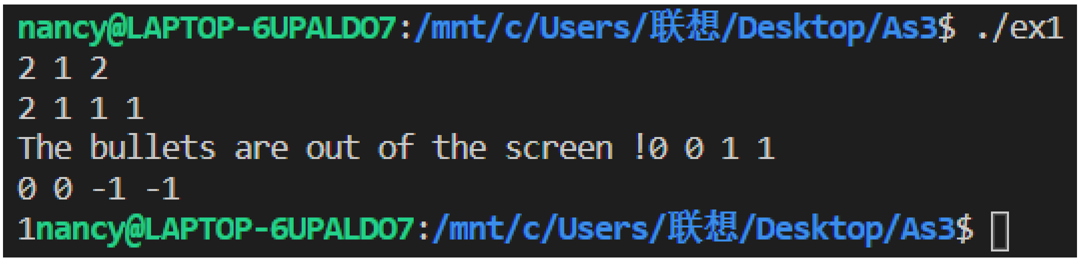


```
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3$ ./ex1
3 4 5
1 1 1 -1
1 1 -1 1
0 3 1 0
0 2 1 0
0 0 -1 -1
```



```
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3$ ./ex1
4 5 6
1 1 1 -1
1 1 -1 1
0 3 1 0
0 2 1 0
0 0 -1 -1
0 0 1 1
9nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3$
```

if the positon of the bullets are **out of the screen**, there's will be a reminder and ask user to input new positon.

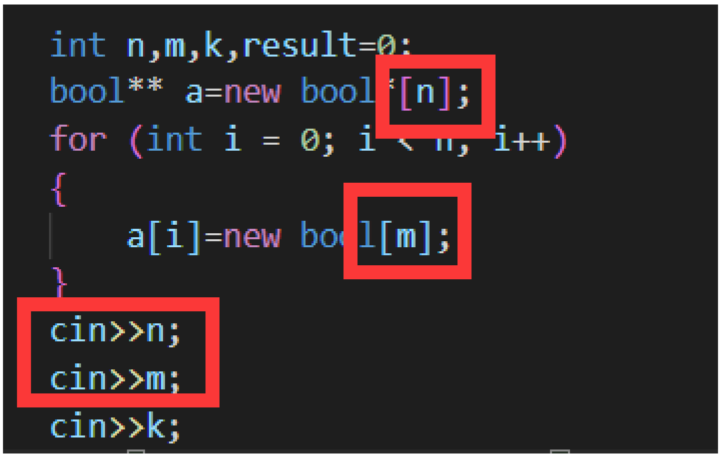


```
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3$ ./ex1
2 1 2
2 1 1 1
The bullets are out of the screen !0 0 1 1
0 0 -1 -1
1nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3$
```

Question1- Difficulties & Solutions

I met a Segmentation Fault in this problem.

Finally I find that the reason is that I using an argument for the length of an array before initialize it.



```
int n,m,k,result=0;
bool** a=new bool*[n];
for (int i = 0; i < n; i++)
{
    a[i]=new bool[m];
}
cin>>n;
cin>>m;
cin>>k;
```

Question2- Analysis

Quesiton describtion:

The question give the size of the matrix and ask us to output the socalled spiral matrix.

Analysis:

After analyzing the problem, I find there are totally four direcitons, which are (in order):

y--, x++, y++, x--;

so I use a flag to denote the current direction.

flag%4==0 --> y--;

flag%4==1 -->x++;

flag%4==2 -->y++;

flag%4==3 -->x--;

Steps:

1. Initial all the element in the matrix to 0;
2. Do a m*n loop to update the element in the matrix. Initially we are at (0,n-1);

   For example:

   we denote current position as **(x,y)**;

   in the **ith run**, we update (x,y) to i, then according to the value of flag to decide which direction we will go next;

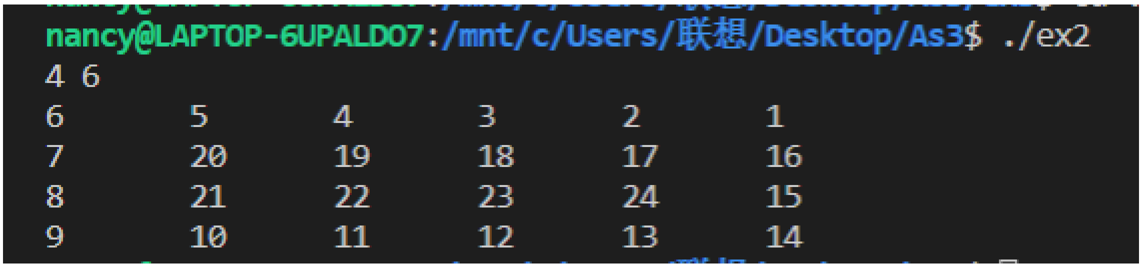
   if we are out of the screen or meet with a positon have non-zero element, we come back and change the direction(flag++);
3. We output the matrix.

