競賽網站：http://algorithm.csie.ncku.edu.tw/ITSA/

2015.04

教育部資訊軟體人才培育計畫

PTC線上程式設計競賽

競賽題目

日期	時間	活動內容
2015/04/07	12:00~20:00	各校連線測試
2015/04/08	16:00~18:00	賽前設定(暫停連線)
	18:00~21:00	比賽

主辦單位：成功大學 ITSA 教育部資訊軟體人才培育 程式設計e-tutor推廣

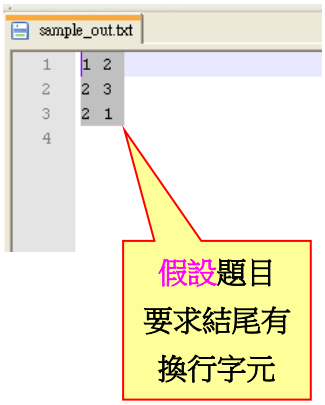
注意事項

一、本比賽系統採用 PC^2，所使用的 I/O 是標準輸出輸入裝置，所以可以使用 C 語言的 scanf ( )、printf ( )，或是 C++語言上的 cin、cout 來讀入及輸出資料，比較要注意的是：本系統並不是用人工方式來 keyin 資料，所以不必在意使用者界面的問題，也就是說不用印出像是 "Please enter a number" 或 "The answer is"・・・之類的文字；此外，有些題目是以讀到 EOF 為 input 結束，有些是讀入 0 結束等等的，必需善用 I/O 函式。上傳檔案的檔名請勿使用中文以免發生不必要的錯誤。

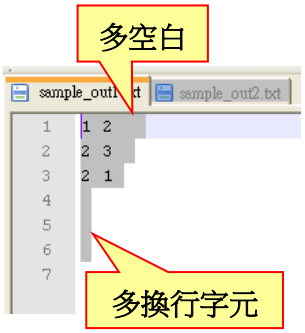
二、比賽用的編譯器版本：gcc 3.4.4 、 g++ 3.4.4 、 jdk 1.6.0_23 、 Microsoft (R) Visual C# 2010 Compiler version 4.0.30319.1 、 Microsoft (R) 32-bit C/C++ Optimizing Compiler Version 16.00.30319.01。若出現 Compilation Error，可能是某些函式不支援。

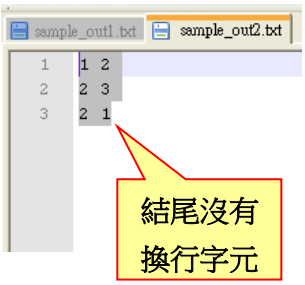
三、PC^2 系統判定錯誤可能原因：

正確答案



錯誤答案





特別注意題目範例是否有換行字元。

四、PC^2 系統判定結果說明：

結果	說明
Yes	解題正確
No - Compilation Error	錯誤：編譯錯誤
No - Run-time Error	錯誤：程序運行錯誤
No - Time-limit Exceeded	錯誤：運行超時（每道題都有運行時間限制）
No - Wrong Answer	錯誤：運行結果與標準答案不一致
No - Excessive Output	錯誤：程序運行佔用內存空間超出要求
No - Output Format Error	錯誤：輸出格式錯誤
No - Other - Contact Staff	未知錯誤

Problem 1. The Shortest Distance between a Straight Line and a Rectangle

(Time Limit: 3 seconds)

Problem Description

Given a straight line $\overline{ab}$ and a rectangle *E*, find the minimum distance between *E* and $\overline{ab}$. Figure 1 illustrates the minimum distance between *E* and $\overline{ab}$.

Let *p* be any of points on $\overline{ab}$, we define *shortDist*(*p*, *E*) as the shortest distance of *p* to the closest point of *E*. The minimum distance between *E* and $\overline{ab}$ is defined as MINDIST(*E*, $\overline{ab}$) = {shortDist(*p*, *E*) | for all *p* on $\overline{ab}$}. Thus, it is clear that if *E* intersects $\overline{ab}$, then the minimum distance is zero.

