

## SPOJ Problem Set (classical)

# 1. Life, the Universe, and Everything

### Problem code: TEST

Your program is to use the brute-force approach in order to *find the Answer to Life, the Universe, and Everything*. More precisely... rewrite small numbers from input to output. Stop processing input after reading in the number 42. All numbers at input are integers of one or two digits.

### Example

**Input :**

1  
2  
88  
42  
99

**Output :**

1  
2  
88

---

Added by: Michał Małafiejski

Date: 2004-05-01

Time limit: 10s

Source limit:50000B

Languages: All

Resource: Douglas Adams, The Hitchhiker's Guide to the Galaxy

# SPOJ Problem Set (classical)

## 2. Prime Generator

### Problem code: PRIME1

Peter wants to generate some prime numbers for his cryptosystem. Help him! Your task is to generate all prime numbers between two given numbers!

#### Input

The input begins with the number  $t$  of test cases in a single line ( $t \leq 10$ ). In each of the next  $t$  lines there are two numbers  $m$  and  $n$  ( $1 \leq m \leq n \leq 1000000000$ ,  $n - m \leq 100000$ ) separated by a space.

#### Output

For every test case print all prime numbers  $p$  such that  $m \leq p \leq n$ , one number per line, test cases separated by an empty line.

#### Example

**Input :**

```
2
1 10
3 5
```

**Output :**

```
2
3
5
7

3
5
```

**Warning: large Input/Output data, be careful with certain languages (though most should be OK if the algorithm is well designed)**

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Added by: Adam Dzedzej

Date: 2004-05-01

Time limit: 6s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 3. Substring Check (Bug Funny)

#### Problem code: SBSTR1

Given two binary strings, A (of length 10) and B (of length 5), output 1 if B is a substring of A and 0 otherwise.

*Please note, that the solution may only be submitted in the following languages: Brainf\*\*k, Whitespace and Intercal.*

#### Input

24 lines consisting of pairs of binary strings A and B separated by a single space.

#### Output

The logical value of: 'B is a substring of A'.

#### Example

First two lines of input:

1010110010 10110

1110111011 10011

First two lines of output:

1

0

---

Added by: Adrian Kosowski

Date: 2004-05-01

Time limit: 7s

Source limit: 50000B

Languages: WSPC BF ICK

## SPOJ Problem Set (classical)

### 4. Transform the Expression

#### Problem code: ONP

Transform the algebraic expression with brackets into RPN form (Reverse Polish Notation). Two-argument operators: +, -, \*, /, ^ (priority from the lowest to the highest), brackets ( ). Operands: only letters: a,b,...,z. Assume that there is only one RPN form (no expressions like a\*b\*c).

#### Input

*t* [the number of expressions <= 100]  
*expression* [length <= 400]  
[other expressions]

Text grouped in [ ] does not appear in the input file.

#### Output

The *expressions* in RPN form, one per line.

#### Example

Input:

```
3
(a+(b*c))
((a+b)*(z+x))
((a+t)*((b+(a+c))^(c+d)))
```

Output:

```
abc*+
ab+zx+*
at+bac++cd+^*
```

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Added by: Michał Małafiejski

Date: 2004-05-01

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: -

## SPOJ Problem Set (classical)

### 5. The Next Palindrome

#### Problem code: PALIN

A positive integer is called a *palindrome* if its representation in the decimal system is the same when read from left to right and from right to left. For a given positive integer  $K$  of not more than 1000000 digits, write the value of the smallest palindrome larger than  $K$  to output. Numbers are always displayed without leading zeros.

#### Input

The first line contains integer  $t$ , the number of test cases. Integers  $K$  are given in the next  $t$  lines.

#### Output

For each  $K$ , output the smallest palindrome larger than  $K$ .

#### Example

**Input :**

2  
808  
2133

**Output :**

818  
2222

**Warning: large Input/Output data, be careful with certain languages**

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Added by: Adrian Kosowski

Date: 2004-05-01

Time limit: 9s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 6. Simple Arithmetics

#### Problem code: ARITH

One part of the new WAP portal is also a calculator computing expressions with very long numbers. To make the output look better, the result is formatted the same way as it is usually used with manual calculations.

Your task is to write the core part of this calculator. Given two numbers and the requested operation, you are to compute the result and print it in the form specified below. With addition and subtraction, the numbers are written below each other. Multiplication is a little bit more complex: first of all, we make a partial result for every digit of one of the numbers, and then sum the results together.

#### Input

There is a single positive integer  $T$  on the first line of input (equal to about 1000). It stands for the number of expressions to follow. Each expression consists of a single line containing a positive integer number, an operator (one of +, - and \*) and the second positive integer number. Every number has at most 500 digits. There are no spaces on the line. If the operation is subtraction, the second number is always lower than the first one. No number will begin with zero.

#### Output

For each expression, print two lines with two given numbers, the second number below the first one, last digits (representing unities) must be aligned in the same column. Put the operator right in front of the first digit of the second number. After the second number, there must be a horizontal line made of dashes (-).

For each addition or subtraction, put the result right below the horizontal line, with last digit aligned to the last digit of both operands.

For each multiplication, multiply the first number by each digit of the second number. Put the partial results one below the other, starting with the product of the last digit of the second number. Each partial result should be aligned with the corresponding digit. That means the last digit of the partial product must be in the same column as the digit of the second number. No product may begin with any additional zeros. If a particular digit is zero, the product has exactly one digit -- zero. If the second number has more than one digit, print another horizontal line under the partial results, and then print the sum of them.

There must be a minimal number of spaces on the beginning of lines, with respect to other constraints. The horizontal line is always as long as necessary to reach the left and right end of both numbers (and operators) directly below and above it. That means it begins in the same column where the leftmost digit or operator of that two lines (one below and one above) is. It ends in the column where is the rightmost digit of that two numbers. The line can be neither longer nor shorter than specified.

Print one blank line after each test case, including the last one.

## Example

Sample Input:

```
4
12345+67890
324-111
325*4405
1234*4
```

Sample Output:

```
  12345
+67890
-----
  80235

  324
-111
----
  213

    325
   *4405
   -----
    1625
     0
  1300
 1300
-----
1431625

1234
 *4
----
4936
```

**Warning: large Input/Output data, be careful with certain languages.**

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Added by: Adrian Kosowski

Date: 2004-05-08

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

### 7. The Bulk!

#### Problem code: BULK

ACM uses a new special technology of building its transceiver stations. This technology is called *Modular Cuboid Architecture (MCA)* and is covered by a patent of Lego company. All parts of the transceiver are shipped in unit blocks that have the form of cubes of exactly the same size. The cubes can be then connected to each other. The MCA is modular architecture, that means we can select preferred transceiver configuration and buy only those components we need.

The cubes must be always connected "face-to-face", i.e. the whole side of one cube is connected to the whole side of another cube. One cube can be thus connected to at most six other units. The resulting equipment, consisting of unit cubes is called *The Bulk* in the communication technology slang.

Sometimes, an old and unneeded bulk is condemned, put into a storage place, and replaced with a new one. It was recently found that ACM has many of such old bulks that just occupy space and are no longer needed. The director has decided that all such bulks must be disassembled to single pieces to save some space. Unfortunately, there is no documentation for the old bulks and nobody knows the exact number of pieces that form them. You are to write a computer program that takes the bulk description and computes the number of unit cubes.

Each bulk is described by its faces (sides). A special X-ray based machine was constructed that is able to localise all faces of the bulk in the space, even the inner faces, because the bulk can be partially hollow (it can contain empty spaces inside). But any bulk must be connected (i.e. it cannot drop into two pieces) and composed of whole unit cubes.

#### Input

There is a single positive integer  $T$  on the first line of input (equal to about 1000). It stands for the number of bulks to follow. Each bulk description begins with a line containing a single positive integer  $F$ ,  $6 \leq F \leq 250$ , stating the number of faces. Then there are  $F$  lines, each containing one face description. All faces of the bulk are always listed, in any order. Any face may be divided into several distinct parts and described like if it was more faces. Faces do not overlap. Every face has one inner side and one outer side. No side can be "partially inner and partially outer".

Each face is described on a single line. The line begins with an integer number  $P$  stating the number of points that determine the face,  $4 \leq P \leq 200$ . Then there are  $3 \times P$  numbers, coordinates of the points. Each point is described by three coordinates  $X, Y, Z$  ( $0 \leq X, Y, Z \leq 1000$ ) separated by spaces. The points are separated from each other and from the number  $P$  by two space characters. These additional spaces were added to make the input more human readable. The face can be constructed by connecting the points in the specified order, plus connecting the last point with the first one.

The face is always composed of "unit squares", that means every edge runs either in  $X$ ,  $Y$  or  $Z$ -axis direction. If we take any two neighbouring points  $X_1, Y_1, Z_1$  and  $X_2, Y_2, Z_2$ , then the points will always differ in exactly one of the three coordinates. I.e. it is either  $X_1 \neq X_2$ , or  $Y_1 \neq Y_2$ , or  $Z_1 \neq Z_2$ .



$Z_2$ , other two coordinates are the same. Every face lies in an orthogonal plane, i.e. exactly one coordinate is always the same for all points of the face. The face outline will never touch nor cross itself.

## Output

Your program must print a single line for every test case. The line must contain the sentence The bulk is composed of  $V$  units., where  $V$  is the volume of the bulk.

## Example

Sample Input:

```
2
12
4 10 10 10 10 10 20 10 20 20 10 20 10
4 20 10 10 20 10 20 20 20 20 20 10
4 10 10 10 10 10 20 20 10 20 20 10 10
4 10 20 10 10 20 20 20 20 20 20 10
4 10 10 10 10 20 10 20 20 10 20 10 10
5 10 10 20 10 20 20 20 20 20 20 15 20 20 10 20
4 14 14 14 14 14 16 14 16 16 14 16 14
4 16 14 14 16 14 16 16 16 16 16 14
4 14 14 14 14 14 16 16 14 16 16 14 14
4 14 16 14 14 16 16 16 16 16 16 14
4 14 14 14 14 16 14 16 16 14 16 14 14
4 14 14 16 14 16 16 16 16 16 14 16
12
4 20 20 30 20 30 30 30 30 30 20 30
4 10 10 10 10 40 10 40 40 10 40 10 10
6 10 10 20 20 10 20 20 30 20 30 30 20 30 40 20 10 40 20
6 20 10 20 20 20 20 30 20 20 30 40 20 40 40 20 40 10 20
4 10 10 10 40 10 10 40 10 20 10 10 20
4 10 40 10 40 40 10 40 40 20 10 40 20
4 20 20 20 30 20 20 30 20 30 20 20 30
4 20 30 20 30 30 20 30 30 30 20 30 30
4 10 10 10 10 40 10 10 40 20 10 10 20
4 40 10 10 40 40 10 40 40 20 40 10 20
4 20 20 20 20 30 20 20 30 30 20 20 30
4 30 20 20 30 30 20 30 30 30 30 20 30
```

Sample Output:

```
The bulk is composed of 992 units.
The bulk is composed of 10000 units.
```

**Warning: large Input/Output data, be careful with certain languages**

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Added by: Adrian Kosowski

Date: 2004-05-08

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

### 8. Complete the Sequence!

#### Problem code: CMPLS

You probably know those quizzes in Sunday magazines: given the sequence 1, 2, 3, 4, 5, what is the next number? Sometimes it is very easy to answer, sometimes it could be pretty hard. Because these "sequence problems" are very popular, ACM wants to implement them into the "Free Time" section of their new WAP portal.

ACM programmers have noticed that some of the quizzes can be solved by describing the sequence by polynomials. For example, the sequence 1, 2, 3, 4, 5 can be easily understood as a trivial polynomial. The next number is 6. But even more complex sequences, like 1, 2, 4, 7, 11, can be described by a polynomial. In this case,  $1/2 \cdot n^2 - 1/2 \cdot n + 1$  can be used. Note that even if the members of the sequence are integers, polynomial coefficients may be any real numbers.

Polynomial is an expression in the following form:

$$P(n) = a_D \cdot n^D + a_{D-1} \cdot n^{D-1} + \dots + a_1 \cdot n + a_0$$

If  $a_D \neq 0$ , the number  $D$  is called a degree of the polynomial. Note that constant function  $P(n) = C$  can be considered as polynomial of degree 0, and the zero function  $P(n) = 0$  is usually defined to have degree -1.

#### Input

There is a single positive integer  $T$  on the first line of input (equal to about 5000). It stands for the number of test cases to follow. Each test case consists of two lines. First line of each test case contains two integer numbers  $S$  and  $C$  separated by a single space,  $1 \leq S < 100$ ,  $1 \leq C < 100$ ,  $(S+C) \leq 100$ . The first number,  $S$ , stands for the length of the given sequence, the second number,  $C$  is the amount of numbers you are to find to complete the sequence.

The second line of each test case contains  $S$  integer numbers  $X_1, X_2, \dots, X_S$  separated by a space. These numbers form the given sequence. The sequence can always be described by a polynomial  $P(n)$  such that for every  $i$ ,  $X_i = P(i)$ . Among these polynomials, we can find the polynomial  $P_{min}$  with the lowest possible degree. This polynomial should be used for completing the sequence.

#### Output

For every test case, your program must print a single line containing  $C$  integer numbers, separated by a space. These numbers are the values completing the sequence according to the polynomial of the lowest possible degree. In other words, you are to print values  $P_{min}(S+1), P_{min}(S+2), \dots, P_{min}(S+C)$ .

It is guaranteed that the results  $P_{min}(S+i)$  will be non-negative and will fit into the standard *integer* type.

## Example

Sample Input:

```
4
6 3
1 2 3 4 5 6
8 2
1 2 4 7 11 16 22 29
10 2
1 1 1 1 1 1 1 1 1 2
1 10
3
```

Sample Output:

```
7 8 9
37 46
11 56
3 3 3 3 3 3 3 3 3
```

**Warning: large Input/Output data, be careful with certain languages**

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Added by: Adrian Kosowski

Date: 2004-05-08

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

### 9. Direct Visibility

#### Problem code: DIRVS

Building the GSM network is a very expensive and complex task. Moreover, after the *Base Transceiver Stations (BTS)* are built and working, we need to perform many various measurements to determine the state of the network, and propose effective improvements to be made.

The ACM technicians have a special equipment for measuring the strength of electro-magnetic fields, the transceivers' power and quality of the signal. This equipment is packed into a huge knapsack and the technician must move with it from one BTS to another. Unfortunately, the knapsack has not enough memory for storing all of the measured values. It has a small cache only, that can store values for several seconds. Then the values must be transmitted to the BTS by an infrared connection (IRDA). The IRDA needs direct visibility between the technician and the BTS.

Your task is to find the path between two neighbouring BTSes such that at least one of those BTSes is always visible.

#### Input

There is a single positive integer  $T$  on the first line of input (equal to about 500). It stands for the number of test cases to follow. Each test case consists of a town description. For simplicity, a town is modelled as a rectangular grid of  $P \times Q$  square fields. Each field is exactly 1 metre wide. For each field, a non-negative integer  $Z_{i,j}$  is given, representing the height of the terrain in that place, in metres. That means the town model is made of cubes, each of them being either solid or empty. There are no "half solid" cubes.

The first line of each test case contains two integer numbers  $P$  and  $Q$ , separated by a single space,  $1 \leq P, Q \leq 200$ . Then there are  $P$  lines each containing  $Q$  integer numbers separated by a space. These numbers are  $Z_{i,j}$ , where  $1 \leq i \leq P$ ,  $1 \leq j \leq Q$  and  $0 \leq Z_{i,j} \leq 5000$ . After the terrain description, there are four numbers  $R_1, C_1, R_2, C_2$  on the last line of each test case. These numbers represent position of two BTSes,  $1 \leq R_1, R_2 \leq P$ ,  $1 \leq C_1, C_2 \leq Q$ . The first coordinate ( $R$ ) determines the row of the town, the second coordinate determines the column.

The technician is moving in steps (*steps* stands for *Standard Technician's Elementary Positional Shift*). Each step is made between two neighbouring square fields. That means the step is always in North, South, West or East direction. It is not possible to move diagonally. The step between two fields  $A$  and  $B$  (step from  $A$  to  $B$ ) is allowed only if the height of the terrain in the field  $B$  is not very different from the height in the field  $A$ . The technician can climb at most 1 metre up or descend at most 3 metres down in a single step.

At the end of each step, at least one of the two BTSes must be visible. However, there can be some point "in the middle of the step" where no BTS is visible. This is OK and the data is handled by the cache. The BTS is considered visible, if there is a direct visibility between the unit cube just above the terrain on the BTSes coordinates and the cube just above the terrain on the square field, where the technician is. Direct visibility between two cubes means that the line connecting the centres of the two

cubes does not intersect any solid cube. However, the line can touch any number of solid cubes. In other words, consider both the BTS and the technician being points exactly half metre above the surface and in the centre of the appropriate square field.

Note that the IRDA beam can go between two cubes that touch each other by their edge, although there is no space between them. It is because such a beam touches both of these two cubes but does not intersect any of them. See the last test case of the sample input for an example of such a situation.

## Output

You are to find the shortest possible path from BTS  $(R_1, C_1)$  to BTS  $(R_2, C_2)$ , meeting the above criteria. All steps must be done between neighbouring fields, the terrain must not elevate or descend too much, and at the end of each step, at least one BTS must be visible.

For each test case, print one line containing the sentence `The shortest path is  $M$  steps long.`, where  $M$  is the number of steps that must be made. If there is no such path, output the sentence `Mission impossible!`.

## Example

Sample Input:

```
4
5 5
8 7 6 5 4
2 2 2 2 2
2 2 2 2 2
2 2 2 2 2
2 2 2 2 2
1 1 5 1
5 8
2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2
9 9 9 9 9 9 9 2
2 2 2 2 2 2 2 2
1 2 5 1
5 8
2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2
2 2 2 2 2 2 2 2
9 9 9 9 9 9 9 2
2 2 2 2 2 2 2 2
1 5 5 1
6 12
5 5 5 5 1 5 5 5 5 5 5 5
5 5 5 5 1 5 5 5 5 5 5 5
5 5 5 5 9 5 5 5 5 5 5 5
5 9 1 5 5 5 5 5 5 5 5 5
5 5 9 5 5 5 5 5 5 5 5 5
5 5 9 5 5 5 5 5 5 5 5 5
6 1 3 12
```

Sample Output:

The shortest path is 10 steps long.  
Mission impossible!  
The shortest path is 14 steps long.  
The shortest path is 18 steps long.

---

Added by: Adrian Kosowski

Date: 2004-05-08

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

### 10. Complicated Expressions

#### Problem code: CMEXPR

The most important activity of ACM is the GSM network. As the mobile phone operator, ACM must build its own transmitting stations. It is very important to compute the exact behaviour of electro-magnetic waves. Unfortunately, prediction of electro-magnetic fields is a very complex task and the formulas describing them are very long and hard-to-read. For example, Maxwell's Equations describing the basic laws of electrical engineering are really tough.

ACM has designed its own computer system that can make some field computations and produce results in the form of mathematic expressions. Unfortunately, by generating the expression in several steps, there are always some unneeded parentheses inside the expression. Your task is to take these partial results and make them "nice" by removing all unnecessary parentheses.

#### Input

There is a single positive integer  $T$  on the first line of input (equal to about 10000). It stands for the number of expressions to follow. Each expression consists of a single line containing only lowercase letters, operators (+, -, \*, /) and parentheses ( ( and ) ). The letters are variables that can have any value, operators and parentheses have their usual meaning. Multiplication and division have higher priority than subtraction and addition. All operations with the same priority are computed from left to right (operators are left-associative). There are no spaces inside the expressions. No input line contains more than 250 characters.

#### Output

Print a single line for every expression. The line must contain the same expression with unneeded parentheses removed. You must remove as many parentheses as possible without changing the semantics of the expression. The semantics of the expression is considered the same if and only if any of the following conditions hold:

- The ordering of operations remains the same. That means " $(a+b)+c$ " is the same as " $a+b+c$ ", and " $a+(b/c)$ " is the same as " $a+b/c$ ".
- The order of some operations is swapped but the result remains unchanged with respect to the addition and multiplication associativity. That means " $a+(b+c)$ " and " $(a+b)+c$ " are the same. We can also combine addition with subtraction and multiplication with division, if the subtraction or division is the second operation. For example, " $a+(b-c)$ " is the same as " $a+b-c$ ".

You cannot use any other laws, namely you cannot swap left and right operands and you cannot replace " $a-(b-c)$ " with " $a-b+c$ ".



## Example

Sample Input:

```
8
(a+ (b*c) )
( (a+b) *c)
(a* (b*c) )
(a* (b/c) *d)
( (a/ (b/c) ) /d)
( (x) )
(a+b) - (c-d) - (e/f)
(a+b) + (c-d) - (e+f)
```

Sample Output:

```
a+b*c
(a+b) *c
a*b*c
a*b/c*d
a/ (b/c) /d
x
a+b- (c-d) -e/f
a+b+c-d- (e+f)
```

---

Added by: Adrian Kosowski

Date: 2004-05-09

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

### 11. Factorial

#### Problem code: FCTRL

The most important part of a GSM network is so called *Base Transceiver Station (BTS)*. These transceivers form the areas called *cells* (this term gave the name to the cellular phone) and every phone connects to the BTS with the strongest signal (in a little simplified view). Of course, BTSes need some attention and technicians need to check their function periodically.

ACM technicians faced a very interesting problem recently. Given a set of BTSes to visit, they needed to find the shortest path to visit all of the given points and return back to the central company building. Programmers have spent several months studying this problem but with no results. They were unable to find the solution fast enough. After a long time, one of the programmers found this problem in a conference article. Unfortunately, he found that the problem is so called "Travelling Salesman Problem" and it is very hard to solve. If we have  $N$  BTSes to be visited, we can visit them in any order, giving us  $N!$  possibilities to examine. The function expressing that number is called factorial and can be computed as a product  $1.2.3.4....N$ . The number is very high even for a relatively small  $N$ .

The programmers understood they had no chance to solve the problem. But because they have already received the research grant from the government, they needed to continue with their studies and produce at least *some* results. So they started to study behaviour of the factorial function.

For example, they defined the function  $Z$ . For any positive integer  $N$ ,  $Z(N)$  is the number of zeros at the end of the decimal form of number  $N!$ . They noticed that this function never decreases. If we have two numbers  $N_1 < N_2$ , then  $Z(N_1) \leq Z(N_2)$ . It is because we can never "lose" any trailing zero by multiplying by any positive number. We can only get new and new zeros. The function  $Z$  is very interesting, so we need a computer program that can determine its value efficiently.

#### Input

There is a single positive integer  $T$  on the first line of input (equal to about 100000). It stands for the number of numbers to follow. Then there are  $T$  lines, each containing exactly one positive integer number  $N$ ,  $1 \leq N \leq 1000000000$ .

#### Output

For every number  $N$ , output a single line containing the single non-negative integer  $Z(N)$ .

#### Example

Sample Input:

6  
3  
60  
100  
1024  
23456  
8735373

**Sample Output:**

0  
14  
24  
253  
5861  
2183837

---

Added by: Adrian Kosowski

Date: 2004-05-09

Time limit: 6s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

# 12. The Game of Master-Mind

### Problem code: MMIND

If you want to buy a new cellular phone, there are many various types to choose from. To decide which one is the best for you, you have to consider several important things: its size and weight, battery capacity, WAP support, colour, price. One of the most important things is also the list of games the phone provides. Nokia is one of the most successful phone makers because of its famous Snake and SnakeII. ACM wants to make and sell its own phone and they need to program several games for it. One of them is Master-Mind, the famous board logical game.

The game is played between two players. One of them chooses a *secret code* consisting of  $P$  ordered pins, each of them having one of the predefined set of  $C$  colours. The goal of the second player is to guess that secret sequence of colours. Some colours may not appear in the code, some colours may appear more than once.

The player makes guesses, which are formed in the same way as the secret code. After each guess, he/she is provided with information on how successful the guess was. This feedback is called *ahint*. Each hint consists of  $B$  black points and  $W$  white points. The black point stands for every pin that was guessed right, i.e. the right colour was put on the right position. The white point means right colour but on the wrong position. For example, if the secret code is "white, yellow, red, blue, white" and the guess was "white, red, white, white, blue", the hint would consist of one black point (for the white on the first position) and three white points (for the other white, red and blue colours). The goal is to guess the sequence with the minimal number of hints.

The new ACM phone should have the possibility to play both roles. It can make the secret code and give hints, but it can also make its own guesses. Your goal is to write a program for the latter case, that means a program that makes Master-Mind guesses.

### Input

There is a single positive integer  $T$  on the first line of input. It stands for the number of test cases to follow. Each test case describes one game situation and you are to make a guess. On the first line of each test case, there are three integer numbers,  $P$ ,  $C$  and  $M$ .  $P$  ( $1 \leq P \leq 10$ ) is the number of pins,  $C$  ( $1 \leq C \leq 100$ ) is the number of colours, and  $M$  ( $1 \leq M \leq 100$ ) is the number of already played guesses.

Then there are  $2 \times M$  lines, two lines for every guess. At the first line of each guess, there are  $P$  integer numbers representing colours of the guess. Each colour is represented by a number  $G_i$ ,  $1 \leq G_i \leq C$ . The second line contains two integer numbers,  $B$  and  $W$ , stating for the number of black and white points given by the corresponding hint.

Let's have a secret code  $S_1, S_2, \dots, S_P$  and the guess  $G_1, G_2, \dots, G_P$ . Then we can make a set  $H$  containing pairs of numbers  $(I, J)$  such that  $S_I = G_J$ , and that any number can appear at most once on the first position and at most once on the second position. That means for every two different pairs from that set,  $(I_1, J_1)$  and  $(I_2, J_2)$ , we have  $I_1 \neq I_2$  and  $J_1 \neq J_2$ . Then we denote  $B(H)$  the number

of pairs in the set, that meet the condition  $I = J$ , and  $W(H)$  the number of pairs with  $I \leftrightarrow J$ .

We define an ordering of every two possible sets  $H_1$  and  $H_2$ . Let's say  $H_1 \leq H_2$  if and only if one of the following holds:

- $B(H_1) < B(H_2)$ , or
- $B(H_1) = B(H_2)$  and  $W(H_1) \leq W(H_2)$

Then we can find a maximal set  $H_{max}$  according to this ordering. The numbers  $B(H_{max})$  and  $W(H_{max})$  are the black and white points for that hint.

## Output

For every test case, print the line containing  $P$  numbers representing  $P$  colours of the next guess. Your guess must be valid according to all previous guesses and hints. The guess is valid if the sequence could be a secret code, i.e. the sequence was not eliminated by previous guesses and hints.

If there is no valid guess possible, output the sentence `You are cheating!`. If there are more valid guesses, output the one that is lexicographically smallest. I.e. find such guess  $G$  that for every other valid guess  $V$  there exists such a number  $I$  that:

- $G_J = V_J$  for every  $J < I$ , and
- $G_I < V_I$ .

## Example

Sample Input:

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

Sample Output

```
1 1 1 3
You are cheating!
9 9 9 9 9 9 9 9
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-05-09

Time limit: 7s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

### 13. Hotline

#### Problem code: HOTLINE

Every customer sometimes needs help with new and unusual products. Therefore, hotline service is very important for every company. We need a single phone number where the customer can always find a friendly voice ready to help with anything. On the other hand, many people are needed to serve as hotline operators, and human resources are always very expensive. Moreover, it is not easy to pretend "friendly voice" at 4am and explain to a drunken man that you are really unable to give him the number to House of Parliament. It was also found that some of the questions repeat very often and it is very annoying to answer them again and again.

ACM is a modern company, wanting to solve its hotline problem. They want to decrease the number of human operators by creating a complex software system that would be able to answer most common questions. The customer's voice is analysed by a special Voice Recognition Module (VRM) and converted to plain text. The text is then taken by an Artificial Automatic Adaptive Answering Algorithm (AAAAA). The most common questions are recognised and answered automatically. The replies are then converted to sound by Text-to-Speech Module (TTS).

You are to write the AAAAA module. Because your algorithm should be adaptive, it has no explicit knowledge base. But it must be able to listen to sentences in English and remember the mentioned facts. Whenever the question is asked about such a fact, the system has to answer it properly. The VRM and TTS modules are already implemented, so the input and output of AAAAA will be in the text form.

#### Input

There is a single positive integer  $T$  on the first line of input. It stands for the number of dialogues to follow. Each dialogue consists of zero or more lines, each of them containing one sentence: either statement or question. The statement ends with a dot character (.), the question ends with a question mark (?). No statement will appear more than once, however the questions can be repeated. There is one extra line after each dialogue. That line ends with an exclamation mark (!).

Sentences can contain words, spaces and punctuation characters (such as commas, colons, semicolons etc.). All words contain only letters of English alphabet and are case-sensitive. That means the same word is always written the same way, usually in lowercase. Acronyms, names and some other words can begin with capital letters. For simplicity, all sentences begin with a lowercase letter. Only if the first word should be written with a capital, the sentence begins with a capital letter. There are no unneeded spaces between words. No line will have more than 100 characters. There will be at most 100 statements per each test case.

#### Statements

Each statement has one of the following two forms ( \_ denotes a space):

*subject* *\_predicate*[s] [ *\_object* ] .

*subject* *\_don't* *doesn't* *\_predicate* [ *\_object* ] .

The square brackets mark an optional part, the vertical line two possible variants. Subject is a single word, noun or pronoun in singular. Predicate is a verb (single word) denoting some activity. Object can be any text. Object does not contain any dots. Any pair "verb + object" determines unique activity. The same verb with different objects makes different independent activities, i.e. the different and independent meaning of the sentence. Sentence without any object can be considered as sentence with an empty object. The verb without an object has different and independent meaning than the same verb with any non-empty object.

The first variant of sentence denotes a positive statement. The word "*predicate[s]*" means verb that matches the subject of the sentence. If the subject is "I" or "you", the verb has the same form as the infinitive. With any other subject, the letter "s" is appended on the end of the verb. Assume there are no irregular verbs.

The second variant is a negative statement. Verb "don't" or "doesn't" must also match the subject. The form "don't" is used with either "I" or "you", "doesn't" is used in any other case.

A special generic subject "everybody" can be used. It means the activity holds for any subject. Other special subject is "nobody". Such sentence also holds for any subject, but its meaning is negative. Both of these generic subjects can be used with the first variant only (without "doesn't"). The sentence "nobody likes something" is exactly equal to "everybody doesn't like something", except the latter form will never occur in the input.

## Questions

Each question has one of the following three forms:

1. `do|does _subject _predicate [ _object] ?`
2. `who _predicates [ _object] ?`
3. `what _do|does _subject do ?`

The word "do|does" always matches the subject ("do I?", "do you?", "does any other subject?"). In the second type of question, predicate always matches the word "who", i.e. the "s" is always appended. Generic subjects cannot be used in questions.

## Output

For each dialogue, your program must output the line `Dialogue #D:`, where *D* is the sequence number of dialogue, starting with 1. Then print exactly three lines for every question: the first line repeats the question, the second line contains the answer, and the third line is empty. Print nothing for statements. After each dialogue, print the same line with an exclamation mark that was in the input. Then print one extra empty line. Empty line contains a new-line character only.

The answer must be properly formatted to be accepted by aTTS module. Only the statements appearing in the input before the answer are used for the corresponding reply. If there is any contradiction among statements, the reply is always `I am abroad..`. If the question and statements consider the special subject "you", it must be replaced with "I" in the answer. If the question considers special subject "I", it must be replaced with "you" in the answer. The verb must always match the subject of the sentence. The exact form of the correct answer depends on the type of question.



### 1.does subject predicate [object] ?

If there is any positive statement about the mentioned subject (or generic subject "everybody"), predicate and object, the answer is:

*yes, \_subject \_predicate[s] [ \_object] .*

If there is any negative statement about the mentioned subject (or generic subject "nobody"), predicate and object, the answer is:

*no, \_subject \_don' tldoesn' t \_predicate [ \_object] .*

Otherwise, the answer is: *maybe .*

Subject in the answer is always the same subject as the subject of the question.

### 2.who predicates [object] ?

If there is a positive statement considering any subject, the specified predicate and object, the answer is:

*subject \_predicate[s] [ \_object] .*

If two or more subjects match the activity, replace the subject in the answer with enumeration of all such subjects, in the same order as the corresponding statements have appeared in the input. Subjects are separated with comma and space, last two subjects are separated with the word "and". If "everybody" belongs to the group of enumerated subjects, do not enumerate subjects, and print "everybody" only. If the enumeration contains at least two subjects, the predicate matches the plural subject (i.e. verb is without trailing "s"), otherwise it matches the only subject.

*subject1 , \_subject2 \_and \_subject3 predicate [ \_object] .*

If there is a negative statement considering the generic subject "nobody", the specified predicate and object, the answer is:

*nobody \_predicates [ \_object] .*

Otherwise, the answer is: *I don' t know .*

### 3.what does subject do ?

If there are one or more sentences (both positive and negative) considering the specified subject (or a generic subject "everybody" or "nobody"), all verbs and objects from such sentences must be included in a reply in the same order as the corresponding sentences have appeared in the input. No verb-object pair can be included more than once (the eventual second appearance must be skipped). The verb-object pairs are separated by a comma followed by a space, the last verb is separated by a comma and the word "and". Please note the comma is printed here although there was no comma when separating the subjects in the previous type of answer (see above). The negative answers have the same form as the statements, that means the verb "don' t" or "doesn' t" is used:

*subject [ \_don' tldoesn' t] \_predicate1[s] [ \_object1] ,  
[ \_don' tldoesn' t] \_predicate2[s] [ \_object2] ,  
\_and [ \_don' tldoesn' t] \_predicate3[s] [ \_object3] .  
subject [ \_don' tldoesn' t] \_predicate1[s] [ \_object1] ,  
\_and [ \_don' tldoesn' t] \_predicate2[s] [ \_object2] .  
subject [ \_don' tldoesn' t] \_predicate[s] [ \_object] .*

Otherwise, the answer is: I don't know.

## Example

### Sample Input:

```
1
I like hotdogs.
nobody likes to work.
everybody smiles.
what do I do?
who smiles?
what do you do?
does Joe smile?
do I like to work?
everybody hurts sometimes.
who walks there?
Michal walks there.
who walks there?
what does Michal do?
do you understand?
nobody walks there.
do you understand now?
bye!
```

### Sample Output:

```
Dialogue #1:
what do I do?
you like hotdogs, don't like to work, and smile.

who smiles?
everybody smiles.

what do you do?
I don't like to work, and smile.

does Joe smile?
yes, Joe smiles.

do I like to work?
no, you don't like to work.

who walks there?
I don't know.

who walks there?
Michal walks there.

what does Michal do?
Michal doesn't like to work, smiles, hurts sometimes, and walks there.

do you understand?
maybe.

do you understand now?
I am abroad.

bye!
```

---

Added by: Adrian Kosowski

Date: 2004-05-09

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

### 14. I-Keyboard

#### Problem code: IKEYB

Most of you have probably tried to type an SMS message on the keypad of a cellular phone. It is sometimes very annoying to write longer messages, because one key must be usually pressed several times to produce a single letter. It is due to a low number of keys on the keypad. Typical phone has twelve keys only (and maybe some other control keys that are not used for typing). Moreover, only eight keys are used for typing 26 letters of an English alphabet. The standard assignment of letters on the keypad is shown in the left picture:

1	2 abc	3 def
4 ghi	5 jkl	6 mno
7 pqrs	8 tuv	9 wxyz
*	0 <i>space</i>	#

1	2 abcd	3 efg
4 hijk	5 lm	6 nopq
7 rs	8 tuv	9 wxyz
*	0 <i>space</i>	#

There are 3 or 4 letters assigned to each key. If you want the first letter of any group, you press that key once. If you want the second letter, you have to press the key twice. For other letters, the key must be pressed three or four times. The authors of the keyboard did not try to optimise the layout for minimal number of keystrokes. Instead, they preferred the even distribution of letters among the keys. Unfortunately, some letters are more frequent than others. Some of these frequent letters are placed on the third or even fourth place on the standard keyboard. For example, *s* is a very common letter in an English alphabet, and we need four keystrokes to type it. If the assignment of characters was like in the right picture, the keyboard would be much more comfortable for typing average English texts.

ACM have decided to put an optimised version of the keyboard on its new cellular phone. Now they need a computer program that will find an optimal layout for the given letter frequency. We need to preserve alphabetical order of letters, because the user would be confused if the letters were mixed. But we can assign any number of letters to a single key.

#### Input

There is a single positive integer  $T$  on the first line of input (equal to about 2000). It stands for the number of test cases to follow. Each test case begins with a line containing two integers  $K, L$  ( $1 \leq K \leq L \leq 90$ ) separated by a single space.  $K$  is the number of keys,  $L$  is the number of letters to be mapped onto those keys. Then there are two lines. The first one contains exactly  $K$  characters each representing a name of one key. The second line contains exactly  $L$  characters representing names of letters of an alphabet. Keys and letters are represented by digits, letters (which are case-sensitive), or any punctuation characters (ASCII code between 33 and 126 inclusively). No two keys have the same character, no two letters are the same. However, the name of a letter can be used also as a name for

akey.

After those two lines, there are exactly  $L$  lines each containing exactly one positive integer  $F_1, F_2, \dots, F_L$ . These numbers determine the frequency of every letter, starting with the first one and continuing with the others sequentially. The higher number means the more common letter. No frequency will be higher than 100000.

## Output

Find an optimal keyboard for each test case. Optimal keyboard is such that has the lowest "price" for typing average text. The *price* is determined as the sum of the prices of each letter. The price of a letter is a product of the letter frequency ( $F_i$ ) and its position on the key. The order of letters cannot be changed, they must be grouped in the given order.

If there are more solutions with the same price, we will try to maximise the number of letters assigned to the last key, then to the one before the last one etc.

More formally, you are to find a sequence  $P_1, P_2, \dots, P_L$  representing the position of every letter on a particular key. The sequence must meet following conditions:

- $P_1 = 1$
- for each  $i > 1$ , either  $P_i = P_{i-1} + 1$  or  $P_i = 1$
- there are at most  $K$  numbers  $P_i$  such that  $P_i = 1$
- the sum of products  $S_P = \sum_{i=1..L} F_i \cdot P_i$  is minimal
- for any other sequence  $Q$  meeting these criteria and with the same sum  $S_Q = S_P$ , there exists such  $M$ ,  $1 \leq M \leq L$  that for any  $J$ ,  $M < J \leq L$ ,  $P_J = Q_J$ , and  $P_M > Q_M$ .

The output for every test case must start with a single line saying `Keypad #I:`, where  $I$  is a sequential order of the test case, starting with 1. Then there must be exactly  $K$  lines, each representing one letter, in the same order that was used in input. Each line must contain the character representing the key, a colon, one space and a list of letters assigned to that particular key. Letters are not separated from each other.

Print one blank line after each test case, including the last one.

## Example

Sample Input:

```
1
8 26
23456789
ABCDEFGHIJKLMNOPQRSTUVWXYZ
3371
589
1575
1614
6212
971
773
1904
2989
```

123  
209  
1588  
1513  
2996  
3269  
1080  
121  
2726  
3083  
4368  
1334  
518  
752  
427  
733  
871

**Sample Output:**

Keypad #1:  
2: ABCD  
3: EFG  
4: HIJK  
5: LM  
6: NOPQ  
7: RS  
8: TUV  
9: WXYZ

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-05-09

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 2000

## SPOJ Problem Set (classical)

### 16. Sphere in a tetrahedron

#### Problem code: TETRA

Of course a Sphere Online Judge System is bound to have some tasks about spheres. So here is one. Given the lengths of the edges of a tetrahedron calculate the radius of a sphere inscribed in that tetrahedron (i.e. a sphere tangent to all the faces).

#### Input

Number N of test cases in a single line. (  $N \leq 30$  ) Each of the next N lines consists of 6 integer numbers -- the lengths of the edges of a tetrahedron separated by single spaces. The edges are not longer than 1000 and for the tetrahedron WXYZ, the order of the edges is: WX, WY, WZ, XY, XZ, YZ.

#### Output

N lines, each consisting of a real number given with four digits decimal precision equal to the radius of a sphere inscribed in the given tetrahedron.

#### Example

```
Input:
2
1 1 1 1 1 1
1000 999 998 5 5 6
```

```
Output:
0.2041
1.4189
```

---

Added by: Adam Dzedzej  
Date: 2004-05-11  
Time limit: 1s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 17. The Bytelandian Cryptographer (Act I)

#### Problem code: CRYPTO1

The infamous Bytelandian Bit-eating Fanatic Organisation (BBFO for short) plans to launch an all-out denial-of-service attack on the Bytelandian McDecimal's fast food network by blocking the entrance to every restaurant with a camel (the purpose being to rid the Organisation of unhealthy competition, obviously). In a sly and perfidious move, the head cryptographer of BBFO decided to disclose the date and time of the planned attack to the management of McDecimal's, but in encrypted form (ha ha). He calculated the number of seconds from midnight 1970.01.01 GMT to the moment of attack, squared it, divided it by 4000000007 and sent the remainder by e-mail to McDecimal's. This made the original date impossible to decode.

Or did it?

\* \* \*

You work as the head algorithmist at McDecimal's HQ and know nothing of what is happening in Byteland. Things are not going well. You are playing a quiet game of hearts against your computer and wondering why on earth Management are considering making you redundant. Suddenly, the CEO bursts into your office, saying:

- Look here, young man[lady]! I have this number and those guys claim it is supposed to be some date. I am giving you one second to tell me what it all means!

I am afraid you have no choice. You can't ask any further questions. You just have to answer, now.

#### Input

The encrypted timestamp.

#### Output

The decrypted GMT time and date of attack, somewhere between 1970 and 2030, using standard 26 character formatting.

#### Example

Input:

1749870067

Output:

Sun Jun 13 16:20:39 2004

---



Added by: Adrian Kosowski  
Date: 2004-05-13  
Time limit: 1s  
Source limit: 10000B  
Languages: All  
Resource: ;)

## SPOJ Problem Set (classical)

### 18. The Bytelandian Cryptographer (Act II)

#### Problem code: CRYPTO2

Encouraged by his last successful exploit, the Bytelandian fanatic cryptographer impudently encrypted a three-digit number by subtracting 1 from it.

This time he has **really** overstepped the mark! Soldier, go and beat him, for Burger King & Country! Oh, and remember your good manners, use Brainf\*\*k (no other language is allowed).

#### Input

An encrypted 3-digit positive integer.

#### Output

The decrypted value.

#### Example

Input:

699

Output:

700

---

Added by: Adrian Kosowski

Date: 2004-05-28

Time limit: 1s

Source limit: 50000B

Languages: BF

Resource: Sometimes the simplest language is the most pleasing.

## SPOJ Problem Set (classical)

### 19. The Bytelandian Cryptographer (Act III)

#### Problem code: CRYPTO3

The Bytelandian cryptographer acknowledged he was sorely beaten in Act 2. He renounced his own methods of encryption and decided to return to the classic techniques.

Not knowing what to do next, he went to the cinema to chew the problem over. To his surprise, he found that the cone containing pop-corn was in fact a rolled up page torn from the classic book, *RSA for newbies in 24 seconds*. The page in question contained the entire key-generating and encryption algorithm. Fascinated, he thought up two different prime numbers  $p$  and  $q$ , and calculated his own public key, and revealed the product  $p*q$  to the wide world. Then, he began work on his wicked scheme of encryption.

History repeats. Once more, you receive an encrypted message from the cryptographer. This time you know that without additional information you are beaten, so you decide to use the psychological approach. You phone the Bytelandian cryptographer, and ask him whether he couldn't give you a little hint. What you really want to know is the number  $u$  of positive integers which are smaller than  $p*q$  and have no common factors with  $p*q$  other than 1. But the cryptographer, sensing that this would allow you to decode the message right away, refuses to tell you this number. Eventually, after a lot of asking, he gives you a piece of utterly useless information: he tells you how many positive integers  $x$  cannot be represented in the form  $x=a*p+b*q$ , regardless of what non-negative integer values  $a$  and  $b$  assume.

You begin to wonder whether the information you received from the cryptographer is not by any chance enough to find the value of  $u$ .

**Even if the only languages at your disposal are Brainf\*\*k and Intercal...**

#### Input

The number provided by the cryptographer (a positive integer of at most 99 decimal digits). The input ends with a new line symbol.

#### Output

The value of  $u$ .

#### Example

**Input :**

1

**Output :**

2

(This example is possible for  $p=2$ ,  $q=3$ )

---

Added by: Adrian Kosowski

Date: 2004-05-29

Time limit: 3s

Source  
limit: 50000B

Languages: BF ICK

Resource: Sadly, the ability to make a simple problem difficult to understand is seldom considered a talent.

## SPOJ Problem Set (classical)

### 20. The Bytelandian Cryptographer (Act IV)

#### Problem code: CRYPTO4

The Bytelandian Cryptographer has been requested by the BBFO to put forward an encryption scheme which would allow the BBFO to communicate with its foreign associates. After some intensive studies, he has decided upon the Vigenère cipher. Messages written using 26 upper case characters of the Latin alphabet: A, B, ..., Z which are interpreted as integers 0,1, ..., 25 respectively. The secret cypher for transmitting a message is known to both sides and consists of  $n$  integers  $k_1, k_2, \dots, k_n$ . Using this cypher, the  $i$ -th number  $x_i$  of the input message  $x$  is encrypted to the form of the  $i$ -th number of the output message  $y$ , as follows:

$$y_i = (x_i + k_{1 + ((i-1) \bmod n)}) \bmod 26.$$

You are trying to find out the content of a message transmitted by the BBFO. By a lucky stroke of fortune, your spys managed to intercept the message in both its plaintext and encrypted form ( $x$  and  $y$  respectively). Unfortunately, during their dramatic escape the files they were carrying were pierced by bullets and fragments of messages  $x$  and  $y$  were inadvertently lost. Or were they? It is your task to reconstruct as much of message  $x$  as you possibly can.

#### Input

The first line of input contains a single integer  $t \leq 200$  denoting the number of test cases.  $t$  test case descriptions follow.

For each test case, the first line contains one integer  $m$  which is some upper bound on the length of the cypher ( $1 \leq n \leq m \leq 100000$ ). The second line of input contains the original message  $x$ , while the third line contains the encrypted message  $y$ . The messages are expressed using characters 'A'-'Z' (interpreted as integers 0-25) and '\*' (denoting a single character illegible due to damage). The total length of the input file is not more than 2MB.

#### Output

For each test case output a single line containing the original message  $x$ , with asterisks '\*' in place of only those characters whose value cannot be determined.

#### Example

**Input :**