Question2- Code

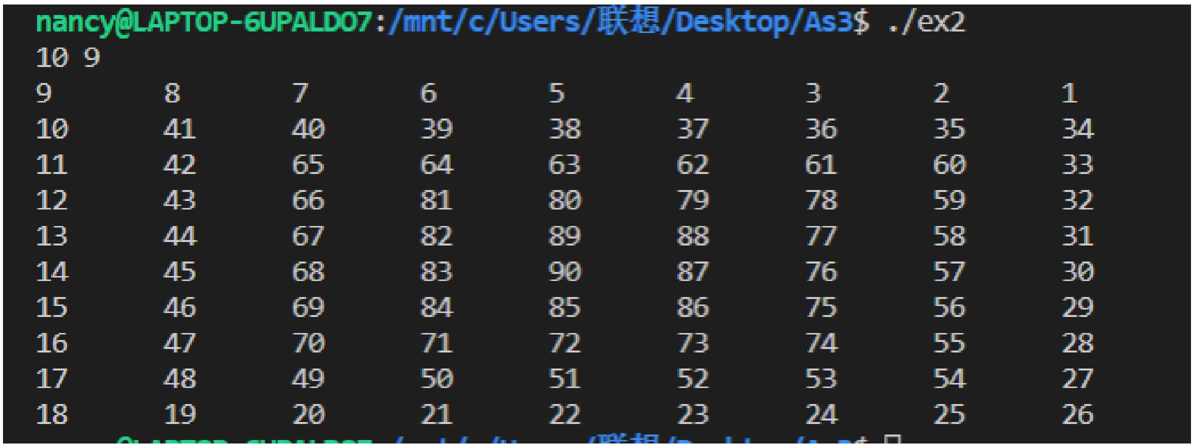
```
#include<iostream>
using namespace std;

int main()
{
    int m,n;
    int flag=0;
    cin>>m;
    cin>>n;
    int x=0,y=n-1;
    int matrix[m][n];
    for (int i = 0; i < m; i++)
    {
        for (int j = 0; j < n; j++)
        {
            matrix[i][j]=0;
        }
    }
    for (int i = 1; ; i++)
    {
        matrix[x][y]=i;
        if (i==m*n) break;

        switch (flag%4)
        {
            case 0:
                y--;
                if (y<0||matrix[x][y]!=0)
                {
                    y++;
                    flag++;
                    i--;
                }
                break;
            case 1:
                x++;
                if (x>=m||matrix[x][y]!=0)
                {
                    x--;
                    flag++;
                    i--;
                }
                break;
            case 2:
                y++;
                if (y>=n||matrix[x][y]!=0)
                {
                    y--;
                    flag++;
                    i--;
                }
                break;
            case 3:
                x--;
                if (matrix[x][y]!=0)
                {
                    x++;
                    flag++;
                    i--;
                }
                break;
        }
    }
    for (int i = 0; i < m; i++)
    {
        for (int j = 0; j < n; j++)
        {
            cout<<matrix[i][j]<<"\t";
        }
        cout<<endl;
    }
}
```

Question2- Result & Verification

I use "\t" to make the matrix look uniform.

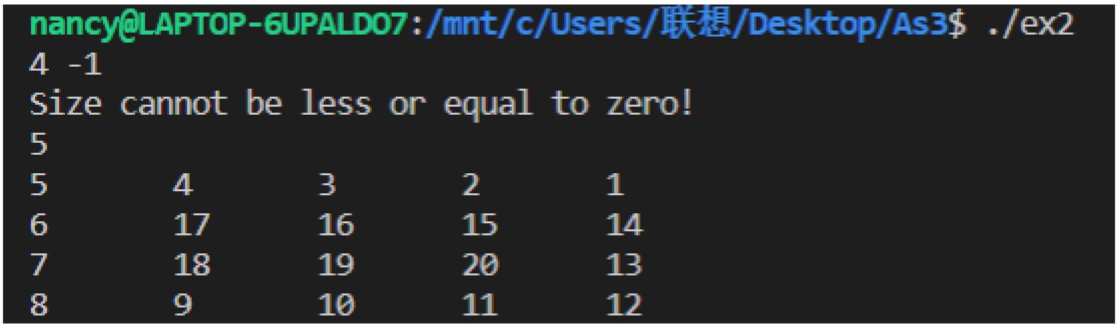


```
nancy@LAPTOP-6UPALD07:/mnt/c/Users/联想/Desktop/As3$ ./ex2
4 6
6       5       4       3       2       1
7       20      19      18      17      16
8       21      22      23      24      15
9       10      11      12      13      14
```



