Debug Lab 1

Intro

In this Lab, you need to fix the bugs in 5 problematic programs so that the programs can execute correctly.

5 programs are stored in P1 . P2 . P3 . P4 . under the P5 folder. There will be some header files under each folder, a main.cpp and a px.cpp (x represents a number, if x is 1, it is p1.cpp). Please note that you can only modify px.cpp to fix bugs. When evaluating the code, we will use the original header file and main.cpp to compile.

In order to prevent you from rewriting the code to solve the problem, we will use the Unix Shell's diff tool to compare the px.cpp you uploaded with the original px.cpp . Each question has its own limit on the number of lines of diff output. This limit usually leaves enough margin, so you don't have to wonder if a bug is fixed by just changing a few lines.

The effect of the diff tool is shown in the figure above. diff a.txt b.txt outputs a total of 8 lines. In order not to interfere with diff , please try not to

Add meaningless spaces and line breaks to code

If you are a Windows user, you can use the following tool instead to check what modifications you have made (such as whether there are spaces). However, please note that the output of fc.exe contains some blank lines, so the number of output lines is usually more than that of diff .

```
fc.exe .\p3.cpp .\p3_answer.cpp | Measure-Object -line
```

P1ÿEasy Link

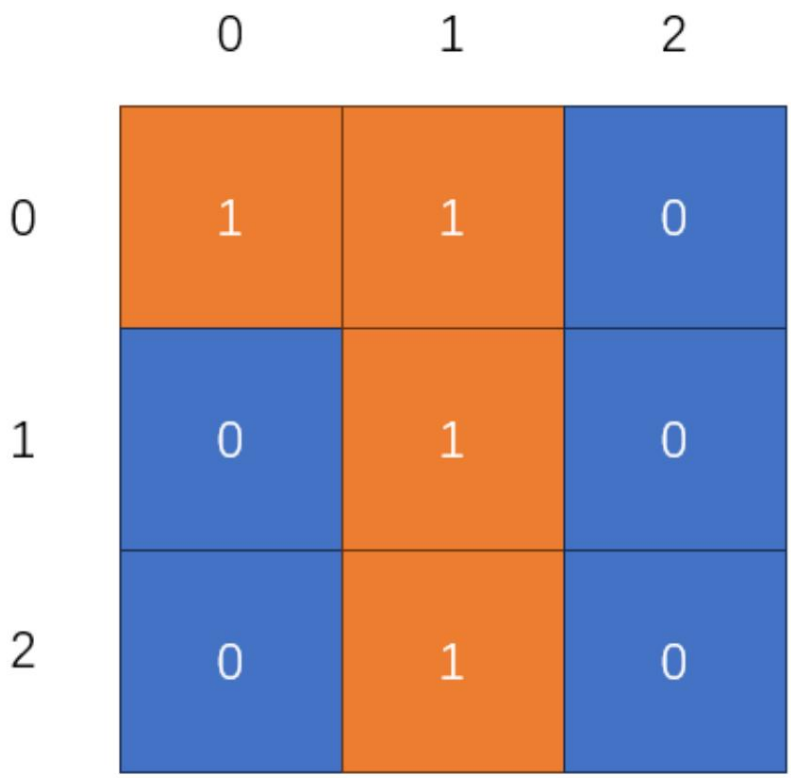
Problem Description

The teaching assistant is currently studying the implementation of Qlink. In order to do some exercises, the teaching assistant wrote a small program. The program wants to accomplish the following goals:

Given an n * m matrix, the matrix consists of integers 0 or 1, 0 means passable, and 1 means unpassable. At the same time, give a starting point (x_{start}, y_{start}) and end point (x_{end}, y_{end}) , to find out whether we can start from the starting point and reach the destination while only passing through the passable matrix grid. End point (assuming both start and end points are accessible).

If it can be reached, output 1, otherwise output 0.

Sample



Example one:

- enter:

```
3 3 2 0 0 2
1 1 0
0 1 0
0 1 0
```

- Output:

```
0
```

- Analysis: The matrix is as above, $(x_{start}, y_{start}) = (2, 0)$, $(x_{end}, y_{end}) = (0, 2)$. $(2, 0)$ represents the lower left corner point, $(0, 2)$ Represents the upper right corner point. Apparently they are separated by an orange impassable grid

Example 2:

- enter:

```
3 3 2 2 0 2
1 1 0
0 1 0
0 1 0
```

- Output:

```
1
```

- Explanation: The matrix is as above, $(x_{start}, y_{start}) = (2, 2)$, $(x_{end}, y_{end}) = (0, 2)$. $(2, 2)$ represents the point in the lower right corner, $(0, 2)$ Represents the upper right corner point. There's obviously nothing separating them

your task

The teaching assistant wrote a program and placed it in the P1 folder. The teaching assistant found that the program always crashed. Please help the teacher solve this problem.