```
4
1
A*X*C
**CM*
4
*B***A
AAAAAA
6
*B***A
AAAAAA
```

4

\*AA\*\*\*\*\*  
AAAAAAAAAA

**Output :**

A\*XHC  
\*BA\*BA  
\*B\*\*\*A  
\*AA\*\*A\*\*\*\*

**Warning: large Input/Output data, be careful with certain languages.  
The time limit is strict for this problem.**

---

Added by: Konrad Piwakowski

Date: 2004-11-16

Time limit: 17s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004 (problemset 3)

## SPOJ Problem Set (classical)

### 22. Triangle From Centroid

#### Problem code: TRICENTR

Given the length of side  $a$  of a triangle and the distances from the centroid (the point of concurrence of the medians - red in the picture) to all sides:  $a$ ,  $b$  and  $c$ , calculate this triangle's area and the distance (blue line) from the orthocenter (the point of concurrence of the heights - green in the picture) to the centroid.

[IMAGE]

#### Input

In the first line integer  $n$  - the number of test cases (equal to about 1000). The next  $n$  lines - 4 floating point values: the length of side  $a$ , and distances from the centroid to sides  $a$ ,  $b$  and  $c$ .

#### Output

$n$  lines consisting of 2 floating point values with 3 digits after the decimal point: the area of the triangle and the distance from the orthocenter to centroid.

#### Example

**Input :**

2

3.0 0.8660254038 0.8660254038 0.8660254038  
657.8256599140 151.6154399062 213.5392629932 139.4878846649

**Output :**

3.897 0.000  
149604.790 150.275

---

Added by: Patryk Pomykalski

Date: 2004-05-22

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 23. Pyramids

#### Problem code: PIR

Recently in Farland, a country in Asia, the famous scientist Mr. Log Archeo discovered ancient pyramids. But unlike those in Egypt and Central America, they have a triangular (not rectangular) foundation. That is, they are tetrahedrons in the mathematical sense. In order to find out some important facts about the early society of the country (it is widely believed that the pyramid sizes are closely connected with Farland's ancient calendar), Mr. Archeo needs to know the volume of the pyramids. Unluckily, he has reliable data about their edge lengths only. Please, help him!

#### Input

t [number of tests to follow] In each of the next t lines six positive integer numbers not exceeding 1000 separated by spaces (each number is one of the edge lengths of the pyramid ABCD). The order of the edges is the following: AB, AC, AD, BC, BD, CD.

#### Output

For each test output a real number - the volume, printed accurate to four digits after decimal point.

#### Example

```
Input:
2
1 1 1 1 1 1
1000 1000 1000 3 4 5
```

```
Output:
0.1179
1999.9937
```

---

Added by: Adam Dzedzej  
Date: 2004-05-14  
Time limit: 1s  
Source limit: 10000B  
Languages: All  
Resource: ACM ICPC 2002-2003 NEERC, Northern Subregion



## SPOJ Problem Set (classical)

### 24. Small factorials

#### Problem code: FCTRL2

You are asked to calculate factorials of some small positive integers.

#### Input

An integer  $t$ ,  $1 \leq t \leq 100$ , denoting the number of testcases, followed by  $t$  lines, each containing a single integer  $n$ ,  $1 \leq n \leq 100$ .

#### Output

For each integer  $n$  given at input, display a line with the value of  $n!$

#### Example

Sample input:

```
4
1
2
5
3
```

Sample output:

```
1
2
120
6
```

---

Added by: Adrian Kosowski

Date: 2004-05-28

Time limit: 1s

Source limit: 2000B

Languages: All

## SPOJ Problem Set (classical)

### 25. Pouring water

#### Problem code: POUR1

Given two vessels, one of which can accommodate  $a$  litres of water and the other -  $b$  litres of water, determine the number of steps required to obtain exactly  $c$  litres of water in one of the vessels.

At the beginning both vessels are empty. The following operations are counted as 'steps':

- emptying a vessel,
- filling a vessel,
- pouring water from one vessel to the other, without spilling, until one of the vessels is either full or empty.

#### Input

An integer  $t$ ,  $1 \leq t \leq 100$ , denoting the number of testcases, followed by  $t$  sets of input data, each consisting of three positive integers  $a$ ,  $b$ ,  $c$ , not larger than 40000, given in separate lines.

#### Output

For each set of input data, output the minimum number of steps required to obtain  $c$  litres, or -1 if this is impossible.

#### Example

Sample input:

```
2
5
2
3
2
3
4
```

Sample output:

```
2
-1
```

---

Added by: Adrian Kosowski

Date: 2004-05-31

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: An ancient problem, formulated in these words by Mr Tadeusz Ratajczak

## SPOJ Problem Set (classical)

### 26. Build the Fence

#### Problem code: BSHEEP

At the beginning of spring all the sheep move to the higher pastures in the mountains. If there are thousands of them, it is well worthwhile gathering them together in one place. But sheep don't like to leave their grass-lands. Help the shepherd and build him a fence which would surround all the sheep. The fence should have the smallest possible length! Assume that sheep are negligibly small and that they are not moving. Sometimes a few sheep are standing in the same place. If there is only one sheep, it is probably dying, so no fence is needed at all...

#### Input

t [the number of tests  $\leq 100$ ]

[empty line]

n [the number of sheep  $\leq 100000$ ]

$x_1$   $y_1$  [coordinates of the first sheep]

...

$x_n$   $y_n$

[integer coordinates from -10000 to 10000]

[empty line]

[other lists of sheep]

Text grouped in [ ] does not appear in the input file. Assume that sheep are numbered in the input order.

#### Output

o [length of circumference, 2 digits precision]

p1 p2 ... pk

[the sheep that are standing in the corners of the fence; the first one should be positioned bottommost and as far to the left as possible, the others ought to be written in anticlockwise order; ignore all sheep standing in the same place but the first to appear in the input file; the number of sheep should be the smallest possible]

[empty line]

[next solutions]

#### Example

Input :

8

5

0 0

0 5

10 5

3 3

10 0

1  
0 0

3  
0 0  
1 0  
2 0

4  
0 0  
0 0  
0 1  
1 0

3  
0 0  
0 1  
1 0

6  
0 0  
-1 -1  
1 1  
2 2  
3 3  
4 4

2  
10 0  
0 0

7  
-3 -4  
2 -3  
4 3  
-4 2  
0 5  
2 -3  
-1 4

Output:  
30.00  
1 5 3 2

0.00  
1

4.00  
1 3

3.41  
1 4 3

3.41  
1 3 2

14.14  
2 6

20.00

2 1

26.98

1 2 3 5 4

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Michał Małafiejski

Date: 2004-06-01

Time limit: 7s

Source limit:50000B

Languages: All

Resource: -

## SPOJ Problem Set (classical)

### 27. Sorting Bank Accounts

#### Problem code: SBANK

In one of the internet banks thousands of operations are being performed every day. Since certain customers do business more actively than others, some of the bank accounts occur many times in the list of operations. Your task is to sort the bank account numbers in ascending order. If an account appears twice or more in the list, write the number of repetitions just after the account number. The format of accounts is as follows: **2** control digits, an **8**-digit code of the bank, **16** digits identifying the owner (written in groups of four digits), for example (at the end of each line there is exactly one space):

**30 10103538 2222 1233 6160 0142**

**Banks are real-time institutions and they need FAST solutions. If you feel you can meet the challenge within a very stringent time limit, go ahead!** A well designed sorting algorithm in a fast language is likely to succeed.

#### Input

*t* [the number of tests  $\leq 5$ ]  
*n* [the number of accounts  $\leq 100\,000$ ]  
[list of accounts]  
[empty line]  
[next test cases]

#### Output

[sorted list of accounts with the number of repeated accounts]  
[empty line]  
[other results]

#### Example

Input :

```
2
6
03 10103538 2222 1233 6160 0142
03 10103538 2222 1233 6160 0141
30 10103538 2222 1233 6160 0141
30 10103538 2222 1233 6160 0142
30 10103538 2222 1233 6160 0141
30 10103538 2222 1233 6160 0142

5
30 10103538 2222 1233 6160 0144
30 10103538 2222 1233 6160 0142
30 10103538 2222 1233 6160 0145
```

```
30 10103538 2222 1233 6160 0146
30 10103538 2222 1233 6160 0143
```

Output:

```
03 10103538 2222 1233 6160 0141 1
03 10103538 2222 1233 6160 0142 1
30 10103538 2222 1233 6160 0141 2
30 10103538 2222 1233 6160 0142 2
```

```
30 10103538 2222 1233 6160 0142 1
30 10103538 2222 1233 6160 0143 1
30 10103538 2222 1233 6160 0144 1
30 10103538 2222 1233 6160 0145 1
30 10103538 2222 1233 6160 0146 1
```

---

Added by: Michał Małafiejski

Date: 2004-06-01

Time limit: 7s

Source limit:50000B

Languages: All

Resource: -

## SPOJ Problem Set (classical)

### 28. Help the Military Recruitment Office!

#### Problem code: HMRO

At the end of year 2004, the regional agencies of the Polish Military Recruitment Office (known as WKU in Polish) is sending a call to all boys born in 1984. Every recruit has his personal 11-digit identification number (PESEL, format: YYMMDDXXXXX, where YYMMDD is the date of birth, and XXXXX is a zero-padded integer smaller than 100000). Every agency of the Military Recruitment Office has its own code (MRO, format: a place code consisting of 3 upper case letters and a one-digit number). But this year the army underwent some reforms and not all boys at conscription age are going to be recruited. The list of closed down MRO points is as follows: the code of the closed down MRO is followed by the code of some other MRO, to which all the recruits are now going to be assigned. The list of recruits contains their PESEL codes. Your task is to prepare the complete list of recruits and determine the codes of their new MRO-s.

#### Input

```
s [the number of tests <= 10]
p [the number of boys at conscription age <= 100000]
PESEL and MRO code
z [the number of closed down MRO points <= 100000]
old_code new_code [old_code - the code of closed down MRO,
new_code - its new MRO code]
p [the number of recruits <= 100000]
PESEL [PESEL code of recruit]
[empty line]
[next tests]
```

#### Output

```
one PESEL and MRO code per line in the order of input
[empty line between tests]
[other results]
```

#### Example

```
Input:
1
4
84101011111 GDA1
84010122222 GDA2
84010233333 GDA2
84020255555 GDY1
1
GDA2 GDA1
3
84101011111
84010122222
84020255555
```



Output:  
84101011111 GDA1  
84010122222 GDA1  
84020255555 GDY1

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Michał Małafiejski  
Date: 2004-06-01  
Time limit: 30s  
Source limit:50000B  
Languages: All  
Resource: -

## SPOJ Problem Set (classical)

### 29. Hash it!

#### Problem code: HASHIT

Your task is to calculate the result of the hashing process in a table of 101 elements, containing keys that are strings of length at most 15 letters (ASCII codes 'A',..., 'z'). Implement the following operations:

- find the index of the element defined by the key (ignore, if no such element),
- insert a new key into the table (ignore insertion of the key that already exists),
- delete a key from the table (without moving the others), by marking the position in table as *empty* (ignore non-existing keys in the table)

When performing find, insert and delete operations define the following function:

*integer Hash(string key),*

which for a string  $key=a_1...a_n$  returns the value:

$Hash(key)=h(key) \bmod 101$ , where

$h(key)=19 \cdot (ASCII(a_1) \cdot 1 + \dots + ASCII(a_n) \cdot n)$ .

Resolve collisions using the open addressing method, i.e. try to insert the key into the table at the first free position:  $(Hash(key)+j^2+23*j) \bmod 101$ , for  $j=1,\dots,19$ . After examining of at least 20 table entries, we assume that the insert operation cannot be performed.

#### Input

$t$  [the number of test cases  $\leq 100$ ]

$n_1$  [the number of operations (one per line)  $\leq 1000$ ]

ADD:string

[or]

DEL:string [other test cases, without empty lines between series]

#### Output

For every test case you have to create a new table, insert or delete keys, and write to the output:

the number of keys in the table [first line]

index:key [sorted by indices]

#### Example

Input:

1

11

ADD:marsz

ADD:marsz

ADD:Dabrowski

ADD:z

ADD:ziemii

ADD:wloskiej

ADD:do

ADD:Polski  
DEL:od  
DEL:do  
DEL:wloskiej

Output:  
5  
34:Dabrowski  
46:Polski  
63:marsz  
76:ziemii  
96:z

---

Added by: Michał Małafiejski  
Date: 2004-06-01  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: -

## SPOJ Problem Set (classical)

### 30. Bytelandian Blingors Network

#### Problem code: BLINNET

*We have discovered the fastest communication medium* Bytelandian scientists announced, and they called it *blingors*. The blingors are incomparably better than other media known before. Many companies in Byteland started to build blingors networks, so the information society in the kingdom of Bytes is fact! The priority is to build the core of the blingors network, joining main cities in the country. Assume there is some number of cities that will be connected at the beginning. The cost of building blingors connection between two cities depends on many elements, but it has been successfully estimated. Your task is to design the blingors network connections between some cities in this way that between any pair of cities is a communication route. The cost of this network should be as small as possible.

#### Remarks

- The name of the city is a string of at most 10 letters from  $a, \dots, z$ .
- The cost of the connection between two cities is a positive integer.
- The sum of all connections is not greater than  $2^{32}-1$ .
- The number of cities is not greater than 10 000.

#### Input

```
s [number of test cases <= 10]
n [number of cities <= 10 000]
NAME [city name]
p [number of neighbouring cities to the city NAME]
neigh cost
    [neigh - the unique number of city from the main list
     cost - the cost of building the blingors connection from NAME to neigh]

[empty line between test cases]
```

#### Output

[separate lines] *cost* [the minimum cost of building the blingors network]

#### Example

##### Input :

```
2

4
gdansk
2
2 1
3 3
bydgoszcz
3
1 1
```

```
3 1
4 4
torun
3
1 3
2 1
4 1
warszawa
2
2 4
3 1

3
ixowo
2
2 1
3 3
iyekowo
2
1 1
3 7
zetowo
2
1 3
2 7
```

**Output :**

```
3
4
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Łukasz Kuszner

Date: 2004-06-01

Time limit: 4s

Source limit: 50000B

Languages: All

Resource: PAL

## SPOJ Problem Set (classical)

### 31. Fast Multiplication

#### Problem code: MUL

Multiply the given numbers.

#### Input

```
n [the number of multiplications <= 1000]
l1 l2 [numbers to multiply (at most 10000 decimal digits each)]
```

Text grouped in [ ] does not appear in the input file.

#### Output

The results of multiplications.

#### Example

```
Input:
5
4 2
123 43
324 342
0 12
9999 12345
```

```
Output:
8
5289
110808
0
123437655
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Darek Dereniowski  
Date: 2004-06-01  
Time limit: 2s  
Source limit: 50000B  
Languages: All  
Resource: PAL

## SPOJ Problem Set (classical)

### 32. A Needle in the Haystack

#### Problem code: NHAY

Write a program that finds all occurrences of a given pattern in a given input string. This is often referred to as finding a *needle* in a *haystack*.

The program has to detect **all** occurrences of the needle in the haystack. It should take the needle and the haystack as input, and output the positions of each occurrence, as shown below. The suggested implementation is the KMP algorithm, but this is not a requirement. However, a naive approach will probably exceed the time limit, whereas other algorithms are more complicated... The choice is yours.

#### Input

The input consists of a number of test cases. Each test case is composed of three lines, containing:

- the length of the needle,
- the needle itself,
- the haystack.

The length of the needle is only limited by the memory available to your program, so do not make any assumptions - instead, read the length and allocate memory as needed. The haystack is **not** limited in size, which implies that your program should not read the whole haystack at once. The KMP algorithm is stream-based, i.e. it processes the haystack character by character, so this is not a problem.

The test cases come one after another, each occupying three lines, with no additional space or line breaks in between.

#### Output

For each test case your program should output all positions of the needle's occurrences within the haystack. If a match is found, the output should contain the position of the first character of the match. Characters in the haystack are numbered starting with zero.

For a given test case, the positions output should be sorted in ascending order, and each of these should be printed in a separate line. For two different test cases, the positions should be separated by an empty line.

#### Example

```
Sample input:2
na
banananobano
6
foobar
```

```
foo
9
foobarfoo
barfoobarfoobarfoobarfoobarfoo
```

Sample output:

```
2
4

3
9
15
21
```

Note the double empty line in the output, which means that no match was found for the second test case.

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Michał Małafiejski

Date: 2004-06-03

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: the problem was phrased and test data was supplied by Mr. Maciej 'hawk' Jarzębski



## SPOJ Problem Set (classical)

### 33. Trip

#### Problem code: TRIP

Alice and Bob want to go on holiday. Each of them has drawn up a list of cities to be visited in turn. A list may contain a city more than once. As they want to travel together, they have to agree upon a common route. No one wants to change the order of the cities on his list or add other cities. Therefore they have no choice but to remove some cities from the list. Of course the common route is to involve as much sight-seeing in cities as possible. There are exactly 26 cities in the region. Therefore they are encoded on the lists as lower case letters from 'a' to 'z'.

#### Input

The first line of input contains a number  $T \leq 10$  that indicates the number of test cases to follow. Each test case consists of two lines; the first line is the list of Alice, the second line is the list of Bob. Each list consists of 1 to 80 lower case letters.

#### Output

The output for each test case should contain all different trips exactly once that meet the conditions described above. There is at least one such trip, but never more than 1000 different ones. You should order the trips in lexicographic order. Print one blank line between the output of different test cases.

#### Example

##### Input

```
1
abcabcaa
acbacba
```

##### Output

```
ababa
abaca
abcba
acaba
acaca
acbaa
acbca
```

---

Added by: Adrian Kuegel  
Date: 2004-06-05  
Time limit: 3s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: own problem, used in CEOI 2003

## SPOJ Problem Set (classical)

### 34. Run Away

#### Problem code: RUNAWAY

One of the traps we will encounter in the Pyramid is located in the Large Room. A lot of small holes are drilled into the floor. They look completely harmless at the first sight. But when activated, they start to throw out very hot java, uh ... pardon, lava. Unfortunately, all known paths to the Center Room (where the Sarcophagus is) contain a trigger that activates the trap. The ACM were not able to avoid that. But they have carefully monitored the positions of all the holes. So it is important to find the place in the Large Room that has the maximal distance from all the holes. This place is the safest in the entire room and the archaeologist has to hide there.

#### Input

The input consists of  $T$  test cases. The number of them ( $T$ ) is given on the first line of the input file. Each test case begins with a line containing three integers  $X, Y, M$  separated by space. The numbers satisfy conditions:  $1 \leq X, Y \leq 10000, 1 \leq M \leq 1000$ . The numbers  $X$  and  $Y$  indicate the dimensions of the Large Room which has a rectangular shape. The number  $M$  stands for the number of holes. Then exactly  $M$  lines follow, each containing two integer numbers  $U_i$  and  $V_i$  ( $0 \leq U_i \leq X, 0 \leq V_i \leq Y$ ) indicating the coordinates of one hole. There may be several holes at the same position.

#### Output

Print exactly one line for each test case. The line should contain the sentence "The safest point is ( $P, Q$ ).", where  $P$  and  $Q$  are the coordinates of the point in the room that has the maximum distance from the nearest hole, rounded to the nearest number with exactly one digit after the decimal point (0.05 rounds up to 0.1).

#### Example

Sample Input:

```
3
1000 50 1
10 10
100 100 4
10 10
10 90
90 10
90 90
3000 3000 4
1200 85
63 2500
2700 2650
2990 100
```

Sample output:

```
The safest point is (1000.0, 50.0).
The safest point is (50.0, 50.0).
The safest point is (1433.0, 1669.8).
```

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 13s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1999

## SPOJ Problem Set (classical)

### 35. Equipment Box

#### Problem code: EQBOX

There is a large room in the Pyramid called *Room-of-No-Return*. Its floor is covered by rectangular tiles of equal size. The name of the room was chosen because of the very high number of traps and mechanisms in it. The ACM group has spent several years studying the secret plan of this room. It has made a clever plan to avoid all the traps. A specially trained mechanic was sent to deactivate the most feared trap called Shattered Bones. After deactivating the trap the mechanic had to escape from the room. It is very important to step on the center of the tiles only; he must not touch the edges. One wrong step and a large rock falls from the ceiling squashing the mechanic like a pancake. After deactivating the trap, he realized a horrible thing: the ACM plan did not take his equipment box into consideration. The box must be laid onto the ground because the mechanic must have both hands free to prevent contact with other traps. But when the box is laid on the ground, it could touch the line separating the tiles. And this is the main problem you are to solve.

#### Input

The input consists of  $T$  test cases ( $T$  is equal to about 10000). The number of them ( $T$ ) is given on the first line of the input file. Each test case consists of a single line. The line contains exactly four integer numbers separated by spaces:  $A$ ,  $B$ ,  $X$  and  $Y$ .  $A$  and  $B$  indicate the dimensions of the tiles,  $X$  and  $Y$  are the dimensions of the equipment box ( $1 \leq A, B, X, Y \leq 50000$ ).

#### Output

Your task is to determine whether it is possible to put the box on a single tile -- that is, if the whole box fits on a single tile without touching its border. If so, you are to print one line with the sentence "Escape is possible.". Otherwise print the sentence "Box cannot be dropped.".

#### Example

Sample Input:

```
2
10 10 8 8
8 8 10 10
```

Sample output:

```
Escape is possible.
Box cannot be dropped.
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1999

## SPOJ Problem Set (classical)

### 36. Secret Code

#### Problem code: CODE1

The Sarcophagus itself is locked by a secret numerical code. When somebody wants to open it, he must know the code and set it exactly on the top of the Sarcophagus. A very intricate mechanism then opens the cover. If an incorrect code is entered, the tickets inside would catch fire immediately and they would have been lost forever. The code (consisting of up to 100 integers) was hidden in the Alexandrian Library but unfortunately, as you probably know, the library burned down completely.

But an almost unknown archaeologist has obtained a copy of the code something during the 18th century. He was afraid that the code could get to the “wrong people” so he has encoded the numbers in a very special way. He took a random complex number  $B$  that was greater (in absolute value) than any of the encoded numbers. Then he counted the numbers as the digits of the system with basis  $B$ . That means the sequence of numbers  $a_n, a_{n-1}, \dots, a_1, a_0$  was encoded as the number  $X = a_0 + a_1 B + a_2 B^2 + \dots + a_n B^n$ .

Your goal is to decrypt the secret code, i.e. to express a given number  $X$  in the number system to the base  $B$ . In other words, given the numbers  $X$  and  $B$  you are to determine the “digit”  $a_0$  through  $a_n$ .

#### Input

The input consists of  $T$  test cases (equal to about 100000). The number of them ( $T$ ) is given on the first line of the input file. Each test case consists of one single line containing four integer numbers  $X_r, X_i, B_r, B_i$  ( $|X_r|, |X_i| \leq 1000000, |B_r|, |B_i| \leq 16$ ). These numbers indicate the real and complex components of numbers  $X$  and  $B$ , i.e.  $X = X_r + i.X_i, B = B_r + i.B_i$ .  $B$  is the basis of the system ( $|B| > 1$ ),  $X$  is the number you have to express.

#### Output

Your program must output a single line for each test case. The line should contain the “digits”  $a_n, a_{n-1}, \dots, a_1, a_0$ , separated by commas. The following conditions must be satisfied:

- for all  $i$  in  $\{0, 1, 2, \dots, n\}$ :  $0 \leq a_i < |B|$
- $X = a_0 + a_1 B + a_2 B^2 + \dots + a_n B^n$
- if  $n > 0$  then  $a_n \neq 0$
- $n \leq 100$

If there are no numbers meeting these criteria, output the sentence "The code cannot be decrypted.". If there are more possibilities, print any of them.

## Example

Sample Input

```
4
-935 2475 -11 -15
1 0 -3 -2
93 16 3 2
191 -192 11 -12
```

Sample output:

```
8,11,18
1
The code cannot be decrypted.
16,15
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1999

## SPOJ Problem Set (classical)

### 37. The Proper Key

#### Problem code: PROPKEY

Many people think that Tetris was invented by two Russian programmers. But that is not the whole truth. The idea of the game is very old -- even the Egyptians had something similar. But they did not use it as a game. Instead, it was used as a very complicated lock. The lock was made of wood and consisted of a large number of square fields, laid out in regular rows and columns. Each field was either completely filled with wood, or empty. The key for this lock was two-dimensional and it was made by joining square parts of the same size as the fields of the lock. So they had a 2D lock and 2D key that could be inserted into the lock from the top. The key was designed so that it was not possible to move it upwards. It could only fall down and it could slide sideways -- exactly like in a Tetris game. The only difference is that the key could not be rotated. Rotation in Tetris is really a Russian invention.

The entry gate into the Pyramid has such a lock. The ACM archaeologists have found several keys and one of them belongs to the lock with a very high probability. Now they need to try them out and find which one to use. Because it is too time-consuming to try all of them, it is better to begin with those keys that may be inserted deeper into the lock. Your program should be able to determine how deep a given key can be inserted into a given lock.

#### Input

The input consists of  $T$  test cases. The number of them ( $T$ ) is given on the first line of the input file. Each test case begins with a line containing two integers  $R$  and  $C$  ( $1 \leq R, C \leq 100$ ) indicating the key size. Then exactly  $R$  rows follow, each containing  $C$  characters. Each character is either a hash mark (#) or a period (.). A hash mark represents one square field made of wood; a period is an empty field. The wooden fields are always connected, i.e. the whole key is made of one piece. Moreover, the key remains connected even if we cut off arbitrary number of rows from its top. There is always at least one non-empty field in the top-most and bottom-most rows and the left-most and right-most columns.

After the key description, there is a line containing two integers  $D$  and  $W$  ( $1 \leq D \leq 10000$ ,  $1 \leq W \leq 1000$ ). The number  $W$  is the lock width, and  $D$  is its depth. The next  $D$  lines contain  $W$  characters each. The character may be either a hash mark (representing the wood) or a period (the free space).

#### Output

Your program should print one line of output for each test case. The line should contain the statement "The key falls to depth  $X$ ". Replace  $X$  with the maximum depth to which the key can be inserted by moving it down and sliding it to the left or right only. The depth is measured as the distance between the bottom side of the key and the top side of the lock. If it is possible to move the key through the whole lock and take it away at the bottom side, output the sentence "The key can fall through".



## Example

Sample Input:

```
4
2 4
#.#.#
###.
3 6
#....#
#....#
#..###
2 3
##.
.##
2 7
#.#.#.#
.#.#.#.
1 1
#
1 10
###....###
3 2
##
.#
.#
1 5
#.#.#
```

Sample output:

```
The key falls to depth 2.
The key falls to depth 0.
The key can fall through.
The key falls to depth 2.
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1999

## SPOJ Problem Set (classical)

### 38. Labyrinth

#### Problem code: LABYR1

The northern part of the Pyramid contains a very large and complicated labyrinth. The labyrinth is divided into square blocks, each of them either filled by rock, or free. There is also a little hook on the floor in the center of every free block. The ACM have found that two of the hooks must be connected by a rope that runs through the hooks in every block on the path between the connected ones. When the rope is fastened, a secret door opens. The problem is that we do not know which hooks to connect. That means also that the necessary length of the rope is unknown. Your task is to determine the maximum length of the rope we could need for a given labyrinth.

#### Input

The input consists of  $T$  test cases. The number of them ( $T$ ) is given on the first line of the input file. Each test case begins with a line containing two integers  $C$  and  $R$  ( $3 \leq C, R \leq 1000$ ) indicating the number of columns and rows. Then exactly  $R$  lines follow, each containing  $C$  characters. These characters specify the labyrinth. Each of them is either a hash mark (#) or a period (.). Hash marks represent rocks, periods are free blocks. It is possible to walk between neighbouring blocks only, where neighbouring blocks are blocks sharing a common side. We cannot walk diagonally and we cannot step out of the labyrinth.

The labyrinth is designed in such a way that there is exactly one path between any two free blocks. Consequently, if we find the proper hooks to connect, it is easy to find the right path connecting them.

#### Output

Your program must print exactly one line of output for each test case. The line must contain the sentence "Maximum rope length is  $X$ ." where  $X$  is the length of the longest path between any two free blocks, measured in blocks.

#### Example

Sample Input:

```
2
3 3
###
#.#
###
7 6
#####
#.#.###
#.#.###
#.#.#.#
#.....#
#####
```

Sample output:

```
Maximum rope length is 0.  
Maximum rope length is 8.
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1999

## SPOJ Problem Set (classical)

### 39. Piggy-Bank

#### Problem code: PIGBANK

Before ACM can do anything, a budget must be prepared and the necessary financial support obtained. The main income for this action comes from Irreversibly Bound Money (IBM). The idea behind is simple. Whenever some ACM member has any small money, he takes all the coins and throws them into a piggy-bank. You know that this process is irreversible, the coins cannot be removed without breaking the pig. After a sufficiently long time, there should be enough cash in the piggy-bank to pay everything that needs to be paid.

But there is a big problem with piggy-banks. It is not possible to determine how much money is inside. So we might break the pig into pieces only to find out that there is not enough money. Clearly, we want to avoid this unpleasant situation. The only possibility is to weigh the piggy-bank and try to guess how many coins are inside. Assume that we are able to determine the weight of the pig exactly and that we know the weights of all coins of a given currency. Then there is some minimum amount of money in the piggy-bank that we can guarantee. Your task is to find out this worst case and determine the minimum amount of cash inside the piggy-bank. We need your help. No more prematurely broken pigs!

#### Input

The input consists of  $T$  test cases. The number of them ( $T$ ) is given on the first line of the input file. Each test case begins with a line containing two integers  $E$  and  $F$ . They indicate the weight of an empty pig and of the pig filled with coins. Both weights are given in grams. No pig will weigh more than 10 kg, that means  $1 \leq E \leq F \leq 10000$ . On the second line of each test case, there is an integer number  $N$  ( $1 \leq N \leq 500$ ) that gives the number of various coins used in the given currency. Following this are exactly  $N$  lines, each specifying one coin type. These lines contain two integers each,  $P$  and  $W$  ( $1 \leq P \leq 50000$ ,  $1 \leq W \leq 10000$ ).  $P$  is the value of the coin in monetary units,  $W$  is its weight in grams.

#### Output

Print exactly one line of output for each test case. The line must contain the sentence "The minimum amount of money in the piggy-bank is  $X$ ." where  $X$  is the minimum amount of money that can be achieved using coins with the given total weight. If the weight cannot be reached exactly, print a line "This is impossible."

#### Example

Sample Input:

```
3
10 110
2
1 1
30 50
10 110
```

```
2
1 1
50 30
1 6
2
10 3
20 4
```

Sample output:

```
The minimum amount of money in the piggy-bank is 60.
The minimum amount of money in the piggy-bank is 100.
This is impossible.
```

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1999

## SPOJ Problem Set (classical)

### 40. Lifting the Stone

#### Problem code: STONE

There are many secret openings in the floor which are covered by a big heavy stone. When the stone is lifted up, a special mechanism detects this and activates poisoned arrows that are shot near the opening. The only possibility is to lift the stone very slowly and carefully. The ACM team must connect a rope to the stone and then lift it using a pulley. Moreover, the stone must be lifted all at once; no side can rise before another. So it is very important to find the centre of gravity and connect the rope exactly to that point. The stone has a polygonal shape and its height is the same throughout the whole polygonal area. Your task is to find the centre of gravity for the given polygon.

#### Input

The input consists of  $T$  test cases (equal to about 500). The number of them ( $T$ ) is given on the first line of the input file. Each test case begins with a line containing a single integer  $N$  ( $3 \leq N \leq 1000000$ ) indicating the number of points that form the polygon. This is followed by  $N$  lines, each containing two integers  $X_i$  and  $Y_i$  ( $|X_i|, |Y_i| \leq 20000$ ). These numbers are the coordinates of the  $i$ -th point. When we connect the points in the given order, we get a polygon. You may assume that the edges never touch each other (except the neighbouring ones) and that they never cross. The area of the polygon is never zero, i.e. it cannot collapse into a single line.

#### Output

Print exactly one line for each test case. The line should contain exactly two numbers separated by one space. These numbers are the coordinates of the centre of gravity. Round the coordinates to the nearest number with exactly two digits after the decimal point (0.005 rounds up to 0.01). Note that the centre of gravity may be outside the polygon, if its shape is not convex. If there is such a case in the input data, print the centre anyway.

#### Example

Sample Input:

```
2
4
5 0
0 5
-5 0
0 -5
4
1 1
11 1
11 11
1 11
```

Sample output:

```
0.00 0.00
6.00 6.00
```

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1999

## SPOJ Problem Set (classical)

### 41. Play on Words

#### Problem code: WORDS1

Some of the secret doors contain a very interesting word puzzle. The team of archaeologists has to solve it to open that door. Because there is no other way to open the doors, the puzzle is very important for us.

There is a large number of magnetic plates on every door. Every plate has one word written on it. The plates must be arranged into a sequence in such a way that every word begins with the same letter as the previous word ends. For example, the word “acm” can be followed by the word “motorola”. Your task is to write a computer program that will read the list of words and determine whether it is possible to arrange all of the plates in a sequence (according to the given rule) and consequently to open the door.

#### Input

The input consists of  $T$  test cases. The number of them ( $T$ , equal to about 500) is given on the first line of the input file. Each test case begins with a line containing a single integer number  $N$  that indicates the number of plates ( $1 \leq N \leq 100000$ ). Then exactly  $N$  lines follow, each containing a single word. Each word contains at least two and at most 1000 lowercase characters, that means only letters 'a' through 'z' will appear in the word. The same word may appear several times in the list.

#### Output

Your program has to determine whether it is possible to arrange all the plates in a sequence such that the first letter of each word is equal to the last letter of the previous word. All the plates from the list must be used, each exactly once. The words mentioned several times must be used that number of times.

If there exists such an ordering of plates, your program should print the sentence "Ordering is possible.". Otherwise, output the sentence "The door cannot be opened.".

#### Example

Sample input:

```
3
2
acm
ibm
3
acm
malform
mouse
2
ok
ok
```



Sample output:

```
The door cannot be opened.  
Ordering is possible.  
The door cannot be opened.
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1999

## SPOJ Problem Set (classical)

### 42. Adding Reversed Numbers

#### Problem code: ADDREV

The Antique Comedians of Malidinesia prefer comedies to tragedies. Unfortunately, most of the ancient plays are tragedies. Therefore the dramatic advisor of ACM has decided to transfigure some tragedies into comedies. Obviously, this work is very hard because the basic sense of the play must be kept intact, although all the things change to their opposites. For example the numbers: if any number appears in the tragedy, it must be converted to its reversed form before being accepted into the comedy play.

Reversed number is a number written in arabic numerals but the order of digits is reversed. The first digit becomes last and vice versa. For example, if the main hero had 1245 strawberries in the tragedy, he has 5421 of them now. Note that all the leading zeros are omitted. That means if the number ends with a zero, the zero is lost by reversing (e.g. 1200 gives 21). Also note that the reversed number never has any trailing zeros.

ACM needs to calculate with reversed numbers. Your task is to add two reversed numbers and output their reversed sum. Of course, the result is not unique because any particular number is a reversed form of several numbers (e.g. 21 could be 12, 120 or 1200 before reversing). Thus we must assume that no zeros were lost by reversing (e.g. assume that the original number was 12).

#### Input

The input consists of  $N$  cases (equal to about 10000). The first line of the input contains only positive integer  $N$ . Then follow the cases. Each case consists of exactly one line with two positive integers separated by space. These are the reversed numbers you are to add.

#### Output

For each case, print exactly one line containing only one integer - the reversed sum of two reversed numbers. Omit any leading zeros in the output.

#### Example

Sample input:

```
3
24 1
4358 754
305 794
```

Sample output:

```
34
1998
1
```

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1998

## SPOJ Problem Set (classical)

### 43. Copying Books

#### Problem code: BOOKS1

Before the invention of book-printing, it was very hard to make a copy of a book. All the contents had to be re-written by hand by so called *scribers*. The scribe had been given a book and after several months he finished its copy. One of the most famous scribes lived in the 15th century and his name was Xaverius Endricus Remius Ontius Xendrianus (*Xerox*). Anyway, the work was very annoying and boring. And the only way to speed it up was to hire more scribes.

Once upon a time, there was a theater ensemble that wanted to play famous Antique Tragedies. The scripts of these plays were divided into many books and actors needed more copies of them, of course. So they hired many scribes to make copies of these books. Imagine you have  $m$  books (numbered  $1, 2 \dots m$ ) that may have different number of pages ( $p_1, p_2 \dots p_m$ ) and you want to make one copy of each of them. Your task is to divide these books among  $k$  scribes,  $k \leq m$ . Each book can be assigned to a single scribe only, and every scribe must get a continuous sequence of books. That means, there exists an increasing succession of numbers  $0 = b_0 < b_1 < b_2, \dots < b_{k-1} \leq b_k = m$  such that  $i$ -th scribe gets a sequence of books with numbers between  $b_{i-1} + 1$  and  $b_i$ . The time needed to make a copy of all the books is determined by the scribe who was assigned the most work. Therefore, our goal is to minimize the maximum number of pages assigned to a single scribe. Your task is to find the optimal assignment.

#### Input

The input consists of  $N$  cases (equal to about 200). The first line of the input contains only positive integer  $N$ . Then follow the cases. Each case consists of exactly two lines. At the first line, there are two integers  $m$  and  $k$ ,  $1 \leq k \leq m \leq 500$ . At the second line, there are integers  $p_1, p_2, \dots, p_m$  separated by spaces. All these values are positive and less than 10000000.

#### Output

For each case, print exactly one line. The line must contain the input succession  $p_1, p_2, \dots, p_m$  divided into exactly  $k$  parts such that the maximum sum of a single part should be as small as possible. Use the slash character ('/') to separate the parts. There must be exactly one space character between any two successive numbers and between the number and the slash.

If there is more than one solution, print the one that minimizes the work assigned to the first scribe, then to the second scribe etc. But each scribe must be assigned at least one book.

#### Example

Sample input:

```
2
9 3
100 200 300 400 500 600 700 800 900
5 4
```

100 100 100 100 100

Sample output:

100 200 300 400 500 / 600 700 / 800 900  
100 / 100 / 100 / 100 100

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1998

## SPOJ Problem Set (classical)

### 44. Substitution Cipher

#### Problem code: SCYPHER

Antique Comedians of Malidinesia would like to play a new discovered comedy of Aristofanes. Putting it on a stage should be a big surprise for the audience so all the preparations must be kept absolutely secret. The ACM director suspects one of his competitors of reading his correspondence. To prevent other companies from revealing his secret, he decided to use a substitution cipher in all the letters mentioning the new play.

Substitution cipher is defined by a substitution table assigning each character of the substitution alphabet another character of the same alphabet. The assignment is a bijection (to each character exactly one character is assigned -- not necessarily different). The director is afraid of disclosing the substitution table and therefore he changes it frequently. After each change he chooses a few words from a dictionary by random, encrypts them and sends them together with an encrypted message. The plain (i.e. non-encrypted) words are sent by a secure channel, not by mail. The recipient of the message can then compare plain and encrypted words and create a new substitution table.

Unfortunately, one of the ACM cipher specialists have found that this system is sometimes insecure. Some messages can be decrypted by the rival company even without knowing the plain words. The reason is that when the director chooses the words from the dictionary and encrypts them, he never changes their order (the words in the dictionary are lexicographically sorted). String  $a_1 a_2 \dots a_p$  is lexicographically smaller than  $b_1 b_2 \dots b_q$  if there exists an integer  $i$ ,  $i \leq p$ ,  $i \leq q$ , such that  $a_j = b_j$  for each  $j$ ,  $1 \leq j < i$  and  $a_i < b_i$ .

The director is interested in which of his messages could be read by the rival company. You are to write a program to determine that.

#### Input

The input consists of  $N$  cases (equal to about 1000). The first line of the input contains only positive integer  $N$ . Then follow the cases. The first line of each case contains only two positive integers  $A$ ,  $1 \leq A \leq 26$ , and  $K$ , separated by space.  $A$  determines the size of the substitution alphabet (the substitution alphabet consists of the first  $A$  lowercase letters of the english alphabet (a--z) and  $K$  is the number of encrypted words. The plain words contain only the letters of the substitution alphabet. The plain message can contain any symbol, but only the letters of the substitution alphabet are encrypted. Then follow  $K$  lines, each containing exactly one encrypted word. At the next line is encrypted message.

#### Output

For each case, print exactly one line. If it is possible to decrypt the message uniquely, print the decrypted message. Otherwise, print the sentence 'Message cannot be decrypted.'.