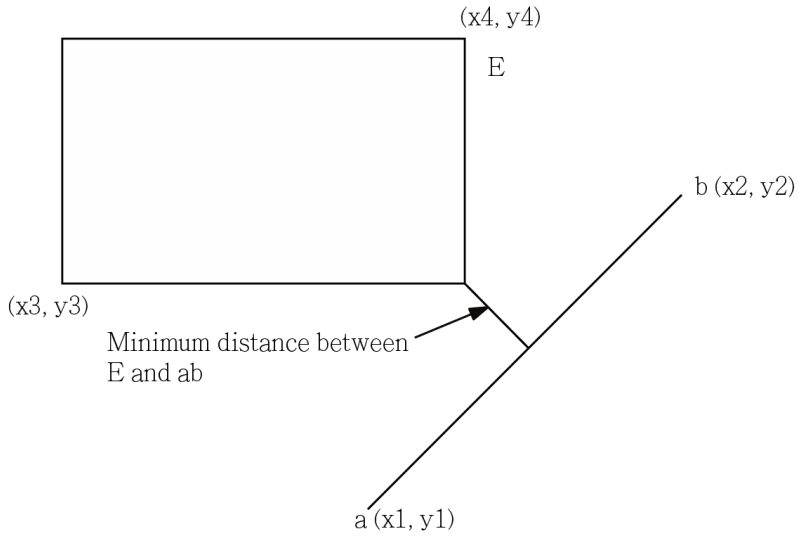


Figure 1 Minimum distance between E and $\overline{ab}$.

Input Format

The first line of the input is the coordinate of *a* (i.e, (x_1, y_1)). x_1 and y_1 are delaminated by a space. $x_1 \in R,\ y_1 \in R, and$ 0 <= x_1, y_1 <= 500.

The second line of the input is the coordinate of *b* (i.e, (x_2, y_2)). X_2 and y_2 are delaminated by a space. $x_2 \in R,\ y_2 \in R, and$ 0 <= x_2, y_2 <= 500.

The third line of the input is the lower-left and upper-right corners of *E* (i.e., (x_3, y_3) and (x_4, y_4)) (see Figure 1). $x_3, x_4, y_3, y_4 \in R\ and\ 0 \leq x_3, x_4, y_3, y_4 \leq 500.$

Output Format

Output the minimum distance between E and $\overline{ab}$. Please chop MINDIST(E, $\overline{ab}$) to the first decimal place

Example

Sample Input:	Sample Output:
0 0 0 5 0 0 5 5	0.0

Problem 2. Summoning Beasts

(Time Limit: 1 seconds)

Problem Description

A festival is starting soon in Akihabara! In order to maintain a steady supply of cake, a large amount of milk is obviously needed. Lady Dynamic is in charge of escorting the milk. The carrying of the milk requires summoned beasts. Summoned beasts are magical beings summoned by mages to do their bindings. Although they are powerful and do not tire easily, the mages do get exhausted after a period of time. Since every mage has limited mana and are of different field of expertise, they all have different maximum summon time and are available at different time slots (for instance, a moon priest may only summon their magical owls at night).

Since this trip is of great importance, Lady Dynamic wants to make sure there be as many summoned beasts as possible available at all times. That is to say, she wants to maximize the number of summoned beasts at the time where there are least summoned beasts. What is the best way she can do that?

Input Format

The first line of input contains an integer T ($1 \leq T \leq 100$) indicating the number of test cases. Each test case starts with a line containing an integer n ($0 < n \leq 50$) where n is the number of mages. Each mage can maintain at most one summoned beast at any given moment. Each of the following n lines contains 25 integers, each representing a mage. The first integer of the line indicates the hours per day the mage can maintain a summoned beast. The next 24 integers of the line are either 0 or 1 indicating whether the mage is available at that hour. For instance,

5 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

means that this mage can summon the beast at any hour except 3 o'clock, and the mage maintain the beast for 5 hours.

Output Format

Output one integers on a line, representing the maximum summoned beasts available at all times.