Hint: Could the program hang because of out-of-bounds memory access?

The diff output between your modified p1.cpp and the original p1.cpp should be less than 20 lines

P2: Tower of Hanoi

Problem Description

Same as Lab3 - Tower of Hanoi

Sample

Same as Lab3 - Tower of Hanoi

your task

The teaching assistant wrote a program when he was studying the Hanoi Tower lab, but the program always reported errors. The teaching assistant is very distressed and asks you to help the teacher fix this problem.

Hint: stack.h contains the implementation of the template stack, and there are some asserts in it . Study when the assertions will be triggered?

Hint: In addition to assertion problems, there are also some low-level errors.

The diff output between your modified p2.cpp and the original p2.cpp should be less than 30 lines

P3: Sudoku

This question comes from Leetcode 37. Solving Sudoku

Problem Description

Write a program to solve Sudoku problems by filling in the blank spaces.

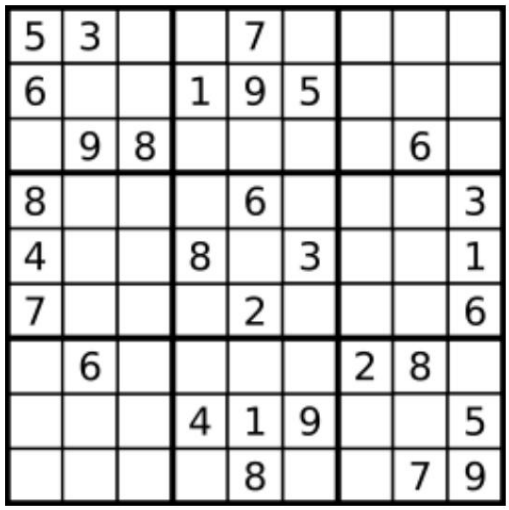
The solution to Sudoku needs **to follow the following rules:**

1. Numbers 1-9 can only appear once in each line.
2. Numbers 1-9 can only appear once in each column.
3. Numbers 1-9 can only appear once in each 3x3 house separated by thick solid lines. (Please refer to the example picture)

~~Some of the blank spaces in Sudoku have been filled in with numbers, and blank spaces~~ are represented by '' ~~.~~

In order to facilitate the processing of input, the `main.cpp` used in `0` to represent blank spaces

Sample



enter:

```
5 3 0 0 7 0 0 0 0
6 0 0 1 9 5 0 0 0
0 9 8 0 0 0 0 6 0
8 0 0 0 6 0 0 0 3
4 0 0 8 0 3 0 0 1
7 0 0 0 2 0 0 0 6
0 6 0 0 0 0 2 8 0
0 0 0 4 1 9 0 0 5
0 0 0 0 8 0 0 7 9
```

Output:

```
5 3 4 6 7 8 9 1 2
6 7 2 1 9 5 3 4 8
1 9 8 3 4 2 5 6 7
8 5 9 7 6 1 4 2 3
4 2 6 8 5 3 7 9 1
7 1 3 9 2 4 8 5 6
9 6 1 5 3 7 2 8 4
2 8 7 4 1 9 6 3 5
3 4 5 2 8 6 1 7 9
```

Explanation: The input Sudoku is as shown above, and the only valid solution is as follows:

5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

your task

The teaching assistant wrote a program to solve Sudoku, but this program cannot solve Sudoku at all. Please help the teaching assistant correct the program.

Hint: You can think that the comments convey the original intention of the teaching assistant, and all comments are correct.

The diff output between `your modified p3.cpp` and the original `p3.cpp` should be `less than 30` lines

P4: Laying tiles

Question from Leetcode 1240. Laying Tiles

Problem Description

You are the foreman of a construction team, and you are preparing to decorate the interior of a house with a unique design style according to the designer's requirements.

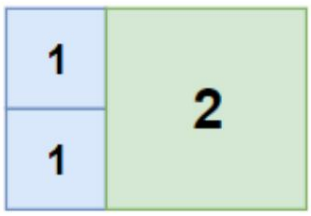
The size of the living room of the house is `n` x `m` . In order to maintain a minimalist style, it is necessary to use as few **square** tiles as possible to cover the floor.