## Example

Sample input:

```
2
5 6
cebdbac
cac
ecd
dca
aba
bac
cedab
4 4
cca
cad
aac
bca
bdac
```

Sample output:

```
abcde
Message cannot be decrypted.
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1998

## SPOJ Problem Set (classical)

### 45. Commedia dell Arte

#### Problem code: COMMEDIA

So called *commedia dell' arte* is a theater genre first played in Italy at the beginning of the sixteenth century. It was inspired with the Roman Theater. The play had no fixed script and the actors (also called *performers*) had to improvise a lot. There were only a simple directions by the author like "enter the stage and make something funny" or "everyone comes on stage and everything is resolved happily". You can see it might be very interesting to play the *commedia dell' arte*. Therefore the ACM want to put a new play on a stage, which was completely unknown before. The main hero has a puzzle that takes a very important role in the play and gives an opportunity of many improvisations. The puzzle is the worldwide known *Lloyd's Fifteen Puzzle*. ACM wants to make the play more interesting so they want to replace the "standard" puzzle with a three-dimensional one. The puzzle consists of a cube containing  $M^3$  slots. Each slot except one contains a cubic tile (one position is free). The tiles are numbered from 1 to  $M^3 - 1$ . The goal of the puzzle is to get the original ordering of the tiles after they have been randomly reshuffled. The only allowed moves are sliding a neighbouring tile into the free position along one of the three principal directions. Original configuration is when slot with coordinates  $(x, y, z)$  from  $\{0, \dots, M-1\}^3$  contains tile number  $z \cdot M^2 + y \cdot M + x + 1$  and slot  $(M-1, M-1, M-1)$  is free.

You are to write a program to determine whether it is possible to solve the puzzle or not.

#### Input

The input consists of  $N$  cases. The first line of the input contains only positive integer  $N$ . Then follow the cases. The first line of each case contains only one integer  $M$ ,  $1 \leq M \leq 100$ . It is the size of 3D puzzle cube. Then follow  $M$  lines, each contains exactly  $M^2$  numbers on the tiles for one layer. First is the layer on the top of the cube and the last one on the bottom. In each layer numbers are arranged from the left top corner linewise to the right bottom corner of the layer. In other words, slot with coordinates  $(x, y, z)$  is described by the  $(x + M \cdot y + 1)$ -th number on the  $(z + 1)$ -th line. Numbers are separated by space. Number 0 means free position.

#### Output

For each case, print exactly one line. If the original configuration can be reached by sliding the tiles, print the sentence 'Puzzle can be solved.'. Otherwise, print the sentence 'Puzzle is unsolvable.'.

#### Example

Sample input:

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



4 6 0 7

Sample output:

Puzzle is unsolvable.  
Puzzle can be solved.

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1998

## SPOJ Problem Set (classical)

### 47. Skyscraper Floors

#### Problem code: SCRAPER

What a great idea it is to build skyscrapers! Using not too large area of land, which is very expensive in many cities today, the skyscrapers offer an extremely large utility area for flats or offices. The only disadvantage is that it takes too long to get to the upper floors. Of course these skyscrapers have to be equipped not only with a stairway but also with several elevators. But even using ordinary elevators is very slow. Just imagine you want to get from the very top floor to the base floor and many other people on other floors want the same. As a result the elevator stops on almost every floor and since its capacity is limited and the elevator is already full from the upper floors, most stops are useless and just cause a delay. If there are more elevators in the skyscrapers, this problem is a little bit eliminated but still not completely. Most people just press all the buttons of all the elevators and then take the first one so that all elevators will stop on the floor anyway.

However, the solution exists as we shall see. The Antique Comedians of Midilesia headquarters reside in a skyscraper with a very special elevator system. The elevators do not stop on every floor but only on every  $X$ -th floor. Moreover each elevator can go just to a certain floor  $Y$  (called starting floor) and cannot go any lower. There is one high-capacity elevator which can stop on every elevator's starting floor.

The ACM has a big problem. The headquarters should be moved to another office this week, possibly on a different floor. Unfortunately, the high-capacity elevator is out of order right now so it is not always possible to go to the base floor. One piece of furniture cannot be moved using the stairway because it is too large to pass through the stairway door. You are to write a program that decides whether it is possible to move a piece of furniture from the original office to the other.

#### Input

The input consists of  $N$  cases (equal to about 2000). The first line contains only one positive integer  $N$ . Then follow the cases. Each case starts with a line containing four integers  $F, E, A, B$ , where  $F, 1 \leq F < 50000000$  determines the number of floors in the skyscraper (this means that there are floors 0 to  $F-1$ ),  $E, 0 < E < 100$  is the number of elevators and  $A, B, 0 \leq A, B < F$  are numbers of the two floors between which the piece of furniture should be moved. Then follow  $E$  lines. Each of them contains description of one elevator. There are exactly two integers  $X$  and  $Y, X > 0, Y \geq 0$  at each line.  $Y$  determines, that the elevator starts on the  $Y$ -th floor and  $X$  determines, that it stops on every  $X$ -th floor, eg. for  $X = 3, Y = 7$  the elevator stops on floors 7, 10, 13, 16, etc.).

#### Output

For each case, print exactly one line. If floor  $B$  is reachable from floor  $A$  not using the stairway, print the sentence 'It is possible to move the furniture.', otherwise print 'The furniture cannot be moved.'.

## Example

Sample input:

```
2
22 4 0 6
3 2
4 7
13 6
10 0
1000 2 500 777
2 0
2 1
```

Sample output:

```
It is possible to move the furniture.
The furniture cannot be moved.
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1998

## SPOJ Problem Set (classical)

### 48. Glass Beads

#### Problem code: BEADS

Once upon a time there was a famous actress. As you may expect, she played mostly Antique Comedies most of all. All the people loved her. But she was not interested in the crowds. Her big hobby were beads of any kind. Many bead makers were working for her and they manufactured new necklaces and bracelets every day. One day she called her main *Inspector of Bead Makers (IBM)* and told him she wanted a very long and special necklace.

The necklace should be made of glass beads of different sizes connected to each other but without any thread running through the beads, so that means the beads can be disconnected at any point. The actress chose the succession of beads she wants to have and the IBM promised to make the necklace. But then he realized a problem. The joint between two neighbouring beads is not very robust so it is possible that the necklace will get torn by its own weight. The situation becomes even worse when the necklace is disjointed. Moreover, the point of disconnection is very important. If there are small beads at the beginning, the possibility of tearing is much higher than if there were large beads. IBM wants to test the robustness of a necklace so he needs a program that will be able to determine the worst possible point of disjointing the beads.

The description of the necklace is a string  $A = a_1 a_2 \dots a_m$  specifying sizes of the particular beads, where the last character  $a_m$  is considered to precede character  $a_1$  in circular fashion.

The disjoint point  $i$  is said to be worse than the disjoint point  $j$  if and only if the string  $a_i a_{i+1} \dots a_n a_1 \dots a_{i-1}$  is lexicographically smaller than the string  $a_j a_{j+1} \dots a_n a_1 \dots a_{j-1}$ . String  $a_1 a_2 \dots a_n$  is lexicographically smaller than the string  $b_1 b_2 \dots b_n$  if and only if there exists an integer  $i$ ,  $i \leq n$ , so that  $a_j = b_j$ , for each  $j$ ,  $1 \leq j < i$  and  $a_i < b_i$ .

#### Input

The input consists of  $N$  cases. The first line of the input contains only positive integer  $N$ . Then follow the cases. Each case consists of exactly one line containing necklace description. Maximal length of each description is 10000 characters. Each bead is represented by a lower-case character of the english alphabet (a--z), where  $a < b \dots z$ .

#### Output

For each case, print exactly one line containing only one integer -- number of the bead which is the first at the worst possible disjointing, i.e. such  $i$ , that the string  $A[i]$  is lexicographically smallest among all the  $n$  possible disjointings of a necklace. If there are more than one solution, print the one with the lowest  $i$ .

## Example

Sample input:

```
4
helloworld
amandamanda
dontcallmebfu
aaabaaa
```

Sample output:

```
10
11
6
5
```

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1998

## SPOJ Problem Set (classical)

### 49. Hares and Foxes

#### Problem code: HAREFOX

The Antique Comedians of Malidinesia play an interesting comedy where many animals occur. Because they want their plays to be as true as possible, a specialist studies the behaviour of various animals. Recently, he is interested in a binary dynamic ecological system hares-foxes (SHF). As a part of this project, you are asked to design and implement intelligent automatic target evaluation simulator (IATES) for this system. The behaviour of the SHF follows so called *standard model*, described by the following set of difference equations.

$$\begin{aligned}h_{y+1} &= a \cdot h_y - b \cdot f_y \\f_{y+1} &= c \cdot f_y + d \cdot h_y\end{aligned}$$

where  $h_y$  resp.  $f_y$  represent the difference of the number of hares resp. foxes in year  $y$  and the reference count determined at the beginning of the experiment. The units of  $h_y$  and  $f_y$  are unknown. Therefore,  $h_y$  and  $f_y$  are to be treated as real numbers. Your task is to write a program to determine the long term evolution of SHF.

#### Input

The input consists of  $N$  cases (equal to about 5000). The first line of the input contains only positive integer  $N$ . Then follow the cases. Each case consists of six real numbers  $a, b, c, d, h_{1998}$  and  $f_{1998}$ , written in this order on three lines, two numbers per line, separated by one or more spaces. The numbers are given in the classical format, i.e. optional sign, sequence of digits, optional dot and optional sequence of digits. The text form of a number does not exceed 10 characters. Each case is followed by one empty line.

#### Output

For each case, print one of the following sentences:

- 'Ecological balance will develop.' - if after sufficiently long time the population of both hares and foxes approaches the reference count with an arbitrary a priori given precision, i.e.  $\lim h_y = 0$  and  $\lim f_y = 0$ .
- 'Hares will die out while foxes will overgrow.' - if after sufficiently long time the population of hares resp. foxes falls under resp. exceeds any a priori given threshold, i.e.  $\lim h_y = -infinity$  and  $\lim f_y = +infinity$ .
- 'Hares will overgrow while foxes will die out.' - if after sufficiently long time the population of foxes resp. hares falls under resp. exceeds any a priori given threshold, i.e.  $\lim h_y = +infinity$  and  $\lim f_y = -infinity$ .
- 'Both hares and foxes will die out.' - if after sufficiently long time the population of both hares and foxes falls under any a priori given threshold, i.e.  $\lim h_y = -infinity$  and  $\lim f_y = -infinity$ .

- 'Both hares and foxes will overgrow.' - if after sufficiently long time the population of both hares and foxes exceeds any a priori given threshold, i.e.  $\lim h_y = +\infty$  and  $\lim f_y = +\infty$ .
- 'Chaos will develop.' - if none of the above mentioned description fits.

## Example

Sample input:

```
2
2 0.5
0.5 0.6
2 3
```

```
0.1 1
2 0.1
1 1
```

Sample output:

```
Both hares and foxes will overgrow.
Hares will die out while foxes will overgrow.
```

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1998

## SPOJ Problem Set (classical)

### 50. Invitation Cards

#### Problem code: INCARDS

In the age of television, not many people attend theater performances. Antique Comedians of Malidinesia are aware of this fact. They want to propagate theater and, most of all, Antique Comedies. They have printed invitation cards with all the necessary information and with the programme. A lot of students were hired to distribute these invitations among the people. Each student volunteer has assigned exactly one bus stop and he or she stays there the whole day and gives invitation to people travelling by bus. A special course was taken where students learned how to influence people and what is the difference between influencing and robbery.

The transport system is very special: all lines are unidirectional and connect exactly two stops. Buses leave the originating stop with passengers each half an hour. After reaching the destination stop they return empty to the originating stop, where they wait until the next full half an hour, e.g. X:00 or X:30, where 'X' denotes the hour. The fee for transport between two stops is given by special tables and is payable on the spot. The lines are planned in such a way, that each round trip (i.e. a journey starting and finishing at the same stop) passes through a *Central Checkpoint Stop* (CCS) where each passenger has to pass a thorough check including body scan.

All the ACM student members leave the CCS each morning. Each volunteer is to move to one predetermined stop to invite passengers. There are as many volunteers as stops. At the end of the day, all students travel back to CCS. You are to write a computer program that helps ACM to minimize the amount of money to pay every day for the transport of their employees.

#### Input

The input consists of  $N$  cases. The first line of the input contains only positive integer  $N$ . Then follow the cases. Each case begins with a line containing exactly two integers  $P$  and  $Q$ ,  $1 \leq P, Q \leq 1000000$ .  $P$  is the number of stops including CCS and  $Q$  the number of bus lines. Then there are  $Q$  lines, each describing one bus line. Each of the lines contains exactly three numbers - the originating stop, the destination stop and the price. The CCS is designated by number 1. Prices are positive integers the sum of which is smaller than 1000000000. You can also assume it is always possible to get from any stop to any other stop.

#### Output

For each case, print one line containing the minimum amount of money to be paid each day by ACM for the travel costs of its volunteers.

#### Example

Sample input:

```
2
2 2
1 2 13
```



```
2 1 33
4 6
1 2 10
2 1 60
1 3 20
3 4 10
2 4 5
4 1 50
```

Sample output:

```
46
210
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Prague 1998

## SPOJ Problem Set (classical)

### 51. Fake tournament

#### Problem code: TOUR

We consider only special type of tournaments. Each tournament consists of a series of matches. We have  $n$  competitors at the beginning of a competition and after each match the loser is moved out of the competition and the winner stays in (there are no draws). The tournament ends when there is only one participant left - the winner. It is a task of National Sports Federation to schedule the matches. Members of this committee can pick the contestants for the first match. Then, after they know the result, they say which of the remaining contestants meet in the second match, and so on until there is only one participant left.

It is easy to see that not only skill and training decides about the win, but also "luck" - i.e. the schedule. The members of NSF know it as well.

The committee used the training time to look carefully on the performance of each probable contestant. It is clear now, at the start of the season, that some of the results between the competitors are 100% predictable. Having this information NSF considers if it is possible to schedule the matches in such a way that the given contestant  $x$  wins. That is to plan the matches for  $x$  only with those who will lose with him (then he wins the whole tournament of course). If it is possible then we say that **the tournament can be set for  $x$ .**

#### Task

Your task is to write a program which determines the number of contestants of a given tournament for which it is possible to set it.

#### Input

$t$  [number of tests to solve].

In the first line of each test:  $n$  ( $1 \leq n \leq 1000$ ) - the number of participants of the tournament. We number the participants with numbers  $1, 2, \dots, n$ . The following line contains a list of participants who will inevitably win with participant 1. This list begins with a number  $m$  (the number of contestants "better" than 1) and numbers  $n_1, n_2, \dots, n_m$  delimited by single spaces.

Next  $n-1$  lines contain analogous lists for participants  $2, 3, \dots, n$ .

Remark 1. The fact that participant  $a$  would lose with  $b$  and  $b$  would lose with  $c$  doesn't necessarily mean that  $a$  would lose with  $c$  in a direct match.

Remark 2. It is not possible that  $a$  is on the list of contestants better than  $b$  and  $b$  is on the list of  $a$  at the same time.

#### Output

For each test your program should output a single integer - the number of participants, for which it is possible to set the tournament.

## Example

Input :

1

3

2 3 2

1 3

0

Output :

1

---

Added by: Adam Dzedzej

Date: 2004-06-08

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Internet Contest **Pogromcy Algorytmów** (Algorithm Tamers)  
Round IV, 2001

## SPOJ Problem Set (classical)

### 54. Julka

#### Problem code: JULKA

Julka surprised her teacher at preschool by solving the following riddle:

*Klaudia and Natalia have 10 apples together, but Klaudia has two apples more than Natalia. How many apples does each of the girls have?*

Julka said without thinking: Klaudia has 6 apples and Natalia 4 apples. The teacher tried to check if Julka's answer wasn't accidental and repeated the riddle every time increasing the numbers. Every time Julka answered correctly. The surprised teacher wanted to continue questioning Julka, but with big numbers she couldn't solve the riddle fast enough herself. Help the teacher and write a program which will give her the right answers.

#### Task

Write a program which

- reads from standard input the number of apples the girls have together and how many more apples Klaudia has,
- counts the number of apples belonging to Klaudia and the number of apples belonging to Natalia,
- writes the outcome to standard output

#### Input

Ten test cases (given one under another, you have to process all!). Every test case consists of two lines. The first line says how many apples both girls have together. The second line says how many more apples Klaudia has. Both numbers are positive integers. It is known that both girls have no more than  $10^{100}$  (1 and 100 zeros) apples together. As you can see apples can be very small.

#### Output

For every test case your program should output two lines. The first line should contain the number of apples belonging to Klaudia. The second line should contain the number of apples belonging to Natalia.

#### Example

**Input :**

10

2

[and 9 test cases more]

**Output :**

6

4

[and 9 test cases more]

Added by: Adam Dzedzej  
Date: 2004-06-08  
Time limit: 2s  
Source limit: 50000B  
Languages: All  
Resource: Internet Contest **Pogromcy Algorytmow** (Algorithm Tamers)  
Round II, 2003

## SPOJ Problem Set (classical)

### 55. Jasiek

#### Problem code: JASIEK

Jasiek is only 6 years old, but he already has many skills. He likes drawing and asking riddles very much. This morning he got a sheet of grid paper and a pencil from his mother and he started drawing. All his drawings have some common properties:

- Jasiek colors full grid squares;
- if some coloured grid squares touch each other, it means they have a common edge or a corner;
- all grid squares are connected, which means between every two coloured grid squares there is a sequence of coloured grid squares, which have a common edge;
- there are no white holes, that is from every white grid box it is possible to draw a line to the boundary of the sheet which never touches any coloured grid square.

At noon mom phoned and asked what Jasiek's today's picture was. The boy didn't answer directly, but described the picture by a sequence of moves needed to walk around the centres of the coloured squares on its boundary, ie. those squares which have at least one common corner with a white square. Jasiek set the starting square and then gave the sequence of moves necessary to walk along the boundary squares anti-clockwise. Mom was very surprised by the complexity of the picture and especially by the number of coloured squares. Given Jasiek's description, can you quickly count how many coloured squares there are in the picture?

#### Task

Write a program which

- reads (from standard input) Jasiek's description of the picture,
- counts the number of coloured squares,
- writes out the outcome (to standard output).

#### Input

Ten test cases (given one under another, you have to process all!). Each of the test cases is a series of lines. Each line consists of only one character. The letter *P* means the beginning of the description. The letter *K* means the end of the description (and the test case). All other lines (if any) contain one of the letters N, W, S or E (N meaning North, W - West, S - South and E - East). Every line of the description corresponds to the relative position of the centre of some square on the boundary of the picture. The first and the last line correspond to the same square. A letter in a line other than the first or the last tells you which way you have to go in order to get to the next boundary square when going around the picture anti-clockwise. Jasiek's description finishes after going around the picture once. The length of the description doesn't exceed 20000 letters.

## Output

For every testcase your program should write (to the standard output) only one line with one integer, equal to the number of coloured squares in Jasiek's picture.

## Example

Example illustration

**Input :**

```
P
S
S
S
E
N
E
E
S
E
E
N
N
N
N
S
S
S
W
W
N
N
W
W
W
N
S
K
[and 9 test cases more]
```

**Output :**

```
23
[and 9 test cases more]
```

---

Added by: Adam Dzedzej

Date: 2004-06-09

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Internet Contest **Pogromcy Algorytmow** (Algorithm Tamers)  
Round III, 2003

## SPOJ Problem Set (classical)

### 56. Dyzio

#### Problem code: DYZIO

Dyzio is Jasiek's friend and he also likes riddles. Here is a riddle he came up with:

*Jasiek, here is a piece of string, which has to be cut into smaller pieces. I will not tell you directly how to do it, but look at this sequence of zeros (0) and ones (1). A one at the begining means that the string has to be cut in half. If the first digit was zero, it would be the only digit in the sequence and mean you don't have to cut anything - I want the whole string. If you have to cut the string anyway then after the first 1 I wrote what to do with the left piece (according to the same rules as with the whole string) and then I wrote what to do with the right piece of string (all the time with the same rules of notation). Every time you have to cut the left piece first, only then can you cut the right one. Now start cutting and tell me, how many cuts you have to do until you have cut off the shortest piece.*

Unfortunately mom hid the scissors from Jasiek, but luckily a computer was at hand and Jasiek quickly wrote a program simulating the string cutting. Can you write such a program?

#### Task

Write a program which

- reads (from standard input) description of the way the string is cut,
- counts how many cuts have to be made in order to get the first shortest piece.
- writes out the outcome (to standard output)

#### Input

Ten test cases (given one under another, you have to process all!). Each test case consists of two lines. In the first line there is a number  $n$  ( $1 \leq n \leq 20000$ ). In the second line one zero-one word (a sequence of zeros and ones without spaces between them) of length  $n$  - the description of the cutting procedure given by Dyzio.

#### Output

For every testcase your program should write (to the standard output) only one line with one integer equal to the number of cuts which have to be made in order to get the shortest piece.

#### Example

**Input :**

9

110011000

[and 9 test cases more]

**Output :**

4

[and 9 test cases more]

---



Added by: Adam Dzedzej  
Date: 2004-06-10  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Internet Contest **Pogromcy Algorytmow** (Algorithm Tamers)  
Round III, 2003

## SPOJ Problem Set (classical)

### 57. Supernumbers in a permutation

#### Problem code: SUPPER

An  $n$ -element permutation is an  $n$ -element sequence of distinct numbers from the set  $\{1, 2, \dots, n\}$ . For example the sequence 2,1,4,5,3 is a 5-element permutation. We are interested in the longest increasing subsequences in a permutation. In this exemplary permutation they are of length 3 and there are exactly 2 such subsequences: 2,4,5 and 1,4,5. We will call a number belonging to any of the longest increasing subsequences a *supernumber*. In the permutation 2,1,4,5,3 the supernumbers are 1,2,4,5 and 3 is not a supernumber. Your task is to find all supernumbers for a given permutation.

#### Task

Write a program which

- reads a permutation from standard input,
- finds all its supernumbers,
- writes all found numbers to standard output.

#### Input

Ten test cases (given one under another, you have to process all!). Each test case consists of two lines. In the first line there is a number  $n$  ( $1 \leq n \leq 100000$ ). In the second line: an  $n$ -element permutation -  $n$  numbers separated by single spaces.

#### Output

For every test case your program should write two lines. In the first line - the number of supernumbers in the input permutation. In the second line the supernumbers separated by single spaces in increasing order.

#### Example

```
Input :
5
2 1 4 5 3
[and 9 test cases more]
Output :
4
1 2 4 5
[and 9 test cases more]
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adam Dzedzej  
Date: 2004-06-10  
Time limit: 9s  
Source limit: 50000B  
Languages: All  
Resource: Internet Contest **Pogromcy Algorytmow** (Algorithm Tamers)  
Round IV, 2003

## SPOJ Problem Set (classical)

### 58. Crime at Piccadily Circus

#### Problem code: PICAD

Sherlock Holmes is carrying out an investigation into the crime at Piccadily Circus. Holmes is trying to determine the maximal and minimal number of people staying simultaneously at the crime scene at a moment when the crime could have been committed. Scotland Yard has already carried out a thorough investigation already, interrogated everyone seen at the crime scene and determined what time they appeared at the crime scene and what time they left. Doctor Watson offered his help to process the data gathered by Scotland Yard and find the numbers interesting Sherlock Holmes, but he has some difficulties. Help him!

#### Task

Write a program which

- reads from standard input the time interval during which the crime was committed and the data gathered by Scotland Yard,
- finds the minimal and the maximal number of people present simultaneously in the time interval when the crime could have been committed, (these numbers can be zero, though it would seem strange that noone was present at the crime scene when the crime was committed, but that's the type of crime Holmes and Watson have to deal with)
- writes the outcome to standard output.

#### Input

Ten test cases (given one under another, you have to process all!). The first line of each test case consists of two integer numbers  $p$  and  $k$ ,  $0 \leq p \leq k \leq 100000000$ . These denote the first and the last moment when the crime could have been committed. The second line of each test case contains one integer  $n$ ,  $3 \leq n \leq 5000$ . This is the number of people interrogated by Scotland Yard. The next  $n$  lines consist of two integers - line  $i+2$  contains numbers  $a_i$  and  $b_i$  separated by a single space,  $0 \leq a_i \leq b_i \leq 100000000$ . These are the moments at which the  $i$ -th person appeared at and left the crime scene respectively. It means that the  $i$ -th person was at the crime scene for the whole time from moment  $a_i$  until moment  $b_i$  (inclusive).

#### Output

For every test case your program should write to the standard output only one line with two integers separated by a single space: the minimal and maximal number of people staying simultaneously at the crime scene, in the interval between moment  $p$  and  $k$ , (inclusive).

## Example

Only one test case.

**Input :**

```
5 10
4
1 8
5 8
7 10
8 9
```

**Output :**

```
1 4
```

---

Added by: Adam Dzedzej

Date: 2004-06-10

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: Internet Contest **Pogromcy Algorytmow** (Algorithm Tamers)  
Round IV, 2003

## SPOJ Problem Set (classical)

### 59. Bytelandian Information Agency

#### Problem code: BIA

Bytelandian Information Agency (BIA) uses a net of  $n$  computers. The computers are numbered from 1 to  $n$ , and the computer number 1 is a server. The computers are connected by one-way information channels. Every channel connects a pair of computers. The whole network is organised in such a way that one can send information from the server to any other computer either directly or indirectly.

When BIA acquires new information, the information is put on the server and propagated in the net. The chief of BIA considers what would happen if one computer stopped working (was blown away by terrorists for example). It could happen that some other computers would stop receiving information from the server, because the broken computer was a necessary transmitter. We will call such computers *critical*. For example in the situation in the picture below the critical computers are 1 and 2. 1 is the server and all information sent from the server to 3 has to go through 2.

BIA computer net

#### Task

Write a program which

- reads a description of the net from standard input,
- finds all critical computers.
- writes the numbers of critical computers to standard output.

#### Input

Ten test cases (given one under another, you have to process all!). Each test case consists of several lines. In the first line there are numbers  $n$  and  $m$ .  $n$  denotes the number of computers in the net, ( $2 \leq n \leq 5000$ ).  $m$  denotes the number of information channels,  $n-1 \leq m \leq 200000$ . The following  $m$  lines describes a single information channel and consist of two integer numbers  $a$  and  $b$  separated by a space. It means the computer  $a$  sends information to computer  $b$  by that channel. You may assume there are no two channels which start and end at the same points  $a, b$ .

#### Output

For every testcase your program should write two lines. In the first line  $k$  - the number of critical computers in the net. In the second line  $k$  numbers separated by single spaces - the numbers of critical computers in increasing order.

#### Example

Input :

```
4 5
1 2
1 4
```

```
2 3
3 4
4 2
[and 9 test cases more]
Output:
2
1 2
[and 9 test cases more]
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adam Dzedzej

Date: 2004-06-14

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: Internet Contest **Pogromcy Algorytmow** (Algorithm Tamers)  
Round IV, 2003

## SPOJ Problem Set (classical)

### 60. The Gordian Dance

#### Problem code: DANCE

The Gordian Dance is a traditional Bytelandian dance performed by two pairs of dancers. At the beginning the dancers are standing in the corners of the square  $ABCD$ , forming two pairs:  $A-B$  and  $C-D$ . Every pair is holding an outstretched string. So in the starting position both strings are stretched horizontally and parallel.

The starting position of dancers.

The dance consists of a series of moves. There are two kinds of moves:

- (S) The dancers standing at points  $B$  and  $C$  swap positions (without releasing their strings) in such a way that the dancer standing at  $B$  raises the hand in which he is holding the string and, when going to point  $C$ , lets the dancer going from  $C$  to  $B$  pass in front of him, under his arm.
- (R) All dancers make a turn by 90 degrees clockwise without releasing their strings. This means that the dancer from  $A$  goes to  $B$ , the dancer from  $B$  goes to  $C$ , the dancer from  $C$  goes to  $D$ , and the dancer from  $D$  goes to  $A$ .

During the dance the strings tangle with each other, but in the end they should be untangled and stretched horizontally and parallel. The dancers do not have to occupy the same spots as in the beginning. The dance requires a lot of experience, because the strings can be extremely tangled during the dance. The sequence of moves after which they are no longer tangled and are stretched horizontally and parallel can be difficult to guess.

Your program should help beginner dancers end a dance. You are to determine the minimal number of moves required to end the dance given a sequence of moves already performed.

#### Illustration

For example after the sequence  $SS$  we get the following configuration.

The configuration after  $SS$

The shortest sequence of moves required to end the dance is of length 5:  $RSRSS$ .

#### Task

Write a program which

- reads from standard input the moves made in a dance,
- finds the minimal number of moves required to untangle the strings and stretch them horizontally and parallel (the dancers don't have to be in their starting spots).
- writes the outcome to standard output.



## Input

Ten test cases (given one under another, you have to process all!). The first line of each test case consists of one integer  $n$  equal to the number of moves already made,  $0 \leq n \leq 1000000$ . The second line of each test case consists of one word of length  $n$ , made up of letters  $S$  and/or  $R$ .

## Output

For every testcase your program should write to standard output only one line with one integer number: the minimal number of moves required to untangle the strings and stretch them horizontally and parallel.

## Example

**Input :**

2

SS

[and 9 test cases more]

**Output :**

5

[and 9 test cases more]

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adam Dzedzej

Date: 2004-06-15

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Internet Contest **Pogromcy Algorytmow**(Algorithm Tamers) 2003 Round V

# SPOJ Problem Set (classical)

## 61. Brackets

### Problem code: BRCKTS

We will call a **bracket word** any word constructed out of two sorts of characters: the opening bracket "(" and the closing bracket ")". Among these words we will distinguish **correct bracket expressions**. These are such bracket words in which the brackets can be matched into pairs such that

- every pair consists of an opening bracket and a closing bracket appearing further in the bracket word
- for every pair the part of the word between the brackets of this pair has equal number of opening and closing brackets

On a bracket word one can do the following operations:

- **replacement** -- changes the  $i$ -th bracket into the opposite one
- **check** -- if the word is a correct bracket expression

### Task

Write a program which

- reads (from standard input) the bracket word and the sequence of operations performed,
- for every check operation determines if the current bracket word is a correct bracket expression,
- writes out the outcome (to standard output).

### Input

Ten test cases (given one under another, you have to process all!). Each of the test cases is a series of lines. The first line of a test consists of a single number  $n$  ( $1 \leq n \leq 30000$ ) denoting the length of the bracket word. The second line consists of  $n$  brackets, not separated by any spaces. The third line consists of a single number  $m$  -- the number of operations. Each of the following  $m$  lines carries a number  $k$  denoting the operation performed.  $k=0$  denotes the check operation,  $k>0$  denotes replacement of  $k$ -th bracket by the opposite.

### Output

For every test case your program should print a line:

Test i:

where  $i$  is replaced by the number of the test and in the following lines, for every check operation in the  $i$ -th test your program should print a line with the word YES, if the current bracket word is a correct bracket expression, and a line with a word NO otherwise. (There should be as many lines as check operations in the test.)

## Example

**Input :**

```
4
() ((
4
4
0
2
0
[and 9 test cases more]
```

**Output :**

```
Test 1:
YES
NO
[and 9 test cases more]
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adam Dzedzej

Date: 2004-06-15

Time limit: 11s

Source limit: 50000B

Languages: All

Resource: Internet Contest **Pogromcy Algorytmow**(Algorithm Tamers) 2003 Round IV

## SPOJ Problem Set (classical)

### 62. The Imp

#### Problem code: IMP

An Imp jumps on an infinite chessboard. Moves possible for the Imp are described by two pairs of integers: (a,b) and (c,d) - from square (x,y) the Imp can move to one of the squares: (x+a,y+b), (x-a,y-b), (x+c,y+d), (x-c,y-d). We want to know for which square different from (0,0) to which the Imp can jump from (0,0) (possibly in many moves) the value  $|x|+|y|$  is the lowest.

#### Task

Write a program which

- reads from standard input two pairs (a,b) and (c,d) of integers, different from (0,0), describing moves of the Imp,
- determines a pair of integers (x,y) different from (0,0), for which the Imp can jump (possibly in many moves) from square (0,0) to square (x,y) and for which the value  $|x|+|y|$  is the lowest.
- writes out to standard output the value  $|x|+|y|$ .

#### Input

Ten test cases. Each test consists of four numbers a,b,c,d in one line, separated by spaces.  
 $-100000 \leq a, b, c, d \leq 100000$

#### Output

For every test case your program should write a single line with a number equal the lowest possible value  $|x|+|y|$ .

#### Example

**Input :**  
13 4 17 5  
[and 9 test cases more]  
**Output :**  
2  
[and 9 answers more]

---

Added by: Adam Dzedzej

Date: 2004-06-15

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Internet Contest **Pogromcy Algorytmow**(Algorithm Tamers) 2003 Round V

## SPOJ Problem Set (classical)

### 63. Square Brackets

#### Problem code: SQRBR

You are given:

- a positive integer  $n$ ,
- an integer  $k$ ,  $1 \leq k \leq n$ ,
- an increasing sequence of  $k$  integers  $0 < s_1 < s_2 < \dots < s_k \leq 2n$ .

What is the number of proper bracket expressions of length  $2n$  with opening brackets appearing in positions  $s_1, s_2, \dots, s_k$ ?

#### Illustration

Several proper bracket expressions:

```
[[]] [[]] []  
[[[]]] [] [[]]
```

An improper bracket expression:

```
[[[] []] [] [[]]
```

There is exactly one proper expression of length 8 with opening brackets in positions 2, 5 and 7.

#### Task

Write a program which for each data set from a sequence of several data sets:

- reads integers  $n$ ,  $k$  and an increasing sequence of  $k$  integers from input,
- computes the number of proper bracket expressions of length  $2n$  with opening brackets appearing at positions  $s_1, s_2, \dots, s_k$ ,
- writes the result to output.

#### Input

The first line of the input file contains one integer  $d$ ,  $1 \leq d \leq 10$ , which is the number of data sets. The data sets follow. Each data set occupies two lines of the input file. The first line contains two integers  $n$  and  $k$  separated by single space,  $1 \leq n \leq 19$ ,  $1 \leq k \leq n$ . The second line contains an increasing sequence of  $k$  integers from the interval  $[1; 2n]$  separated by single spaces.

## Output

The  $i$ -th line of output should contain one integer - the number of proper bracket expressions of length  $2n$  with opening brackets appearing at positions  $s_1, s_2, \dots, s_k$ .

## Example

**Sample input:**

```
5
1 1
1
1 1
2
2 1
1
3 1
2
4 2
5 7
```

**Sample output:**

```
1
0
2
3
2
```

---

Added by: Adrian Kosowski

Date: 2004-06-22

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

## SPOJ Problem Set (classical)

### 64. Permutations

#### Problem code: PERMUT1

Let  $A = [a_1, a_2, \dots, a_n]$  be a permutation of integers  $1, 2, \dots, n$ . A pair of indices  $(i, j)$ ,  $1 \leq i < j \leq n$ , is an *inversion* of the permutation  $A$  if  $a_i > a_j$ . We are given integers  $n > 0$  and  $k \geq 0$ . What is the number of  $n$ -element permutations containing exactly  $k$  inversions?

For instance, the number of 4-element permutations with exactly 1 inversion equals 3.

#### Task

Write a program which for each data set from a sequence of several data sets:

- reads integers  $n$  and  $k$  from input,
- computes the number of  $n$ -element permutations with exactly  $k$  inversions,
- writes the result to output.

#### Input

The first line of the input file contains one integer  $d$ ,  $1 \leq d \leq 10$ , which is the number of data sets. The data sets follow. Each data set occupies one line of the input file and contains two integers  $n$  ( $1 \leq n \leq 12$ ) and  $k$  ( $0 \leq k \leq 98$ ) separated by a single space.

#### Output

The  $i$ -th line of the output file should contain one integer - the number of  $n$ -element permutations with exactly  $k$  inversions.

#### Example

**Sample input:**

```
1
4 1
```

**Sample output:**

```
3
```

---

Added by: Adrian Kosowski

Date: 2004-06-22

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

## SPOJ Problem Set (classical)

### 65. Ball

#### Problem code: BALL1

On the rectangular chessboard of  $n \times m$  square fields we choose one field adjacent to the edge of the chessboard, called the starting field. Then we put a ball in the center of this field and push it to roll through the chessboard. The diameter of the ball equals the width (and height) of chessboard field. The angle between the direction of ball movement and the edge of the chessboard equals 45 degrees. The ball bounces off the edges of the chessboard: if the ball touches the edge of the chessboard then each composite of its velocity perpendicular to the edge touched is reversed. At the start the ball is pushed toward increasing coordinates (when the starting field is a field of the highest coordinate, the ball bounces momentarily).

We assign a point to a field of the chessboard each time the point of adjacency between the ball and the chessboard enters the interior of the field. The game is over when a point is assigned to the starting field. What is the number of fields to which an odd number of points is assigned? The following figures illustrate the problem. The route of the ball is marked with a dashed line. Fields with the odd number of points are shadowed.

[IMAGE]

#### Task

Write a program which for each data set from a sequence of several data sets:

- reads the dimensions of the chessboard and the coordinates of starting field from input,
- computes the number of fields with the odd number of points,
- writes the result to output.

#### Input

The first line of the input file contains one integer  $d$ ,  $1 \leq d \leq 10$ , which is the number of data sets. The data sets follow. Each data set occupies one line of the input file. Such a line consists of four integers  $x$ ,  $y$ ,  $a$ ,  $b$  separated with single spaces. These integers are the  $x$ - and  $y$ -dimensions of the chessboard and  $x$ - and  $y$ -coordinates of the starting field, respectively. Integers  $x$  and  $y$  are greater than two, the number of fields of the chessboard does not exceed  $10^9$ , the starting field is adjacent to the edge of the chessboard.

#### Output

The  $i$ -th line of output should contain one integer which is equal to the number of fields of the chessboard with the odd number of points.



## Example

Sample input:

```
2
13 6 1 5
10 7 1 5
```

Sample output:

```
2
22
```

---

Added by: Adrian Kosowski

Date: 2004-06-06

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

## SPOJ Problem Set (classical)

### 66. Cross-country

#### Problem code: CRSCNTRY

Agness, a student of computer science, is very keen on cross-country running, and she participates in races organised every Saturday in a big park. Each of the participants obtains a route card, which specifies a sequence of checkpoints, which they need to visit in the given order. Agness is a very attractive girl, and a number of male runners have asked her for a date. She would like to choose one of them during the race. Thus she invited all her admirers to the park on Saturday and let the race decide. The winner would be the one, who scores the maximum number of points. Agnes came up with the following rules:

- a runner scores one point if he meets Agnes at the checkpoint,
- if a runner scored a point at the checkpoint, then he cannot get another point unless he and Agnes move to the next checkpoints specified in their cards.
- route specified by the card may cross the same checkpoint more than once,
- each competitor must strictly follow race instructions written on his card.

Between two consecutive meetings, the girl and the competitors may visit any number of checkpoints. The boys will be really doing their best, so you may assume, that each of them will be able to visit any number of checkpoints whilst Agnes runs between two consecutive ones on her route.

#### Task

Write a program which for each data set from a sequence of several data sets:

- reads in the contents of Agnes' race card and contents of race cards presented to Tom,
- computes the greatest number of times Tom is able to meet Agnes during the race,
- writes it to output.

#### Input

There is one integer  $d$  in the first line of the input file,  $1 \leq d \leq 10$ . This is the number of data sets. The data sets follow. Each data set consists of a number of lines, with the first one specifying the route in Agnes' race card. Consecutive lines contain routes on cards presented to Tom. At least one route is presented to Tom. The route is given as a sequence of integers from interval  $[1, 1000]$  separated by single spaces. Number 0 stands for the end of the route, though when it is placed at the beginning of the line it means the end of data set. There are at least two and at most 2000 checkpoints in a race card.

#### Output

The  $i$ -th line of the output file should contain one integer. That integer should equal the greatest number of times Tom is able to meet with Agnes for race cards given in the  $i$ -th data set.

## Example

Sample input:

```
3
1 2 3 4 5 6 7 8 9 0
1 3 8 2 0
2 5 7 8 9 0
1 1 1 1 1 1 2 3 0
1 3 1 3 5 7 8 9 3 4 0
1 2 35 0
0
1 3 5 7 0
3 7 5 1 0
0
1 2 1 1 0
1 1 1 0
0
```

Sample output:

```
6
2
3
```

---

Added by: Adrian Kosowski

Date: 2004-06-08

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

## SPOJ Problem Set (classical)

### 67. Cutting out

#### Problem code: CUTOUT

One has to cut out a number of rectangles from a paper square. The sides of each rectangle are to be parallel to the sides of the square. Some rectangles can be already cut out. What is the largest area of a rectangle which can be cut out from the remaining paper?

#### Illustration

Three rectangles have been cut out from the square 10x10 in the figure shown below. The area of the largest rectangle that can be cut out from the remaining paper is 16. One of such rectangles is shown with a dashed line.

[IMAGE]

#### Task

Write a program that for each data set from a sequence of several data sets:

- reads descriptions of a square and rectangles from the input,
- computes the area of the largest rectangle which can be cut out from the remaining paper,
- writes the result to output.

#### Input

The first line of the input file contains one positive integer  $d$  not larger than 10. This is the number of data sets. The data sets follow. Each set of data occupies two consecutive lines of the input file. The first line of each data set contains two integers  $n$  and  $r$ ,  $1 \leq n \leq 40000$ ,  $0 \leq r \leq 100$ . The integer  $n$  is the length of the sides of an input square. The integer  $r$  is the number of rectangles which have been cut out from the square. The second line of the data set contains a sequence of  $4r$  integers  $x_1, x_2, \dots, x_{4r}$  from the interval  $[0, n]$  separated by single spaces. For each  $i = 1, \dots, r$ , integers  $x_{4i-3}, x_{4i-2}, x_{4i-1}, x_{4i}$  describe the  $i$ -th rectangle:  $x_{4i-3}$  is the distance of its left side from the left side of the square,  $x_{4i-2}$  is the distance of its right side from the left side of the square,  $x_{4i-1}$  is the distance of the bottom side of the rectangle from the bottom side of the square and  $x_{4i}$  is the distance of its top side from the bottom side of the square.

#### Output

For each  $i = 1, \dots, d$ , your program should write only one integer to the  $i$ -th line of the output file -- the largest area of a rectangle which can be cut out from the rest of the  $i$ -th square.

## Example

Sample input:

```
2
6 2
0 3 0 3 3 6 3 6
10 3
0 5 0 5 0 10 5 10 9 10 0 5
```

Sample output:

```
9
20
```

---

Added by: Adrian Kosowski

Date: 2004-06-08

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

## SPOJ Problem Set (classical)

### 68. Expression

#### Problem code: EXPR1

We are given an integer  $k$  and an arithmetic expression  $E$  with the operations '+', '-', and arguments from the set  $\{0,1,\dots,9\}$ . Is it possible to put some parentheses in  $E$  to get a new expression  $E'$  whose value equals  $k$ ? If the answer is positive what is the minimum number of pairs of parentheses '(', ')' that are necessary?

#### Illustration

It is sufficient to put one pair of parentheses in the expression  $5 - 4 + 5$  to get an expression with value -4, namely  $5 - (4 + 5) = -4$ .

#### Task

Write a program that for each data set from a sequence of several data sets:

- reads an expression  $E$  and an integer  $k$  from input,
- verifies whether it is possible to put some parentheses in  $E$  to get a new expression  $E'$  whose value equals  $k$  and computes the minimal number of pairs of parentheses '(', ')' necessary, if the answer is positive,
- writes the result to output.

#### Input

The first line of the input file contains one positive integer  $d$  not larger than 10. This is the number of data sets. The data sets follow. Each set of data occupies two consecutive lines of the input file. The first line contains two integers  $n$  and  $k$ ,  $2 \leq n \leq 40$ ,  $-180 \leq k \leq 180$ . The even integer  $n$  is the length of  $E$ . The second line contains the expression itself written as a string of length  $n$ . The string contains operators '+' or '-' in odd positions and numbers from the set  $\{0,1,\dots,9\}$  in even positions.

#### Output

For each  $i = 1, \dots, d$ , your program should write to the  $i$ -th line of the output file one word 'NO' if the  $i$ -th input expression cannot be transformed into any expression of value  $k$ , and the smallest number of pairs of parentheses necessary otherwise.