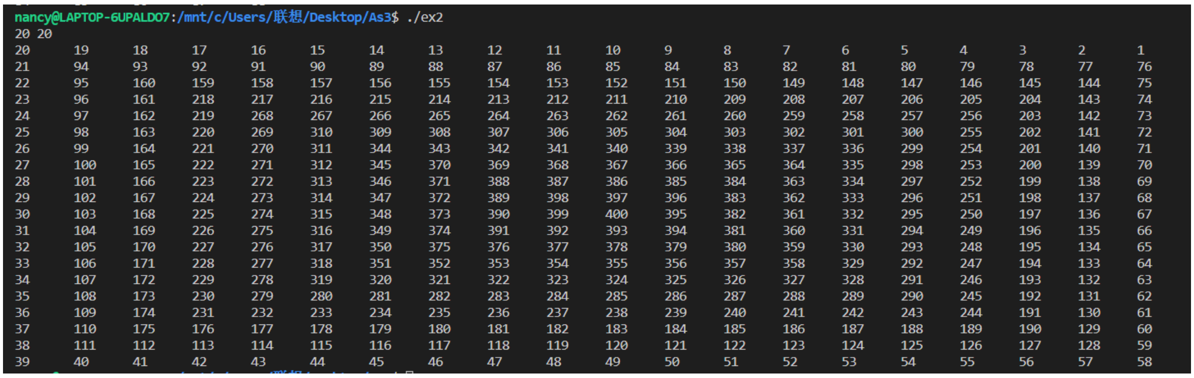
```
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3$ ./ex2
10 9
9       8       7       6       5       4       3       2       1
10      41      40      39      38      37      36      35      34
11      42      65      64      63      62      61      60      33
12      43      66      81      80      79      78      59      32
13      44      67      82      89      88      77      58      31
14      45      68      83      90      87      76      57      30
15      46      69      84      85      86      75      56      29
16      47      70      71      72      73      74      55      28
17      48      49      50      51      52      53      54      27
18      19      20      21      22      23      24      25      26
```

If the size user input is **less or equal than 0**, program will give a reminder and ask user to input that particular argument again.



```
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3$ ./ex2
4 -1
Size cannot be less or equal to zero!
5
5       4       3       2       1
6       17      16      15      14
7       18      19      20      13
8       9       10      11      12
```

For relatively big data:



```
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3$ ./ex2
20 20
20      19      18      17      16      15      14      13      12      11      10      9       8       7       6       5       4       3       2       1
21      94      93      92      91      90      89      88      87      86      85      84      83      82      81      80      79      78      77      76
22      95      160     159     158     157     156     155     154     153     152     151     150     149     148     147     146     145     144     75
23      96      161     218     217     216     215     214     213     212     211     210     209     208     207     206     205     204     143     74
24      97      162     219     268     267     266     265     264     263     262     261     260     259     258     257     256     203     142     73
25      98      163     220     269     310     309     308     307     306     305     304     303     302     301     300     255     202     141     72
26      99      164     221     270     311     344     343     342     341     340     339     338     337     336     299     254     201     140     71
27      100     165     222     271     312     345     370     369     368     367     366     365     364     335     298     253     200     139     70
28      101     166     223     272     313     346     371     388     387     386     385     384     363     334     297     252     199     138     69
29      102     167     224     273     314     347     372     389     398     397     396     383     362     333     296     251     198     137     68
30      103     168     225     274     315     348     373     390     399     400     395     382     361     332     295     250     197     136     67
31      104     169     226     275     316     349     374     391     392     393     394     381     360     331     294     249     196     135     66
32      105     170     227     276     317     350     375     376     377     378     379     380     359     330     293     248     195     134     65
33      106     171     228     277     318     351     352     353     354     355     356     357     358     329     292     247     194     133     64
34      107     172     229     278     319     320     321     322     323     324     325     326     327     328     291     246     193     132     63
35      108     173     230     279     280     281     282     283     284     285     286     287     288     289     290     245     192     131     62
36      109     174     231     232     233     234     235     236     237     238     239     240     241     242     243     244     191     130     61
37      110     175     176     177     178     179     180     181     182     183     184     185     186     187     188     189     190     129     60
38      111     112     113     114     115     116     117     118     119     120     121     122     123     124     125     126     127     128     59
39      40      41      42      43      44      45      46      47      48      49      50      51      52      53      54      55      56      57      58
```

Question2- Difficulties & Solutions

1. I have a problem with the program getting stuck in an endless loop and spend a lot of time to debug and finally find that in one of the cases, the break loop contiditon is wrong.
2. To improve the efficiency, I use Switch instead of nested if branch.
3. For the format, I first using if-else to judge how many spaces I should put to make the matrix look uniform, but then I think that It is not of universal significance to do that, considering the m,n can be very big, so finally I choose "\t".