Assume that the specifications of square tiles are not limited and the side lengths are all integers.

Could you please help the designer calculate the minimum number of square tiles needed?

Sample

Example 1:



Input: 2 3

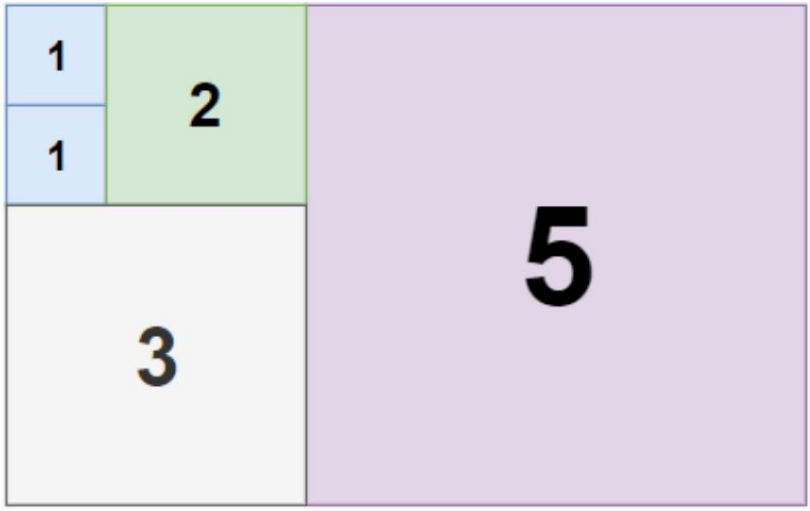
Output: 3

Explanation: 3 floor tiles can cover the bedroom.