#### Example

Sample input:

```
5
6 -4
+5-4+5
2 1
+1
```

```
4 1
-1+1
4 0
-1+1
4 -2
-1+1
```

Sample output:

```
1
0
NO
0
1
```

---

Added by: Adrian Kosowski

Date: 2004-06-08

Time limit: 5s

Source limit:50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

## SPOJ Problem Set (classical)

### 69. Moulds

#### Problem code: MOULDS

In a factory, moulds for casting metal objects are produced by a special cutting device. The device is equipped with cuboid-shaped blade of size 1 mm x 1 mm x 30 mm (its height) which operates with each of its sides thus producing the mould from cuboid of size 250 mm x 250 mm x 30 mm (its height). The end of the blade never lowers below the bottom surface of the cuboid. In any moment the distance between initial and current position doesn't exceed 1000.

The machine understands special command language which has the following grammar:

```
<command block> ::= [ <command> ; {<command> ; } ]
<command>       ::= <lift> | <shift> | <command block>
<lift>          ::= ^ <distance>
<shift>         ::= @ <direction> <distance>
<direction>     ::= N | S | W | E
<distance>      ::= <sign> <number> | <number>
<number>        ::= <digit> {<digit>}
<sign>          ::= - | +
<digit>         ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
```

where {exp} means zero or more exps.

The command <lift> causes moving the blade downwards when the distance is a positive number and upwards otherwise. The command <shift> moves the blade in the appropriate direction (N--north, S--south, W--west, E--east).

#### Task

Write a program which for each data set from a sequence of several data sets:

- reads a command block from input,
- computes the volume of hollows made by the machine commanded by a given command block (assuming that before the execution the blade is located 1 mm above the north-west corner of the virgin cuboid),
- writes the result to output.

#### Input

The first line of the input file contains one integer  $d$ ,  $1 \leq d \leq 10$ , which is the number of data sets. The data sets follow. Each data set occupies one line of the input file and is a word derived from <command block> of the above grammar of length not exceeding 10000 characters.



## Output

The  $i$ -th line of the output file should contain one integer -- the volume (in cubic mm) of the hollows made by the machine controlled by the command block given in the  $i$ -th data set.

## Example

Sample input:

```
1
[^2;@S2;]
```

Sample output:

```
3
```

---

Added by: Adrian Kosowski

Date: 2004-06-08

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

## SPOJ Problem Set (classical)

### 70. Relations

#### Problem code: RELATS1

You are given a directed graph, whose edges are labeled with relational symbols '<', '>' and '='. For a nonnegative integer  $k$ , a  $k$ -correct  $G$ -labeling is a mapping from vertices of  $G$  into integers from interval  $[0, k]$  such that numbers at the ends of each edge satisfy the relation described by the label of the edge. We assume that an element on the left side of the relational symbol is a number assigned to the initial vertex. Compute the smallest  $k$  for which  $k$ -correct  $G$ -labeling exists or verify that such labeling doesn't exist for any  $k$ .

#### Illustration

For the graph in the figure the smallest  $k = 2$ .

[IMAGE]

#### Task

Write a program that for each data set from a sequence of several data sets:

- reads a description of a graph  $G$  from the input file,
- verifies whether there exist an integer  $k$  for which it is possible to label  $G$   $k$ -correctly and, if the answer is positive, computes the smallest such  $k$ ,
- writes the result to the output file.

#### Input

The first line of the input file contains one positive integer  $d$  not larger than 10. This is the number of data sets. The data sets follow. Each data set is described in two consecutive lines of the input file. In the first line there are two integers  $n$  and  $m$  separated by a single space. The number  $n$  is the number of vertices of  $G$  and  $m$  is the number of edges of  $G$ . Numbers  $n$  and  $m$  satisfy the inequalities:  $1 \leq n \leq 1000$ ,  $0 \leq m \leq 10000$ . The vertices are numbered with integers from 1 to  $n$  and are identified by these numbers. There are no parallel edges and self-loops in the graph. (Two different edges  $u_1 \rightarrow v_1$  and  $u_2 \rightarrow v_2$  are parallel iff  $u_1 = u_2$  and  $v_1 = v_2$ .) There are  $3m$  integers separated by single spaces in the second line. The numbers at positions  $3i-2$  and  $3i-1$ ,  $1 \leq i \leq m$ , are the ends of the  $i$ -th edge, the beginning and the end, respectively, whereas the number at position  $3i$  is a number from the set  $\{-1, 0, 1\}$  and it is the label of the  $i$ -th edge:  $-1$  represents '<',  $0$  represents '=' and  $1$  represents '>'.

#### Output

For the  $i$ -th data set,  $1 \leq i \leq d$ , your program should write one word NO in the  $i$ -th line of the output file if a  $k$ -correct labeling doesn't exist for any  $k$ , or the smallest integer  $k$  for which such a labeling exists.

## Example

Sample input:

```
4
4 4
1 2 -1 2 3 0 2 4 -1 3 4 -1
2 2
1 2 -1 2 1 -1
2 2
1 2 -1 2 1 1
3 3
1 2 0 3 2 0 3 1 0
```

Sample output:

```
2
NO
1
0
```

---

Added by: Adrian Kosowski

Date: 2004-06-08

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

# SPOJ Problem Set (classical)

## 71. Tree

### Problem code: TREE1

Consider an  $n$ -vertex binary search tree  $T$  containing  $n$  keys  $1, 2, \dots, n$ . A permutation  $p = [p_1, \dots, p_n]$  of the integers  $1, 2, \dots, n$  is said to be *consistent with the tree  $T$*  if the tree can be built from the empty one as the result of inserting integers  $p_1, p_2, \dots, p_n$ . Find how many permutations are consistent with the tree  $T$ .

### Illustration

Exactly 2 permutations are consistent with the tree in the figure below.

[IMAGE]

### Task

Write a program that for each data set from a sequence of several data sets:

- reads from the input file a description of an input tree  $T$ ,
- computes the number of permutations consistent with  $T$ ,
- writes the result to output.

### Input

The first line of the input file contains one positive integer  $d$  not larger than 10. This is the number of data sets. The data sets follow. Each set of data occupies two consecutive lines of the input file. The first line contains only one integer  $n$ ,  $1 \leq n \leq 30$ . This is the number of vertices of the tree. The second line contains a sequence of  $n$  integers separated by single spaces. The integers are keys in the input tree given in the prefix order. The first integer in the sequence is the key from the root of the tree. It is followed by the keys from the left subtree written in the prefix order. The sequence ends with the keys from the right subtree, also given in the prefix order.

### Output

For each  $i = 1, \dots, d$ , your program should write to the  $i$ -th line of output the number of permutations consistent with the tree described in the  $i$ -th data set.

### Example

Sample input:

```
5
3
2 1 3
3
1 2 3
```

```
1
1
4
2 1 3 4
4
1 4 2 3
```

Sample output:

```
2
1
1
3
1
```

---

Added by: Adrian Kosowski

Date: 2004-06-08

Time limit: 5s

Source limit:50000B

Languages: All

Resource: III Polish Collegiate Team Programming Contest (AMPPZ), 1998

## SPOJ Problem Set (classical)

### 73. Bacterial

#### Problem code: BAC

In the biology laboratory we are observing several bacterial samples, and under the microscope we have them shaded with different colors to see them expanding their territory on the plate.

It is interesting to know that the bacterial are quite 'friendly' that once they meet each other, they do not expand into each other's occupation any more. The bacterial samples are expanding at similar speeds and we take them as the same speed.

Since the experiment is tedious and lengthy (Oh My God! there are several thousand samples at our pick), we are going to run a simulation based on this reality, taking the variable that these samples may be planted in different starting spots.

We are using rectangular plates and bacterial racing is bounded within the plate.

[IMAGE]

#### Input format

There are multiple test cases (about 20000 of them) each taking the following format:

- one line with two integers between 1 and 1000 inclusive indicating width and height of the plate
- one line with one integer between 1 and 100 inclusive indicating the number of bacterial samples
- for each bacterial sample there is one line with two integers indicating the sample's position: x y, where x, y specify a position within or on the bound of the plate.

The plate lies in such a coordinating system that the lower-left corner of it is (0,0) and the upper-right corner is (width,height).

A test with zero plate area marks the end of the tests and this one shall not be processed.

Between each input block there is a blank line.

#### Output format

Generate a report having the samples sorted on their domination, with each line taking the following format:

<sample id> <area occupation>

where: 'sample id' takes 3 columns right justified, with '0' padded to the left as necessary, and 'area occupation' takes 14 columns with 2 digit precision, right justified.

The sample occupying more area shall be reported prior to those occupying less. The input data will ensure enough difference in areas to avoid ambiguity.

Between each output block there shall be a blank line.

## Example

**Sample input:**

```
10 10
2
5 5
0 0

0 0
```

**Sample output:**

```
001      87.50
002      12.50
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Neal Zane  
Date: 2004-06-08  
Time limit: 9s  
Source limit: 50000B  
Languages: All  
Resource: Neal Zane

## SPOJ Problem Set (classical)

### 74. Divisor Summation

#### Problem code: DIVSUM

Given a natural number  $n$  ( $1 \leq n \leq 500000$ ), please output the summation of all its proper divisors.

*Definition:* A proper divisor of a natural number is the divisor that is strictly less than the number.

e.g. number 20 has 5 proper divisors: 1, 2, 4, 5, 10, and the divisor summation is:  $1 + 2 + 4 + 5 + 10 = 22$ .

#### Input

An integer stating the number of test cases (equal to about 200000), and that many lines follow, each containing one integer between 1 and 500000 inclusive.

#### Output

One integer each line: the divisor summation of the integer given respectively.

#### Example

Sample Input:

```
3
2
10
20
```

Sample Output:

```
1
8
22
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Neal Zane  
Date: 2004-06-10  
Time limit: 3s  
Source limit: 5000B  
Languages: All  
Resource: Neal Zane



# SPOJ Problem Set (classical)

## 75. Editor

### Problem code: EDIT1

Have you ever programmed in Brainf\*\*k? If yes, then you know how annoying it is to press the same key several times in a row. So what we all need, is a good editor. Here are the functions that the editor should have:

- '\n': begin a new line. If the last line was empty, stop processing and print out all lines.
- 'd': copy all characters from the current line, and append them after the last character in this line. For example, if current line contains ab, and d is pressed two times, the result will be abababab
- any other character: append it to the current line.

**Please note, that the solution may only be submitted in Brainf\*\*k or Intercal.**

### Input

There is exactly one test case. You can assume, that there is no key press of 'd' when the line is still empty.

### Output

Print the output that the editor described above would produce on the given input. You can assume, that no line is created with more than 150 characters.

### Example

**Input :**

sample-test-dd-d-ddend signalled by two newlines

**Output :**

sample-test-----enen signalleenen signalle by two newlines

---

Added by: Adrian Kuegel

Date: 2004-06-12

Time limit: 3s

Source limit:50000B

Languages: BF ICK

Resource: own problem

## SPOJ Problem Set (classical)

### 76. Editor Inverse

#### Problem code: EDIT2

You are given a text. Calculate the minimum number of keystrokes needed to produce this text, if the editor described below is used.

If you haven't read the problem "Editor" before, here is a description of the functionality of the editor:

- `'\n'`: begin a new line. If the last line was empty, stop processing and print out all lines.
- `'d'`: copy all characters from the current line, and append them after the last character in this line.  
For example, if current line contains `ab`, and `d` is pressed two times, the result will be `abababab`
- any other character: append it to the current line.

#### Input

The input consists of **exactly ten** test cases. Each test case consists of a line with at most 600 characters. The character `'d'` is not used in any of the lines, but all other printable ascii characters may occur.

#### Output

For each test case, first print a line containing the minimum number of key strokes to produce the given line of text. In the next lines, write the keys that are pressed to produce the text. If there are several possibilities with minimum number of keystrokes, you should also minimise the number of lines, if there is still more than one possibility, minimise number of keystrokes before the first `'\n'`, then second `'\n'`, ...

Since `'d'` is a costly operation in the editor, for each output line you should minimise the number of `'d'` characters as the 2nd criterion after minimising number of keystrokes in this line.

The original input line should be the same as the output of the editor (processing the output you produce), if `'\n'` characters are ignored.

**Notice that you have to terminate the input for the editor with two `'\n'`.**

#### Example

Here only two test cases.

**Input :**

00001123444456789000011234444446789

**Output :**

18

00d1123444456789

18

00d1123

444d6789

---

Added by: Adrian Kuegel

Date: 2004-06-12

Time limit: 3s

Source limit:50000B

Languages: All

Resource: own problem

## SPOJ Problem Set (classical)

### 77. New bricks disorder

#### Problem code: BRICKS

You have  $n$  bricks arranged in a line on the table. There is exactly one letter on each of them. Your task is to rearrange those bricks so that letters on them create some specified inscription. While rearranging you can only swap adjacent bricks with specified letters (you are given  $m$  pairs  $(a_1, b_1), \dots, (a_m, b_m)$  and you are only allowed to swap bricks with  $a_i$  on one of them and  $b_i$  on the second, for some  $i=1, \dots, m$ ). You should check if it is possible to accomplish this - and if it is - calculate minimal needed number of swaps.

#### Input

There is a single integer  $c$  on the first line of input. Then  $c$  test cases follow: each of them consists of two lines of small letters (a..z) with lengths not exceeding 100000 (descriptions of starting and ending configurations), one integer  $m$  in the next line and then  $m$  lines with two letters  $a_i, b_i$  in each of them.

#### Output

For each test case you should print -1 if it is not possible to rearrange bricks or the minimal number of swaps if it is possible (if so, output this value modulo  $2^{32}$ ).

#### Example

Input :

```
4
ab
ba
0
abc
cba
3
ab
cb
ca
cabbbc
cbabbc
1
ab
abba
baab
1
ab
```

Output :

```
-1
3
1
2
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Pawel Gawrychowski

Date: 2004-06-17

Time limit: 9s

Source limit:10000B

Languages: All

## SPOJ Problem Set (classical)

### 78. Marbles

#### Problem code: MARBLES

Hänschen dreams he is in a shop with an infinite amount of marbles. He is allowed to select  $n$  marbles. There are marbles of  $k$  different colors. From each color there are also infinitely many marbles. Hänschen wants to have at least one marble of each color, but still there are a lot of possibilities for his selection. In his effort to make a decision he wakes up. Now he asks you how many possibilities for his selection he would have had. Assume that marbles of equal color can't be distinguished, and the order of the marbles is irrelevant.

#### Input

The first line of input contains a number  $T \leq 100$  that indicates the number of test cases to follow. Each test case consists of one line containing  $n$  and  $k$ , where  $n$  is the number of marbles Hänschen selects and  $k$  is the number of different colors of the marbles. You can assume that  $1 \leq k \leq n \leq 1000000$ .

#### Output

For each test case print the number of possibilities that Hänschen would have had. You can assume that this number fits into a signed 64 bit integer.

#### Example

**Input :**

```
2
10 10
30 7
```

**Output :**

```
1
475020
```

---

Added by: Adrian Kuegel

Date: 2004-06-19

Time limit: 1s

Source limit: 10000B

Languages: All

Resource: own problem

## **SPOJ Problem Set (classical)**

### **82. Easy Problem**

#### **Problem code: EASYPIE**

Last year there were a lot of complaints concerning the set of problems. Most contestants considered our problems to be too hard to solve. One reason for this is that the team members responsible for the problems are not able to evaluate properly whether a particular problem is easy or hard to solve. (We have created until now so many problems, that all seems quite easy.) Because we want our future contests to be better we would like to be able to evaluate the hardness of our problems after the contest using a history of submissions.

There are a few statistics that we can use for evaluating the hardness of a particular problem: the number of accepted solutions of the problem, the average number of submissions of the problem and the average time consumed to solve it (as "General rules" of the contest state "the time consumed for a solved problem is the time elapsed from the beginning of the contest to the submittal of the accepted run"). For the latter two statistics we consider only the teams which solved this particular problem. Needless to say we ask you to write a program that computes aforementioned statistics for all problems.

#### **Task**

Write a program that:

- reads a history of submissions during an ACM contest,
- computes for each problem the number of accepted solutions of the problem, the average number of submissions and the average time consumed to solve it,
- writes the result.

#### **Input**

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case, the first line of the input contains one integer  $n$  ( $1 \leq n \leq 2000$ ) being the number of submissions during the contest. Each of the next  $n$  lines describes one submission and contains a submission time (measured in seconds from the beginning of the contest), a team identifier, a problem identifier and a result of evaluating the submission separated by single spaces. The submission time is a positive integer not greater than 18000. The team identifier is a non-empty string consisting of at most five small letters or digits. The problem identifier is a capital letter A, B, ..., or I. The result is a capital letter A (the submission is accepted) or R (the submission is rejected).

Submissions are given in nondecreasing order according to submission times and there are 62 teams competing.

Please note that if a problem is accepted all further submission of this problem by the same team are possible but they should not be taken to the statistics.

## Output

For each test case the output consists of nine lines. The first line corresponds to problem A, the second line to problem B, and so on. Each line should contain the problem identifier, the number of accepted solutions of the problem, the average number of submissions done by teams that solved that problem and the average time consumed to solve it separated by single spaces. The latter two statistics should be printed only if there was at least one accepted solution of the given problem and should be rounded to two fractional digits (in particular 1.235 should be rounded to 1.24).

## Example

### Sample input:

```
1
12
10 wawu1 B R
100 chau1 A A
2000 uwr2 B A
2010 wawu1 A R
2020 wawu1 A A
2020 wawu1 B A
4000 wawu2 C R
6000 chau1 A R
7000 chau1 A A
8000 ppl A A
8000 zil2 B R
9000 zil2 B A
```

### Sample output:

```
A 3 1.33 3373.33
B 3 1.67 4340.00
C 0
D 0
E 0
F 0
G 0
H 0
I 0
```

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003



## SPOJ Problem Set (classical)

### 83. Bundling

#### Problem code: BUNDLE

Outel, a famous semiconductor company, recently released a new model of microprocessor called Platinum. Like many modern processors, Platinum can execute many instructions in one clock step providing that there are no dependencies between them (instruction  $I_2$  is dependent on instruction  $I_1$  if for example  $I_2$  reads a register that  $I_1$  writes to). Some processors are so clever that they calculate on the fly which instructions can be safely executed in parallel. Platinum however expects this information to be explicitly specified. A special marker, called simply a stop, inserted between two instructions indicates that some instructions after the stop are possibly dependent on some instructions before the stop. In other words instructions between two successive stops can be executed in parallel and there should not be dependencies between them.

Another interesting feature of Platinum is that an instruction sequence must be split into groups of one, two or three successive instructions. Each group has to be packed into a container called a bundle. Each bundle has 3 slots and a single instruction can be put into each slot, however some slots may stay empty. Each instruction is categorized into one of 10 instruction types denoted by consecutive capital letters from A to J (instructions of the same type have similar functionality, for example type A groups integer arithmetic instructions and type F groups instructions). Only instructions of certain types are allowed to be packed into one bundle. A template specifies one permissible combination of instruction types within a bundle. A template can also specify a position of a stop in the middle of a bundle (there is at most one such stop allowed). In addition, stops are allowed between any two adjoining bundles. A set of templates is called a bundling profile. When packing instructions into bundles, one has to use templates from bundling profile only.

Although Platinum is equipped with an instruction cache it was found that for maximal performance it is most crucial to pack instructions as densely as possible. Second important thing is to use a small number of stops.

Your task is to write a program for bundling Platinum instructions. For the sake of simplicity we assume that the instructions cannot be reordered.

#### Task

Write a program that:

- reads a bundling profile and a sequence of instructions,
- computes the minimal number of bundles into which the sequence can be packed without breaking the dependencies and the minimal number of all stops that are required for the minimal number of bundles,
- writes the result.

## Input

The input begins with the integer  $z$ , the number of test cases. Then  $z$  test cases follow.

The first line of each test case description contains two integers  $t$  and  $n$  separated by a single space. Integer  $t$  ( $1 \leq t \leq 1500$ ) is the number of templates in the bundling profile. Integer  $n$  ( $1 \leq n \leq 100000$ ) is the number of instructions to be bundled.

Each of the next  $t$  lines specifies one template and contains 3 capital letters  $t_1, t_2, t_3$  with no spaces in between followed by a space and an integer  $p$ . Letter  $t_i$  ( $A \leq t_i \leq J$ ) is an instruction type allowed in the  $i$ -th slot. Integer  $p$  ( $0 \leq p \leq 2$ ) is the index of the slot after which the stop is positioned (0 means no stop within the bundle).

Each of the next  $n$  lines specifies one instruction. The  $i$ -th line of these  $n$  lines contains one capital letter  $c_i$  and an integer  $d_i$ , separated by a single space. Letter  $c_i$  ( $A \leq c_i \leq J$ ) is the type of the  $i$ -th instruction. Integer  $d_i$  ( $0 \leq d_i < i$ ) is the index of the last instruction (among the previous ones) that the  $i$ -th instruction is dependent on (0 means that the instruction is not dependent on any former instruction).

You can assume that for each instruction type  $c$  describing an instruction in the instruction sequence there is at least one template containing  $c$ .

## Output

For each test case, the first and only line of the output contains two integers  $b$  and  $s$ . Integer  $b$  is the minimal number of bundles in a valid packing. Integer  $s$  is the minimal number of all stops that are required for the minimal number of bundles.

## Example

**Sample input:**

```
1
4 9
ABB 0
BAD 1
AAB 0
ABB 2
B 0
B 1
A 1
A 1
B 4
D 0
A 0
B 3
B 0
```

**Sample output:**

```
4 3
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003

## SPOJ Problem Set (classical)

### 84. Shortcut

#### Problem code: SHORTCUT

Mirek has a favourite way from home to the university that he traverses every working day. The route consists of sections and each section is a straight segment 10 meters long. Each section is either a straight ahead extension of the previous section or it is perpendicular to the previous section. After traversing each section Mirek takes a small break to admire the beauty of the nature. During his walk he never visits the same place twice.

A sample map

Yesterday Mirek stayed up long in the night at the party and today he got up late from bed. He knows that he will miss the first lecture unless he changes his usual route. He plans to make one shortcut but he wants the shortcut to be as short as possible (well, we can tell you in secret that he doesn't want to be on time, he just wants to calm his conscience). The shortcut must be either a horizontal or vertical segment connecting two break points of Mirek's route.

Please help Mirek find the shortest shortcut.

#### Task

Write a program that:

- reads Mirek's route,
- computes the shortest shortcut on the route,
- writes the result.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case, the first line of the input contains one integer  $n$  ( $3 \leq n \leq 250\,000$ ) being the number of sections of the route. The second line of the input contains a sequence of  $n$  characters N, E, S or W with no spaces in between. Each character is a description of one section of the route. Character N, E, S or W means that Mirek walks 10 meters north, east, south or west respectively. You may assume that at least one shortcut exists for the given route.

#### Output

The first and only line of the output contains integers  $l$ ,  $b$ ,  $e$  and character  $d$  separated by single spaces. Integer  $l$  is the length of the shortest shortcut (measured in 10 m segments). Integers  $b$  and  $e$  are the numbers of break points where the shortcut begins and ends respectively (we number break points with consecutive integers from 0 for Mirek's home to  $n$  for the university). Character  $d$  is the direction of the shortcut. If more than one shortcut of the minimal length exists you should output the one that begins earliest on the route. If more than one shortcut of the minimal length begins at the same break point you should output the one that ends furthest on the route.

## Example

**Sample input:**

```
1
12
NNNENNWWWSSW
```

**Sample output:**

```
2 3 11 W
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003

## SPOJ Problem Set (classical)

### 85. Dice Contest

#### Problem code: DICE1

Everyone loves gambling in the Dicent City. Every Saturday the whole community meets to attend a dice contest. They started a few years ago with a classic six-sided die with 1 to 6 dots displayed on the sides and had a lot of fun.

A die

However they soon got bored and that's why more sophisticated dice are in use nowadays. They put a sticker on each side and write a positive integer on each sticker.

The contest is run on a strip divided into squares in a chessboard-like manner. The strip is 4 squares wide and infinite to the left and to the right (is anyone going to say it can't exist in the real world, huh?). The rows of the strip are numbered from 1 to 4 from the bottom to the top and the columns are numbered by consecutive integers from the left to the right. Each square is identified by a pair (x,y) where x is a column number and y is a row number.

The game begins with a die placed on a square chosen by a contest committee with one-dot side on the top and two-dots side facing the player. To move the die the player must roll the die over an edge to an adjacent (either horizontally or vertically) square. The number displayed on the top of the die after a roll is the cost of the move. The goal of the game is to roll the die from the starting square to the selected target square so that the sum of costs of all moves is minimal.

#### Task

Write a program that:

- reads the description of a die, a starting square and a target square,
- computes the minimal cost of rolling the die from the starting square to the target square,
- writes the result.

Note: all teams participating in the contest received dice from the organisers.

#### Input

The input begins with the integer t, the number of test cases. Then t test cases follow.

For each test case the first line of the input contains six integers  $l_1, l_2, l_3, l_4, l_5, l_6$  ( $1 \leq l_i \leq 50$ ) separated by single spaces. Integer  $l_i$  is the number written on a side having originally i dots. The second line of the input contains four integers  $x_1, y_1, x_2, y_2$  ( $-10^9 \leq x_1, x_2 \leq 10^9, 1 \leq y_1, y_2 \leq 4$ ) separated by single spaces. Integers  $x_1, y_1$  are the column and the row number of the starting square respectively. Integers  $x_2, y_2$  are the column and the row number of the target square respectively.

## Output

For each test case the first and the only line of the output should contain the minimal cost of rolling the die from the starting square to the target square.

## Example

**Sample input:**

```
1
1 2 8 3 1 4
-1 1 0 2
```

**Sample output:**

```
7
```

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003

## SPOJ Problem Set (classical)

### 86. November Rain

#### Problem code: RAIN1

Contemporary buildings can have very complicated roofs. If we take a vertical section of such a roof it results in a number of sloping segments. When it is raining the drops are falling down on the roof straight from the sky above. Some segments are completely exposed to the rain but there may be some segments partially or even completely shielded by other segments. All the water falling onto a segment as a stream straight down from the lower end of the segment on the ground or possibly onto some other segment. In particular, if a stream of water is falling on an end of a segment then we consider it to be collected by this segment.

#### Rooftops

For the purpose of designing a piping system it is desired to compute how much water is down from each segment of the roof. To be prepared for a heavy November rain you should count one liter of rain water falling on a meter of the horizontal plane during one second.

#### Task

Write a program that:

- reads the description of a roof,
- computes the amount of water down in one second from each segment of the roof,
- writes the results.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line of the input contains one integer  $n$  ( $1 \leq n \leq 40000$ ) being the number of segments of the roof. Each of the next  $n$  lines describes one segment of the roof and contains four integers  $x_1, y_1, x_2, y_2$  ( $0 \leq x_1, y_1, x_2, y_2 \leq 1000000, x_1 < x_2, y_1 < y_2$ ) separated by single spaces. Integers  $x_1, y_1$  are respectively the horizontal position and the height of the left end of the segment. Integers  $x_2, y_2$  are respectively the horizontal position and the height of the right end of the segment. The segments don't have common points and there are no horizontal segments. You can also assume that there are at most 25 segments placed above any point on the ground level.

#### Output

For each test case the output consists of  $n$  lines. The  $i$ -th line should contain the amount of water (in liters) down from the  $i$ -th segment of the roof in one second.



## Example

**Sample input:**

```
1
6
13 7 15 6
3 8 7 7
1 7 5 6
5 5 9 3
6 3 8 2
9 6 12 8
```

**Sample output:**

```
2
4
2
11
0
3
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003

## SPOJ Problem Set (classical)

### 87. Football

#### Problem code: FOOTBALL

Eric has a classic football that is made of 32 pieces of leather: 12 black pentagons and 20 white hexagons. Each pentagon adjoins 5 hexagons and each hexagon adjoins 3 pentagons and 3 hexagons. Eric drew a polygon (i.e. a closed line without intersections) along the edges of the pieces. The polygon divided the ball into two parts and Eric painted one of them green.

Eric's football

He is curious if given a description of the polygon you are able to compute the number of black, white and green pieces?

#### Task

Write a program that:

- reads the description of a polygon,
- computes the number of black, white and green pieces,
- writes the result.

Contest note: the first accepted solution will be awarded with the original football used for preparing the problem, signed by Eric, the author of the problem!

SPOJ note: the first accepted solution will be awarded some other sphere, without anybody's signatures, sent in PNG format to the author's email address [the offer is invalid, the sphere has already been presented to Robin Nittka, University of Ulm, Germany].

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case, the first line of the input contains one integer  $n$  being the number of vertices of the polygon. The second line of the input contains  $n$  integers  $a_1, a_2, \dots, a_n$  separated by single spaces. Integer  $a_i$  (equal 1 or 2) is the number of green pieces adjoining the  $i$ -th vertex of the polygon. The side of the polygon connecting the  $n$ -th and the first vertex always lies between two hexagons.

#### Output

For each test case the first and only line of the output contains three integers  $b$ ,  $w$  and  $g$  - the numbers of black, white and green pieces respectively.

## Example

**Sample input:**

```
1
21
1 2 1 2 1 2 1 1 1 2 2 1 1 1 1 2 2 2 1 1 1
```

**Sample output:**

```
11 15 6
```

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003 (E. Kopczynski)

## SPOJ Problem Set (classical)

### 88. Which is Next

#### Problem code: TREE2

Every computer science student knows binary trees. Here is one of many possible definitions of binary trees. Binary trees are defined inductively. A binary tree  $t$  is either an external node (leaf)  $o$  or an ordered pair  $t = (t_1, t_2)$  representing an internal node  $*$  with two subtrees attached, left subtree  $t_1$  and right subtree  $t_2$ . Under this definition the number of nodes in any binary tree is odd. Given an odd integer  $n$  let  $B(n)$  denote the set of all binary trees with  $n$  nodes, both internal and external. For instance  $B(1)$  consists of only one tree  $o$ ,  $B(3) = \{(o, o)\}$  and  $B(5) = \{(o, (o, o)), ((o, o), o)\}$ . The trees of  $B(5)$  are depicted in the figure below.

The trees  $B(5)$

Denote by  $|t|$  the number of nodes in a tree  $t$ . Given a tree  $t$  we define its unique integer identifier  $N(t)$  as follows:

- $N(o) = 0$
- $N(t_1, t_2) = 2^{|t_1|+|t_2|} + 2^{|t_2|} * N(t_1) + N(t_2)$

For instance,  $N(o, o) = 2^2 + 2^1 * 0 + 0 = 4$ ,  $N(o, (o, o)) = 2^4 + 2^3 * 0 + 4 = 20$ ,  
 $N((o, o), o) = 2^4 + 2^1 * 4 + 0 = 24$ .

Consider the following linear order on all binary trees:

- 1)  $o \leq t$
- 2)  $(t_1, t_2) \leq (u_1, u_2)$  when  $t_1 < u_1$ , or  $t_1 = u_1$  and  $t_2 \leq u_2$

In this order a single leaf  $o$  is the smallest tree and given two nonleaf trees, the smaller one is that with the smaller left tree, if the left subtrees are different, and that with the smaller right subtree, otherwise. Hence for instance  $(o, (o, o)) < ((o, o), o)$ , since we have  $o < (o, o)$ . Assume now that the trees in  $B(n)$  were sorted using the relation  $\leq$ . Then, for each tree  $t$  in  $B(n)$  we define the successor of  $t$  as the tree that immediately follows  $t$  in  $B(n)$ . If  $t$  is the largest one in  $B(n)$  then the successor of  $t$  is the smallest tree in set  $B(n)$ . For instance, the successor of  $(o, o)$  in  $B(3)$  is the same tree  $(o, o)$  and the successor of  $(o, (o, o))$  in  $B(5)$  is  $((o, o), o)$ . Given the integer identifier of some tree  $t$  can you give the identifier of the successor of  $t$  in  $B(|t|)$ ?

#### Task

Write a program that:

- reads the identifier of some binary tree  $t$ ,
- computes the identifier of the successor of  $t$  in  $B(|t|)$ ,
- writes the result.

## Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first and only line of the input contains one integer  $n$  ( $0 \leq n < 2^{30}$ ) - the identifier of some binary tree  $t$ .

## Output

For each test case the first and only line of the output should contain one integer  $s$  - the identifier of the successor of  $t$  in  $B(lt)$ .

## Example

**Sample input:**

1  
20

**Sample output:**

24

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003

## SPOJ Problem Set (classical)

### 89. Hang or not to hang

#### Problem code: HANGLET

Little Tom is learning how to program. He has just written some programs but is afraid to run them, because he does not know if they will ever stop. Please write a program to help him. This task is not as easy as it may seem, because Tom's programs are possibly not deterministic. Given a program written by Tom, your program should tell him whether his program can stop and if so, what is the shortest possible time before it stops.

Tom's computer consists of 32 1-bit registers and the program consists of  $n$  instructions. The registers are numbered from 0 to 31 and the instructions are numbered from 0 to  $n-1$ .

Below,  $\text{MEM}[a]$  stands for the contents of the  $a$ -th register,  $0 \leq a, b < 32$ ,  $0 \leq x < n$ ,  $0 \leq c \leq 1$ .

The instruction set is as follows:

Instruction	Semantics
AND a b	$\text{MEM}[a] := \text{MEM}[a] \text{ and } \text{MEM}[b]$
OR a b	$\text{MEM}[a] := \text{MEM}[a] \text{ or } \text{MEM}[b]$
XOR a b	$\text{MEM}[a] := \text{MEM}[a] \text{ xor } \text{MEM}[b]$
NOT a	$\text{MEM}[a] := \text{not } \text{MEM}[a]$
MOV a b	$\text{MEM}[a] := \text{MEM}[b]$
SET a c	$\text{MEM}[a] := c$
RANDOM a	$\text{MEM}[a] := \text{random value (0 or 1)}$
JMP x	jump to the instruction with the number x
JZ x a	jump to the instruction with the number x if $\text{MEM}[a] = 0$
STOP	stop the program

The last instruction of a program is always STOP (although there can be more than one STOP instruction). Every program starts with the instruction number 0. Before the start, the contents of the registers can be arbitrary values. Each instruction (including STOP) takes 1 processor cycle to execute.

#### Task

Write a program that:

- reads the program,
- computes the shortest possible running time of the program,
- writes the result.

## Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line of the input contains an integer  $n$  ( $1 \leq n \leq 16$ ) being the number of instructions of the program. Each of the next  $n$  lines contains one instruction of the program in the format given above. You may assume that the only white characters in the program are single spaces between successive tokens of each instruction.

## Output

For each test case the first and only line of the output should contain the shortest possible running time of the program, measured in processor cycles. If the program cannot stop, output should contain the word HANGS.

## Example

**Sample input:**

```
2
5
SET 0 1
JZ 4 0
RANDOM 0
JMP 1
STOP
5
MOV 3 5
NOT 3
AND 3 5
JZ 0 3
STOP
```

**Sample output:**

```
6
HANGS
```

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003

## SPOJ Problem Set (classical)

### 90. Minimizing maximizer

#### Problem code: MINIMAX

The company Chris Ltd. is preparing a new sorting hardware called Maximizer. Maximizer has  $n$  inputs numbered from 1 to  $n$ . Each input represents one integer. Maximizer has one output which represents the maximum value present on Maximizer's inputs.

Maximizer is implemented as a pipeline of sorters  $\text{Sorter}(i_1, j_1), \dots, \text{Sorter}(i_k, j_k)$ . Each sorter has  $n$  inputs and  $n$  outputs.  $\text{Sorter}(i, j)$  sorts values on inputs  $i, i+1, \dots, j$  in non-decreasing order and lets the other inputs pass through unchanged. The  $n$ -th output of the last sorter is the output of the Maximizer.

An intern (a former ACM contestant) observed that some sorters could be excluded from the pipeline and Maximizer would still produce the correct result. What is the length of the shortest subsequence of the given sequence of sorters in the pipeline still producing correct results for all possible combinations of input values?

#### Task

Write a program that:

- reads a description of a Maximizer, i.e. the initial sequence of sorters in the pipeline,
- computes the length of the shortest subsequence of the initial sequence of sorters still producing correct results for all possible input data,
- writes the result.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line of the input contains two integers  $n$  and  $m$  ( $2 \leq n \leq 50000$ ,  $1 \leq m \leq 500000$ ) separated by a single space. Integer  $n$  is the number of inputs and integer  $m$  is the number of sorters in the pipeline. The initial sequence of sorters is described in the next  $m$  lines. The  $k$ -th of these lines contains the parameters of the  $k$ -th sorter: two integers  $i_k$  and  $j_k$  ( $1 \leq i_k < j_k \leq n$ ) separated by a single space.

#### Output

For each test case the output consists of only one line containing an integer equal to the length of the shortest subsequence of the initial sequence of sorters still producing correct results for all possible data.



## Example

**Sample input:**

```
1
40 6
20 30
1 10
10 20
20 30
15 25
30 40
```

**Sample output:**

```
4
```

**Warning: enormous Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-06-26

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2003

## SPOJ Problem Set (classical)

### 91. Two squares or not two squares

#### Problem code: TWOSQRS

Given integer  $n$  decide if it is possible to represent it as a sum of two squares of integers.

#### Input

First line of input contains one integer  $c \leq 100$  - number of test cases. Then  $c$  lines follow, each of them consisting of exactly one integer  $0 \leq n \leq 10^{12}$ .

#### Output

For each test case output Yes if it is possible to represent given number as a sum of two squares and No if it is not possible.

#### Example

Input :

```
10
1
2
7
14
49
9
17
76
2888
27
```

Output :

```
Yes
Yes
No
No
Yes
Yes
Yes
No
Yes
No
```

---

Added by: Pawel Gawrychowski

Date: 2004-06-29

Time limit: 2s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 92. Cutting off Squares

#### Problem code: CUTSQRS

Two players take it in turns to cut off squares from a rectangle. If the lengths of the sides of the rectangle are  $a$  and  $b$  ( $a \leq b$ ) at the beginning of a player's turn, he may cut off as many squares with a side of length  $a$  as he likes (but at least 1 square), provided the square he is cutting off has at least three of its sides lying on the sides of the rectangle he is trimming. After every cut, the cut off square is removed from the rectangle. When the last part of the rectangle is removed, the game ends and the person who cut it off wins.

Michael, a friend of the players', is taking down a log of the games they are playing in the form of a sequence of consecutive numbers, each number denoting how many squares a player cut off in his turn. Since the game is rather slow, Michael is getting a little bored and he has started writing a detailed analysis of the game in his notebook. For given starting dimensions  $a$  and  $b$ , he always writes down:

- the number of different possible game sequences,
- the number of different possible game sequences in which the starting player wins,
- the word 'first' if the starting player can win (provided he does not make any mistakes) regardless of what the other player does, and the word 'second' in all other cases.

After writing for several hours Michael began to worry whether he had enough room left in his notebook for all the information he wanted to write down. Please help him answer this question.

#### Input

An integer  $t$  denoting the number of test cases, ( $t \leq 10000$ ) followed by  $t$  pairs of integers  $a$ ,  $b$ , ( $1 \leq a \leq b \leq 10^9$ ) given in separate lines.

#### Output

For each test case, output the number of characters Michael has to write down (excluding spaces).

#### Example

**Sample input:**

```
2
1 1
2 3
```

**Sample output:**

```
7
8
```

(In the first case Michael has to write '1 1 first', in the second case '2 1 second'.)

---

Added by: Adrian Kosowski

Date: 2004-06-22

Time limit: 3s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004 (problemset 1)

## SPOJ Problem Set (classical)

### 94. Numeral System of the Maya

#### Problem code: MAYA

The Maya lived in Central America during the first millennium. In many regards, they constituted one of the most developed and most fascinating cultures of this epoch. Even though draught animals and the wheel were unknown to the Mayas, they excelled in the fields of weaving, architecture and pottery. But truly breath-taking were their achievements in the fields of astronomy and mathematics. Whilst Europe was trudging through the dark Middle Ages, the Maya determined the solar year to 365.242 days (modern-day measurement: 365.242198) and the lunar cycle to 29.5302 days (modern-day measurement: 29.53059). Such astonishingly precise findings were hardly possible without a powerful numeral system. In this task we will explore the Maya's numeral system.

Maya priests and astronomers used a numerical system to the base of 20. Unusual to their time, their system also included the concepts of digits and of the zero. Both concepts were completely unknown to the Europeans at this time. The first nineteen numbers of the vigesimal system were represented by dots and dashes according to the following table:

[IMAGE]

The zero was written down as a symbol resembling a shell. Multi-digit numbers (i.e. the numbers bigger than 19) were written in vertical arrangement, with the highest-value digit on top. For example, the number 79 was written as

[IMAGE]

As can be seen, the second digit possesses a value of 20.

Due to an interference of the two calendar systems of the Maya, the third digit did not hold the value 400 ( $20 \times 20$ ), as would be expected, but 360. All the following digits were again treated regularly, i.e. the fourth digit counted 7200 ( $360 \times 20$ ), the fifth 144000 ( $7200 \times 20$ ), and so on.

Hence, the number 13495 ( $=1 \times 7200 + 17 \times 360 + 8 \times 20 + 15$ ) was written as follows:

[IMAGE]

Write a program to convert Maya numbers to decimal numbers!

#### Input

The input file contains a list of numbers written down in Maya fashion. Of course, dots are represented as points (.), and dashes are represented as hyphens (-). The zero digit, the shell symbol, is written as a capital letter S (S). Description of a Maya number starts with  $n$  - the number of the Maya digits. The following  $n$  lines contain one digit each. One digit is written from top to bottom using spaces as vertical separators.

One number will not have more than seven digits. Each two numbers are separated by a blank line.  
Input terminates with  $n = 0$

## Output

Your program has to output the value of the number in the input file in the nowadays more common decimal system. One number per line.

## Example

**Sample input:**

1

..

5

... -

. - -

S

S

S

0

**Sample output:**

2

1231200

---

Added by: Michał Czuczman

Date: 2004-07-11

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Swiss Olympiad in Informatics 2004

## SPOJ Problem Set (classical)

### 95. Street Parade

#### Problem code: STPAR

For sure, the love mobiles will roll again on this summer's street parade. Each year, the organisers decide on a fixed order for the decorated trucks. Experience taught them to keep free a side street to be able to bring the trucks into order.

The side street is so narrow that no two cars can pass each other. Thus, the love mobile that enters the side street last must necessarily leave the side street first. Because the trucks and the ravers move up closely, a truck cannot drive back and re-enter the side street or the approach street.

You are given the order in which the love mobiles arrive. Write a program that decides if the love mobiles can be brought into the order that the organisers want them to be.

#### Input

There are several test cases. The first line of each test case contains a single number  $n$ , the number of love mobiles. The second line contains the numbers 1 to  $n$  in an arbitrary order. All the numbers are separated by single spaces. These numbers indicate the order in which the trucks arrive in the approach street. No more than 1000 love mobiles participate in the street parade. Input ends with number 0.

#### Output

For each test case your program has to output a line containing a single word `yes` if the love mobiles can be re-ordered with the help of the side street, and a single word `no` in the opposite case.

#### Example

**Sample input:**

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

**Sample output:**

```
yes
```

#### Illustration

The sample input reflects the following situation:

[IMAGE]

The five trucks can be re-ordered in the following way:

[IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE]

---

Added by: Patryk Pomykalski  
Date: 2004-07-01  
Time limit: 2s  
Source limit: 50000B  
Languages: All  
Resource: Swiss Olympiad in Informatics 2004



## SPOJ Problem Set (classical)

### 96. Shopping

#### Problem code: SHOP

Crowd in the supermarket The old tube screen to your computer turned out to be the cause of your chronic headaches. You therefore decide to buy one of these new flat TFT monitors. At the entrance of the computer shop you see that it is quite full with customers.