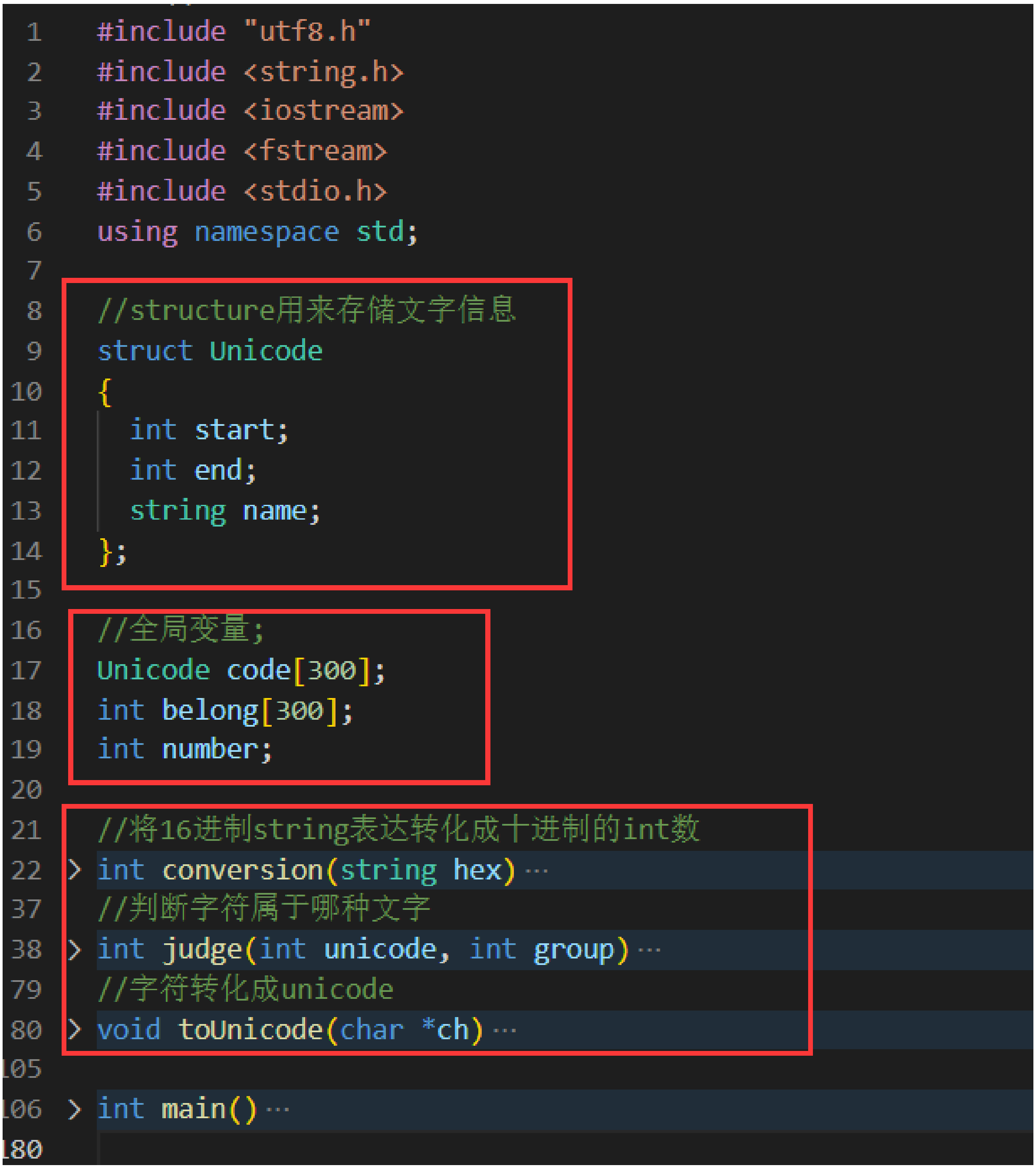
Question3- Analysis

Quesiton describtion:

The question give several txts containing many characters and we need to judge which group of words this txt most possibly belong to, based on the language they used.

Solution:

The structure of my program is as following:



```
#include "utf8.h"
#include <string.h>
#include <iostream>
#include <fstream>
#include <stdio.h>
using namespace std;

//structure用来存储文字信息
struct Unicode
{
  int start;
  int end;
  string name;
};

//全局变量;
Unicode code[300];
int belong[300];
int number;

//将16进制string表达转化成十进制的int数
int conversion(string hex) ···
//判断字符属于哪种文字
int judge(int unicode, int group) ···
//字符转化成unicode
void toUnicode(char *ch) ···

int main() ···

```

Global variable:

Unicode code[300];//存储对应信息

int belong[300];//统计变量

int number; //block中的字符种类个数

Steps:

1.using **ifstream** to read Block.txt and store the information in a structure.

We should filter unneed information like lines starts with"#".

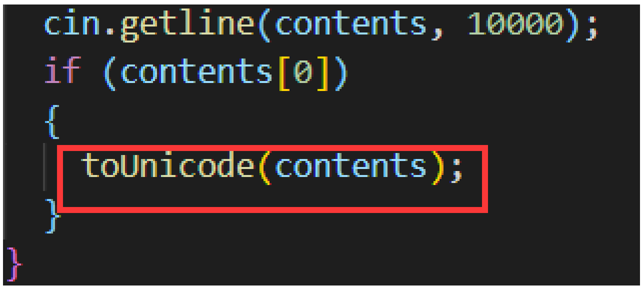
We get unicode in the form of string and I define the function to convert it to decimal integer and then store it to make the comparison easier.

```
2.Then we read the sample txt and manipulate it using several functions.
```

Each time we do following things:

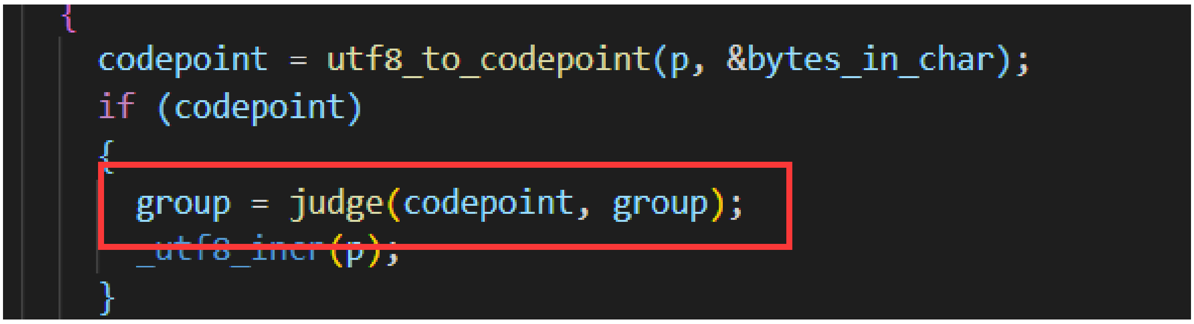
Read a line from sample txt

Using toUnicode to get the unicode of each character



```
cin.getline(contents, 10000);
if (contents[0])
{
  toUnicode(contents);
}
}
```

Use the unicode to search in the array to judge which block the character belongs to and update the statistical variable(belong[])



```
{
  codepoint = utf8_to_codepoint(p, &bytes_in_char);
  if (codepoint)
  {
    group = judge(codepoint, group);
    _utf8_incr(p);
  }
```

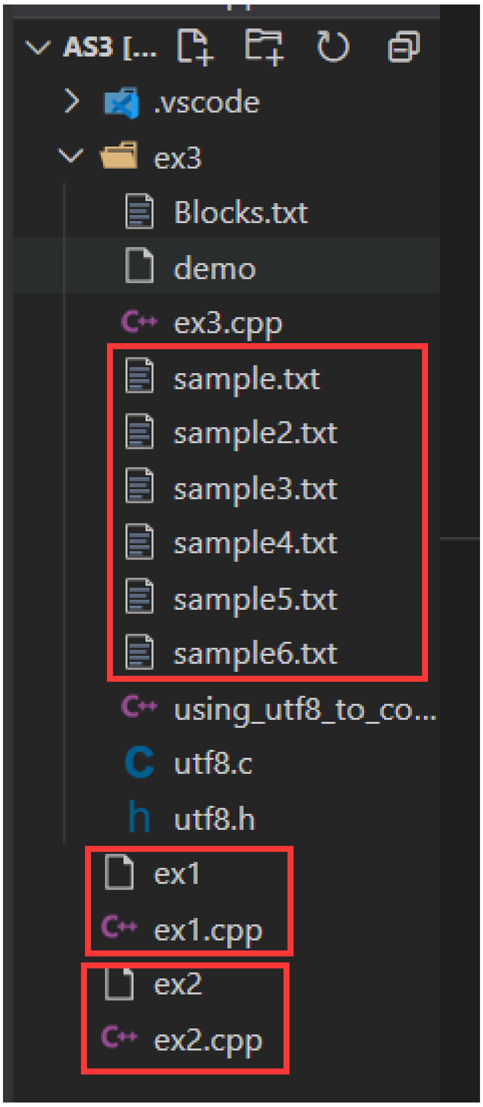
Check the statistical variable to get the result