2 1x1 **floor tiles** 1

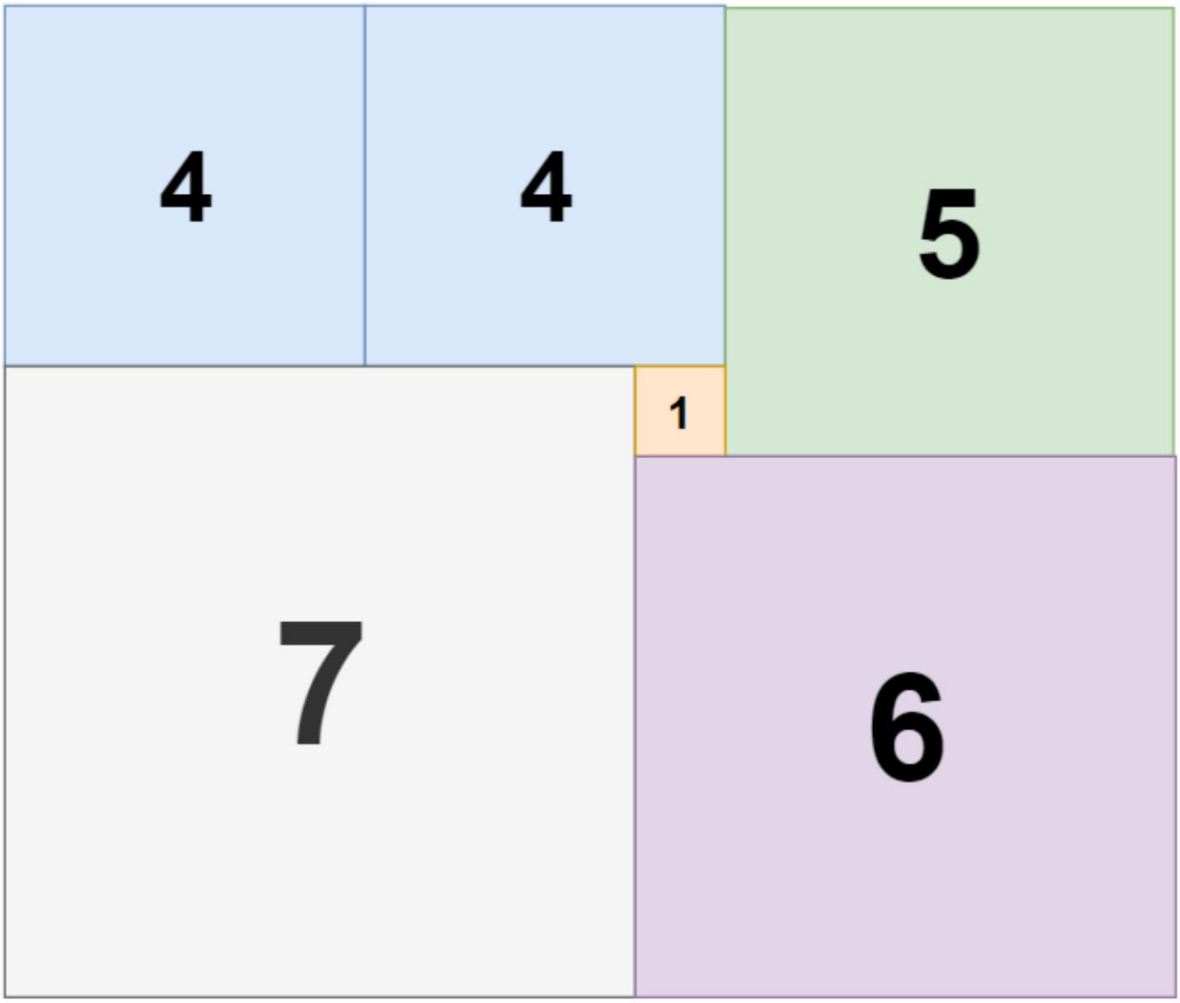
2x2 **floor tile**

Example 2:



Input: **5** 8
Output: **5**

Example 3:



Input: **11** 13
Output: **6**

hint:

- 1 <= n <= 50
- 1 <= m <= 50

- Yes, the data range is larger than the questions on Leetcode

your task

The teaching assistant thought for a while and decided to use a search algorithm to solve this problem. But I can't write it correctly. Please help me correct the program.

Hint: If you can't fix the problem, you can try to check whether each variable in `dfs` behaves as expected

The diff output between `your modified p4.cpp` and the `original p4.cpp` should be less than 60 lines

P5: Is C++ the best language?

Problem Description

The teaching assistant recently learned C++ and felt that C++ was the best language in the world, so he decided to write some programs to practice his skills. The teaching assistant's program wants to complete three tasks in sequence:

1. Create three stacks, numbered 0, 1, 2
2. Repeatedly fill numbers into the stack
3. Repeatedly pop elements from the stack until the stack is empty

The program input is as follows

1. An integer, indicating that there will be a line of input next n
2. Line n input, each line consists of the sum of two numbers i, x, which means filling in numbers into the stack numbered i x

The expected output is as follows:

1. Three lines of output, each line is the result of continuously popping the stack numbered i

Sample

enter:

```
5
0 2
0 3
1 4
2 5
1 1
```

Output:

```
stack 0: 3 2
stack 1: 1 4
stack 2: 5
```

explain:

Push 2 and 3 into the stack numbered 0 in sequence, so the results of popping the stack are 3 and 2. Same for other stacks

your task

The teaching assistant wrote a program, but found that the program always failed to output correctly. Please correct the program.

Hint: If you are not particularly familiar with C++, you can confirm the many functions defined by p5.cpp by printing logs, single-step execution, etc.

Which ones were executed in what order?

Hint: If you can't understand why the program is executing like this, you can check out lvalues, rvalues, temporary quantities, and life cycles in C++.

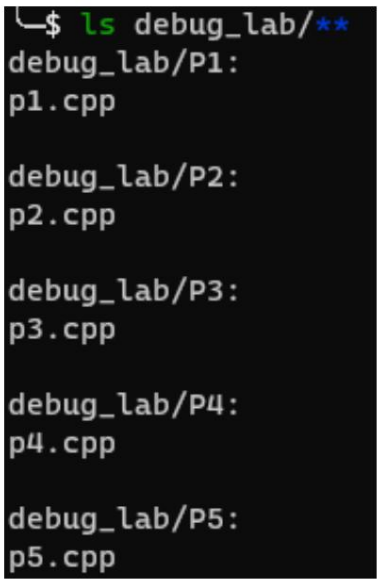
conceptual information

The diff output between your modified p5.cpp and the original p5.cpp should be less than 30 lines

Submission format

You need to upload a compressed package named debug_lab.7z . The compressed package should be decompressed into a folder named debug_lab .

Contains 5 folders P1 P2 P3 P4 each folder contains the px.cpp file you modified . As shown below



You can place other files in the debug_lab folder, but these files will not be included in the evaluation.