In fact, the shop is rather packed with customers and moving inside involves a certain amount of elbowing. Since you want to return home quickly to complete your half finished SPOJ tasks, you want to sidestep the crowd as much as possible. You examine the situation somewhat closer and realise that the crowding is less in some parts of the shop. Thus, there is reason for hope that you can reach your goal in due time, provided that you take the shortest way. But which way is the shortest way?

You sketch the situation on a piece of paper but even so, it is still a tricky affair. You take out your notebook from your pocket and start to write a program which will find the shortest way for you.

#### Input

The first line of the input specifies the width  $w$  and height  $h$  of the shop. Neither dimension exceeds 25.

The following  $h$  lines contain  $w$  characters each. A letter  $X$  symbolises a shelf, the letter  $S$  marks your starting position, and the letter  $D$  marks the destination (i.e. the square in front of the monitors). All free squares are marked with a digit from 1 to 9, meaning the number of seconds needed to pass this square.

There are many test cases separated by an empty line. Input terminates with width and height equal 0 0.

#### Output

Your program is to output the minimum number of seconds needed to reach to destination square. Each test case in a separate line. Movements can only be vertical and horizontal. Of course, all movements must take place inside the grid. There will always be a way to reach the destination.

#### Example

**Sample input:**

```
4 3
X1S3
42X4
X1D2
```

```
5 5
S5213
2X2X5
51248
4X4X2
```

1445D

0 0

**Sample output:**

4

23

---

Added by: Michał Czuczman

Date: 2004-07-01

Time limit: 3s

Source limit:50000B

Languages: All

Resource: Swiss Olympiad in Informatics 2004

## SPOJ Problem Set (classical)

### 97. Party Schedule

#### Problem code: PARTY

You just received another bill which you cannot pay because you lack the money.

Unfortunately, this is not the first time to happen, and now you decide to investigate the cause of your constant monetary shortness. The reason is quite obvious: the lion's share of your money routinely disappears at the entrance of party localities.

You make up your mind to solve the problem where it arises, namely at the parties themselves. You introduce a limit for your party budget and try to have the most possible fun with regard to this limit.

You inquire beforehand about the entrance fee to each party and estimate how much fun you might have there. The list is readily compiled, but how do you actually pick the parties that give you the most fun and do not exceed your budget?

Write a program which finds this optimal set of parties that offer the most fun. Keep in mind that your budget need not necessarily be reached exactly. Achieve the highest possible fun level, and do not spend more money than is absolutely necessary.

#### Input

The first line of the input specifies your party budget and the number  $n$  of parties.

The following  $n$  lines contain two numbers each. The first number indicates the entrance fee of each party. Parties cost between 5 and 25 francs. The second number indicates the amount of fun of each party, given as an integer number ranging from 0 to 10.

The budget will not exceed 500 and there will be at most 100 parties. All numbers are separated by a single space.

There are many test cases. Input ends with 0 0.

#### Output

For each test case your program must output the sum of the entrance fees and the sum of all fun values of an optimal solution. Both numbers must be separated by a single space.

#### Example

##### Sample input:

```
50 10
12 3
15 8
16 9
16 6
10 2
21 9
18 4
12 4
17 8
18 9
```

```
50 10
13 8
19 10
16 8
12 9
10 2
12 8
13 5
15 5
11 7
16 2

0 0
```

**Sample output:**

```
49 26
48 32
```

---

Added by: Patryk Pomykalski

Date: 2004-07-01

Time limit: 3s

Source limit:50000B

Languages: All

Resource: Swiss Olympiad in Informatics 2004

## SPOJ Problem Set (classical)

### 98. Dance Floor

#### Problem code: DFLOOR

You recently watched a video clip in which a singer danced on a grid of colourful tiles enlightened from below. Each step on a tile flipped the tile's state, i.e. light on or off. In addition to that, all the neighbouring tiles flipped their states, too.

In this task, you are supposed to come up with a short program that decides if it is possible for the singer to switch on the lights of all the tiles, provided that he dances on the appropriate tiles.

The dance floor has rectangular shape. At the beginning, some of the tiles are already alight. Your program may temporarily switch off some tiles, if it deems that necessary to reach its goal. Stepping on a tile toggles its own state as well as the states of the four neighbouring tiles directly above, below, to the left and to the right. Of course, in the case of a peripheral tile, there will be only three or two neighbouring tiles.

Here comes an example:

[IMAGE]

If the dancer steps on the tile indicated by the brown shoe, all the tiles within the white area change their states. The resulting dance floor is depicted on the right.

You may assume that the singer is fit enough to jump from any tile to any other tile, even if the destination tile lies on the opposite side of the dance floor.

#### Input

There are several test cases. The first line of each case contains two integer numbers  $x$  and  $y$ , indicating the width and the height of the dance floor grid. The numbers are separated by a single space and satisfy  $3 \leq x, y \leq 15$ .

The following  $y$  lines containing  $x$  characters each describe the initial on/off states of the tiles. A zero means "the tile is switched off", a one digit means "the tile is alight".

Input ends with 0 0.

#### Output

For each test case your program should output the number of steps needed to switch all the lights on, followed by exactly that many lines with two space-separated numbers  $i$  and  $j$ . Each individual line commands the singer to step on the  $i$ -th tile of the  $j$ -th row. Starting with the situation of the input file and executing all the commands in the output file, all the tiles must be switched on.

If more than one solution exist, your program should output an arbitrary one of them. If, on the other hand, no solution exists, your program should write the number "-1".

#### Example

**Sample input**

```
4 3
0111
1010
1000
```

```
0 0
```

**Sample output**

```
3
1 2
1 3
4 3
```

---

Added by: Michał Czuczman

Date: 2004-07-01

Time limit: 3s

Source limit:50000B

Languages: All

Resource: Swiss Olympiad in Informatics 2004

## SPOJ Problem Set (classical)

### 99. Bus

#### Problem code: BUS

[IMAGE] The city Buscelona (as the name suggests) has a great bus transport system. All buses have circular lines. The bus drivers in Buscelona like to chat. Fortunately most bus lines have some stops in common. If a bus driver meets a colleague on a bus stop they chat a bit and exchange all news they know.

The operation of buses is highly synchronized. The time necessary to get from one stop to the next stop is always exactly 1 minute.

Each morning each bus driver has some important news that only he knows. When a busdriver meets a colleague he will tell him all news he knows. If two bus drivers share the same start station, they will exchange their news there already (before they start working). Note that exchanging news and stopping does not take any time.

#### Input

The first line of a test case contains the number of bus lines  $n$  ( $0 < n < 50$ ). The following  $n$  lines start with a number  $s$  ( $0 < s < 50$ ) indicating the stops of a busline. On the same line follow  $s$  numbers representing a bus station each. A bus starts at the first station. When a bus reaches the last station, the bus will drive to the first station again.

There are many test cases separated by an empty line. Input data terminates with  $n = 0$ .

#### Output

For each test case you should output the time in minutes which it takes until all bus drivers know all news. If that never happens, your program should write the word "NEVER" (without quotes).

#### Example

**Sample input:**

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

```
2
2 1 2
2 5 8
```

```
0
```

**Sample output:**

```
12
NEVER
```

---

Added by: Michał Czuczman  
Date: 2004-07-03  
Time limit: 7s  
Source limit: 50000B  
Languages: All  
Resource: Swiss Olympiad in Informatics 2004



## SPOJ Problem Set (classical)

### 100. Tower of Babylon

#### Problem code: BABTWR

[IMAGE] Apart from the Hanging Gardens the Babylonians (around 3000-539 b.c.) built the Tower of Babylon as well. The tower was meant to reach the sky, but the project failed because of a confusion of language imposed from much higher above.

For the 2638th anniversary a model of the tower will be rebuilt.  $n$  different types of blocks are available. Each one of them may be duplicated as many times as you like. Each type has a height  $y$ , a width  $x$  and a depth  $z$ . The blocks are to be stacked one upon each other so that the resulting tower is as high as possible. Of course the blocks can be rotated as desired before stacking. However for reasons of stability a block can only be stacked upon another if *both* of its baselines are shorter.

#### Input

The number of types of blocks  $n$  is located in the first line of each test case. On the subsequent  $n$  lines the height  $y_i$ , the width  $x_i$  and the depth  $z_i$  of each type of blocks are given. There are never more than 30 different types available.

There are many test cases, which come one by one. Input terminates with  $n = 0$ .

#### Output

For each test case your program should output one line with the height of the highest possible tower.

#### Example

**Sample input:**

```
5
31 41 59
26 53 58
97 93 23
84 62 64
33 83 27
1
1 1 1
0
```

**Sample output:**

```
342
1
```

---

Added by: Michał Czuczman  
Date: 2004-07-06  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Swiss Olympiad in Informatics 2004

## SPOJ Problem Set (classical)

### 101. Fishmonger

#### Problem code: FISHER

A Fishmonger A fishmonger wants to bring his goods from the port to the market. On his route he has to traverse an area with many tiny city states. Of course he has to pay a toll at each border.

Because he is a good business man, he wants to choose the route in such a way that he has to pay as little money for tolls as possible. On the other hand, he has to be at the market within a certain time, otherwise his fish start to smell.

#### Input

The first line contains the number of states  $n$  and available time  $t$ . The first state is the port, the last state is the market. After this line there are  $n$  lines with  $n$  numbers each, specifying for each state the travel time to the  $i$ -th state. This table is terminated with an empty line. The table of the tolls follows in the same format.

$n$  is at least 3 and at most 50. The time available is less than 1000. All numbers are integers.

There are many test cases separated by an empty line. Input terminates with number of states and time equal 0 0.

#### Output

For each test case your program should print on one line the total amount of tolls followed by the actual travelling time.

#### Example

**Sample input:**

```
4 7
0 5 2 3
5 0 2 3
3 1 0 2
3 3 2 0
```

```
0 2 2 7
2 0 1 2
2 2 0 5
7 2 5 0
```

```
0 0
```

**Sample output:**

```
6 6
```

This corresponds to the following situation, the connections are labeled with (time, toll):

[IMAGE]

---

Added by: Michał Czuczman

Date: 2004-07-07

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Swiss Olympiad in Informatics 2004

## SPOJ Problem Set (classical)

### 102. GX Light Pipeline Inc

#### Problem code: LITEPIPE

The GX Light Pipeline Inc. started to prepare bent pipes for the new transgalactic light pipeline. However during the design of the pipeline they ran into the problem of determining how far the light can reach inside the pipe. In order to improve your scarce budget you decided to fill a summer job at the GX Light Pipeline Inc. Now it's your task to create a program which computes how far the light reaches in the pipeline.

The pipeline consists of seamlessly welded together segments made of non-reflecting opaque materials. The upper points of the pipe contour are described by a sequence of points  $[x_1, y_1]$ ,  $[x_2, y_2]$ ,  $[x_3, y_3]$ , ...,  $[x_n, y_n]$ , where  $x_k < x_{k+1}$ . The bottom points of the pipe contour are the same points with  $y$ -coordinate decreased by 1.

The company wants to find the points with maximal  $x$ -coordinate that the light will reach. The light is emitted by a segment source with endpoints  $[x_1, y_1]$  and  $[x_1, y_1 - 1]$  (endpoints are emitting light too). Assume that the light is not bent at the pipe bent points and the bent points do not stop the light beam.

[IMAGE]

#### Input

Each test case starts with the number of bent points  $n$ . Each of the next  $n$  lines contains a pair of real values  $x_i, y_i$  separated by space.

The number of bent points never exceeds 200.

There are many test cases. Input terminates with  $n = 0$ .

#### Output

For each test case your program should output on a single line the maximal  $x$ -coordinate of the point where the light can reach from the source segment, written with precision of two decimal places. If the light goes through all the pipe, your program should output  $x_n$ .

#### Example

**Sample input:**

```
4
0.00 1.00
2.00 2.00
4.00 1.00
6.00 4.00
0
```

**Sample output:**

```
4.67
```

---

Added by: Michał Czuczman  
Date: 2004-07-11  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Swiss Olympiad in Informatics 2004

## SPOJ Problem Set (classical)

### 104. Highways

#### Problem code: HIGH

In some countries building highways takes a lot of time... Maybe that's because there are many possibilities to construct a network of highways and engineers can't make up their minds which one to choose. Suppose we have a list of cities that can be connected directly. Your task is to count how many ways there are to build such a network that between every two cities there exists exactly one path. Two networks differ if there are two cities that are connected directly in the first case and aren't in the second case. At most one highway connects two cities. No highway connects a city to itself. Highways are two-way.

#### Input

The input begins with the integer  $t$ , the number of test cases (equal to about 1000). Then  $t$  test cases follow. The first line of each test case contains two integers, the number of cities ( $1 \leq n \leq 12$ ) and the number of direct connections between them. Each next line contains two integers  $a$  and  $b$ , which are numbers of cities that can be connected. Cities are numbered from 1 to  $n$ . Consecutive test cases are separated with one blank line.

#### Output

The number of ways to build the network, for every test case in a separate line. Assume that when there is only one city, the answer should be 1. The answer will fit in a signed 64-bit integer.

#### Example

**Sample input:**

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

2 1
2 1

1 0

3 3
1 2
2 3
3 1
```

**Sample output:**

8  
1  
1  
3

---

Added by: Piotr Łowiec  
Date: 2004-07-02  
Time limit: 7s  
Source limit: 50000B  
Languages: All



## SPOJ Problem Set (classical)

### 105. Alice and Bob

#### Problem code: ALICEBOB

This is a puzzle for two persons, let's say Alice and Bob. Alice draws an  $n$ -vertex convex polygon and numbers its vertices with integers  $1, 2, \dots, n$  in an arbitrary way. Then she draws a number of noncrossing diagonals (the vertices of the polygon are not considered to be crossing points). She informs Bob about the sides and the diagonals of the polygon but not telling him which are which. Each side and diagonal is specified by its ends. Bob has to guess the order of the vertices on the border of the polygon. Help him solve the puzzle.

If  $n = 4$  and  $(1,3), (4,2), (1,2), (4,1), (2,3)$  are the ends of four sides and one diagonal then the order of the vertices on the border of this polygon is  $1, 3, 2, 4$  (with the accuracy to shifting and reversing).

#### Task

Write a program that:

- reads the description of sides and diagonals given to Bob by Alice,
- computes the order of the vertices on the border of the polygon,
- writes the result.

#### Input

The first line of the input contains exactly one positive integer  $d$  equal to the number of data sets,  $1 \leq d \leq 20$ . The data sets follow.

Each data set consists of exactly two consecutive lines.

The first of those lines contains exactly two integers  $n$  and  $m$  separated by a single space,  $3 \leq n \leq 1000$ ,  $0 \leq m \leq n-3$ . Integer  $n$  is the number of vertices of a polygon and integer  $m$  is the number of its diagonals, respectively.

The second of those lines contains exactly  $2(m+n)$  integers separated by single spaces. Those are ends of all sides and some diagonals of the polygon. Integers  $a_j, b_j$  on positions  $2j-1$  and  $2j$ ,  $1 \leq j \leq m+n$ ,  $1 \leq a_j \leq n$ ,  $1 \leq b_j \leq n$ ,  $a_j \neq b_j$ , specify ends of a side or a diagonal. The sides and the diagonals can be given in an arbitrary order. There are no duplicates. Alice does not cheat, i.e. the puzzle always has a solution.

#### Output

Line  $i$ ,  $1 \leq i \leq d$ , should contain a sequence of  $n$  integers separated by single spaces - a permutation of  $1, 2, \dots, n$ , i.e. the numbers of subsequent vertices on the border of the polygon from the  $i$ -th data set, the sequence should always start from 1 and its second element should be the smaller vertex of the two border neighbours of vertex 1.

## Example

**Sample input:**

```
1
4 1
1 3 4 2 1 2
4 1 2 3
```

**Sample output:**

```
1 3 2 4
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-02

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2001

## SPOJ Problem Set (classical)

### 106. Binary Stirling Numbers

#### Problem code: BINSTIRL

The Stirling number of the second kind  $S(n, m)$  stands for the number of ways to partition a set of  $n$  things into  $m$  nonempty subsets. For example, there are seven ways to split a four-element set into two parts:  $\{1, 2, 3\} \cup \{4\}$ ,  $\{1, 2, 4\} \cup \{3\}$ ,  $\{1, 3, 4\} \cup \{2\}$ ,  $\{2, 3, 4\} \cup \{1\}$ ,  $\{1, 2\} \cup \{3, 4\}$ ,  $\{1, 3\} \cup \{2, 4\}$ ,  $\{1, 4\} \cup \{2, 3\}$ .

There is a recurrence which allows you to compute  $S(n, m)$  for all  $m$  and  $n$ .

$$S(0, 0) = 1,$$

$$S(n, 0) = 0, \text{ for } n > 0,$$

$$S(0, m) = 0, \text{ for } m > 0,$$

$$S(n, m) = m \cdot S(n-1, m) + S(n-1, m-1), \text{ for } n, m > 0.$$

Your task is much "easier". Given integers  $n$  and  $m$  satisfying  $1 \leq m \leq n$ , compute the parity of  $S(n, m)$ , i.e.  $S(n, m) \bmod 2$ .

For instance,  $S(4, 2) \bmod 2 = 1$ .

#### Task

Write a program that:

- reads two positive integers  $n$  and  $m$ ,
- computes  $S(n, m) \bmod 2$ ,
- writes the result.

#### Input

The first line of the input contains exactly one positive integer  $d$  equal to the number of data sets,  $1 \leq d \leq 200$ . The data sets follow.

Line  $i + 1$  contains the  $i$ -th data set - exactly two integers  $n_i$  and  $m_i$  separated by a single space,  $1 \leq m_i \leq n_i \leq 10^9$ .

#### Output

The output should consist of exactly  $d$  lines, one line for each data set. Line  $i$ ,  $1 \leq i \leq d$ , should contain 0 or 1, the value of  $S(n_i, m_i) \bmod 2$ .

## Example

**Sample input:**

```
1
4 2
```

**Sample output:**

```
1
```

---

Added by: Adrian Kosowski

Date: 2004-07-02

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2001

## SPOJ Problem Set (classical)

### 107. Calendar of the Maya

#### Problem code: MAYACAL

The Classical Maya civilization developed in what is today southern Mexico, Guatemala, Belize and northern Honduras. During its height they developed a sophisticated system for time keeping which they used both to record history and for divinatory rituals. Their calendar consisted of 3 components. the Tzolkin, the Haab and the Long Count.

For divinatory purposes the Maya used the Tzolkin which was composed of 20 day names to which numeric coefficients from 1 to 13 were attached giving a total of 260 distinct combinations. This is the size of the Tzolkin, or ritual, year. From Spanish colonial sources, we know the names of the days: Imix, Ik, Akbal, Kan, Chikchan, Kimi, Manik, Lamat, Muluk, Ok, Chuen, Eb, Ben, Ix, Men, Kib, Kaban, Etznab, Kawak, Ajaw. The sequence of days developed as follows (starting for example at 9 Imix):

9 Imix, 10 Ik, 11 Akbal, 12 Kan, 13 Chikchan, 1 Kimi, 2 Manik, ...

The Haab calendar was an astronomical one. It had 365 days divided into 19 months each with 20 days, except the last one which had only 5 days. In a manner similar to the Tzolkin each month name had a number from 1 to 20 indicating the day number within the month. Again, from Spanish colonial sources, we know the names of the months: Pohp, Wo, Sip, Zotz, Sek, Xul, Yaxkin, Mol, Chen, Yax, Sak, Keh, Mak, Kankin, Muan, Pax, Kayab, Kumku, Wayeb. The month Wayeb had just 5 days and was considered an unlucky time of the year.

The Tzolkin and Haab were combined in the inscriptions to create the Calendar Round, combining the 260 day cycle of the Tzolkin and the 365 day cycle of the Haab. A typical Calendar Round date in the inscriptions might be. 3 Lamat 6 Pax. Note that not all of the combination of days, months and coefficients are possible.

A typical sequence of days in the Calendar Round (starting for example at 3 Lamat 6 Pax):

3 Lamat 6 Pax, 4 Muluk 7 Pax, 5 Ok 8 Pax, 6 Chuen 9 Pax, 7 Eb 10 Pax,  
8 Ben 11 Pax, 9 Ix 12 Pax, 10 Men 13 Pax, 11 Kib 14 Pax, 12 Kaban 15 Pax,  
13 Etznab 16 Pax, 1 Kawak 17 Pax, 2 Ajaw 18 Pax, 3 Imix 19 Pax, 4 Ik 20 Pax,  
5 Akbal 1 Kayab, 6 Kan 2 Kayab, ...

Finally, at the beginning of the Classic Period (AD 200 - 900), the Maya developed an absolute calendar called Long Count which counted the days from a fixed date in the past (the date when the current world was created according to Maya belief). Dates in the Long Count are given (for simplicity) in 5-tuples of the form. 9.2.3.4.5. Such a date one reads "9 baktuns 2 katuns 3 tuns 4 winals 5 kins since the zero date". A "kin" is just one day. A winal is a group of 20 days. A tun is a group of 18 winals (thus a tun has  $20 \times 18 = 360$  days, 5 days short of a year). From here on all units come in multiples of 20. Thus a katun is equal to 20 tuns (almost 20 years) and a baktun means 20 katuns (almost 400 years). Thus 9.2.3.4.5 really means " $9 \times 144000 + 2 \times 7200 + 3 \times 360 + 4 \times 20 + 5$  days since the zero date". Note that for every Long Count date b.k.t.w.i we have  $0 \leq k < 20$ ;  $0 \leq t < 20$ ;  $0 \leq w < 18$ ;  $0 \leq i < 20$ . Given the periodicity of the Calendar Round, a legal date such as 3 Lamat 6 Pax has multiple occurrences in the Long Count. Thus, one difficulty in reading inscriptions is in establishing a

date for the inscription when the date is given only in terms of a Calendar Round (very common). In this case one must compute "all" the possible Long Count dates associated with the particular Calendar Round and based in some other context information deduce (for example, the text mentions a king for which other dates are known) which one applies.

We limit our interest to the Long Count dates in the baktuns 8 and 9 (they cover all the Classic Period). We know that the Long Count date 8.0.0.0.0 fell on the Calendar Round 9 Ajaw 3 Sip.

## Task

Write a program that:

- reads a Calendar Round date,
- computes all Long Count dates in the baktuns 8 and 9 for the given Calendar Round date if this date is legal,
- writes the result.

## Input

The first line of the input contains exactly one positive integer  $d$  equal to the number of data sets,  $1 \leq d \leq 30$ . The data sets follow.

Each data set consists of exactly one line that contains exactly one Calendar Round date (maybe illegal). Tzolkin day number, Tzolkin day name, Haab day number and Haab month name separated by single spaces.

## Output

For every data set your program must output an ascending sequence of Long Count dates computed for a given Calendar Round date. The first line of the output for the given input set should contain exactly one integer  $n$  equal to the length of the sequence (0, if the input date is illegal).

Each of the next  $n$  lines should contain exactly one Long Count date specified by exactly 5 integers (meaning the numbers of baktuns, katuns, tuns, winals and kins respectively) separated by single dots.

## Example

**Sample input:**

```
2
3 1amat 6 Pax
1 Ajaw 9 Chen
```

**Sample output:**

```
15
8.0.17.17.8
8.3.10.12.8
8.6.3.7.8
8.8.16.2.8
8.11.8.15.8
8.14.1.10.8
8.16.14.5.8
8.19.7.0.8
9.1.19.13.8
9.4.12.8.8
```

9.7.5.3.8  
9.9.17.16.8  
9.12.10.11.8  
9.15.3.6.8  
9.17.16.1.8  
0

---

Added by: Adrian Kosowski

Date: 2004-07-02

Time limit: 3s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2001

## SPOJ Problem Set (classical)

### 108. Decoding Morse Sequences

#### Problem code: MORSE

Before the digital age, the most common "binary" code for radio communication was the Morse code. In Morse code, symbols are encoded as sequences of short and long pulses (called dots and dashes respectively). The following table reproduces the Morse code for the alphabet, where dots and dashes are represented as ASCII characters "." and "-":

A	.-	B	-...	C	-.-.	D	-..
E	.	F	..-.	G	--.	H	....
I	..	J	.-...	K	-. -	L	.-..
M	--	N	-.	O	---	P	.-.-
Q	--.-	R	.-.	S	...	T	-
U	..-	V	...-	W	.- -	X	-. -.
Y	-. -	Z	--..				

Notice that in the absence of pauses between letters there might be multiple interpretations of a Morse sequence. For example, the sequence `-.-.--` could be decoded both as CAT or NXT (among others). A human Morse operator would use other context information (such as a language dictionary) to decide the appropriate decoding. But even provided with such dictionary one can obtain multiple phrases from a single Morse sequence.

#### Task

Write a program that:

- reads a Morse sequence and a list of words (a dictionary),
- computes the number of distinct phrases that can be obtained from the given Morse sequence using words from the dictionary,
- writes the result.

Notice that we are interested in full matches, i.e. the complete Morse sequence must be matched to words in the dictionary.

#### Input

The first line of the input contains exactly one positive integer  $d$  equal to the number of data sets,  $1 \leq d \leq 20$ . The data sets follow.

The first line of each data set contains a Morse sequence - a nonempty sequence of at most 10000 characters "." and "-" with no spaces in between.

The second line contains exactly one integer  $n$ ,  $1 \leq n \leq 10000$ , equal to the number of words in a dictionary. Each of the following  $n$  lines contains one dictionary word - a nonempty sequence of at most 20 capital letters from "A" to "Z". No word occurs in the dictionary more than once.



## Output

The output should consist of exactly  $d$  lines, one line for each data set. Line  $i$  should contain one integer equal to the number of distinct phrases into which the Morse sequence from the  $i$ -th data set can be parsed. You may assume that this number is at most  $2 \cdot 10^9$  for every single data set.

## Example

**Sample input:**

```
1
.---.---.---.---.---.
6
AT
TACK
TICK
ATTACK
DAWN
DUSK
```

**Sample output:**

```
2
```

---

Added by: Adrian Kosowski

Date: 2004-07-02

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2001

## SPOJ Problem Set (classical)

### 109. Exchanges

#### Problem code: EXCHNG

Given  $n$  integer registers  $r_1, r_2, \dots, r_n$  we define a Compare-Exchange Instruction  $CE(a,b)$ , where  $a, b$  are register indices ( $1 \leq a < b \leq n$ ):

```
CE(a, b)::  
    if content( $r_a$ ) > content( $r_b$ ) then  
        exchange the contents of registers  $r_a$  and  $r_b$ ;
```

A Compare-Exchange program (shortly CE-program) is any finite sequence of Compare-Exchange instructions. A CE-program is called a Minimum-Finding program if after its execution the register  $r_1$  always contains the smallest value among all values in the registers. Such a program is called reliable if it remains a Minimum-Finding program after removing any single Compare-Exchange instruction. Given a CE-program  $P$ , what is the smallest number of instructions that should be added at the end of program  $P$  in order to get a reliable Minimum-Finding program?

For instance, consider the following CE-program for 3 registers:  $CE(1, 2)$ ,  $CE(2, 3)$ ,  $CE(1, 2)$ . In order to make this program a reliable Minimum-Finding program it is sufficient to add only two instructions:  $CE(1, 3)$  and  $CE(1, 2)$ .

#### Task

Write a program that:

- reads the description of a CE-program,
- computes the smallest number of CE-instructions that should be added to make this program a reliable Minimum-Finding program,
- writes the result.

#### Input

The first line of the input contains exactly one positive integer  $d$  equal to the number of data sets,  $1 \leq d \leq 10$ . The data sets follow.

Each data set consists of exactly two consecutive lines. The first of those lines contains exactly two integers  $n$  and  $m$  separated by a single space,  $2 \leq n \leq 10000$ ,  $0 \leq m \leq 25000$ . Integer  $n$  is the number of registers and integer  $m$  is the number of program instructions.

The second of those lines contains exactly  $2m$  integers separated by single spaces - the program itself. Integers  $a_j, b_j$  on positions  $2j-1$  and  $2j$ ,  $1 \leq j \leq m$ ,  $1 \leq a_j < b_j \leq n$ , are parameters of the  $j$ -th instruction in the program.

## Output

The output should consist of exactly  $d$  lines, one line for each data set. Line  $i$ ,  $1 \leq i \leq d$ , should contain only one integer - the smallest number of instructions that should be added at the end of the  $i$ -th input program in order to make this program a reliable Minimum-Finding program.

## Example

**Sample input:**

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

**Sample output:**

```
2
```

---

Added by: Adrian Kosowski

Date: 2004-07-02

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2001

## SPOJ Problem Set (classical)

### 110. Fill the Cisterns

#### Problem code: CISTFILL

During the next century certain regions on earth will experience severe water shortages. The old town of Uqbar has already started to prepare itself for the worst. Recently they created a network of pipes connecting the cisterns that distribute water in each neighbourhood, making it easier to fill them at once from a single source of water. But in case of water shortage the cisterns above a certain level will be empty since the water will flow to the cisterns below.

Example of cistern arrangement

You have been asked to write a program to compute the level to which cisterns will be filled with a certain volume of water, given the dimensions and position of each cistern. To simplify we will neglect the volume of water in the pipes.

#### Task

Write a program that:

- reads the description of cisterns and the volume of water,
- computes the level to which the cisterns will be filled with the given amount of water,
- writes the result.

#### Input

The first line of the input contains the number of data sets  $k$ ,  $1 \leq k \leq 30$ . The data sets follow.

The first line of each data set contains one integer  $n$ , the number of cisterns,  $1 \leq n \leq 50000$ . Each of the following  $n$  lines consists of 4 nonnegative integers, separated by single spaces:  $b$ ,  $h$ ,  $w$ ,  $d$  - the base level of the cistern, its height, width and depth in meters, respectively. The integers satisfy  $0 \leq b \leq 10^6$  and  $1 \leq h*w*d \leq 40000$ . The last line of the data set contains an integer  $V$  - the volume of water in cubic meters to be injected into the network. Integer  $V$  satisfies  $1 \leq V \leq 2*10^9$ .

#### Output

The output should consist of exactly  $d$  lines, one line for each data set. Line  $i$ ,  $1 \leq i \leq d$ , should contain the level that the water will reach, in meters, rounded up to two fractional digits, or the word 'OVERFLOW', if the volume of water exceeds the total capacity of the cisterns.

#### Example

Sample input:

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

```
4
11 7 5 1
15 6 2 2
5 8 5 1
19 4 8 1
132
4
11 7 5 1
15 6 2 2
5 8 5 1
19 4 8 1
78
```

**Sample output:**

```
1.00
OVERFLOW
17.00
```

**Warning: enormous Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-02

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2001

## SPOJ Problem Set (classical)

### 112. Horizontally Visible Segments

#### Problem code: SEGVIS

There is a number of disjoint vertical line segments in the plane. We say that two segments are horizontally visible if they can be connected by a horizontal line segment that does not have any common points with other vertical segments. Three different vertical segments are said to form a triangle of segments if each two of them are horizontally visible. How many triangles can be found in a given set of vertical segments?

#### Task

Write a program that:

- reads the description of a set of vertical segments,
- computes the number of triangles in this set,
- writes the result.

#### Input

The first line of the input contains exactly one positive integer  $d$  equal to the number of data sets,  $1 \leq d \leq 20$ . The data sets follow.

The first line of each data set contains exactly one integer  $n$ ,  $1 \leq n \leq 8000$ , equal to the number of vertical line segments.

Each of the following  $n$  lines consists of exactly 3 nonnegative integers separated by single spaces:  $y'_i, y''_i, x_i$  (that is the  $y$ -coordinate of the beginning of a segment,  $y$ -coordinate of its end and its  $x$ -coordinate, respectively). The coordinates satisfy:  $0 \leq y'_i < y''_i \leq 8000$ ,  $0 \leq x_i \leq 8000$ . The segments are disjoint.

#### Output

The output should consist of exactly  $d$  lines, one line for each data set. Line  $i$  should contain exactly one integer equal to the number of triangles in the  $i$ -th data set.

#### Example

**Sample input:**

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

0 2 3

**Sample output:**

1

---

Added by: Adrian Kosowski

Date: 2004-07-02

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2001

## SPOJ Problem Set (classical)

### 115. Family

#### Problem code: FAMILY

We want to find out how much related are the members of a family of monsters. Each monster has the same number of genes but the genes themselves may differ from monster to monster. It would be nice to know how many genes any two given monsters have in common. This is impossible, however, since the number of genes is very large. Still, we do know the family tree (well, not actually a tree, but you cannot really blame them, these are monsters, right?) and we do know how the genes are inherited so we can estimate the number of common genes quite well.

The inheritance rule is very simple: if a monster C is a child of monsters A and B then each gene of C is identical to the corresponding gene of either A or B, each with probability 50%. Every gene of every monster is inherited independently.

Let us define the degree of relationship of monsters X and Y as the expected number of common genes. For example consider a family consisting of two completely unrelated (i.e. having no common genes) monsters A and B and their two children C and D. How much are C and D related? Well, each of C's genes comes either from A or from B, both with probability 50%. The same is true for D. Thus, the probability of a given gene of C being the same as the corresponding gene of D is 50%. Therefore the degree of relationship of C and D (the expected number of common genes) is equal to 50% of all the genes. Note that the answer would be different if A and B were related. For if A and B had common genes, these would be necessarily inherited by both C and D.

Your task is to write a program that, given a family graph and a list of pairs of monsters, computes the degree of relationship for each of these pairs.

#### Task

Write a program that:

- reads the description of a family and a list of pairs of its members from the standard input,
- computes the degree of relationship (in percentages) for each pair on the list,
- writes the result to the standard output.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line of the input contains two integers  $n$  and  $k$  separated by a single space. Integer  $n$  ( $2 \leq n \leq 300$ ) is the number of members in a family. Family members are numbered arbitrarily from 1 to  $n$ . Integer  $k$  ( $0 \leq k \leq n - 2$ ) is the number of monsters that do have parents (all the other monsters were created by gods and are completely unrelated to each other).

Each of the next  $k$  lines contains three different integers  $a, b, c$  separated by single spaces. The triple  $a, b, c$  means that the monster  $a$  is a child of monsters  $b$  and  $c$ .



The next input line contains an integer  $m$  ( $1 \leq m \leq n^2$ ) - the number of pairs of monsters on the list. Each of the next  $m$  lines contains two integers separated by a single space - these are the numbers of two monsters.

You may assume that no monster is its own ancestor. You should not make any additional assumptions on the input data. In particular, you should not assume that there exists any valid sex assignment.

## Output

For each test case the output consists of  $m$  lines. The  $i$ -th line corresponds to the  $i$ -th pair on the list and should contain single number followed by the percentage sign. The number should be the exact degree of relationship (in percentages) of the monsters in the  $i$ -th pair. Unsignificant zeroes are not allowed in the output (please note however that there must be at least one digit before the period sign so for example the leading zero in number 0.1 is significant and you cannot print it as .1). Confront the example output for the details of the output format.

## Example

**Sample input:**

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

**Sample output:**

```
0%
50%
81.25%
100%
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-07

Time limit: 15s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2002

## SPOJ Problem Set (classical)

### 116. Intervals

#### Problem code: INTERVAL

You are given  $n$  closed integer intervals  $[a_i, b_i]$  and  $n$  integers  $c_1, \dots, c_n$ .

#### Task

Write a program that:

- reads the number of intervals, their endpoints and integers  $c_1, \dots, c_n$  from the standard input,
- computes the minimal size of a set  $Z$  of integers which has at least  $c_i$  common elements with interval  $[a_i, b_i]$ , for each  $i = 1, 2, \dots, n$ ,
- writes the answer to the standard output.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line of the input contains an integer  $n$  ( $1 \leq n \leq 50000$ ) - the number of intervals. The following  $n$  lines describe the intervals. Line  $(i+1)$  of the input contains three integers  $a_i, b_i$  and  $c_i$  separated by single spaces and such that  $0 \leq a_i \leq b_i \leq 50000$  and  $1 \leq c_i \leq b_i - a_i + 1$ .

#### Output

For each test case the output contains exactly one integer equal to the minimal size of set  $Z$  sharing at least  $c_i$  elements with interval  $[a_i, b_i]$ , for each  $i = 1, 2, \dots, n$ .

#### Example

**Sample input:**

```
1
5
3 7 3
8 10 3
6 8 1
1 3 1
10 11 1
```

**Sample output:**

```
6
```

**Warning: enormous Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-07

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2002

## SPOJ Problem Set (classical)

### 118. Rhombs

#### Problem code: RHOMBS

An unbounded triangular grid is a plane covered by equilateral triangles:

rhombs

Two neighboring triangles in the grid form a rhomb. There are 3 types of such rhombs:

rhombs

A grid polygon is a simple polygon which sides consist entirely of sides of triangles in the grid. We say that a grid polygon is rhombastic if it can be partitioned into internally disjoint rhombs of types A, B and C.

As an example let's consider the following grid hexagon:

rhombs

This hexagon can be partitioned into 4 rhombs of type A, 4 rhombs of type B and 4 rhombs of type C:

rhombs

For a given rhombastic grid polygon P compute the numbers of rhombs of types A, B and C in some correct partition.

#### Task

Write a program that:

- reads a description of a rhombastic grid polygon from the standard input,
- computes the numbers of rhombs of types A, B and C in some correct partition of the polygon,
- writes the results to the standard output.

#### Input

The input begins with the integer t, the number of test cases. Then t test cases follow.

For each test case the first line of the input contains an integer n ( $3 \leq n \leq 50000$ ) - the number of sides of a rhombastic grid polygon. Each of the next n lines contains a description of one side of the polygon. The sides are given one by one in the clockwise order. No two consecutive sides of the polygon lie on the same straight line. The description of a side consists of two integers d and k. Integer d says what is the direction of the side according to the following figure:

rhombs

Integer  $k$  is the length of the polygon side measured in the number of sides of grid triangles. Sum of all numbers  $k$  is not larger than 100000.

## Output

For each test case the first and only line of the output contains three integers separated by single spaces denoting the number of rhombs of type A, B and C respectively, in some partition of the input polygon.

## Example

**Sample input:**

```
1
6
1 2
2 2
3 2
4 2
5 2
6 2
```

**Sample output:**

```
4 4 4
```

---

Added by: Adrian Kosowski

Date: 2004-07-07

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2002

## SPOJ Problem Set (classical)

### 119. Servers

#### Problem code: SERVERS

The Kingdom of Byteland decided to develop a large computer network of servers offering various services.

The network is built of  $n$  servers connected by bidirectional wires. Two servers can be directly connected by at most one wire. Each server can be directly connected to at most 10 other servers and every two servers are connected with some path in the network. Each wire has a fixed positive data transmission time measured in milliseconds. The distance (in milliseconds)  $D(V, W)$  between two servers  $V$  and  $W$  is defined as the length of the shortest (transmission time-wise) path connecting  $V$  and  $W$  in the network. For convenience we let  $D(V, V) = 0$  for all  $V$ .

Some servers offer more services than others. Therefore each server  $V$  is marked with a natural number  $r(V)$ , called a rank. The bigger the rank the more powerful a server is.

At each server, data about nearby servers should be stored. However, not all servers are interesting. The data about distant servers with low ranks do not have to be stored. More specifically, a server  $W$  is interesting for a server  $V$  if for every server  $U$  such that  $D(V, U) \leq D(V, W)$  we have  $r(U) \leq r(W)$ .

For example, all servers of the maximal rank are interesting to all servers. If a server  $V$  has the maximal rank, then exactly the servers of the maximal rank are interesting for  $V$ . Let  $B(V)$  denote the set of servers interesting for a server  $V$ .

We want to compute the total amount of data about servers that need to be stored in the network being the total sum of sizes of all sets  $B(V)$ . The Kingdom of Byteland wanted the data to be quite small so it built the network in such a way that this sum does not exceed  $30 \cdot n$ .

#### Task

Write a program that:

- reads the description of a server network from the standard input,
- computes the total amount of data about servers that need to be stored in the network,
- writes the result to the standard output.

#### Input

The input begins with the integer  $z$ , the number of test cases. Then  $z$  test cases follow.

For each test case, in the first line there are two natural numbers  $n, m$ , where  $n$  is the number of servers in the network ( $1 \leq n \leq 30000$ ) and  $m$  is the number of wires ( $1 \leq m \leq 5n$ ). The numbers are separated by single space.

In the next  $n$  lines the ranks of the servers are given. Line  $i$  contains one integer  $r_i$  ( $1 \leq r_i \leq 10$ ) - the rank of  $i$ -th server.

In the following  $m$  lines the wires are described. Each wire is described by three numbers  $a, b, t$  ( $1 \leq t \leq 1000, 1 \leq a, b \leq n, a \neq b$ ), where  $a$  and  $b$  are numbers of the servers connected by the wire and  $t$  is the transmission time of the wire in milliseconds.

## Output

For each test case the output consists of a single integer equal to the total amount of data about servers that need to be stored in the network.

## Example

**Sample input:**

```
1
4 3
2
3
1
1
1 4 30
2 3 20
3 4 20
```

**Sample output:**

```
9
```

(because  $B(1) = \{1, 2\}$ ,  $B(2) = \{2\}$ ,  $B(3) = \{2, 3\}$ ,  $B(4) = \{1, 2, 3, 4\}$ )

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-07

Time limit: 12s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2002

## SPOJ Problem Set (classical)

### 120. Solitaire

#### Problem code: SOLIT

Solitaire is a game played on an 8x8 chessboard. The rows and columns of the chessboard are numbered from 1 to 8, from the top to the bottom and from left to right respectively.

There are four identical pieces on the board. In one move it is allowed to:

- move a piece to an empty neighboring field (up, down, left or right),
- jump over one neighboring piece to an empty field (up, down, left or right).

possible moves in solitaire

There are 4 moves allowed for each piece in the configuration shown above. As an example let's consider a piece placed in the row 4, column 4. It can be moved one row up, two rows down, one column left or two columns right.

#### Task

Write a program that:

- reads two chessboard configurations from the standard input,
- verifies whether the second one is reachable from the first one in at most 8 moves,
- writes the result to the standard output.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case, each of two input lines contains 8 integers  $a_1, a_2, \dots, a_8$  separated by single spaces and describes one configuration of pieces on the chessboard. Integers  $a_{2j-1}$  and  $a_{2j}$  ( $1 \leq j \leq 4$ ) describe the position of one piece - the row number and the column number respectively.

#### Output

For each test case the output should contain one word for each test case - 'YES' if a configuration described in the second input line is reachable from the configuration described in the first input line in at most 8 moves, or one word 'NO' otherwise.

#### Example

Sample input:

```
1
4 4 4 5 5 4 6 5
```



2 4 3 3 3 6 4 6

**Sample output:**

YES

---

Added by: Adrian Kosowski

Date: 2004-07-07

Time limit: 7s

Source limit:50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2002

## SPOJ Problem Set (classical)

### 121. Timetable

#### Problem code: TTABLE

You are the owner of a railway system between  $n$  cities, numbered by integers from 1 to  $n$ . Each train travels from the start station to the end station according to a very specific timetable (always on time), not stopping anywhere between. On each station a departure timetable is available. Unfortunately each timetable contains only direct connections. A passenger that wants to travel from city  $p$  to city  $q$  is not limited to direct connections however - he or she can change trains. Each change takes zero time, but a passenger cannot change from one train to the other if it departs before the first one arrives. People would like to have a timetable of all optimal connections. A connection departing from city  $p$  at  $A$  o'clock and arriving in city  $q$  at  $B$  o'clock is called optimal if there is no connection that begins in  $p$  not sooner than at  $A$ , ends in  $q$  not later than at  $B$ , and has strictly shorter travel time than the considered connection. We are only interested in connections that can be completed during same day.

#### Task

Write a program that:

- reads the number  $n$  and departure timetable for each of  $n$  cities from the standard input,
- creates a timetable of optimal connections from city 1 to city  $n$ ,
- writes the answer to the standard output.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line of the input contains an integer  $n$  ( $2 \leq n \leq 100000$ ). The following lines contain  $n$  timetables for cities 1, 2, ...,  $n$  respectively.

The first line of the timetable description contains only one integer  $m$ . Each of the following  $m$  lines corresponds to one position in the timetable and contains: departure time  $A$ , arrival time  $B$  ( $A < B$ ) and destination city number  $t$  ( $1 \leq t \leq n$ ) separated by single spaces. Departure time  $A$  and arrival time  $B$  are written in format  $hh : mm$ , where  $hh$  are two digits representing full hours ( $00 \leq hh \leq 23$ ) and  $mm$  are two digits representing minutes ( $00 \leq mm \leq 59$ ). Positions in the timetable are given in non-decreasing order according to the departure times. The number of all positions in all timetables does not exceed 1000000.

#### Output

For each test case the first line of the output contains an integer  $r$  - the number of positions in the timetable being the solution. Each of the following  $r$  lines contains a departure time  $A$  and an arrival time  $B$  separated by single space. The time format should be like in the input and positions in the timetable should be ordered increasingly according to the departure times. If there is more then one optimal connection with the same departure and arrival time, your program should output just one.

## Example

**Sample input:**