Example

Sample Input:	Sample Output:
2 2 50 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 24 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 4 12 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 20 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 8 0 0 0 0 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0	1 1

Problem 3. Number Puzzle

(Time Limit: 3 seconds)

Problem Description

The number puzzle is a popular game for enhancing the children's arithmetic skills. Here we will introduce a number addition puzzle. In the puzzle, we use an alphabet (A~G) to represent a number digit (0~ 9), the digits of different alphabets are distinct each other. A puzzle contains an equation $E_1 + E_2 = E_3$ with three numbers E_1, E_2, and E_3, where E_1 and E_2 are 2-digit numbers and E_3 is a 3-digit number. The goal of the puzzle is to recover the digits of the numbers. For example, one answer of the following puzzle "AB + BC = EED" is "A = 8", "B = 3", "C = 2", "D = 5", and "E = 1".

```
  AB
+ BC
-----
 EED
```

For any given puzzle, there may have multiple answers or no answer. Please write a program to verify whether a given puzzle has answers or not.

Input Format

The input consists of several test cases. For each test case, there have three lines of alphabet-numbers. The first and the second lines consist of 2 alphabets and the third line consists of 3 alphabets. Notice that different alphabets represent distinct number digits.

Output Format

The output contains one line for each test case. If there exist answers for the puzzle, then output "YES", otherwise output "NO".

Example

Sample Input:	Sample Output:
AB BC EED AA BB ABA	YES NO

Problem 4. Bilibili's Railgun

(Time Limit: 3 seconds)

Problem Description

Bilibili (Misaka Mikoto) is a level 5 electro master in the academy city. In any day, when Bilibili fires her railgun, she needs 1 unit of electric energy for the first shot. Bilibili may fire her railgun more than once in the same day; in general, she needs $2k-1$ units of electric energy for the kth shot. So, the first shot costs 1 unit, the second shot (in the same day) costs 3 units, the third (in the same day) costs 5 units, and so on.

It is known that N events will happen in academy city, each event i would last a period of time $[s_i, e_i]$ with a boss i. A railgun shot in this period is sufficient to defeat the boss i to solve this event completely. Bilibili wants to use as little electric energy as possible to defeat all the bosses. Can you find out the minimum electric energy that is needed?

Input Format

Input begins with an integer T ($1 \leqq T \leqq 100$), the number of test cases. Each test case would be in the following format.

Line 1: N: one integer, the number of events, where $1 \leqq N \leqq 1000$.

Line 2: $s_1\ e_1$: two integers separated by one blank, the start time and end time of event 1.

…

Line 2+N–1: $s_N\ \ e_N$: two integers separated by one blank, the start time and end time of event N.

($1 \leqq\ s_i, e_i\ \leqq 100$)

Output Format

For each test case, output the minimum energy that Bilibili needs.

Example

Sample Input:	Sample Output:
4 3 1 3 1 3 1 3 3 2 3 1 2 1 2 5 2 3 1 2 1 2 3 3 3 3 6 2 3 1 2 1 2 3 3 3 3 2 3	3 3 9 12

Problem 5. Gray Zone

(Time Limit: 3 seconds)

Problem Description

Given a sequence of W (white) and B (black) starting with a B, please find a longest continuous segment that contains the same amount of W's and B's. For instance, given BBBBBWWWBWWBBB, the longest segment would be BBWWWBWWBB starting at the fourth element. A sequence might be very long, but it consists of only two kinds of characters. So we can use run-length encoding to represent this kind of sequence. As a result, the above example BBBBBWWWBWWBBB would be encoded into the encoded sequence 5 3 1 2 3.

Input Format

The first line of input contains an integer T ($T \leq 20$) indicating the number of test cases. Each test case is given on a line. The first number of the line n ($0 \leq n \leq 10^5$) indicates the length of the encoded sequence, and the following n numbers a_1, a_2, …,a_n represent the encoded sequence. You may assume $0 < a_i \leq 1000$ for $1 \leq i \leq n$.

Output Format

Output an integer on a line representing the length of the longest possible segment containing the same amount of W's and B's.

Example

Sample Input:	Sample Output:
4 5 5 3 1 2 3 5 1 2 3 4 5 6 1 2 1 2 1 2 7 1 9 1 9 1 3 1	10 12 4 2