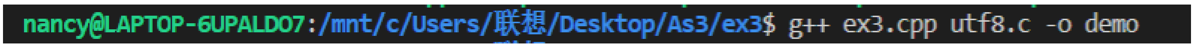
Question3- Code

```
#include "utf8.h"
#include <string.h>
#include <iostream>
#include <fstream>
#include <stdio.h>
using namespace std;

//structure用来存储文字信息
struct Unicode
{
  int start;
  int end;
  string name;
};

//全局变量;
Unicode code[300];//存储对应信息
int belong[300];//统计变量
int number; //block中的字符种类个数

//将16进制string表达转化成十进制的int数
int conversion(string hex)
{
  int result = 0;
  int length = hex.length();
  for (int i = 0; i < length; i++)
  {
    if (isalpha(hex[i]))
    {
      result = result * 16 + (hex[i] - 'A' + 10);
    }
    else
      result = result * 16 + (hex[i] - '0');
  }
  return result;
}
//判断字符属于哪种文字
int judge(int unicode, int group)
{
  //group 表示上一轮匹配到的组 因为大部分应属于同一组 所以先判断是不是该组内的
  //belong 用来计数
  //code[] 是存储的structure数组;
  if (unicode >= code[group].start && unicode <= code[group].end)
  {
    belong[group]++;
    return group;
  }

  else
  {
    int left=0;
    int right=number;
    int mid;
    while(left<=right){
      mid=(left+right)/2;
      if (unicode >= code[mid].start && unicode <= code[mid].end)
      {
        belong[mid]++;
        return mid;
      }
      else if (unicode>code[mid].start)
      {
        left=mid+1;
      }
      else right=mid-1;
    }

    /*for (int i = 0; i < 300; i++)
    {
      if (code[i].name&&code[i].start && unicode >= code[i].start && unicode <= code[i].end)
      {
        belong[i]++;
        return i;
      }
    }*/
  }
  return 0;
}
//字符转化成unicode
void toUnicode(char *ch)
{
  //处理过程 封装成方法
  unsigned char *p;
  int bytes_in_char;
  int i;
  unsigned int codepoint;

  p = (unsigned char *)ch;
  int group = 0;
  while (*p)
  {
    codepoint = utf8_to_codepoint(p, &bytes_in_char);
    if (codepoint)
    {
      group = judge(codepoint, group);
      _utf8_incr(p);
    }
    else
    {
      cout << ch << " is Invalid UTF-8." << endl;
      p++;
    }
  }
}

int main()
{
  //读入block.txt文件;
  //存入structure数组的模块
  char contents[10000];
  ifstream block;
  number=0;
  block.open("Blocks.txt");
  if (block.is_open())
  {
    int index = 0;
    while (!block.eof())
    {
      block.getline(contents, 10000);

      bool isnumber = false;
      if (contents[0] - '0' >= 0 && contents[0] - '0' <= 9)
      {
        isnumber = true;
      }

      if (isalpha(contents[0]) || isnumber)
      {
        string elements[3];
        const char *d = ".;";
        char *p;
        p = strtok(contents, d);
        while (p)
        {
          index = index + 1;
          code[index].start = conversion(p);
          p = strtok(NULL, d);
          code[index].end = conversion(p);
          p = strtok(NULL, d);
          code[index].name = p;
          p = strtok(NULL, d);
          number++;
        }
      }
    }
    block.close();
  }
  else
    cout << "Cannot open the file.";

  //读入测试并检测样例文件
  //初始化统计变量
  for (int i = 0; i < 300; i++)
  {
    belong[i] = 0;
  }

    while (!cin.eof())
    {
      cin.getline(contents, 10000);
      if (contents[0])
      {
        toUnicode(contents);
      }
    }
    //判断属于哪种语言;
    int max = 0;
    int index = 0;
    for (int i = 0; i < 300; i++)
    {
      if (belong[i] > max)
      {
        max = belong[i];
        index = i;
      }
    }
    cout << index << " ";
    cout << code[index].name << endl;
}
```

Question3- Result & Verification

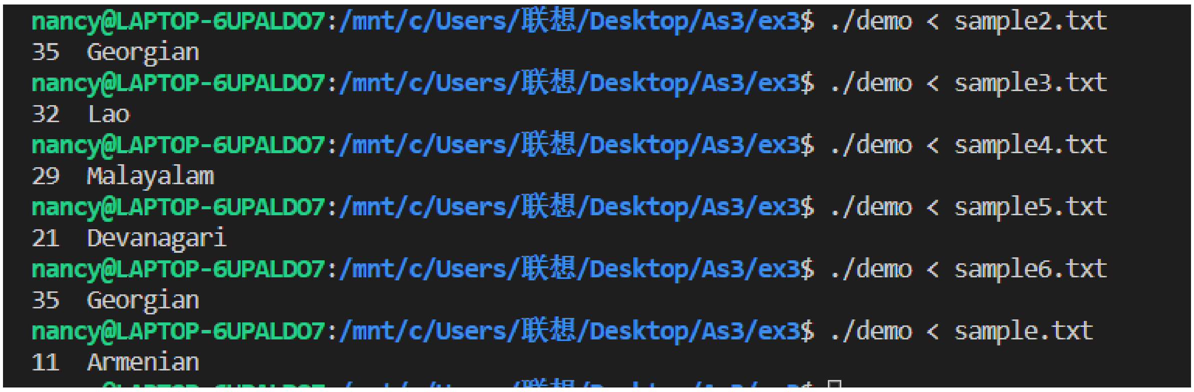
Content:





```
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3/ex3$ g++ ex3.cpp utf8.c -o demo
```

The first integer indicate the line number of the corresponding name of word;