```
1
3
3
09:00 15:00 3
10:00 12:00 2
11:00 20:00 3
2
11:30 13:00 3
12:30 14:00 3
0
```

**Sample output:**

```
2
10:00 14:00
11:00 20:00
```

**Warning: enormous Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-07

Time limit: 9s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2002

## SPOJ Problem Set (classical)

### 122. Voracious Steve

#### Problem code: STEVE

Steve and Digit bought a box containing a number of donuts. In order to divide them between themselves they play a special game that they created. The players alternately take a certain, positive number of donuts from the box, but no more than some fixed integer. Each player's donuts are gathered on the player's side. The player that empties the box eats his donuts while the other one puts his donuts back into the box and the game continues with the "loser" player starting. The game goes on until all the donuts are eaten. The goal of the game is to eat the most donuts. How many donuts can Steve, who starts the game, count on, assuming the best strategy for both players?

#### Task

Write a program that:

- reads the parameters of the game from the standard input,
- computes the number of donuts Steve can count on,
- writes the result to the standard output.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first and only line of the input contains exactly two integers  $n$  and  $m$  separated by a single space,  $1 \leq m \leq n \leq 100$  - the parameters of the game, where  $n$  is the number of donuts in the box at the beginning of the game and  $m$  is the upper limit on the number of donuts to be taken by one player in one move.

#### Output

For each test case the output contains exactly one integer equal to the number of donuts Steve can count on.

#### Example

**Sample input:**

```
1
5 2
```

**Sample output:**

```
3
```

---

Added by: Adrian Kosowski

Date: 2004-07-07

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: ACM Central European Programming Contest, Warsaw 2002

## SPOJ Problem Set (classical)

### 123. Paying in Byteland

#### Problem code: PAYING

There are infinitely many coin denominations in the Byteland. They have values of  $2^i$  for  $i=0,1,2,\dots$ . We will say that set of coins  $c_1, c_2, \dots, c_k$  is perfect when it is possible to pay every amount of money between 0 and  $c_1 + \dots + c_k$  using some of them (so  $\{4, 2, 2, 1\}$  is perfect while  $\{8, 1\}$  is not). The question is - is it always possible to change given sum  $n$  into a perfect set of coins? Of course it is possible ;). Your task will be more complicated: for a sum  $n$  you should find minimal number of coins in its perfect representation.

#### Input

First line of input contains one integer  $c \leq 50$  - number of test cases. Then  $c$  lines follow, each of them consisting of exactly one integer  $n \leq 10^{1000}$ .

#### Output

For each test case output minimal number of coins.

#### Example

Input :

```
5
507
29
8574
233
149
```

Output :

```
14
7
21
11
10
```

---

Added by: Pawel Gawrychowski

Date: 2004-07-07

Time limit: 7s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 130. Rent your airplane and make money

#### Problem code: RENT

"ABEAS Corp." is a very small company that owns a single airplane. The customers of ABEAS Corp are large airline companies which rent the airplane to accommodate occasional overcapacity.

Customers send renting orders that consist of a time interval and a price that the customer is ready to pay for renting the airplane during the given time period. Orders of all the customers are known in advance. Of course, not all orders can be accommodated and some orders have to be declined. Eugene LAWLER, the Chief Scientific Officer of ABEAS Corp would like to maximize the profit of the company.

You are requested to compute an optimal solution.

#### Small Example

Consider for instance the case where the company has 4 orders:

- Order 1 (start time 0, duration 5, price 10)
- Order 2 (start time 3, duration 7, price 8)
- Order 3 (start time 5, duration 9, price 7)
- Order 4 (start time 6, duration 9, price 8)

The optimal solution consists in declining Order 2 and 3 and the gain is  $10+8 = 18$ .

Note that the solution made of Order 1 and 3 is feasible (the airplane is rented with no interruption from time 0 to time 14) but non-optimal.

#### Input

The first line of the input contains a number  $T \leq 30$  that indicates the number of test cases to follow. The first line of each test case contains the number of orders  $n$  ( $n \leq 10000$ ). In the following  $n$  lines the orders are given. Each order is described by 3 integer values: The start time of the order  $st$  ( $0 \leq st < 1000000$ ), the duration  $d$  of the order ( $0 < d < 1000000$ ), and the price  $p$  ( $0 < p < 100000$ ) the customer is ready to pay for this order.

#### Output

You are required to compute an optimal solution. For each test case your program has to write the total price paid by the airlines.

#### Example

Input :

```
1
4
0 5 10
3 7 14
```

5 9 7

6 9 8

**Output :**

18

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kuegel

Date: 2004-07-13

Time limit: 3s

Source limit:50000B

Languages: All

Resource: ACM Southwestern European Regional Contest, Paris 2003



## SPOJ Problem Set (classical)

### 131. Square dance

#### Problem code: SQDANCE

You are hired by french NSA to break the RSA code used on the Pink Card. The easiest way to do that is to factor the public modulus and you have found the fastest algorithm to do that, except that you have to solve a subproblem that can be modeled in the following way.

Let  $\mathcal{P} = \{p_1, p_2, \dots, p_n\}$  be a set of prime numbers. If  $S = \{s_1, s_2, \dots, s_u\}$  and  $T = \{t_1, \dots, t_v\}$  are formed with elements of  $\mathcal{P}$ , then  $S \cdot T$  will denote the quantity

$$s_1 \cdot s_2 \cdot \dots \cdot s_u \cdot t_1 \cdot t_2 \cdot \dots \cdot t_v.$$

We call relation a set of two primes  $p, q$ , where  $p$  and  $q$  are distinct elements of  $\mathcal{P}$ . You dispose of a collection of  $R$  relations  $S_i = \{p_i, q_i\}$  and you are interested in finding sequences of these,  $S_{i_1}, S_{i_2}, \dots, S_{i_k}$  such that

$$S_{i_1} \cdot S_{i_2} \cdot \dots \cdot S_{i_k}$$

is a perfect square.

The way you look for these squares is the following. The ultimate goal is to count squares that appear in the process. Relations arrive one at a time. You maintain a collection  $\mathcal{C}$  of relations that do not contain any square subproduct. This is easy: at first,  $\mathcal{C}$  is empty. Then a relation arrives and  $\mathcal{C}$  begins to grow. Suppose a new relation  $\{p, q\}$  arrives. If no square appears when adding  $\{p, q\}$  to  $\mathcal{C}$ , then  $\{p, q\}$  is added to the collection. Otherwise, a square is about to appear, we increase the number of squares, but we do not store this relation, hence  $\mathcal{C}$  keeps the desired property.

Let us consider an example. First arrives  $S_1 = \{2, 3\}$  and we put it in  $\mathcal{C}$ ; then arrives  $S_2 = \{5, 11\}$ ,  $S_3 = \{3, 7\}$  and they are stored in  $\mathcal{C}$ . Now enters the relation  $S_4 = \{2, 7\}$ . This relation could be used to form the square:

$$S_1 \cdot S_3 \cdot S_4 = (2 \cdot 3) \cdot (3 \cdot 7) \cdot (2 \cdot 7) = (2 \cdot 3 \cdot 7)^2.$$

So we count 1 and do not store  $S_4$  in  $\mathcal{C}$ . Now we consider  $S_5 = \{5, 11\}$  that could make a square with  $S_2$ , so we count 1 square more. Then  $S_6 = \{2, 13\}$  is put into  $\mathcal{C}$ . Now  $S_7 = \{7, 13\}$  could make the square  $S_1 \cdot S_3 \cdot S_6 \cdot S_7$ . Eventually, we get 3 squares.

#### Input

The first line of the input contains a number  $T \leq 30$  that indicates the number of test cases to follow. Each test case begins with a line containing two integers  $P$  and  $R$ :  $P \leq 10^5$  is the number of primes occurring in the test case;  $R \leq 10^5$  is the number of sets of primes that arrive. The subsequent  $R$  lines each contain two integers  $i$  and  $j$  making a set  $\{p_i, p_j\}$  ( $1 \leq i, j \leq P$ ). Note that we actually do not deal with the primes, they are irrelevant to the solution.

## Output

For each test case, output the number of squares that can be formed using the preceding rules.

## Example

**Input :**

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

**Output :**

```
3
2
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kuegel

Date: 2004-07-13

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Southwestern European Regional Contest, Paris 2003

## SPOJ Problem Set (classical)

### 132. Help R2-D2!

#### Problem code: HELPR2D2

In Episode III of Star Wars (whose alleged title is "How I became Vader"), R2-D2 (Artoo-Detoo) is again confronted to a tedious work. He is responsible for the loading of the republic transport starships in the fastest way. Imagine a huge space area where  $n$  starships are parked. Each starship has a capacity of  $K$  cubic femtoparsec. Containers  $C_i$  arrive one at a time with some volume  $v_i$  (expressed in cubic femtoparsec). R2-D2 wants to minimize the number of starships used for a given sequence of containers.

Smart as he is, R2-D2 knows for sure that the problem is a hard one, even with the force being around. Here is the heuristics he selected to solve his problem. Start with all starships ready to load, and numbered  $S_0, S_1, \text{etc.}$  When a container  $C_j$  arrives, select the starship of minimal index  $i$  that can contain  $C_j$  and put it in  $S_i$ . In some sense, this heuristic minimizes the move of the container arriving before its loading.

At the end of the  $n$  arrivals, R2-D2 counts the number  $s$  of starships used and he measures the total waste  $w$  of the sequence. For  $i=0..s-1$ , the waste in starship  $i$  is given by the unused volume.

Your task is to simulate the algorithm of R2-D2.

#### Input

The first line of the input contains a number  $T \leq 10$  that indicates the number of test cases to follow. Each test case begins with  $K$  on a line ( $K \leq 1000$ ), followed by the number of containers in the sequence,  $n$ , on the second line ( $1 \leq n \leq 1000000$ ). There are two possible formats for the remaining lines. If it contains one integer, then this is the next  $v_i$ . If it begins with the character  $b$  (for block), it is followed by 2 integers  $r$  and  $v$ . This means that the  $r$  next containers arriving have volume  $v$ .

#### Output

Your program must output the number  $s$  of starships used, followed by a blank, followed by the total waste  $w$ .

You can assume, that at most 100000 starships are needed, and R2-D2 has to change the starships in which the next container is loaded at most 100000 times.

#### Example

**Input :**

```
2
100
3
50
25
70
100
4
50
b 2 40
```

20

**Output :**

2 55

2 50

---

Added by: Adrian Kuegel

Date: 2004-07-14

Time limit: 7s

Source limit:50000B

Languages: All

Resource: ACM Southwestern European Regional Contest, Paris 2003

## SPOJ Problem Set (classical)

### 134. Phony Primes

#### Problem code: PHONY

You are chief debugger for Poorly Guarded Privacy, Inc. One of the top selling product, ReallySecureAgent(c), seems to have a problem with its prime number generator. It produces from time to time bogus primes  $N$ .

After a while, you realize that the problem is due to the way primes are recognized.

Every phony prime  $N$  you discover can be characterized as follows. It is odd and has distinct prime factors, say  $N = p_1 * p_2 * \dots * p_k$  with  $p_i \neq p_j$ , where the number  $k$  of factors is at least 3. Moreover, for all  $i=1..k$ ,  $p_{i-1}$  divides  $N-1$ . For instance,  $561 = 3*11*17$  is a phony prime.

Intrigued by this phenomenon, you decide to write a program that enumerates all such  $N$ 's in a given interval  $[N_{\min}, N_{\max}]$  with  $1 \leq N_{\min} \leq N_{\max} \leq 2^{31}$ ,  $N_{\max} - N_{\min} \leq 10^6$ .

**Please note, that the source code limit for this problem is 2000 Bytes to avoid precalculated tables.**

#### Input

Each test case contains one line. On this line are written two integers  $N_{\min}$  and  $N_{\max}$  separated by a blank. The end of the input is signalled by a line containing two zeros. The number of test cases is approximately 2000.

#### Output

For each test case, output the list of phony primes in increasing order, one per line. If there are no phony primes in the interval, then simply output none on a line.

#### Example

##### Input:

```
10 2000
20000 21000
0 0
```

##### Output:

```
561
1105
1729
none
```

---

Added by: Adrian Kuegel

Date: 2004-07-15

Time limit: 13s

Source limit:2000B

Languages: All

Resource: ACM Southwestern European Regional Contest, Paris 2003

## SPOJ Problem Set (classical)

### 135. Men at work

#### Problem code: MAWORK

Every morning you have to drive to your workplace. Unfortunately, roads are under constant repair. Fortunately, administration is aware that this may cause trouble and they enforce a strict rule on roadblocks: roads must be blocked only half of the time. However, contractors are free to schedule their working hours, still they must follow regulations:

- Working periods (when the road is blocked) and rest periods (when the road is open) must alternate and be of fixed length.
- The beginning of the day (time zero) must coincide with the beginning of a period.

Write a program that, given a description of the road network and of contractors schedules outputs the minimal time needed to drive from home to work.

#### Input

The first line of the input contains a number  $T \leq 10$  that indicates the number of test cases to follow. The road network is represented on a  $N \times N$  grid and the first line of each test case consists in the number  $N$ ,  $2 \leq N \leq 25$ .

Then follows  $N$  lines of  $N$  characters that represent the road network at time zero. Those lines are made of "." (standing for open road) and "\*" (standing for roadblock) and they encode the rows of the grid in increasing order, while columns are also presented in increasing order. Conventionally, your home is at the position first row, first column, while your workplace is at the position last row, last column. Furthermore, you leave home at time  $t=0$ , that is, your starting position is first row, first column at time zero.

At a given time  $t$ , your car must be on some "open road" cell. It takes one time unit to drive to any of the four adjacent cells heading toward north, south, west or east, and you may also choose to stay on the same cell for one time unit. Of course, those five moves are valid if and only if the target cell exists and is free at time  $t+1$ .

Finally comes  $N$  lines of  $N$  characters that represent the contractors schedules. Those lines match the ones of the grid description and are made of  $N$  characters 0,1,...,9 that specify the duration of the working (and rest) period for a given cell. Observe that 0 is a bit special, since it means that the corresponding cell status does not change.

#### Output

The output consist in a single line for each test case, holding either the requested time, or NO, if driving from home to work is not possible.

## Example

### Input:

```
2
10
.*****
. ....**
* .*****
* .*****
* .*****
* .*****
* . ....
* .*****
* .*****
* . ....
*****.
000000000
000000000
000000000
000000000
000000000
0123456780
000000000
000000000
0123456780
000000000
3
...
**
**
021
002
000
```

### Output:

```
34
NO
```

---

Added by: Adrian Kuegel

Date: 2004-07-16

Time limit: 9s

Source limit: 50000B

Languages: All

Resource: ACM Southwestern European Regional Contest, Paris 2003



## SPOJ Problem Set (classical)

### 136. Transformation

#### Problem code: TRANS

You are given two short sequences of numbers, X and Y. Try to determine the minimum number of steps of transformation required to convert sequence X into sequence Y, or determine that such a conversion is impossible.

In every step of transformation of a sequence, you are allowed to replace exactly one occurrence of one of its elements by a sequence of 2 or 3 numbers inserted in its place, according to a rule specified in the input file.

#### Input

The input begins with the integer t, the number of test cases. Then t test cases follow.

For each test case, the first line of input contains four integers - N, M, U, V ( $1 \leq N, M \leq 50$ ). The next two lines of input contain sequences X and Y, consisting of N and M integers respectively. The next U lines contain three integers: *a b c* each, signifying that integer *a* can be converted to the sequence *b c* in one step of transformation. The next V-U lines contain four integers: *a b c d* each, signifying that integer *a* can be converted to the sequence *b c d* in one step of transformation. With the exception of N and M, all integers provided at input are positive and do not exceed 30.

The format of one set of input data is illustrated below.

[IMAGE]

#### Output

For each test case output -1 if it is impossible to convert sequence X into sequence Y, or the minimum number of steps required to achieve this conversion otherwise.

#### Example

**Sample input:**

```
1
3 10 2 3
2 3 1
2 1 1 2 2 1 2 1 2 1
3 1 2
3 3 3
3 1 3 2
```

**Sample output:**

```
6
```

---

Added by: Adrian Kosowski

Date: 2004-07-18

Time limit: 7s

Source  
limit: 50000B

Languages: All

Resource: based on a problem from the VI Polish Collegiate Team Programming Contest (AMPPZ),  
2001

## SPOJ Problem Set (classical)

### 137. Partition

#### Problem code: PARTIT

A *partition* of positive integer  $m$  into  $n$  components is any sequence  $a_1, \dots, a_n$  of positive integers such that  $a_1 + \dots + a_n = m$  and  $a_1 \leq a_2 \leq \dots \leq a_n$ . Your task is to determine the partition, which occupies the  $k$ -th position in the lexicographic order of all partitions of  $m$  into  $n$  components.

The lexicographic order is defined as follows: sequence  $a_1, \dots, a_n$  comes before  $b_1, \dots, b_n$  iff there exists such an integer  $i, 1 \leq i \leq n$ , that  $a_j = b_j$  for all  $j, 1 \leq j < i$ , and  $a_i < b_i$ .

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the input consists of three lines, containing the positive integers  $m$ ,  $n$  and  $k$  respectively ( $1 \leq n \leq 10$ ,  $1 \leq m \leq 220$ ,  $k$  is not larger than the number of partitions of  $m$  into  $n$  components).

#### Output

For each test case output the ordered elements of the sought partition, separated by spaces.

#### Example

**Sample input:**

```
1
9
4
3
```

**Sample output:**

```
1 1 3 4
```

---

Added by: Adrian Kosowski

Date: 2004-07-19

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: VI Polish Collegiate Team Programming Contest (AMPPZ), 2001

## SPOJ Problem Set (classical)

### 138. Election Posters

#### Problem code: POSTERS

A parliamentary election was being held in Byteland. Its enterprising and orderly citizens decided to limit the entire election campaign to a single dedicated wall, so as not to ruin the panorama with countless posters and billboards. Every politician was allowed to hang exactly one poster on the wall. All posters extend from top to bottom, but are hung at different points of the wall, and may be of different width. The wall is divided horizontally into sections, and a poster completely occupies two or more adjacent sections.

With time, some of the posters were covered (partially or completely) by those of other politicians. Knowing the location of all the posters and the order in which they were hung, determine how many posters have at least one visible section in the end.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

Each test case begins with a line containing integer  $n$  - the number of posters ( $1 \leq n \leq 40000$ ). Then  $n$  lines follow, the  $i$ -th ( $1 \leq i \leq n$ ) containing exactly two integers  $l_i$   $r_i$ , denoting the numbers of the leftmost and rightmost sections covered by the  $i$ -th poster ( $1 \leq l_i < r_i \leq 10^7$ ). The input order corresponds to the order of hanging posters.

#### Output

For each test case output a line containing one integer- the number of posters with visible sections.

#### Example

**Sample input:**

```
1
5
1 4
2 6
8 10
3 4
7 10
```

**Sample output:**

```
4
```

An illustration of the sample input is given below.  
The wall with posters

---

Added by: Adrian Kosowski

Date: 2004-07-19

Time limit: 7s

Source limit:50000B

Languages: All

Resource: VI Polish Collegiate Team Programming Contest (AMPPZ), 2001

## SPOJ Problem Set (classical)

### 139. The Long and Narrow Maze

#### Problem code: MAZE

Consider a maze consisting of 3 rows of  $n$  square blocks each. The passageways in every block match one of three possible patterns, numbered 0 (empty), 1 (straight) and 2 (bent), as depicted below.

Illustration of possible patterns

Your task is to determine whether it is possible to create a passage in a given maze, with an entrance at the left end and an outlet at the right end of the maze, only by rotating some of the squares of the maze by a multiple of 90 degrees.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

Each test case begins with a line containing a single integer  $n$  - the number of squares in one row of the maze ( $1 \leq n \leq 200000$ ). The next  $n$  lines contain three integers each, denoting the types of blocks in consecutive columns of the maze. A column description is of the form  $a\ b\ c$  ( $0 \leq a, b, c \leq 2$ ), where  $a$  represents the type of the block in the first row,  $b$  - in the second row and  $c$  - in the third row.

#### Output

For each test case output the word `yes` if it is possible to rotate the squares so as to form a connection between the left and right edge, and the word `no` in the opposite case.

#### Example

**Sample input:**

```
1
6
1 0 1
1 2 2
2 2 1
2 2 1
2 2 1
1 2 2
```

**Sample output:**

```
yes
```

Indeed, the sample input corresponds to the following maze:

Input illustration

for which there exists a correct solution to the problem:

Illustration of the solution

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-19

Time limit: 10s

Source limit:50000B

Languages: All

Resource: VI Polish Collegiate Team Programming Contest (AMPPZ), 2001

## SPOJ Problem Set (classical)

### 140. The Loner

#### Problem code: LONER

The *loner* is a one-dimensional board game for a single player. The board is composed of squares arranged in a single line, some of which initially have pawns on them. The player makes a move by jumping with a pawn over a pawn on an adjacent field, to an empty square two fields to the right or left of its initial position. The pawn that was jumped over is removed directly after the move, as illustrated below.

The two acceptable types of moves

The game is considered won if exactly one pawn remains on the gaming board, and is lost if the player cannot make a move.

Given the initial state of the gaming board, your task is to determine whether it is possible for the player to win the game.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

Each test case begins with the positive integer  $n \leq 32000$ , denoting the size of the gaming board. The second and last line of the test case description contains a sequence of  $n$  characters 0 or 1, without any white spaces. The  $i$ -th square of the board is occupied by a pawn at the start of the game iff the  $i$ -th character of this sequence is 1.

#### Output

For each test case output the word `yes` if it is possible for the player to win the game for the presented starting configuration, or the word `no` in the opposite case.

#### Example

**Sample input:**

```
2
7
0110011
6
111001
```

**Sample output:**

```
yes
no
```

---



Added by: Adrian Kosowski

Date: 2004-07-21

Time limit: 7s

Source limit:50000B

Languages: All

Resource: VI Polish Collegiate Team Programming Contest (AMPPZ), 2001

## SPOJ Problem Set (classical)

### 142. Johnny and the Glue

#### Problem code: GLUE

Little Johnny decided he needed to stick an open metal box to the floor in the hall of his parents' house, so that all guests coming in would trip on it. He knew that as soon as his parents saw what he had done, they would try to remove it, and he wasn't going to stand for this. So, he chose the strongest glue in his possession and left lots of dabs of it on the floor (from our point of view, these can be regarded as points). Now, the only question that remained was how to stick the box onto the floor. Johnny is very particular about the way he does this: the box is always stuck face down, so that it only touches the floor on the four edges of the rectangle that forms its base. He would like each of these edges to make contact with at least two dabs of glue. Furthermore, he doesn't want any of the dabs to stay outside the box, since this would ruin the fun (there is no way you can trip someone up, if you've glued them to the floor, is there?).

Obviously, Johnny can sometimes reach his objective in more than one way (especially since he has prepared boxes of all possible dimensions for his act of mischief). Depending on how he does this, a different section of floor will be covered by the box. Determine in how many ways Johnny can choose the section of floor to be covered by the box when gluing.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

The first line of each test case contains positive integer  $n \leq 10000$  - the number of dabs of glue on the floor. The next  $n$  lines contain two integers,  $x$   $y$  ( $-15000 \leq x, y \leq 15000$ ), representing the  $x$  and  $y$  coordinates of the dabs (given in the order in which they were placed by Johnny ;).

#### Output

For each test case output the number of different sections of floor Johnny may choose to cover (possibly 0).

#### Example

**Sample input:**

```
1
8
1 0
1 4
0 3
5 4
5 0
6 1
6 3
0 1
```

**Sample output:**

```
2
```

---

Added by: Adrian Kosowski  
Date: 2004-07-22  
Time limit: 7s  
Source limit: 50000B  
Languages: All  
Resource: based on a problem from the VI Polish Collegiate Team Programming Contest (AMPPZ), 2001

## SPOJ Problem Set (classical)

### 145. Aliens

#### Problem code: ALIENS

Aliens visited our planet with an obvious intention to find some new species for their space zoo. After entering Earth's orbit, they positioned themselves over the town of Belgrade, having detected some life-form activity on the ground. As they approached the surface, they saw a group of half-intelligent beings. Those creatures were actually competitors of the Balkan Olympiad in Informatics who were enjoying the excursion after intense contest. Aliens want to abduct all  $n$  ( $2 \leq n \leq 100000$ ) competitors since they are very compassionate, and don't want their creatures to feel lonely in the space zoo.

Aliens use tractor beam to take their prey. Tractor beam works in the following way: it projects a circle-shaped beam from the spacecraft to the ground vertically beneath it, and all beings that are found in that circle or on its boundary are taken. Projecting the tractor beam needs a certain amount of energy to be spent. As the radius of the tractor beam (radius of the circle on the ground) increases, more and more energy is required. Although extremely intelligent, aliens are much more advanced in social sciences than in programming. That's why they are asking you to help them find the position of their spacecraft so that the energy required to take all of the  $n$  competitors is minimal.

Help our alien brothers! Write a program that will find the required minimal radius of tractor beam that contains all  $n$  competitors and the optimal spacecraft location - which is the same as the center of the circle on the ground.

#### Input

First line of input contains one integer  $c \leq 20$  - number of test cases. Each test case begins with number  $n$  ( $2 \leq n \leq 100000$ ). Then  $n$  lines follow and  $i$ -th of them contains two real numbers  $x_i$  and  $y_i$  ( $-10000.0 \leq x_i, y_i \leq 10000.0$ ) representing coordinates of the  $i$ -th competitor.

#### Output

For each test case output radius of the tractor beam and coordinates of the spacecraft. Numbers should be rounded to two decimal places.

#### Example

Input :

```
1
6
8.0 9.0
4.0 7.5
1.0 2.0
5.1 8.7
9.0 2.0
4.5 1.0
```

Output :

```
5.00
5.00 5.00
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Pawel Gawrychowski  
Date: 2004-07-21  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: Balkan Olympiad in Informatics 2002

## SPOJ Problem Set (classical)

### 146. Fast Multiplication Again

#### Problem code: MULTIPLY

After trying to solve Problem Number 31 (Fast Multiplication) with some script languages that support arbitrary large integers and timing out, you wonder what would be the best language to do fast multiplication of integers. And naturally it comes to your mind: Of course it is brainf\*\*k, because there are only very cheap operations in that language.

#### Input

Two positive integers, ended with a line feed (ASCII 10) each.

#### Output

The product of the two integers, terminated by a line feed. You may assume that this number will be less than 10000.

#### Example

Input :

1  
2

Output :

2

---

Added by: Robin Nittka

Date: 2004-07-21

Time limit: 2s

Source limit: 5000B

Languages: BF

## SPOJ Problem Set (srednie)

### 147. Tautology

#### Problem code: TAUT

Write a program that checks if the given logical expression is a tautology. The logical expression is a tautology if it is always true, regardless of logical value of its variables.

#### Input

On the first line there is the number of expressions to check (at most 35). The expression is in a prefix notation, that means that operator precedes its arguments. The following logical operators will be used:

C - and  
D - or  
I - implies  
E - if, and only if  
N - not

The variables will be lowercase letters (a-z). There will be no more than 16 different letters in the expression. The length of the expression will not exceed 111 characters.

#### Output

For each expression write one word: YES if it is a tautology, NO in other case.

#### Example

**Sample input:**

```
7
IIpqDpNp
NCNpp
Iaz
NNNNNNNp
IIqrIIpqIpr
Ipp
Ezz
```

**Sample output:**

```
YES
YES
NO
NO
YES
YES
YES
```

---

Added by: Piotr Łowiec

Date: 2004-07-25

Time limit: 7s

Source limit:50000B

Languages: C C99 strict C++ JAVA NEM PERL PYTH RUBY ICON TEXT



## SPOJ Problem Set (classical)

### 148. Land for Motorways

#### Problem code: MLAND

With every year, the plans for the construction of motorways in Poland are more and more advanced. For some time, it seemed as if the building was actually going to start, so the question of purchasing the land under the roads was of some importance. Only certain cities can be connected by a road directly, provided the farmer owning the land under it agrees to sell out. As a result of the constant swing of moods, the price demanded for the land by each farmer changes in a linear fashion, with possibly different coefficients for every road. It may either increase or decrease (and sometimes even be negative, if the owner anticipates future profit from the proximity of a motorway).

It has been decided that the purchase of land will be made at some moment in between two fixed dates. At that moment, the current prices of land will be frozen, and the least costly configuration of bidirectional roads connecting all cities (directly or indirectly) will be chosen. All the land under the selected roads will subsequently be bought at the frozen price. Since business in the proximity of a motorway does have its advantages, some land owners might actually want their land to be bought and they may offer money into the bargain, consequently making the price of purchase negative.

You act as an intermediary for the purchase and charge a steady commission, proportional to the total sum of purchase. Oddly enough, when signing the contract you missed the clause about the possibility of the price being negative and now you begin to wonder whether you won't end up being charged for your own hard work. Since it is one of your tasks to select the moment of purchase, do so in such a way as to maximise your profit (if this is impossible, at least cut your losses as much as possible).

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line contains two integers  $n$   $m$ , denoting the number of cities to be connected and the number of available potential roads, respectively ( $1 \leq n \leq 120, 1 \leq m \leq 820$ ). The next line contains two integers  $t_1$   $t_2$ , which stand for the earliest possible and latest possible moments of purchase ( $-10000 \leq t_1 \leq t_2 \leq 10000$ ). Each of the following  $m$  lines contains four integers, the  $i$ -th being:  $u_i$   $v_i$   $a_i$   $b_i$ , which means that the  $i$ -th road connects city  $u_i$  with city  $v_i$ , and the purchase of the land under it costs  $b_i + j \cdot a_i$  units of currency at moment  $j$  (e.g. at moment 0 the land costs  $b_i$  units). Please note that these integers are chosen from the following ranges:  $0 \leq u_i, v_i \leq n-1$ ,  $-32000 \leq a_i, b_i \leq 32000$ .

#### Output

For each test case output a line with two floating point numbers, accurate to three digits after the decimal point. The first represents the moment of transaction you ought to choose, the second - the total value of the transaction at that moment. If more than one moment fulfills the conditions of the problem, choose the earliest.

## Example

### Sample input:

```
2
5 6
0 5
1 0 -6 -4
2 0 3 -3
3 0 1 5
3 1 -2 -3
4 1 -3 -2
4 3 -2 -3
5 7
-20 20
1 0 1 2
2 1 -7 4
3 1 -9 0
3 2 4 9
4 1 0 -2
4 2 2 3
4 3 6 -5
```

### Sample output:

```
0.000 -13.000
0.111 -1.000
```

---

Added by: Adrian Kosowski

Date: 2004-07-24

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: VII Polish Collegiate Team Programming Contest (AMPPZ), 2002

## SPOJ Problem Set (classical)

### 149. Fencing in the Sheep

#### Problem code: FSHEEP

A shepherd is having some trouble penning in his flock of sheep. After several hours of ineffectual efforts he gives up, with some of the sheep within their polygon-shaped pen and some outside. Exhausted, he moves to a place within the pen from which he can see the whole interior of the pen (without any fence getting in the way) and begins to count the sheep which are within it. Please assist him in his task.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

The first line of each test case contains two integers  $n$   $m$ , denoting the number of vertices of the polygon forming the fence, and the number of sheep in the whole herd ( $3 \leq n \leq 100000$ ,  $0 \leq m \leq 100000$ ). The next  $n$  lines contain two integers each, the  $i$ -th being  $x_i$   $y_i$  - the  $x$  and  $y$  coordinates of the  $i$ -th vertex of the fence (given in anti-clockwise order,  $-32000 \leq x_i, y_i \leq 32000$ ). The next  $m$  lines contain two integers each, the  $j$ -th being  $x_j$   $y_j$  - the  $x$  and  $y$  coordinates of the  $j$ -th sheep (arranged in decreasing order of seniority,  $-32000 \leq x_j, y_j \leq 32000$ ). The shepherd's observation point is within the pen and has coordinates  $(0,0)$ .

#### Output

For each test case output a line with a single integer - the number of sheep within the pen. The sheep which are sitting back on the fence and enjoying a cigarette should be included in the count.

#### Example

**Sample input:**

```
1
6 5
2 2
4 4
6 6
-3 1
-1 -1
5 1
2 1
3 2
6 6
3 3
-3 0
```

**Sample output:**

```
3
```

Illustration of the sample test data:  
The sheep with their shepherd

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-24

Time limit: 7s

Source  
limit: 50000B

Languages: All

Resource: based on a problem from the VII Polish Collegiate Team Programming Contest  
(AMPPZ), 2002

## SPOJ Problem Set (classical)

### 150. Where to Drink the Plonk?

#### Problem code: PLONK

Consider a city bounded by a square, whose  $n$  horizontal and  $n$  vertical streets divide it into  $(n+1)^2$  square blocks. However, in tribute to the ancient traditions of the first dwellers (who tended to overindulge in alcohol), all the inhabitants live at crossroads. A group of friends would like to meet for an evening of merriment at the place of residence of one of them. With a good deal of foresight, anticipating the difficulties they might have getting back to their respective homes, they would like to meet in the house of the friend which minimises the total walking distance for all of them. Assume that everybody walks along the streets, turning only at crossroads, and the distance between any pair of adjacent crossroads is 1.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line of input contains the integer  $n$  - the number of friends who want to meet ( $1 \leq n \leq 10000$ ). The next  $n$  lines contain two integers each, the  $i$ -th being  $x_i$   $y_i$ , standing for the  $x$  and  $y$  coordinates of the crossroads at which the  $i$ -th friend lives ( $0 \leq x_i, y_i \leq 100000$ ).

#### Output

For each test case output the total distance covered by all friends when walking to the meeting place.

#### Example

**Sample input:**

```
1
7
1 3
3 2
3 5
6 9
10 1
12 4
5 7
```

**Sample output:**

```
39
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-28

Time limit: 6s

Source  
limit: 50000B

Languages: All

Resource: based on a problem from the VII Polish Collegiate Team Programming Contest  
(AMPPZ), 2002

## SPOJ Problem Set (classical)

### 151. The Courier

#### Problem code: COURIER

Byteland is a scarcely populated country, and residents of different cities seldom communicate with each other. There is no regular postal service and throughout most of the year a one-man courier establishment suffices to transport all freight. However, on Christmas Day there is somewhat more work for the courier than usual, and since he can only transport one parcel at a time on his bicycle, he finds himself riding back and forth among the cities of Byteland.

The courier needs to schedule a route which would allow him to leave his home city, perform the individual orders in arbitrary order (i.e. travel to the city of the sender and transport the parcel to the city of the recipient, carrying no more than one parcel at a time), and finally return home. All roads are bi-directional, but not all cities are connected by roads directly; some pairs of cities may be connected by more than one road. Knowing the lengths of all the roads and the errands to be performed, determine the length of the shortest possible cycling route for the courier.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

Each test case begins with a line containing three integers:  $n$   $m$   $b$ , denoting the number of cities in Byteland, the number of roads, and the number of the courier's home city, respectively ( $1 \leq n \leq 100, 1 \leq m \leq 10000$ ). The next  $m$  lines contain three integers each, the  $i$ -th being  $u_i$   $v_i$   $d_i$ , which means that cities  $u_i$  and  $v_i$  are connected by a road of length  $d_i$  ( $1 \leq u_i, v_i \leq 100, 1 \leq d_i \leq 10000$ ). The following line contains integer  $z$  - the number of transport requests the courier has received ( $1 \leq z \leq 5$ ). After that,  $z$  lines with the description of the orders follow. Each consists of three integers, the  $j$ -th being  $u_j$   $v_j$   $b_j$ , which signifies that  $b_j$  parcels should be transported (individually) from city  $u_j$  to city  $v_j$ . The sum of all  $b_j$  does not exceed 12.

#### Output

For each test case output a line with a single integer - the length of the shortest possible bicycle route for the courier.

#### Example

**Sample input:**

```
1
5 7 2
1 2 7
1 3 5
1 5 2
2 4 10
2 5 1
3 4 3
3 5 4
3
```

1 4 2  
5 3 1  
5 1 1

**Sample output:**

43

---

Added by: Adrian Kosowski

Date: 2004-07-28

Time limit: 7s

Source  
limit: 50000B

Languages: All

Resource: based on a problem from the VII Polish Collegiate Team Programming Contest  
(AMPPZ), 2002



## SPOJ Problem Set (classical)

### 153. Balancing the Stone

#### Problem code: SCALES

You are given scales for weighing loads. On the left side lies a single stone of known weight  $W < 2^N$ . You own a set of  $N$  different weights, weighing  $1, 2, 4, \dots, 2^{N-1}$  units of mass respectively. Determine how many possible ways there are of placing some weights on the sides of the scales, so as to balance them (put them in a state of equilibrium). Output this value modulo a small integer  $D$ .

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case, the first line contains three integers:  $N$   $L$   $D$ , where  $N$  denotes the number of weights at your disposal,  $L$  is the length of the binary representation of number  $W$ , and  $D$  is the modulus ( $1 \leq L \leq N \leq 1000000$ ,  $2 \leq D \leq 100$ ). The second line contains the value of  $W$ , encoded in the binary system as a sequence of exactly  $L$  characters  $0$  or  $1$  without separating spaces.

#### Output

For each test case, output a single line containing one integer - the calculated number of possible weight placements, modulo  $D$ .

#### Example

**Sample input:**

```
2
6 4 6
1000
6 6 100
100110
```

**Sample output:**

```
3
5
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-07-31

Time limit: 7s

Source  
limit: 50000B

Languages: All

Resource: based on a problem from the VII Polish Collegiate Team Programming Contest (AMPPZ), 2002

## SPOJ Problem Set (classical)

### 154. Sweet and Sour Rock

#### Problem code: ROCK

A manufacturer of sweets has started production of a new type of sweet called *rock*. Rock comes in sticks composed of one-centimetre-long segments, some of which are sweet, and the rest are sour. Before sale, the rock is broken up into smaller pieces by splitting it at the connections of some segments.

Today's children are very particular about what they eat, and they will only buy a piece of rock if it contains more sweet segments than sour ones. Try to determine the total length of rock which can be sold after breaking up the rock in the best possible way.

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case, the first line of input contains one integer  $N$  - the length of the stick in centimetres ( $1 \leq N \leq 200$ ). The next line is a sequence of  $N$  characters '0' or '1', describing the segments of the stick from the left end to the right end ('0' denotes a sour segment, '1' - a sweet one).

#### Output

For each test case output a line with a single integer: the total length of rock that can be sold after breaking up the rock in the best possible way.

#### Example

**Sample input:**

```
2
15
100110001010001
16
0010111101100000
```

**Sample output:**

```
9
13
```

---

Added by: Adrian Kosowski

Date: 2004-08-03

Time limit: 7s

Source  
limit: 50000B

Languages: All

Resource: based on a problem from the VII Polish Collegiate Team Programming Contest (AMPPZ), 2002

## SPOJ Problem Set (classical)

### 160. Choosing a Palindromic Sequence

#### Problem code: PALSEC

Given two sequences of words:  $X=(x_1, \dots, x_n)$  and  $Y=(y_1, \dots, y_n)$ , determine how many binary sequences  $P=(p_1, \dots, p_n)$  exist, such that the word concatenation  $z_1 z_2 \dots z_n$ , where  $z_i=x_i$  iff  $p_i=1$  and  $z_i=y_i$  iff  $p_i=0$ , is a palindrome (a word which is the same when read from left to right and from right to left).

#### Input

The input begins with the integer  $t$ , the number of test cases. Then  $t$  test cases follow.

For each test case the first line contains the positive integer  $n$  - the number of words in a sequence ( $1 \leq n \leq 30$ ). The following  $n$  lines contain consecutive words of the sequence  $X$ , one word per line. The next  $n$  lines contain consecutive words of the sequence  $Y$ , one word per line. Words consist of lower case letters of the alphabet ('a' to 'z'), are non-empty, and not longer than 400 characters.

#### Output

For each test case output one line containing a single integer - the number of different possible sequences  $P$ .

#### Example

**Sample input:**

```
1
5
ab
a
a
ab
a
a
baaaa
a
a
ba
```

**Sample output:**

```
12
```

---

Added by: Adrian Kosowski

Date: 2004-08-07

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: IV Polish Olympiad in Informatics (Wojciech Rytter)

## SPOJ Problem Set (classical)

### 174. Paint templates

#### Problem code: PAINTTMP

The Painter's Studio is preparing mass production of paintings. Paintings are going to be made with aid of square matrices of various sizes. A matrix of size  $i$  consists of  $2^i$  rows and  $2^i$  columns. There are holes on intersections of some rows and columns. Matrix of size 0 has one hole. For  $i > 0$ , matrix of size  $i$  is built of four squares of size  $2^{(i-1)} * 2^{(i-1)}$ . Look at the following figure:

[IMAGE]

Both squares on the right side and the bottom-left square are matrices of size  $i-1$ . Top-left square has no holes. Pictures are constructed in the following way. First, we fix three non-negative integers  $n$ ,  $x$ ,  $y$ . Next, we take two matrices of size  $n$ , place one of them onto the other and shift the upper one  $x$  columns right and  $y$  rows up. We place such a pattern on a white canvas and cover the common part of matrices with the yellow paint. In this way we get yellow stains on the canvas in the places where the holes in both matrices agree.

#### Example

Consider two matrices of size 2.

[IMAGE]

The upper matrix was shifted 2 columns right and 2 rows up. There are three places where holes agree.

#### Task

Write a program that for each test case:

- reads the sizes of two matrices and the numbers of columns and rows that the upper matrix should be shifted by, from the standard input;
- computes the number of yellow stains on the canvas;
- writes the result to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line

There is one integer  $n$ ,  $0 \leq n \leq 100$  in the first line of each test case. This number is the size of matrices used for production of paintings. In the second line there is one integer  $x$  and in the third line one integer  $y$ , where  $0 \leq x, y \leq 2^n$ . The integer  $x$  is the number of columns and  $y$  is the number of rows that the upper matrix should be shifted by.

## Output

For each test case your program should produce one line with exactly one integer - the number of stains on the canvas.

## Example

**Sample input:**

```
1
2
2
2
```

**Sample output:**

```
3
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 1 (Wojciech Rytter)

## SPOJ Problem Set (classical)

### 175. Polygon

#### Problem code: POLY1

We say that two triangles intersect if their interiors have at least one common point. A polygon is called convex if every segment connecting any two of its points is contained in this polygon. A triangle whose vertices are also vertices of a convex polygon is called an elementary triangle of this polygon. A triangulation of a convex polygon is a set of elementary triangles of this polygon, such that no two triangles from the set intersect and a union of all triangles covers the polygon. We are given a polygon and its triangulation. What is the maximal number of triangles in this triangulation that can be intersected by an elementary triangle of this polygon?

#### Example

Consider the following triangulation:

[IMAGE]

The elementary triangle (1,3,5) intersects all the triangles in this triangulation.

#### Task

Write a program that for each test case:

- reads the number of vertices of a polygon and its triangulation;
- computes the maximal number of triangles intersected by an elementary triangle of the given polygon;
- writes the result to standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line

In the first line of a test case there is a number  $n$ ,  $3 \leq n \leq 1000$ , which equals the number of vertices of the polygon. The vertices of the polygon are numbered from 0 to  $n-1$  clockwise. The following  $n-2$  lines describe the triangles in the triangulation. There are three integers separated by single spaces in the  $(i+1)$ -st line, where  $1 \leq i \leq n-2$ . These are the numbers of the vertices of the  $i$ -th triangle in the triangulation.

#### Output

For each test case your program should produce one line with exactly one integer - the maximal number of triangles in the triangulation, that can be intersected by a single elementary triangle of the input polygon.

## Example

**Sample input:**

```
1
6
0 1 2
2 4 3
0 5 4
2 4 0
```

**Sample output:**

```
4
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 1 (Krzysztof Diks)



## SPOJ Problem Set (classical)

### 176. Sum of one-sequence

#### Problem code: SUM1SEQ

We say that a sequence of integers is a one-sequence if the difference between any two consecutive numbers in this sequence is 1 or -1 and its first element is 0. More precisely:  $[a_1, a_2, \dots, a_n]$  is a one-sequence if

- for any  $k$ , such that  $1 \leq k < n : |a_k - a_{k+1}| = 1$  and
- $a_1 = 0$

#### Task

Write a program that for each test case:

- reads two integers describing the length of the sequence and the sum of its elements;
- finds a one-sequence of the given length whose elements sum up to the given value or states that such a sequence does not exist;
- writes the result to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of a test case there is a number  $n$ , such that  $1 \leq n \leq 10\,000$ , which is the number of elements in the sequence. In the second line there is a number  $S$ , which is the sum of the elements of the sequence, such that  $|S| \leq 50\,000\,000$ .

#### Output

For each test case there should be written  $n$  integers (each integer in a separate line) that are the elements of the sequence ( $k$ -th element in the  $k$ -th line) whose sum is  $S$  or the word "No" if such a sequence does not exist. If there is more than one solution your program should output any one.

Consequent test cases should be separated by an empty line.

#### Example

**Sample input:**

```
1
8
4
```

**Sample output:**

```
0
1
2
```

1  
0  
-1  
0  
1

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 3s

Source limit:50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 1 (Grzegorz Jakacki)

## SPOJ Problem Set (classical)

### 177. AB-words

#### Problem code: ABWORDS

Every sequence of small letters a and b (also the empty sequence) is called an ab-word. If  $X = [x_1, \dots, x_n]$  is an ab-word and  $i, j$  are integers such that  $1 \leq i \leq j \leq n$  then  $X[i..j]$  denotes the subword of  $X$  consisting of the letters  $x_i, \dots, x_j$ . We say that an ab-word  $X = [x_1 \dots x_n]$  is nice if it has as many letters a as b and for all  $i = 1, \dots, n$  the subword  $X[1..i]$  has at least as many letters a as b.

Now, we give the inductive definition of the similarity between nice ab-words.

- Every two empty ab-words (i.e. words with no letters) are similar
- Two non-empty nice ab-words  $X = [x_1, \dots, x_n]$  and  $Y = [y_1, \dots, y_m]$  are similar if they have the same length ( $n = m$ ) and one of the following conditions is fulfilled:
  1.  $x_1 = y_1, x_n = y_n$  and  $X[2..n-1]$  and  $Y[2..n-1]$  are similar ab-words and they are both nice;
  2. there exists  $i, 1 \leq i \leq n$ , such that  $X[1..i], X[i+1..n]$  are nice ab-words and
    - a)  $Y[1..i], Y[i+1..n]$  are nice ab-words and  $X[1..i]$  is similar to  $Y[1..i]$  and  $X[i+1..n]$  is similar to  $Y[i+1..n]$ , or
    - b)  $Y[1..n-i], Y[n-i+1..n]$  are nice ab-words and  $X[1..i]$  is similar to  $Y[n-i+1..n]$  and  $X[i+1..n]$  is similar to  $Y[1..n-i]$ .

A **level of diversity** of a non-empty set  $S$  of nice ab-words is the maximal number of ab-words that can be chosen from  $S$  in such a way that for each pair  $w_1, w_2$  of chosen words,  $w_1$  is not similar to  $w_2$ .

#### Task

Write a program that for each test case:

- reads elements of  $S$  from standard input;
- computes the level of diversity of the set  $S$ ;
- writes the result to standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of a test case there is a number  $n$  of elements of the set  $S$ ,  $1 \leq n \leq 1000$ ; in the following  $n$  lines there are elements of the set  $S$ , i.e. nice ab-words (one word in each line); the first letter of every ab-word is the first symbol in line and there are no spaces between two consecutive letters in the word; the length of every ab-word is an integer from the range  $[1..200]$ .

## Output

For each test case your program should output one line with one integer - the level of diversity of  $S$ .

## Example

**Sample input:**

```
1
3
aabaabbbab
abababaabb
abaaabbabb
```

**Sample output:**

```
2
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 1 (Krzysztof Diks)

## SPOJ Problem Set (classical)

### 178. Road net

#### Problem code: ROADNET

A diskette was enclosed to a road map. The diskette contains the table of the shortest ways (distances) between each pair of towns on the map. All the roads are two-way. The location of towns on the map has the following interesting property: *if the length of the shortest way from town A to town B equals the sum of the lengths of the shortest ways from A to C and C to B then town C lies on (certain) shortest way from A to B*. We say that towns A and B are neighbouring towns if there is no town C such that the length of the shortest way from A to B equals the sum of the lengths of the shortest ways from A to C and C to B. Find all the pairs of neighbouring towns.

#### Example

For the table of distances:

	A	B	C
A	0	1	2
B	1	0	3
C	2	3	0

the neighbouring towns are A, B and A, C.

#### Task

Write a program that for each test case:

- reads the table of distances from standard input;
- finds all the pairs of neighbouring towns;
- writes the result to standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of each test case there is an integer  $n$ ,  $1 \leq n \leq 200$ , which equals the number of towns on the map. Towns are numbered from 1 to  $n$ .

The table of distances is written in the following  $n$  lines. In the  $(i+1)$ -th line,  $1 \leq i \leq n$ , there are  $n$  non-negative integers not greater than 200, separated by single spaces. The  $j$ -th integer is the distance between towns  $i$  and  $j$ .

## Output

For each test case your program should write all the pairs of the neighbouring towns (i.e. their numbers). There should be one pair in each line. Each pair can appear only once. The numbers in each pair should be given in increasing order. Pairs should be ordered so that if the pair  $(a, b)$  precedes the pair  $(c, d)$  then  $a < c$  or  $(a = c \text{ and } b < d)$ .

Consequent test cases should be separated by an empty line.

## Example

**Sample input:**

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

**Sample output:**

```
1 2
1 3
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 2 (Piotr Chrzastowski-Wachtel)

## SPOJ Problem Set (classical)

### 179. Word equations

#### Problem code: WORDEQ

Every non-empty sequence of elements 0 and 1 is called a binary word. A word equation is an equation of the form  $x_1x_2...x_l = y_1y_2...y_r$ , where  $x_i$  and  $y_j$  are binary digits (0 or 1) or variables i.e. small letters of English alphabet. For every variable there is a fixed length of the binary words that can be substituted for this variable. This length is called a length of variable. In order to solve a word equation we have to assign binary words of appropriate length to all variables (the length of the word assigned to the variable  $x$  has to be equal to the length of this variable) in such a way that if we substitute words for variables then both sides of the equation (which are binary words after substitution) become equal.

For a given equation compute how many distinct solutions it has.

#### Example

Let a, b, c, d, e be variables and let 4, 2, 4, 4, 2 be their lengths (4 is the length of a, 2 is the length of b etc.). Consider the equation:

1bad1 = acbe

This equation has 16 distinct solutions.

#### Input

The number of equations  $t$  is in the first line of input, then  $t$  descriptions of equations follow separated by an empty line.

Each description consists of 6 lines. An equation is described in the following way: in the first line of the description there is an integer  $k$ ,  $0 \leq k \leq 26$ , which denotes the number of distinct variables in the equation. We assume that variables are the first  $k$  small letters of English alphabet. In the second line there is a sequence of  $k$  positive integers separated by single spaces. These numbers denote the lengths of variables a, b, ... from the equation (the first number is the length of a, the second - b, etc.). There is an integer  $l$  in the third line of the description, which is the length of the left size of equation, i.e. the length of the word built of digits 0 or 1 and variables (single letters). The left side of the equation is written in the next line as a sequence of digits and variables with no spaces between them. The next two lines contain the description of the right side of the equation. The first of these lines contains a positive integer  $r$ , which is the length of the right side of the equation. The second line contains the right side of the equation which is encoded in the same way as the left side. The number of digits plus sum of the lengths of variables (we count all appearances of variables) on each side of the equation is not greater than 10000.

## Output

For each equation your program should output one line with the number of distinct solutions.

## Example

**Sample input:**

```
1
5
4 2 4 4 2
5
1bad1
4
acbe
```

**Sample output:**

```
16
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 2 (Wojciech Rytter)



## SPOJ Problem Set (classical)

### 180. How to pack containers

#### Problem code: CONTPACK

Products of a factory are packed into cylindrical boxes. All boxes have the same bases. A height of a box is a non-negative integer being a power of 2, i.e. it is equal to  $2^i$  for some  $i = 0, 1, 2, \dots$ . The number  $i$  (exponent) is called a size of a box. All boxes contain the same goods but their value may be different. Goods produced earlier are cheaper. The management decided, that the oldest (cheapest) goods should be sold out first. From the warehouse goods are transported in containers. Containers are also cylindrical. A diameter of each container is a little bigger than a diameter of a box, so that boxes can be easily put into containers. A height of a container is a non-negative power of 2. This number is called a size of a container. For safe transport containers should be tightly packed with boxes, i.e. the sum of heights of boxes placed in a container have to be equal to the height of this container. A set of containers was delivered to the warehouse. Check if it is possible to pack all the containers tight with boxes that are currently stored in the warehouse. If so, find the minimal value of goods that can be tightly packed into these containers.

Consider a warehouse with 5 boxes. Their sizes and values of their contents are given below:

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

Two containers of size 1 and 2 can be tightly packed with two boxes of total value 3, 4 or 5, or three boxes with total value 9. The container of size 5 cannot be tightly packed with boxes from the warehouse.

#### Task

Write a program that for each test case:

- reads descriptions of boxes (size, value) from a warehouse and descriptions of containers (how many containers of a given size we have);
- checks if all containers can be tightly packed with boxes from the warehouse and if so, computes the minimal value of goods that can be tightly packed into these containers;
- writes the result.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of a test case there is an integer  $n$ ,  $1 \leq n \leq 10000$ , which is the number of boxes in the warehouse. In each of the following  $n$  lines there are written two non-negative integers separated by a single space. These numbers describe a single box. First of them is the size of the box and the second - the value of goods contained in this box. The size is not greater than 1000 and the value is not

greater than 10000. The next line contains a positive integer  $q$ , which is the number of different sizes of containers delivered to the warehouse. In each of the following  $q$  lines there are two positive integers separated by a single space. The first integer is the size of a container and the second one is the number of containers of this size. The maximal number of containers is 5000, a size of a container is not greater than 1000.

## Output

For each test case your program should output exactly one line containing:

- a single word "No" if it is not possible to pack the containers from the given set tight with the boxes from the warehouse, or
- a single integer equal to the minimal value of goods in boxes with which all the containers from the given set can be packed tight.

## Example

**Sample input:**

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

**Sample output:**

```
3
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 2 (Wojciech Rytter)

## SPOJ Problem Set (classical)

### 181. Scuba diver

#### Problem code: SCUBADIV

A scuba diver uses a special equipment for diving. He has a cylinder with two containers: one with oxygen and the other with nitrogen. Depending on the time he wants to stay under water and the depth of diving the scuba diver needs various amount of oxygen and nitrogen. The scuba diver has at his disposal a certain number of cylinders. Each cylinder can be described by its weight and the volume of gas it contains. In order to complete his task the scuba diver needs specific amount of oxygen and nitrogen. What is the minimal total weight of cylinders he has to take to complete the task?

#### Example

The scuba diver has at his disposal 5 cylinders described below. Each description consists of: volume of oxygen, volume of nitrogen (both values are given in litres) and weight of the cylinder (given in decagrams):

```
3 36 120
10 25 129
5 50 250
1 45 130
4 20 119
```

If the scuba diver needs 5 litres of oxygen and 60 litres of nitrogen then he has to take two cylinders of total weight 249 (for example the first and the second ones or the fourth and the fifth ones).

#### Task

Write a program that for each test case:

- reads scuba diver's demand for oxygen and nitrogen, the number of accessible cylinders and their descriptions;
- computes the minimal total weight of cylinders the scuba diver needs to complete his task;
- outputs the result.

**Note:** the given set of cylinders always allows to complete the given task.

#### Input

The number of test cases  $c$  is in the first line of input, then  $c$  test cases follow separated by an empty line.

In the first line of a test case there are two integers  $t, a$  separated by a single space,  $1 \leq t \leq 21$  and  $1 \leq a \leq 79$ . They denote volumes of oxygen and nitrogen respectively, needed to complete the task. The second line contains one integer  $n$ ,  $1 \leq n \leq 1000$ , which is the number of accessible cylinders. The following  $n$  lines contain descriptions of cylinders;  $i$ -th line contains three integers  $t_i, a_i, w_i$  separated by single spaces, ( $1 \leq t_i \leq 21$ ,  $1 \leq a_i \leq 79$ ,  $1 \leq w_i \leq 800$ ). These are respectively:

volume of oxygen and nitrogen in the  $i$ -th cylinder and the weight of this cylinder.

## Output

For each test case your program should output one line with the minimal total weight of cylinders the scuba diver should take to complete the task.

## Example

**Sample input:**

```
1
5 60
5
3 36 120
10 25 129
5 50 250
1 45 130
4 20 119
```

**Sample output:**

```
249
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 2

## SPOJ Problem Set (classical)

### 182. Window

#### Problem code: WINDOW1

We have a polygon chosen in the cartesian coordinate system. Sides of the polygon are parallel to the axes of coordinates. Every two consecutive sides are perpendicular and coordinates of every vertex are integers. We have also given a window that is a rectangle whose sides are parallel to the axes of coordinates. The interior of the polygon (but not its periphery) is coloured red. What is the number of separate red fragments of the polygon that can be seen through the window?

#### Example

Look at the figure below:

[IMAGE]

There are two separate fragments of the polygon that can be seen through the window.

#### Task

Write a program that for each test case:

- reads descriptions of a window and a polygon;
- computes the number of separate red fragments of the polygon that can be seen through the window;
- outputs the result.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of a test case there are four integers  $x_1, y_1, x_2, y_2$  from the range  $[0..10000]$ , separated by single spaces. The numbers  $x_1, y_1$  are the coordinates of the top-left corner of the window. The numbers  $x_2, y_2$  are the coordinates of the bottom-right corner of the window. The next line of the input file contains one integer  $n$ ,  $4 \leq n \leq 5000$ , which equals the number of vertices of the polygon. In the following  $n$  lines there are coordinates of polygon's vertices given in anticlockwise direction, i.e. the interior of the polygon is on the left side of its periphery when we move along the sides of the polygon according to the given order. Each line contains two integers  $x, y$  separated by a single space,  $0 \leq x \leq 10000$ ,  $0 \leq y \leq 10000$ . The numbers in the  $i$ -th line, are coordinates of the  $i$ -th vertex of the polygon.

## Output

For each test case you should output one line with the number of separate red fragments of the polygon that can be seen through the window.

## Example

**Sample input:**

```
1
0 5 8 1
24
0 0
4 0
4 2
5 2
5 0
7 0
7 3
3 3
3 2
2 2
2 4
1 4
1 5
2 5
2 6
3 6
3 5
4 5
4 6
5 6
5 4
7 4
7 7
0 7
```

**Sample output:**

```
2
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 2 (Wojciech Guzicki)

## SPOJ Problem Set (classical)

### 183. Assembler circuits

#### Problem code: ASCIRC

Bytetel Company decided to improve computers they produce. They want to replace assembler programs with special systems called assembler circuits. Assembler programs consist solely of assignments. Each assignment is determined by four elements:

- two registers from which data are taken,
- elementary operation that should be performed on the data,
- register to which the result should be written.

We assume that there are at most 26 registers. They are represented by small letters of English alphabet. There are at most 4 elementary operations and they are represented by capital letters A, B, C, D.

An assembler circuit has:

- inputs assigned to registers; initial value of appropriate register is passed to the input;
- outputs, also assigned to registers; their final values are passed to these registers.

There are gates inside a circuit. Each gate has two inputs and one output. The gate performs an elementary operation on data delivered on its inputs and passes the result to its output. Inputs of gates and outputs of the whole circuit are connected to outputs of other gates or inputs of the circuit. Outputs of gates and inputs of the circuit can be connected to many inputs of other gates or outputs of the circuit. Connections among gates cannot form cycles.

An assembler circuit is equivalent to an assembler program if for any initial state of registers the final state of registers produced by the program and the circuit are the same.

#### Task

Write a program that for each test case:

- reads a description of an assembler program;
- computes the minimal number of gates in an assembler circuit equivalent to the given program;
- writes the result.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of each test case there is one integer  $n$  ( $1 \leq n \leq 1000$ ), which is the number of instructions in the program.

In the following  $n$  lines there are descriptions of consecutive instructions in the program. Each description is a four-letter word beginning with an elementary operation symbol: A, B, C or D. The second and the third letter (which are small letters of English alphabet) are names of registers, in which data are placed. The fourth letter is a name of a register, in which the result should be placed.

## Output

For each test case you should output one line with the minimal number of gates in an assembler circuit equivalent to the given program.

## Example

**Sample input:**

```
1
8
Afbc
Bfbd
Cddd
Bcbc
Afcc
Afbf
Cfbb
Dfdb
```

**Sample output:**

```
6
```

A circuit equivalent to the given program is shown in the figure.

[IMAGE]

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 3 (Marcin Kubica)



## SPOJ Problem Set (classical)

### 184. Automatic Teller Machines

#### Problem code: ATMS

Every member of Byteland Credit Society is entitled to loan any amount of Bytelandish ducats unless it is  $10^{30}$  or more, but he has to return the whole amount within seven days. There are 100 ATMs in the Client Service Room of the Society. They are numbered from 0 to 99. Every ATM can perform one action only: it can pay or receive a fixed amount. The  $i$ -th ATM pays  $2^i$  ducats if  $i$  is even or it receives  $2^i$  ducats if  $i$  is odd. If a client is going to loan a fixed sum of money it is necessary to check if he is able to get the money using every ATM at most once. If so, numbers of ATMs he has to use should be determined. It is also necessary to check if the client can return the money in a similar way, and if so, to determine numbers of ATMs he has to use.

#### Example

A client who is going to loan 7 ducats gets 16 ducats from the ATM # 4 and 1 ducat from the ATM # 0 and then he returns 8 ducats in the ATM # 3 and 2 ducats in the ATM # 1. In order to return the amount of 7 ducats he receives 1 ducat from the ATM # 0 and then he returns 8 ducats in ATM # 3.

#### Task

Write a program that:

- reads the number of clients  $n$ , for every client reads from the same file the amount of money he is going to loan;
- checks for every client if he is able to get the money using every ATM at most once and if so, determines the numbers of ATMs he has to use;
- outputs the results.

#### Input

In the first line of input there is one positive integer  $n \leq 10000$ , which equals the number of clients.

In each of the following  $n$  lines there is one positive integer less than  $10^{30}$  (at most 30 decimal digits). The number in the  $i$ -th line describes the amount of ducats which the client  $i$  is going to loan.

#### Output

For each client you should output two lines with a decreasing sequence of positive integers from the range  $[0..99]$  separated by single spaces, or one word "No":

In the first line of the  $i$ -th pair of lines there should be numbers of ATMs (in decreasing order) that the client  $i$  should use to get his loan or one word "No" if the loan cannot be received according to the rules;

In the second line of the  $i$ -th pair there should be numbers of ATMs (in decreasing order) which the client  $i$  should use to return his loan or the word "No".

## Example

**Sample input:**

```
2
7
633825300114114700748351602698
```

**Sample output:**

```
4 3 1 0
3 0
No
99 3 1
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 3 (Piotr Chrzastowski-Wachtel)

## SPOJ Problem Set (classical)

### 185. Chase

#### Problem code: CHASE1

Chase is a two-person board game. A board consists of squares numbered from 1 to  $n$ . For each pair of different squares it is known if they are adjacent to one another or they are not. Each player has a piece at his disposal. At the beginning of a game pieces of players are placed on fixed, distinct squares. In one turn a player can leave his piece on the square it stands or move it to an adjacent square.

A game board has the following properties:

- it contains no triangles, i.e. there are no three distinct squares such that each pair of them is adjacent,
- each square can be reached by each player.

A game consists of many turns. In one turn each player makes a single move. Each turn is started by player A. We say that player A is caught by player B if both pieces stand on the same square. Decide, if for a given initial positions of pieces, player B can catch player A, independently of the moves of his opponent. If so, how many turns player B needs to catch player A if both play optimally (i.e. player A tries to run away as long as he can and player B tries to catch him as quickly as possible).

#### Example

[IMAGE]

Consider the board in the figure. Adjacent squares (denoted by circles) are connected by edges. If at the beginning of a game pieces of players A and B stand on the squares 9 and 4 respectively, then player B can catch player A in the third turn (if both players move optimally). If game starts with pieces on the squares 8 (player A) and 4 (player B) then player B cannot catch player A (if A plays correctly).

#### Task

Write a program that for each test case:

- reads the description of a board and numbers of squares on which pieces are placed initially.
- decides if player B can catch player A and if so, computes how many turns he needs (we assume that both players play optimally);
- outputs the result.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of a test case there are four integers  $n$ ,  $m$ ,  $a$  and  $b$  separated by single spaces, where  $2 \leq n \leq 3000$ ,  $n-1 \leq m \leq 15000$ ,  $1 \leq a, b \leq n$ . These are (respectively): the number of squares of the board, the number of adjacent (unordered) pairs, the number of the square on which the piece of player A is placed, the number of the square on which the piece of player B is placed. In each of the following lines there are two distinct positive integers separated by a single space, which denote numbers of adjacent squares.

## Output

For each test case you should output one line containing:

- one word "No", if player B cannot catch player A, or
- one integer - the number of turns needed by B to catch A (if B can catch A).

## Example

**Sample input:**

```
1
9 11 9 4
1 2
3 2
1 4
4 7
7 5
5 1
6 9
8 5
9 8
5 3
4 8
```

**Sample output:**

```
3
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 3 (Adam Borowski)

## SPOJ Problem Set (classical)

### 186. The lightest language

#### Problem code: LITELANG

Alphabet  $A_k$  consists of  $k$  initial letters of English alphabet. A positive integer called a weight is assigned to each letter of the alphabet. A weight of a word built from the letters of the alphabet  $A_k$  is the sum of weights of all letters in this word. A language over an alphabet  $A_k$  is any finite set of words built from the letters of this alphabet. A weight of a language is the sum of weights of all its words. We say that the language is prefixless if for each pair of different words  $w, v$  from this language  $w$  is not a prefix of  $v$ .

We want to find out what is the minimal possible weight of an  $n$ -element, prefixless language over an alphabet  $A_k$ .

#### Example

Assume that  $k = 2$ , the weight of the letter a is  $W(a) = 2$  and the weight of the letter b is  $W(b) = 5$ . The weight of the word ab is  $W(ab) = 2 + 5 = 7$ .  $W(aba) = 2 + 5 + 2 = 9$ . The weight of the language  $J = \{ab, aba, b\}$  is  $W(J) = 21$ . The language  $J$  is not prefixless, since the word ab is a prefix of aba. The lightest three-element, prefixless language over the alphabet  $A_2$  (assuming that weights of the letters are as before) is  $\{b, aa, ab\}$ ; its weight is 16.

#### Task

Write a program that for each test case:

- reads two integers  $n, k$  and the weights of  $k$  letters of an alphabet  $A_k$ ;
- computes the minimal weight of a prefixless,  $n$ -element language over the alphabet  $A_k$ ;
- outputs the result.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of a test case there are two positive integers  $n$  and  $k$  separated by a single space, ( $2 \leq n \leq 10000$ ,  $2 \leq k \leq 26$ ). These are the number of words in a language and the number of letters in an alphabet respectively. The second line contains  $k$  positive integers separated by single spaces. Each of them is not greater than 10000. The  $i$ -th number is the weight of the  $i$ -th letter.

## Output

For each test case you should output one line with the weight of the lightest prefixless  $n$ -element language over the alphabet  $A_k$ .

## Example

**Sample input:**

```
1
3 2
2 5
```

**Sample output:**

```
16
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 3 (Wojciech Rytter)

## SPOJ Problem Set (classical)

### 187. Flat broken lines

#### Problem code: FLBRKLIN

We have a cartesian coordinate system drawn on a sheet of paper. Let us consider broken lines that can be drawn with a single pencil stroke from the left to the right side of the sheet. We also require that for each segment of the line the angle between the straight line containing this segment and the OX axis belongs to  $[-45^\circ, 45^\circ]$  range. A broken line fulfilling above conditions is called a flat broken line. Suppose we are given  $n$  distinct points with integer coordinates. What is the minimal number of flat broken lines that should be drawn in order to cover all the points (a point is covered by a line if it belongs to this line)?

#### Example

[IMAGE]

For 6 points whose coordinates are (1,6), (10,8), (1,5), (2,20), (4,4), (6,2) the minimal number of flat broken lines covering them is 3.

#### Task

Write a program that for each test case:

- reads the number of points and their coordinates;
- computes the minimal number of flat broken lines that should be drawn to cover all the points;
- outputs the result.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of a test case there is one positive integer  $n$ , not greater than 30000, which denotes the number of points. In the following  $n$  lines there are coordinates of points. Each line contains two integers  $x, y$  separated by a single space,  $0 \leq x \leq 30000$ ,  $0 \leq y \leq 30000$ . The numbers in the  $i$ -th line are the coordinates of the  $i$ -th point.

#### Output

For each test case you should output one line with the minimal number of flat broken lines that should be drawn to cover all the points.

## Example

**Sample input:**

```
1
6
1 6
10 8
1 5
2 20
4 4
6 2
```

**Sample output:**

```
3
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 3 (Grzegorz Jakacki, Krzysztof Sobusiak)



## SPOJ Problem Set (classical)

### 188. Rectangles

#### Problem code: RECTNG1

There are  $n$  rectangles drawn on the plane. Each rectangle has sides parallel to the coordinate axes and integer coordinates of vertices.

We define a block as follows:

- each rectangle is a block,
- if two distinct blocks have a common segment then they form the new block otherwise we say that these blocks are separate.

#### Examples

The rectangles in Figure 1 form two separate blocks.

Figure 1

[IMAGE]

The rectangles in Figure 2 form a single block

Figure 2

[IMAGE]

#### Task

Write a program that for each test case:

- reads the number of rectangles and coordinates of their vertices;
- finds the number of separate blocks formed by the rectangles;
- writes the result to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line.

In the first line of a test case there is an integer  $n$ ,  $1 \leq n \leq 7000$ , which is the number of rectangles. In the following  $n$  lines there are coordinates of rectangles. Each rectangle is described by four numbers: coordinates  $x, y$  of the bottom-left vertex and coordinates  $x, y$  of the top-right vertex. All these coordinates are non-negative integers not greater than 10000.

## Output

For each test case you should output one line with the number of separate blocks formed by the given rectangles.

## Example

**Sample input:**

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

**Sample output:**

```
2
```

---

Added by: Michał Czuczman

Date: 2004-08-10

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 5th Polish Olympiad in Informatics, stage 3 (Wojciech Rytter)

## SPOJ Problem Set (classical)

### 196. Musketeers

#### Problem code: MUSKET

In the time of Louis XIII and his powerful minister cardinal Richelieu in the Full Barrel Inn  $n$  musketeers had consumed their meal and were drinking wine. Wine had not run short and therefore the musketeers were eager to quarrel, a drunken brawl broke out, in which each musketeer insulted all the others.

A duel was inevitable. But who should fight who and in what order? They decided (for the first time since the brawl they had done something together) that they would stay in a circle and draw lots in order. A drawn musketeer fought against his neighbor to the right. A loser "quit the game" and to be more precise his corpse was taken away by servants. The next musketeer who stood beside the loser became the neighbor of a winner.

After years, when historians read memories of the winner they realized that a final result depended in a crucial extent on the order of duels. They noticed that a fence practice had indicated, who against who could win a duel. It appeared that (in mathematical language) the relation "**A** wins **B**" was not transitive! It could happen that the musketeer **A** fought better than **B**, **B** better than **C** and **C** better than **A**. Of course, among three of them the first duel influenced the final result. If **A** and **B** fight as the first, **C** wins eventually. But if **B** and **C** fight as the first, **A** wins finally. Historians fascinated by their discovery decided to verify which musketeers could survive. The fate of France and the whole civilized Europe indeed depended on that!

#### Task

$N$  persons with consecutive numbers from 1 to  $n$  stay in a circle. They fight  $n-1$  duels. In the first round one of these persons (e.g. with the number  $i$ ) fights against its neighbor to the right, i.e. against the person numbered  $i+1$  (or, if  $i=n$ , against the person numbered 1). A loser quits the game, and the circle is tighten so that the next person in order becomes a winner's neighbor. We are given the table with possible duels results, in the form of a matrix. If  $A_{i,j} = 1$  then the person with the number  $i$  always wins with the person  $j$ . If  $A_{i,j} = 0$  the person  $i$  loses with  $j$ . We can say that the person  $k$  may win the game if there exists such a series of  $n-1$  drawings, that  $k$  wins the final duel.

Write a program which:

- reads matrix **A** from the standard input,
- computes numbers of persons, who may win the game,
- writes them into the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case integer  $n$  which satisfies the inequality  $3 \leq n \leq 100$  is written. In each of the following  $n$  lines appears one word consisting of  $n$  digits 0 or 1. A digit on  $j$ -th position in  $i$ -th line denote  $A_{i,j}$ . Of course  $A_{i,j} = 1 - A_{j,i}$ , for  $i < j$ . We assume that  $A_{i,i} = 1$ , for each  $i$ .

## Output

For each test case in the first line there should be written  $m$  - the number of persons, who may win the game. In the following  $m$  lines numbers of these persons should be written in ascending order, one number in each line.

## Example

**Sample input:**

```
1
7
1111101
0101100
0111111
0001101
0000101
1101111
0100001
```

**Sample output:**

```
3
1
3
6
```

The order of duels: 1-2, 1-3, 5-6, 7-1, 4-6, 6-1 gives a final victory to the person numbered 6. You can also check that only two persons more (1 and 3) may win the game.

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 1

## SPOJ Problem Set (classical)

### 199. Empty Cuboids

#### Problem code: EMPTY

We call a cuboid **regular** if:

- one of its vertices is a point with coordinates (0,0,0),
- edges beginning in this vertex lie on the positive semi-axes of the coordinate system,
- the edges are not longer than  $10^6$

There is given a set **A** of points of space, whose coordinates are integers from the interval  $[1..10^6]$ . We try to find a regular cuboid of maximal volume which does not contain any of the points from the set **A**. A point belongs to the cuboid if it belongs to the interior of the cuboid, i.e. it is a point of the cuboid, but not of its wall.

#### Task

Write a program which:

- reads from the standard input the coordinates of points from the set **A**,
- finds one of the regular cuboids of maximal volume which does not contain any points from the set **A**,
- writes the result to standard output.

#### Input

Input begins with a line containing integer  $t \leq 10$ , the number of test cases.  $t$  test cases follow.

In the first line of each test case one non-negative integer  $n$  is written ( $n \leq 5000$ ). It is the number of elements in the set **A**. In the following  $n$  lines of the input there are triples of integers from the interval  $[1..10^6]$ , which are the X, Y and Z coordinates of points from **A**, respectively. Numbers in each line are separated by single spaces.

#### Output

For each test case there should be three integers separated by single spaces. These are the X, Y and Z coordinates (respectively) of the vertex of the regular cuboid of maximal volume. If there is more than one such a cuboid, choose whichever. We require that all coordinates be positive.

#### Example

**Sample input:**

```
1
4
3 3 300000
2 200000 5
90000 3 2000
```

2 2 1000

**Sample output:**

1000000 200000 1000

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 1

## SPOJ Problem Set (classical)

### 200. Monodigital Representations

#### Problem code: MONODIG

Let  $K$  be a decimal digit different from 0. We say that an arithmetic expression is a **K-representation of the integer X** if a value of this expression is X and if it contains only numbers composed of a digit K. (All the numbers are of course decimal). The following arithmetical operations are allowed in the expression: addition, subtraction, multiplication and division. Round brackets are allowed too. Division may appear only when a dividend is a multiple of a divisor.

#### Example

Each of the following expressions is the 5-representation of the number 12:

- $5+5+(5:5)+(5:5)$
- $(5+(5))+5:5+5:5$
- $55:5+5:5$
- $(55+5):5$

The **length** of the  $K$ -representation is the number of occurrences of digit  $K$  in the expression. In the example above the first two representations have the length 6, the third - 5, and the forth - 4.

#### Task

Write a program which:

- reads the digit  $K$  and the series of numbers from the standard input,
- verifies for each number from the series, whether it has a  $K$ -representation of length at most 8, and if it does, then the program finds the minimal length of this representation,
- writes results to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. The first line of each test case contains digit  $K$ ,  $K$  is an element of  $\{1, \dots, 9\}$ . The second line contains number  $n$ ,  $1 \leq n \leq 10$ . In the following  $n$  lines there is the series of natural numbers  $a_1, \dots, a_n$ ,  $1 \leq a_i \leq 32000$  (for  $i=1, \dots, n$ ), one number in each line.

#### Output

The output for each test case composes of  $n$  lines. The  $i$ -th line should contain:

- exactly one number which is the minimal length of  $K$ -representation of  $a_i$ , assuming that such a representation of length not greater than 8 exists,
- one word NO, if the minimal length of the  $K$ -representation of the number  $a_i$  is greater than 8.

## Example

**Sample input:**

```
1
5
2
12
31168
```

**Sample output**

```
4
NO
```

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 1



## SPOJ Problem Set (classical)

### 201. The Game of Polygons

#### Problem code: POLYGAME

Two players take part in the game **polygons**. A convex polygon with  $n$  vertices divided by  $n-3$  diagonals into  $n-2$  triangles is necessary. These diagonals may intersect in vertices of the polygon only. One of the triangles is black and the remaining ones are white. Players proceed in alternate turns. Each player, when its turn comes, cuts away one triangle from the polygon. players are allowed to cut off triangles along the given diagonals. The winner is the player who cuts away the black triangle. NOTE: We call a polygon **convex** if a segment joining any two points of the polygon is contained in the polygon.

#### Task

Write a program which:

- reads from the standard input the description of the polygon,
- verifies whether the player who starts the game has a winning strategy,
- writes the result to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. The first line of each test case contains an integer  $n$ ,  $4 \leq n \leq 50000$ . This is the number of vertices in the polygon. The vertices of the polygon are numbered, clockwise, from  $0$  to  $n-1$ . The next  $n-2$  lines comprise descriptions of triangles in the polygon. In the  $i+1$ -th line,  $1 \leq i \leq n-2$ , there are three non-negative integers  $a, b, c$  separated by single spaces. These are numbers of vertices of the  $i$ -th triangle. The first triangle in a sequence is black.

#### Output

The output for each test case should have one line with the word:

- YES, if the player, who starts the game has a winning strategy,
- NO, if he does not have a winning strategy.

#### Example

**Sample input:**

```
1
6
0 1 2
2 4 3
4 2 0
0 5 4
```

**Sample output:**

```
YES
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 1

## SPOJ Problem Set (classical)

### 202. Rockets

#### Problem code: ROCKETS

There are two separate,  $n$ -element sets of points of a two dimensional map: **R** and **W**. None triple of points from the set **RUW** is collinear. Rockets earth-to-earth are located on points from the set **R**. Enemy objects, which should be destroyed, are located on points from the set **W**. The rockets may fly only in the straight line and their trajectories cannot intersect. We are about to find for each rocket a target to destroy.

#### Task

Write a program which:

- reads from the standard input coordinates of the points from the sets **R** and **W**,
- finds the set of  $n$  pairwise not-intersecting segments, so that one end of each segment belongs to the set **R**, while the other belongs to the set **W**,
- writes the result into the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case there is written one integer  $n$ ,  $1 \leq n \leq 10000$ , equal to the number of elements of the sets **R** and **W**.

In each of the following  $2n$  lines of the input one pair of integer numbers from the interval  $[-10000, 10000]$  is written. Numbers in each pair are separated by a single space. They are coordinates of the point on a map (first coordinate  $x$ , then  $y$ ). The first  $n$  lines comprise coordinates of the points from the set **R**, the last  $n$  lines comprise the points from the set **W**. In the  $(i+1)$ -th line there are coordinates of the point  $r_i$ , in the  $(i+n+1)$ -th line there are coordinates of the point  $w_i$ ,  $1 \leq i \leq n$ .

#### Output

The output for each test case should consist of  $n$  lines. In the  $i$ -th line there should be one integer  $k(i)$ , such that the segment  $r_i w_{k(i)}$  belongs to the set of segments which your program found. (This means that the rocket from the point  $r_i$  destroys an object in the point  $w_{k(i)}$ ).

#### Example

Sample input:

```
1
4
0 0
1 5
4 2
2 6
1 2
```

5 4  
4 5  
3 1

**Sample output:**

2  
1  
4  
3

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 2

## SPOJ Problem Set (classical)

### 203. Potholers

#### Problem code: POTHOLE

A team of speleologists organizes a training in the Grate Cave of Byte Mountains. During the training each speleologist explores a route from Top Chamber to Bottom Chamber. The speleologists may move down only, i.e. the level of every consecutive chamber on a route should be lower then the previous one. Moreover, each speleologist has to start from Top Chamber through a different corridor and each of them must enter Bottom Chamber using different corridor. The remaining corridors may be traversed by more then one speleologist. How many speleologists can train simultaneously?

#### Task

Write a program which:

- reads the cave description from the standard input,
- computes the maximal number of speleologists that may train simultaneously,
- writes the result to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case there is one integer  $n$  ( $2 \leq n \leq 200$ ), equal to the number of chambers in the cave. The chambers are numbered with integers from  $1$  to  $n$  in descending level order - the chamber of grater number is at the higher level than the chamber of the lower one. (Top Chamber has number  $1$ , and Bottom Chamber has number  $n$ ). In the following  $n-1$  lines (i.e. lines  $2, 3, \dots, n$ ) the descriptions of corridors are given. The  $(i+1)$ -th line contains numbers of chambers connected by corridors with the  $i$ -th chamber. (only chambers with numbers grater then  $i$  are mentioned). The first number in a line,  $m$ ,  $0 \leq m \leq (n-i+1)$ , is a number of corridors exiting the chamber being described. Then the following  $m$  integers are the numbers of the chambers the corridors are leading to.

#### Output

Your program should write one integer for each test case. This number should be equal to the maximal number of speleologists able to train simultaneously,

#### Example

**Sample input:**

```
1
12
4 3 4 2 5
1 8
2 9 7
2 6 11
1 8
2 9 10
2 10 11
```

```
1 12
2 10 12
1 12
1 12
```

**Sample output:**

```
3
```

The sample input corresponds to the following cave:

[IMAGE]

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 2

## SPOJ Problem Set (classical)

### 204. Sleepwalker

#### Problem code: SLEEP

There is a building with flat square roof of size  $3^k * 3^k$  and sides parallel to north-south and east-west directions. The roof is covered with square tiles of size  $l$  (with a side of length 1), but one of the tiles has been removed and there is a hole in the roof (big enough to fall in). The tiles form a rectangular mesh on the roof, so their positions may be specified with coordinates. The tile at the southwestern corner has coordinates  $(1,1)$ . The first coordinate increases while going eastwards, and the second while going northwards.

Sleepwalker wanders across the roof, in each step moving from the tile he is standing on to the adjacent one on the east(E), west(W), south(S), or north(N). The sleepwalker roof ramble starts from the southwestern corner tile. The description of the path is a word  $d_k$  built of the letters N, S, E, W denoting respectively a step to the north, south, east and west. For  $k = 1$  the word describing the path of sleepwalker is

$d_1 = \text{EENNWSWN}$

For  $k = 2$  the word describing the path of sleepwalker is

$d_2 = \text{NNEESWSEENNEESWSEEEENNWSWNNEENNWSW -}$   
 $\text{NNEENNWSWNWWWSSSENESSSSWWNENWWSSW -}$   
 $\text{WNENWNEENNWSWN.}$

(See the picture that shows how the sleepwalker would go across a roof of dimension  $3*3$  or  $9*9$ .) Generally, if  $k \geq 1$ , the description of a sleepwalker's path on the roof of dimension  $3^{k+1} * 3^{k+1}$  is a word:

$d_{k+1} = a(d_k) E a(d_k) E d_k N d_k N d_k W c(d_k) S b(d_k) W b(d_k) N d_k$

where functions **a**, **b** and **c** denote the following permutations of letters specifying directions:

a: E→N W→S N→E S→W  
b: E→S W→N N→W S→E  
c: E→W W→E N→S S→N

E.g.  $a(\text{SEN})=\text{WNE}$ ,  $b(\text{SEN})=\text{ESW}$ ,  $c(\text{SEN})=\text{NWS}$ .

We start observing sleepwalker at the time he stands on the tile of coordinates  $(u_1, u_2)$ . After how many steps will sleepwalker fall into the hole made after removing the tile of coordinates  $(v_1, v_2)$ ?

## Example

There are sleepwalker's paths on roofs of dimension  $3*3$  and  $9*9$  on the picture below. In the second case, the point at which the observation starts and the hole have been marked. The sleepwalker has exactly 20 steps to the hole (from the moment the observation starts).

[IMAGE] [IMAGE]

## Task

Write a program which:

- reads from the standard input integer  $k$  denoting the size of the roof ( $3^k * 3^k$ ), the position of the sleepwalker at the moment the observation starts and the position of the hole,
- computes the number of steps that the sleepwalker will make before he falls into the hole,
- writes the result to the standard output.

## Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case one integer  $k$ ,  $1 \leq k \leq 60$ , denoting the size of the roof ( $3^k * 3^k$ ) is written. In each of the following two lines of the test case two natural numbers  $x, y$  separated with a space are written,  $1 \leq x \leq 3^k$ ,  $1 \leq y \leq 3^k$ . The numbers in the second line are the coordinates of the tile the sleepwalker is standing on. The numbers in the third line are the coordinates of the hole. You may assume, that with these data the sleepwalker will eventually fall into the hole after some number of steps.

## Output

The only line of output for each test case should contain the number of steps on the sleepwalker's path to the hole.

## Example

**Sample input:**

```
1
2
3 2
7 2
```

**Sample output**

```
20
```

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 2



## SPOJ Problem Set (classical)

### 205. Icerink

#### Problem code: ICERINK

A skating competition was organized on the largest icerink in Byteland. The icerink is a square of size  $10000 * 10000$ . A competitor begins skating at the START point chosen by referees and his task is to finish sliding at the FINISH point, also chosen by referees. The points of START and FINISH are different. One can slide in directions parallel to the sides of the icerink. There are some obstacles placed on the icerink. Each obstacle is a prism, which base is a polygon with sides parallel to the sides of the icerink. Each two adjacent sides of the base are always perpendicular. The obstacles do not have common points. Each slide finishes up at the point where a competitor, for the first time, meets the wall of an obstacle, which is perpendicular to the direction of the slide. In other words, one can stop only when he crashes on a wall or in the FINISH point. Falling out of the icerink causes disqualification. Competitor may slide along walls of an obstacle.