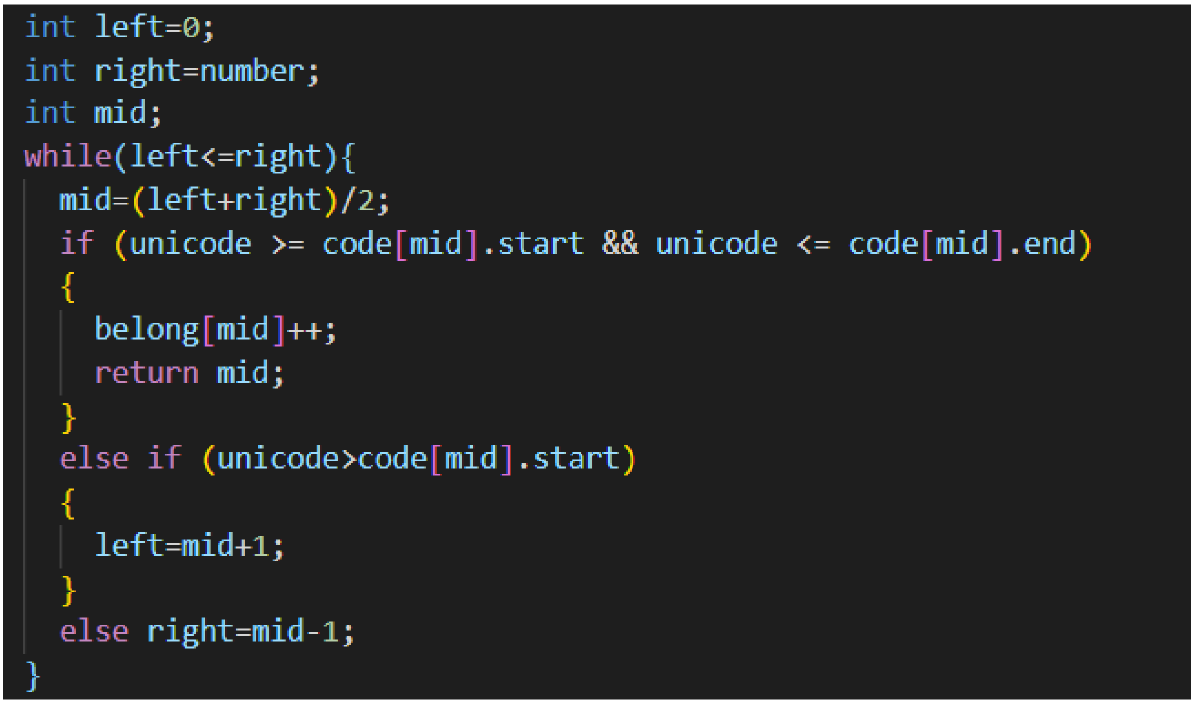


```
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3/ex3$ ./demo < sample2.txt
35  Georgian
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3/ex3$ ./demo < sample3.txt
32  Lao
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3/ex3$ ./demo < sample4.txt
29  Malayalam
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3/ex3$ ./demo < sample5.txt
21  Devanagari
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3/ex3$ ./demo < sample6.txt
35  Georgian
nancy@LAPTOP-6UPALDO7:/mnt/c/Users/联想/Desktop/As3/ex3$ ./demo < sample.txt
11  Armenian
```

Question3- Difficulties & Solutions

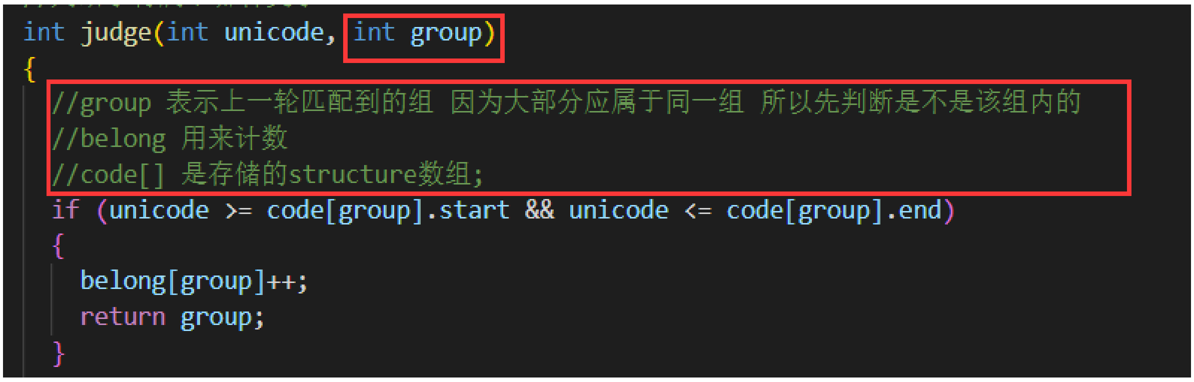
Some strategies to improve the performance.

1.using the *method* *of* *bisection* to search in the array.



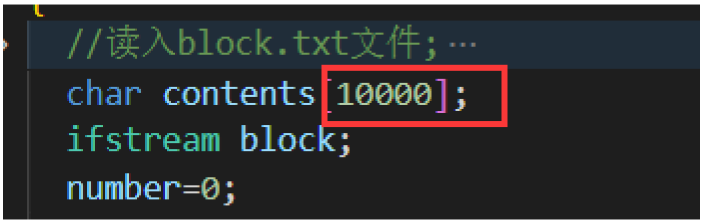
```
int left=0;
int right=number;
int mid;
while(left<=right){
    mid=(left+right)/2;
    if (unicode >= code[mid].start && unicode <= code[mid].end)
    {
        belong[mid]++;
        return mid;
    }
    else if (unicode>code[mid].start)
    {
        left=mid+1;
    }
    else right=mid-1;
}
```

2. Do some presiction. Assure that most character should belong to the same block.



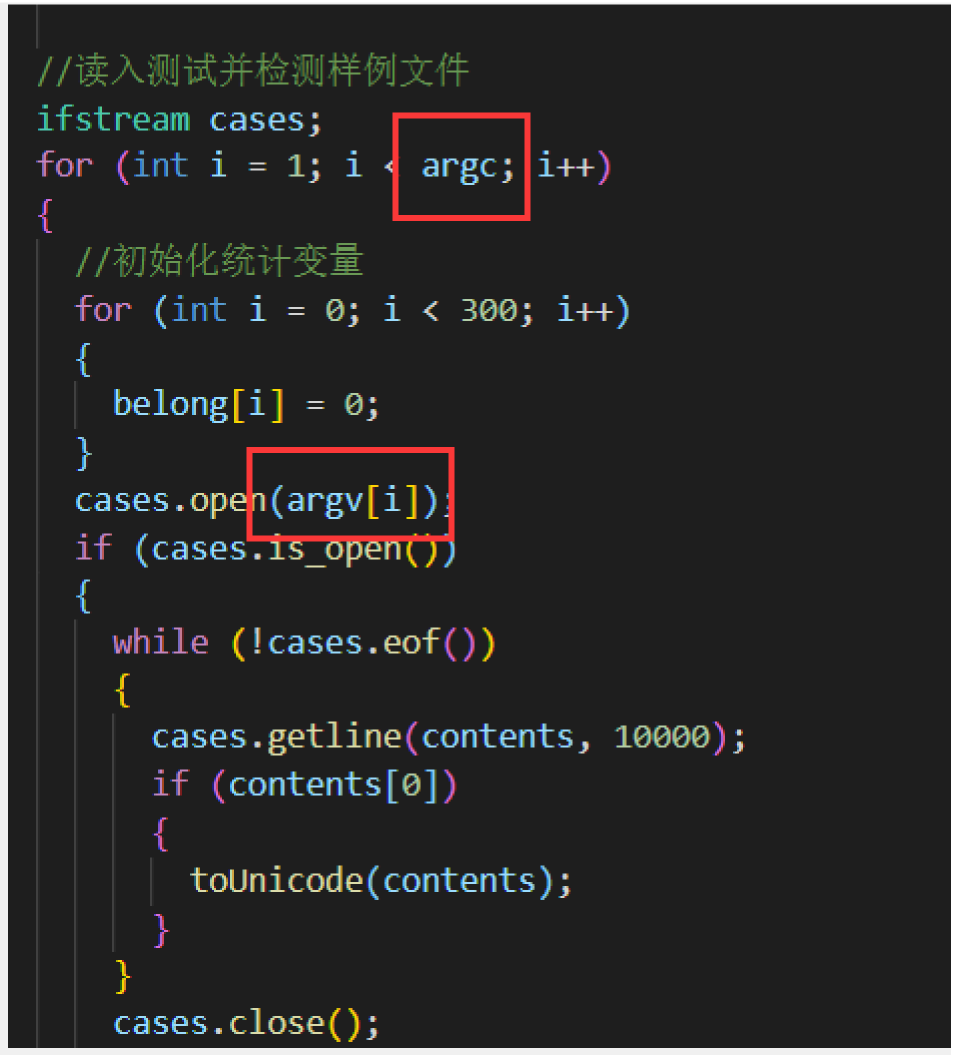
```
int judge(int unicode, int group)
{
    //group 表示上一轮匹配到的组 因为大部分应属于同一组 所以先判断是不是该组内的
    //belong 用来计数
    //code[] 是存储的structure数组;
    if (unicode >= code[group].start && unicode <= code[group].end)
    {
        belong[group]++;
        return group;
    }
```

3. At first, I set the length of **contents** variable(used to read a line from sample) to only 200, and I got some mysterious mistakes, then I set it to 10000 and solve the problem.



```
    //读入block.txt文件;…
    char contents[10000];
    ifstream block;
    number=0;
```

4.At first,I forgot to use the standard input. Instead, I use the following way:

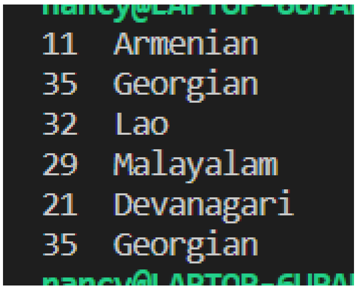


```
//读入测试并检测样例文件
ifstream cases;
for (int i = 1; i < argc; i++)
{
    //初始化统计变量
    for (int i = 0; i < 300; i++)
    {
        belong[i] = 0;
    }
    cases.open(argv[i]);
    if (cases.is_open())
    {
        while (!cases.eof())
        {
            cases.getline(contents, 10000);
            if (contents[0])
            {
                toUnicode(contents);
            }
        }
        cases.close();
```

and using this instruction to run my program:

./demo sample.txt sample2.txt sample3.txt sample4.txt sample5.txt sample6.txt

result:



```
nancy@LAPTOP-6UPA
11  Armenian
35  Georgian
32  Lao
29  Malayalam
21  Devanagari
35  Georgian
nancy@LAPTOP-6UPA
```

Then I recalled the requirements and modify my program.