[IMAGE]

[IMAGE]

Decide, whether a competitor who slides according to the given rules may reach the finish point, assuming he begun sliding from the starting point. If so, what is the minimal number of slides he needs to do?

#### Task

Write a program which:

- reads the description of the icerink, obstacles, and the coordinates of the start and finish point from the standard input,
- verifies, whether a competitor who begins from the starting point and slides according the rules may reach the finish point, and if so, computes the minimal number of slides he needs to do,
- writes the result in the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. We define a system of coordinates to describe positions of objects on a rink. The rink is a square with vertices  $(0,0), (10000,0), (10000,10000), (0,10000)$ . In the first line of each test case there are two integers  $z_1$  and  $z_2$  separated by a single space,  $0 \leq z_1, z_2 \leq 10000$ . The pair  $(z_1, z_2)$  denotes coordinates of the START point. In the second line of the file there are two integers  $t_1$  and  $t_2$  separated by single space,  $0 \leq t_1, t_2 \leq 10000$ . The pair  $(t_1, t_2)$  denotes coordinates of the FINISH point. The third line of the file contains one integer  $s$ ,  $1 \leq s \leq 2500$ . This is the number of obstacles. The following lines comprise descriptions of  $s$  obstacles. Each description of an obstacle begins with the line containing one positive integer  $r$  equal to the number of walls (sides of the base) of the obstacle. In each of the following  $r$  lines there are two integers  $x$  and  $y$  separated by a single space.

These are the coordinates of the vertices of the obstacle's base, given in a clockwise order. (i.e. when going around the obstacle in this direction the inside is on the left-hand side). The total number of side walls of the obstacles does not exceed 10000.

## Output

Your program should write for each test case:

- either one word 'NO' if it's impossible to get from the START point to the FINISH point
- or the minimal number of slides necessary to get to the FINISH point, if it is possible.

## Example

**Sample input:**

```
1
40 10
5 40
3
6
0 15
0 60
20 60
20 55
5 55
5 15
12
30 55
30 60
60 60
60 0
0 0
0 5
55 5
55 35
50 35
50 40
55 40
55 55
6
30 25
15 25
15 30
35 30
35 15
30 15
```

**Sample output:**

```
4
```

The sample input corresponds to the following situation:

[IMAGE]

These are the possible sequences of slides of length 4:

[IMAGE] [IMAGE] [IMAGE]

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 2

## SPOJ Problem Set (classical)

### 206. Bitmap

#### Problem code: BITMAP

There is given a rectangular bitmap of size  $n*m$ . Each pixel of the bitmap is either white or black, but at least one is white. The pixel in  $i$ -th line and  $j$ -th column is called the pixel  $(i,j)$ . The distance between two pixels  $\mathbf{p}_1=(i_1,j_1)$  and  $\mathbf{p}_2=(i_2,j_2)$  is defined as:

$$d(\mathbf{p}_1,\mathbf{p}_2)=|i_1-i_2|+|j_1-j_2|.$$

#### Task

Write a program which:

- reads the description of the bitmap from the standard input,
- for each pixel, computes the distance to the nearest white pixel,
- writes the results to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case there is a pair of integer numbers  $n, m$  separated by a single space,  $1 \leq n \leq 182$ ,  $1 \leq m \leq 182$ . In each of the following  $n$  lines of the test case exactly one zero-one word of length  $m$ , the description of one line of the bitmap, is written. On the  $j$ -th position in the line  $(i+1)$ ,  $1 \leq i \leq n$ ,  $1 \leq j \leq m$ , is '1' if, and only if the pixel  $(i,j)$  is white.

#### Output

In the  $i$ -th line for each test case,  $1 \leq i \leq n$ , there should be written  $m$  integers  $f(i,1), \dots, f(i,m)$  separated by single spaces, where  $f(i,j)$  is the distance from the pixel  $(i,j)$  to the nearest white pixel.

#### Example

**Sample input:**

```
1
3 4
0001
0011
0110
```

**Sample output:**

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

---

Added by: Piotr Łowiec  
Date: 2004-09-13  
Time limit: 4s  
Source limit: 50000B  
Languages: All  
Resource: 6th Polish Olympiad in Informatics, stage 2

## SPOJ Problem Set (classical)

### 207. Three-coloring of binary trees

#### Problem code: THREECOL

A **tree** consists of a node and some (zero, one or two) subtrees connected to it. These subtrees are called children.

A **specification** of the tree is a sequence of digits. If the number of children in the tree is:

- zero, then the specification is a sequence with only one element '0';
- one, the specification begins with '1' followed by the specification of the child;
- two, the specification begins with '2' followed by the specification of the first child, and then by the specification of the second child.

Each of the vertices in the tree must be painted either red or green or blue. However, we need to obey the following rules:

- the vertex and its child cannot have the same color,
- if a vertex has two children, then they must have different colors.

How many vertices may be painted green?

#### Task

Write a program which:

- reads the specification of the tree from the standard input,
- computes the maximal and the minimal number of vertices that may be painted green,
- writes the results in the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. Each test case consists of one word (no longer than 10000 characters), which is a specification of a tree.

#### Output

Your program should write for each test case exactly two integers separated by a single space, which respectively denote the maximal and the minimal number of vertices that may be painted green.

#### Example

**Sample input:**

1

1122002010

**Sample output:**

5 2

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 3

## SPOJ Problem Set (classical)

### 208. Store-keeper

#### Problem code: STORE

The floor of a store is a rectangle divided into  $n*m$  square fields. Two fields are adjacent, if they have a common side. A parcel lays on one of the fields. Each of the remaining fields is either empty, or occupied by a case, which is too heavy to be moved by a store-keeper. The store-keeper has to shift the parcel from the starting field **P** to the final field **K**. He can move on the empty fields, going from the field on which he stands to a chosen adjacent field. When the store-keeper stays on a field adjacent to the one with the parcel he may push the parcel so that it moves to the next field (i.e. the field on the other side of the parcel), assuming condition that there are no cases on this field.

#### Task

Write a program, which:

- reads from the standard input a store scheme, a starting position of the store-keeper and a final position of the parcel,
- computes minimal number of the parcel shifts through borders of fields, which are necessary to put the parcel in the final position or decides that it is impossible to put the parcel there,
- writes the result into the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case two positive integers separated by a single space,  $n, m \leq 100$ , are written. These are dimensions of the store. In each of the following  $n$  lines there appears one  $m$ -letter word made of letters S, M, P, K, w. A letter on  $i$ -th position in  $j$ -th word denotes a type of the field with coordinates  $(i, j)$  and its meaning is following:

- S - case,
- M - starting position of the store-keeper,
- P - starting position of the parcel,
- K - final position of the parcel,
- w - empty field.

Each letter M, P and K appears in the test case exactly once.

#### Output

Your program should write to the standard output for each test case:

- exactly one word NO if the parcel cannot be put on the target field,
- exactly one integer, equal to the minimal number of the parcel shifts through borders of the fields, necessary to put a parcel on a final position, if it is possible to put the parcel there.



## Example

**Sample input:**

```
1
10 12
SSSSSSSSSSSS
SwwwwwwwSSSS
SwSSSSwwSSSS
SwSSSSwwSKSS
SwSSSSwwSwSS
SwwwwwPwwwww
SSSSSSSwSwSw
SSSSSSMwSwww
SSSSSSSSSSSS
SSSSSSSSSSSS
```

**Sample output**

7

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 3

## SPOJ Problem Set (classical)

### 209. The Map

#### Problem code: MAP

After a new administrative division of Byteland cartographic office works on a new demographic map of the country. Because of technical reasons only a few colors can be used. The map should be colored so that regions with the same or similar population (number of inhabitants) have the same color. For a given color  $k$  let  $A(k)$  be the number, such that:

- at least half of regions with color  $k$  has population not greater than  $A(k)$
- at least half of regions with color  $k$  has population not less than  $A(k)$

A **coloring error of a region** is an absolute value of the difference between  $A(k)$  and the region's population. A **cumulative error** is a sum of coloring errors of all regions. We are looking for an optimal coloring of the map (the one with the minimal cumulative error).

#### Task

Write a program which:

- reads the population of regions in Byteland from the standard input,
- computes the minimal cumulative error,
- writes the result to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case an integer  $n$  is written, which is the number of regions in Byteland,  $10 < n < 3000$ . In the second line the number  $m$  denoting the number of colors used to color the map is written,  $2 \leq m \leq 10$ . In each of the following  $n$  lines there is one non-negative integer - a population of one of the regions of Byteland. No population exceeds  $2^{30}$ .

#### Output

Your program should write for each test case one integer number equal to a minimal cumulative error, which can be achieved while the map is colored (optimally).

#### Example

Sample input:

```
1
11
3
21
14
6
18
10
```

2  
15  
12  
3  
2  
2

**Sample output:**

15

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 3

## SPOJ Problem Set (classical)

### 210. The Altars

#### Problem code: ALTARS

According to Chinese folk beliefs evil spirits can move only on a straight line. It is of a great importance when temples are built. The temples are constructed on rectangular planes with sides parallel to the north - south or east - west directions. No two of the rectangles have common points. An entrance is situated in the middle of one of four walls and its width is equal to the half of the length of the wall. An altar appears in the center of the temple, where diagonals of the rectangle intersect. If an evil spirit appears in this point, a temple will be profaned. It may happen only if there exists a ray which runs from an altar, through an entrance to infinity and neither intersects nor touches walls of any temple (on a plane parallel to the plane of a construction area), i.e. one can draw at a construction area a line which starts at the altar and runs to the infinity without touching any wall.

#### Task

Write a program which:

- reads descriptions of the temples from the standard input,
- verifies which temples could be profaned,
- writes their numbers to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case one integer  $n$ , the number of temples  $1 \leq n \leq 1000$ , is written.

In each of the following  $n$  lines there is a description of one temple (in  $i$ -th line a description of the  $i$ -th temple). The description of a temple consists of four non-negative integers, not greater than 8000 and a letter E, W, S or N. Two first numbers are coordinates of a temple's northern-west corner and two following are coordinates of an opposite southern-east corner. In order to specify coordinates of a point first we give its geographical longitude, which increases from the west to the east, and then its latitude, which increases from the south to the north. The fifth element of the description indicates the wall with the entrance (E - Eastern, W - Western, S - Southern, N - Northern). The elements of the temple's description are separated by single spaces.

#### Output

In the following lines of the output for each test case your program should write in ascending order numbers of the temples, which may be profaned by an evil spirit. Each number is placed in a separate line. If there are no such numbers, you should write one word: NONE.

## Example

Sample input

```
6
1 7 4 1 E
3 9 11 8 S
6 7 10 4 N
8 3 10 1 N
11 4 13 1 E
14 8 20 7 W
```

Sample output

```
1
2
5
6
```

The picture shows the temples described in the example. The dashed lines show possible routes of evil spirits.

[IMAGE]

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 3

## SPOJ Problem Set (classical)

### 211. Primitivus recurencis

#### Problem code: PRIMIT

A **genetic code** of the abstract primitivus (*Primitivus recurencis*) is a series of natural numbers  $K=(a_1, \dots, a_n)$ . A **feature** of primitivus we call each ordered pair of numbers  $(l, r)$ , which appears successively in the genetic code, i.e. there exists such  $i$  that  $l=a_i$ ,  $r=a_{i+1}$ . There are no  $(p, p)$  features in a primitivus' genetic code.

#### Task

Write a program which:

- reads the list of the features from the standard input,
- computes the length of the shortest genetic code having given features,
- writes the results to the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case one positive integer number  $n$  is written. It is the number of different features of the primitivus. In each of the following  $n$  lines there is a pair of natural numbers  $l$  and  $r$  separated by a single space,  $1 \leq l \leq 1000$ ,  $1 \leq r \leq 1000$ . A pair  $(l, r)$  is one of the primitivus' features. The features do not repeat in the input file

#### Output

Your program should write for each test case exactly one integer number equal to the length of the shortest genetic code of the primitivus, comprising the features from the input.

#### Example

**Sample input:**

```
1
12
2 3
3 9
9 6
8 5
5 7
7 6
4 5
5 1
1 4
4 2
2 8
```

8 6

**Sample output:**

15

All the features from the example are written in the following genetic code:

(8, 5, 1, 4, 2, 3, 9, 6, 4, 5, 7, 6, 2, 8, 6)

**Warning: enormous Input/Output data, be careful with certain languages**

---

Added by: Piotr Łowiec

Date: 2004-09-13

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: 6th Polish Olympiad in Informatics, stage 3

## SPOJ Problem Set (classical)

### 212. Water among Cubes

#### Problem code: WATER

On a rectangular mesh comprising  $n*m$  fields,  $n*m$  cuboids were put, one cuboid on each field. A base of each cuboid covers one field and its surface equals to one square inch. Cuboids on adjacent fields adhere one to another so close that there are no gaps between them. A heavy rain pelted on a construction so that in some areas puddles of water appeared.

#### Task

Write a program which:

- reads from the standard input a size of the chessboard and heights of cuboids put on the fields,
- computes maximal water volume, which may gather in puddles after the rain,
- writes results in the standard output.

#### Input

The number of test cases  $t$  is in the first line of input, then  $t$  test cases follow separated by an empty line. In the first line of each test case two positive integers  $1 \leq n \leq 100$ ,  $1 \leq m \leq 100$  are written. They are the size of the mesh. In each of the following  $n$  lines there are  $m$  integers from the interval  $[1..10000]$ ;  $i$ -th number in  $j$ -th line denotes a height of a cuboid given in inches put on the field in the  $i$ -th column and  $j$ -th row of the chessboard.

#### Output

Your program should write for each test case one integer equal to the maximal volume of water (given in cubic inches), which may gather in puddles on the construction.

#### Example

**Sample input:**

```
1
3 6
3 3 4 4 4 2
3 1 3 2 1 4
7 3 1 6 4 1
```

**Sample output:**

```
5
```

The picture below shows the mesh after the rain (seen from above). Puddles are drawn in gray.

[IMAGE]

[IMAGE]



---

Added by: Piotr Łowiec  
Date: 2004-09-13  
Time limit: 7s  
Source limit: 50000B  
Languages: All  
Resource: 6th Polish Olympiad in Informatics, stage 3

## SPOJ Problem Set (classical)

### 215. Panic in the Plazas

#### Problem code: PANIC

Have you ever heard of the BBFO? The Bytelandian Bit-eating Fanatic Organisation regards itself as a collection of people with slightly unorthodox views on law and order in the world, and is regarded by others as the most wildly dangerous and unpredictable terrorist organisation which afflicts the small and otherwise peaceful country of Byteland.

Intelligence reports claim that the next act of violence to be performed by the BBFO is a widescale, distributed bomb attack in the Bytelandian capital. Therefore, all precautions have been undertaken to prevent any such action. The BBFO, seeing the futility of their original scheme, decided to change the plan of action. The new idea is endowed with devilish simplicity.

The capital of Byteland is a network of plazas, some of which (but not necessarily all) are connected by bidirectional streets of different length. Crowds of people are sitting at all the plazas, sipping coffee and generally relaxing. The terrorists plan to creep up to some of the plazas armed with inflatable paper bags. Then, exactly at midday, all the bags will be burst in such a way as to simulate the bang of a bomb. Panic will ensue at the plazas where the bags were burst, and will spread throughout some of the city. Panic breaks out at a plaza the moment a bag explodes in it, or immediately after a panicking crowd rushes into the plaza from at least one of the side streets. The people in the plaza then split up into crowds, which rush out by all possible streets except those by which people have just run in. After entering a street, a crowd runs along it at constant speed until it reaches the plaza at the other end, causing panic there, etc. If there is no possible way of escape from a plaza, everybody in it perishes. Similarly, if two crowds rushing in opposite directions collide in mid-street, all the people are lethally trampled.

A small illustration

Despite the panic, people in the city retain a little free will. They don't move at all until the panic reaches them, but when they have to escape, they can always choose the escape route from a plaza that suits them best. Assuming you were to sit in one of the plazas of Byteland at noon that fateful day... which plaza would you choose to sit in? All your normal preferences concerning the quality of coffee in the cafes are temporarily forgotten, and your only aim is to survive as long as possible.

#### Input

The first line of input contains a single integer  $t \leq 500$ , the number of test cases.  $t$  test cases follow. Each test case begins with a line containing three integers  $n$   $m$   $k$  ( $1 \leq n \leq 50000$ ,  $0 \leq m \leq 250000$ ,  $0 \leq k \leq n$ ) denoting the total number of plazas, the number of streets in the city, and the number of plazas in which bags are planted, respectively. Each of the following  $m$  lines contains 4 integers  $u$   $v$   $t_{uv}$   $t_{vu}$  ( $1 \leq u, v \leq n$ ,  $1 \leq t_{uv}, t_{vu} \leq 1000$ ) representing a single road in the city - leading from plaza  $u$  to plaza  $v$  and requiring  $t_{uv}$  time to cover when running at constant speed from  $u$  to  $v$ , and  $t_{vu}$  time when running the other way. The last line of a test case description contains a list of the  $k$  numbers of plazas at which bags explode at noon.

## Output

For each test case, the output should contain a single line with a space separated increasing sequence of integers - the numbers of all the plazas which offer the maximum possible survival time to a person sitting there at noon.

## Example

**Input :**

```
2

4 5 2
1 2 10 10
2 4 30 30
3 2 10 10
4 3 50 5
3 1 5 50
1 2

2 0 1
2
```

**Output :**

```
2 3 4
1
```

(In the first case the life expectancy is 22.5, in the second case it is more or less infinite.)

**Warning: enormous Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-09-27

Time limit: 17s

Source limit: 50000B

Languages: All

Resource: DASM Programming League 2004 (problemset 2)

## SPOJ Problem Set (classical)

### 217. Soldiers on Parade

#### Problem code: SOPARADE

Protocol is really weird in Byteland. For instance, it is required that, when presenting arms before an officer, soldiers should stand in a single row (at positions numbered from 1 to  $n$ ). Soldiers may have one of 4 possible ranks, distinguished by the number of squiggles on the epaulets (between 1 and 4). Soldiers standing beside each other must have a difference in rank of at least two squiggles. Moreover, there are additional sets of rules (different for every province). Each rule states that soldiers standing at some given positions of the row must differ in rank by at least a squiggle.

Starting from the new year onwards, some provinces are changing their set of protocol rules. As the Senior Military Secretary of Protocol, it is your task to approve the new rules. To your surprise, some of the provinces have put forward protocol rules which are quite impossible to fulfill, even if the soldiers were to be specially selected for the purpose of presenting arms. Detect all such offending provinces and on no account approve their laws.

#### Input

The first line of input contains a single positive integer  $t \leq 10$  - the number of provinces which are proposing new laws.  $t$  sets of rules follow, separated by empty lines.

Each set of rule begins with a line containing two non-negative integers  $n$   $p$  ( $n \leq 100000$ ,  $p \leq 100000$ ) - the number of soldiers arranged and the number of rules proposed in the province, respectively. Each of the next  $p$  lines contains a single rule: an integer  $b_i$  ( $2 \leq b_i \leq n$ ), followed by  $b_i$  integers  $a_1, a_2, \dots, a_{b_i}$  ( $1 \leq a_k \leq n$ ). Such a rule means that soldiers standing at positions  $a_1, a_2, \dots, a_{b_i}$  must all be of different rank.

#### Output

For every set of rules presented at input, output a single line containing the word *rejected* if no unit of soldiers can be arranged in accordance with protocol, or the word *approved* in the opposite case.

#### Example

**Input :**

2

2 1

2 1 2

5 2

3 1 3 2

4 2 3 4 5

**Output :**

approved

rejected

---

Added by: Adrian Kosowski

Date: 2004-10-08

Time limit: 9s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004 (problemset 1)

## SPOJ Problem Set (classical)

### 220. Relevant Phrases of Annihilation

#### Problem code: PHRASES

You are the King of Byteland. Your agents have just intercepted a batch of encrypted enemy messages concerning the date of the planned attack on your island. You immediately send for the Bytelandian Cryptographer, but he is currently busy eating popcorn and claims that he may only decrypt the most important part of the text (since the rest would be a waste of his time). You decide to select the fragment of the text which the enemy has strongly emphasised, evidently regarding it as the most important. So, you are looking for a fragment of text which appears in all the messages disjointly at least twice. Since you are not overfond of the cryptographer, try to make this fragment as long as possible.

#### Input

The first line of input contains a single positive integer  $t \leq 10$ , the number of test cases.  $t$  test cases follow. Each test case begins with integer  $n$  ( $n \leq 10$ ), the number of messages. The next  $n$  lines contain the messages, consisting only of between 2 and 10000 characters 'a'-'z', possibly with some additional trailing white space which should be ignored.

#### Output

For each test case output the length of longest string which appears disjointly at least twice in all of the messages.

#### Example

**Input :**

```
1
4
abbabba
dabddkababa
bacaba
baba
```

**Output :**

```
2
```

(in the example above, the longest substring which fulfills the requirements is 'ba')

---

Added by: Adrian Kosowski

Date: 2004-10-11

Time limit: 9s

Source limit: 50000B

Languages: All

Resource: DASM Programming League 2004 (problemset 1)

## SPOJ Problem Set (classical)

### 224. Vonny and her dominos

#### Problem code: VONNY

Vonny loves playing with dominos. And so she owns a standard set of dominos. A standard set of dominos consists of 28 pieces called bones, tiles or stones. Each bone is a rectangular tile with a line dividing its face into two square ends. Each square is labeled with a number between 0 and 6. The 28 stones are labeled (0,0),(0,1),(0,2),(0,3),(0,4),(0,5),(0,6), (1,1),(1,2),..., (5,5),(5,6),(6,6). Tommy - the brother of Vonny - build a box for Vonny's dominos. This box is sized 7 x 8 squares. Every square is labeled with a number between 0 and 6. You can see a example box here.

```
0 3 0 2 2 0 2 3
1 5 6 5 5 1 2 2
3 4 1 4 5 4 4 4
6 6 1 0 5 2 3 0
4 0 3 2 4 1 6 0
1 4 1 5 6 6 3 0
1 2 6 5 5 6 3 3
```

Now Vonny wants to arrange her 28 stones in such way that her stones cover all squares of the box. A stone can only be placed on two adjacent squares if the numbers of the squares and of the domino stone are equal. Tommy asks Vonny in how many different ways she can arrange the dominos. Tommy assumes that Vonny need a lot of time to answer the question. And so he can take some of Vonny's candies while she solves the task. But Vonny is a smart and clever girl. She asks you to solve the task and keeps an eye on her candies.

#### Input

The first line of the input contains the number of testcases. Each case consists of 56 numbers (7 rows and 8 cols) between 0 and 6 which represents Tommy's box.

#### Output

For each testcase output a single line with the number which answers Tommy's question.

#### Example

**Input :**

```
2
0 3 0 2 2 0 2 3
1 5 6 5 5 1 2 2
3 4 1 4 5 4 4 4
6 6 1 0 5 2 3 0
4 0 3 2 4 1 6 0
1 4 1 5 6 6 3 0
1 2 6 5 5 6 3 3

5 3 1 0 0 1 6 3
0 2 0 4 1 2 5 2
1 5 3 5 6 4 6 4
```

```
0 5 0 2 0 4 6 2
4 5 3 6 0 6 1 1
2 3 5 3 4 4 5 3
2 1 1 6 6 2 4 3
```

**Output :**

18

1

---

Added by: Simon Gog

Date: 2004-10-18

Time limit: 20s

Source limit:50000B

Languages: All



## SPOJ Problem Set (set2)

### 226. Jewelry and Fashion

#### Problem code: JEWELS

You work for a small jewelers' company, renowned for the exquisite necklaces and multi-colored amber strings it produces. For the last three centuries, the sales of strings alone have been enough to keep business going without a hitch. Now however, the influence of fashion is greater than ever, and you face the prospect of imminent bankruptcy unless you adapt to the needs and fancies of the rather unusual part of society who constitute your main clientele. These elderly ladies have recently decided that fashion has changed: strings are out, and earrings are in. There is nothing to be done about it -- you have to comply and switch to the production of earrings.

One problem remains: what to do with the impressive heap of amber strings piled up in your shop? One of your assistants has a bright idea: he recommends cutting the strings into two parts, removing some stones to make both parts have an identical color pattern (either immediately, or after rotation by 180 degrees), and selling what remains as pairs of earrings. After a moment's thought, you decide to go ahead with the plan. But your careful managerial eye tells you that minimising the number of wasted (removed) stones may not be as easy as it sounds...

Example of string2earring conversion ;)

#### Input

The first line of input contains a single integer  $t \leq 500$ , the number of test cases. The next  $t$  lines contain one test case each, in the form of a string of at most 8000 characters 'a'-'z' (terminated by a new line, optionally preceded by whitespace which should be ignored). The  $i$ -th character of the line corresponds to the design on the  $i$ -th stone in the amber string it represents. The total length of the input file is not more than 100kB.

#### Output

For each test case output two numbers: the largest possible total length of the pair of earrings which can be produced from the string, and a positive integer denoting the number of the stone after which the string ought to be cut so as to achieve this. If more than one cutting position is possible, output the leftmost (smallest) one.

#### Example

**Input :**

```
3
abcacdd
acbddabedff
abcbca
```

**Output :**

```
4 3
6 4
4 2
```

(the first case is illustrated in the figure, in the second case we produce a pair of earrings of the form 'abd', in the third - a pair of earrings which look like 'ab' after rotating the second one by 180 degrees).

---

Added by: Adrian Kosowski

Date: 2004-10-29

Time limit: 25s

Source limit:50000B

Languages: All except: C99 strict

Resource: DASM Programming League 2004, problemset 2

## SPOJ Problem Set (classical)

### 227. Ordering the Soldiers

#### Problem code: ORDERS

As you are probably well aware, in Byteland it is always the military officer's main worry to order his soldiers on parade correctly. In Bitland ordering soldiers is not really such a problem. If a platoon consists of  $n$  men, all of them have different rank (from 1 - lowest to  $n$  - highest) and on parade they should be lined up from left to right in increasing order of rank.

Sounds simple, doesn't it? Well, Msgt Johnny thought the same, until one day he was faced with a new command. He soon discovered that his elite commandos preferred to do the fighting, and leave the thinking to their superiors. So, when at the first rollcall the soldiers lined up in fairly random order it was not because of their lack of discipline, but simply because they couldn't work out how to form a line in correct order of ranks. Msgt Johnny was not at all amused, particularly as he soon found that none of the soldiers even remembered his own rank. Over the years of service every soldier had only learned which of the other soldiers were his superiors. But Msgt Johnny was not a man to give up easily when faced with a true military challenge. After a moment's thought a solution of brilliant simplicity struck him and he issued the following order: "men, starting from the left, one by one, do: (step forward; go left until there is no superior to the left of you; get back in line)". This did indeed get the men sorted in a few minutes. The problem was solved... for the time being.

The next day, the soldiers came in exactly the same order as the day before, and had to be rearranged using the same method. History repeated. After some weeks, Msgt Johnny managed to force each of his soldiers to remember how many men he passed when going left, and thus make the sorting process even faster.

If you know how many positions each man has to walk to the left, can you try to find out what order of ranks the soldiers initially line up in?

#### Input

The first line of input contains an integer  $t \leq 50$ , the number of test cases. It is followed by  $t$  test cases, each consisting of 2 lines. The first line contains a single integer  $n$  ( $1 \leq n \leq 200000$ ). The second line contains  $n$  space separated integers  $w_i$ , denoting how far the  $i$ -th soldier in line must walk to the left when applying Msgt Johnny's algorithm.

#### Output

For each test case, output a single line consisting of  $n$  space separated integers - the ranks of the soldiers, given from left to right in their initial arrangement.

## Example

**Input :**

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

**Output :**

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

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-10-30

Time limit: 13s

Source limit: 50000B

Languages: All

Resource: DASM Programming League 2004, problemset 2

## SPOJ Problem Set (classical)

### 228. Shamans

#### Problem code: SHAMAN

In the far bare land there lives a mysterious tribe. They suffer from drought every year but they stick to their faith in god that they will never leave their home land. To counter the dry weather the shamans in the tribe must pray during the hard time and hope the blessed rain will aid their production of food.

There are 4 chief shamans in the tribe and each of them will choose a summit in the territory to proceed with his praying. The area in which the shamans' spells take effect will be the quadrangle they form, each of them being one of its vertices (which the god will see when he looks down from the high heavens). The land is quite full of pinch and punch and the tribe has selected quite a few peaks for the shamans to pray on. Of course the area of the quadrangle is expected to be as large as possible so before the shamans actually go out, they will have to choose the 4 peaks that best suit their purpose.

#### Input

One integer in the first line, stating the number of test cases, followed by a blank line. There will be not more than 80 tests.

For each test case, the first line is an integer  $n$  ( $4 \leq n \leq 2000$ ) stating the number of peaks. Then  $n$  lines follow, each presenting the position of a peak, with two integers  $x, y$  ( $-20000 \leq x, y \leq 20000$ ).

The test cases will be separated by a single blank line.

#### Output

A floating point number with exactly 1 digit precision: the maximum area the shamans can cover.

#### Example

**Input :**

2

4

0 0

1 0

1 1

0 1

4

0 0

0 1

1 1

1 0

**Output :**

1.0

1.0

---

Added by: Neal Zane  
Date: 2004-11-02  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: Neal Zane

## SPOJ Problem Set (classical)

### 229. Sorting is easy

#### Problem code: SORTING

Do you think sorting is easy?  
try your luck  
in brainfuck

**For those who don't know that brainfuck is a programming language: Take a look at the converter to C. It will ignore every unknown command, therefore submitting a program in any other language won't necessarily lead to compile error, but certainly not to Accepted.**

#### Input

The input consists of a line of up to 1000 uppercase letters, terminated with a '\n' character (ASCII value 10).

#### Output

The output should contain a line consisting of the same characters as the input line, but in non-descending order.

#### Example

**Input :**

BRAINFULCK

**Output :**

ABCFIKNRU

---

Added by: Adrian Kuegel  
Date: 2004-11-04  
Time limit: 1s  
Source limit: 500B  
Languages: BF  
Resource: own problem

## SPOJ Problem Set (classical)

### 231. The Zebra Crossing

#### Problem code: ZEBRA

Have you ever wondered why people collide with each other at pedestrian crossings? The reasons are probably difficult to analyse from a scientific point of view, but we can hazard a guess. A part of the problem seems to be that the statistical pedestrian, when faced with a red light, will either cross at once (this category of pedestrians doesn't really interest us, since they tend to collide with cars rather than with each other), or will stop dead and stand still until the light changes. Only when the light turns green does he begin to act rationally and heads for his destination using the shortest possible path. Since this usually involves crossing the road slightly on the bias, he will inevitably bump into someone going across and heading another way.

One day, while you are approaching the traffic lights you usually cross at, you begin to wonder how many other people you could possibly collide with if you really wanted. All the people are standing at different points on the same side of the street as you are. From past observations you can predict the exact angle and speed at which individual pedestrians are going to cross. You can decide at which point along the side of the street you will wait for the green light (any real coordinate other than a place where some other pedestrian is already standing) and at what angle and at what speed you intend to cross. There is an upper bound on the speed you may cross at.

Assume that once the light turns green, all pedestrians start moving along straight lines, at constant speed, and that collisions, however painful they may be, have no effect on their further progress. Since you wouldn't like to arouse anyone's suspicions, you also have to cross in accordance with these rules. A collision only occurs if at a given moment of time you have exactly the same x and y coordinates as some other pedestrian.

#### Input

Input starts with a single integer  $t$ , the number of test cases ( $t \leq 100$ ).  $t$  test cases follow.

Each test case begins with a line containing three integers  $n$   $w$   $v$ , denoting the number of people other than you who wish to cross the street, the width of the street expressed in meters, and the maximum speed you can walk at given in meters per second, respectively ( $1 \leq n \leq 10000$ ,  $1 \leq w \leq 100$ ,  $1 \leq v \leq 10000$ ). Each of the next  $n$  lines contains three integers  $x_i$   $t_i$   $a_i$ , which describe the starting position of the  $i$ -th pedestrian measured in meters, the time (in seconds) he takes to cross the street, and the angle at which he is walking with respect to the line normal to the sides of the street, expressed in 1/60 parts of a degree ( $-10000 \leq x_i \leq 10000$ ,  $1 \leq t_i \leq 10000$ ,  $-5000 \leq a_i \leq 5000$ ).

Illustration of problem input

#### Output

For each test case output a single integer -- the maximum number of people you can collide with by the time you reach the opposite side of the street.



## Example

### Input :

```
1
5 20 2
-20 10 2700
20 10 -2700
-5 1 4000
-4 1 4000
5 1 -4000
```

### Output :

```
2
```

(In the example, due to the imposed speed limit, it is only possible to collide with the first two pedestrians while crossing the street, at the last possible moment.)

---

Added by: Adrian Kosowski

Date: 2004-11-13

Time limit: 17s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004, problemset 7

## SPOJ Problem Set (classical)

### 234. Getting Rid of the Holidays (Act I)

#### Problem code: HOLIDAY1

King Johnny of Byteland has in his short period of sovereignty established quite a few national holidays (close on thirty, in fact) in honour of... more or less anything he could think of. Each of these holidays occurs every a fixed number of days (possibly different for every holiday), and is accompanied by feasts, cabaret shows, and general merrymaking. Sometimes more than one holiday occurs on a single day, and once in a while all holidays take place on the same day. If this happens, the celebrations are combined and even more festive. After one such party, king Johnny started behaving strangely and had to be temporarily isolated from society.

For the period of king Johnny's absence (about 48 hours) you have been appointed Regent of Byteland. As a true patriot, you know that holidays are not good for the people, and would like to remove some before king Johnny returns (he won't mind, he never remembers anything after a party anyway). The people however, very sadly, don't know what is good for them, and will revolt if you remove more than  $k$  holidays. Try to choose the holidays you remove in such a way as to guarantee that the number of days which elapse between two consecutive holiday parties is as long as possible.

**Solve the problem in at most 4kB of source code.**

#### Input

The first line of input contains a single integer  $t \leq 200$  - the number of test cases.  $t$  test case descriptions follow.

For each test case, the first line contains two space separated integers  $n$   $k$  ( $1 \leq k < n \leq 30$ ), denoting the total number of holidays and the number of holidays to be removed. The next line contains  $n$  space separated integers, the  $i$ -th being  $t_i$  ( $1 \leq t_i \leq 10^{18}$ ) - the number of days every which the  $i$ -th holiday occurs.

#### Output

For each test case, output one line containing an increasing sequence of exactly  $k$  integers - the numbers of the holidays to be removed (holidays are numbered in the input order from 1 to  $n$ ).

#### Example

**Input :**

```
1
5 2
6 13 10 15 7
```

**Output :**

```
2 5
```

(The shortest period between two successive holiday parties is 2 days.)

---

Added by: Adrian Kosowski

Date: 2004-11-25

Time limit: 17s

Source limit:4096B

Languages: All

Resource: DASM Programming League 2004, problemset 4

## SPOJ Problem Set (classical)

### 235. Very Fast Multiplication

#### Problem code: VFMUL

Multiply the given numbers.

#### Input

`n` [the number of multiplications  $\leq 101$ ]

`l1 l2` [numbers to multiply (at most 300000 decimal digits each)]

Text grouped in [ ] does not appear in the input file.

#### Output

The results of multiplications.

#### Example

Input:

```
5
4 2
123 43
324 342
0 12
9999 12345
```

Output:

```
8
5289
110808
0
123437655
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Darek Dereniowski

Date: 2004-11-27

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: PAL

## SPOJ Problem Set (classical)

### 236. Converting number formats

#### Problem code: ROMAN

Given the number  $n$  of test cases, convert  $n$  positive integers less than  $2^{32}$  (given one per line) from one representation to another. For convenience,  $n$  is given in the same format as the other numbers.

#### Input

Input is given by spelling the number in english digits (all upper case letters). Thus the range of (32-bit) input values permissible extends from ZERO (or OH) through FOUR TWO NINE FOUR NINE SIX SEVEN TWO NINE FIVE.

#### Output

Output 2 lines for each test case. Output is in the form of "extended" Roman numerals (also called "butchered" Roman numerals), with an overline (see sample for details) indicating the value below is "times 1000", and lower-case letters indicating "times 1000000". Thus, the range of (32-bit) output values possible is from through ivccxcivCMLXVII<sup>CCXCV</sup>, where there is a line above iv and CMLXVII. Note: For values whose residues modulo 1000000 are less than 4000, M is used to represent 1000; for values whose residues are 4000 or greater, I is used. Thus 3999 would read out as MMMCMXCIX while 4000 would readout as IV with an overline. Similar rules apply to the use of M and i for 1000000, and to that of m and i for 1000000000.

**WARNING: This problem has a somewhat strict source limit**

#### Example

**Input :**

```
THREE
FOUR OH
ONE NINE NINE NINE NINE NINE NINE NINE NINE NINE
ONE TWO THREE ZERO FOUR FIVE
```

**Output :**

```
XL
_____
mcmxcivCMXCIXCMXCIX
_____
CXXMMMXLV
```

---

Added by: Robin Nittka

Date: 2004-11-30

Time limit: 9s

Source limit:2048B

Languages: All

## SPOJ Problem Set (classical)

### 237. Sums in a Triangle

#### Problem code: SUMITR

Let us consider a triangle of numbers in which a number appears in the first line, two numbers appear in the second line etc. Develop a program which will compute the largest of the sums of numbers that appear on the paths starting from the top towards the base, so that:

- on each path the next number is located on the row below, more precisely either directly below or below and one place to the right;
- the number of rows is strictly positive, but less than 100;
- all numbers are positive integers between 0 and 99.

Take care about your fingers, do not use more than **256** bytes of code.

#### Input

In the first line integer  $n$  - the number of test cases (equal to about 1000). Then  $n$  test cases follow. Each test case starts with the number of lines which is followed by their content.

#### Output

For each test case write the determined value in a separate line.

#### Example

**Input :**

```
2
3
1
2 1
1 2 3
4
1
1 2
4 1 2
2 3 1 1
```

**Output :**

```
5
9
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Łukasz Kuszner

Date: 2004-12-01

Time limit: 2s

Source  
limit: 256B

Languages: All

Resource: 6-th International Olympiad In Informatics July 3-10. 1994. Stockholm - Sweden,  
Problem 1

## SPOJ Problem Set (classical)

### 238. Getting Rid of the Holidays (Act II)

#### Problem code: HOLIDAY2

As King Johnny's temporary indisposition lengthens from days to weeks, and you still hold the office of Regent of Byteland, you begin to feel that acting king is not all that much fun. You encounter various absurdly weird problems. For instance, you find that contrary to your expectations the recent removal of holidays brought about a decrease in the efficiency of the kingdom's workforce.

There appears to be only one rational explanation for all this. It seems that although every holiday occurs every a fixed number of days, the periods between consecutive holidays are long and very irregular. And it is the lack of regularity that is the root of the problem.

So, you decide it is time to tackle the problem once again, and solve it properly this time. Your main purpose is to establish an  $r$ -day working rhythm (for some integer  $r$ ). Workers will work for  $(r-1)$  days, have a single day off, work for another  $(r-1)$  days, and so on. The rhythm must be arranged in such a way that holidays only ever occur on the day off work. Choose exactly  $k$  of the  $n$  holidays to remove in such a way as to be able to establish a working rhythm of the maximum possible length  $r$ .

**Solve the problem in at most 4kB of source code.**

#### Input

The first line of input contains a single integer  $t \leq 100$  - the number of test cases.  $t$  test case descriptions follow.

For each test case, the first line contains two space separated integers  $n$   $k$  ( $1 \leq k < n \leq 100$ ), denoting the total number of holidays and the number of holidays to be removed. The next line contains  $n$  space separated integers, the  $i$ -th being  $t_i$  ( $1 \leq t_i \leq 10^{18}$ ) - the number of days every which the  $i$ -th holiday occurs.

#### Output

For each test case, output one line containing an increasing sequence of exactly  $k$  integers - the numbers of the holidays to be removed (holidays are numbered in the input order from 1 to  $n$ ).

#### Example

**Input :**

```
2
6 4
1 3 4 5 6 1
8 4
200 125 200 999 380 500 200 500
```

**Output :**

```
1 3 4 6
2 4 5 6
```



(In the first test case  $r$  is equal to 3 days, in the second case it is equal to 100 days. For the second test case the output '1 2 4 5', '2 3 4 5', '2 4 5 6', '2 4 5 7' or '2 4 5 8' is also correct.)

---

Added by: Adrian Kosowski

Date: 2004-12-07

Time limit: 17s

Source limit: 4096B

Languages: All

Resource: DASM Programming League 2004, problemset 4

## SPOJ Problem Set (classical)

### 239. Tour de Byteland

#### Problem code: BTOUR

As the mayor of Byteland's term of office draws to a close, he starts his preparations for reelection. For the first time in the 40 years of his political career his chances of victory seem somewhat uncertain. His main cause of worry are the disturbing results of an opinion poll which state that over 90% of the citizens regard the mayor as a portly, heavily smoking individual who sleeps in his armchair more or less all day.

After careful consultation with his public relations director, the mayor has decided to change his image. He is going to organise, sponsor and compete in... Byteland's first bicycle race! Quite naturally, the only relevant part of the race is the media coverage of the mayor; everything else is to be done at minimum cost. The street-map of Byteland consists of a not necessarily planar system of bi-directional street segments connecting intersections, in such a way that between 0 and 4 street segments meet at an intersection. The cyclists are to ride round and round a simple loop (a fixed, closed route consisting of several street segments, such that a cyclist goes along a street and through an intersection exactly once in each round). For innumerable reasons (not so difficult to guess at) the mayor would like to choose the shortest possible route for the race (in the sense of total street length). Help him determine the length of such a loop, and tell him how many different shortest loops he can choose from when organising the race.

#### Input

The input starts with a line containing a single integer  $t \leq 200$ , the number of test cases.  $t$  test cases follow.

Each test case begins with a line with two integers  $n$   $m$ , denoting the number of intersections and the number of streets in Byteland, respectively ( $1 \leq n \leq 1000$ ).  $m$  lines follow, each containing three integers  $u_i$   $v_i$   $d_i$ , denoting the end points and the length of the  $i$ -th street segment, respectively ( $1 \leq u_i \leq v_i \leq n$ ,  $1 \leq d_i \leq 10^6$ ).

#### Output

For each test case output a single line containing exactly two space separated non-negative integers  $d$   $c$  - the length of the shortest possible race loop, and the number of routes of this length in the graph. Output 0 0 if the race cannot be held.

#### Example

**Input :**

```
2
3 2
1 2 1
1 3 2
4 6
1 2 5
1 4 5
```

2 3 4  
2 4 5  
3 4 5  
3 1 5

**Output :**

0 0  
14 2

---

Added by: Krzysztof Kluczek

Date: 2004-12-09

Time limit: 17s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004, problemset 4

## SPOJ Problem Set (classical)

### 241. Arranging the Blocks

#### Problem code: BLOCKS

A group of  $n$  children are playing with a set of  $n^2$  flat square blocks. Each block is painted from above with one colour, and there are no more than 2 blocks of each colour. The blocks are initially arranged in an  $n \times n$  square forming some sort of picture.

The children have been provided with some other  $n \times n$  picture and asked to rearrange the blocks to that form. Since this is not really what they enjoy doing most, they intend to solve the task together and spend as little time on it as possible. Thus, every minute each child chooses a single  $1 \times n$  row or  $n \times 1$  column of blocks to rearrange. This row/column may never intersect with rows/columns chosen by other children in the same minute. A child takes one minute to perform any rearrangement (permutation) of the blocks within its row/column it likes.

Determine whether the children can perform their task of converting one block image into the other, and if so -- find the minimum possible time in minutes required to achieve this.

#### Input

The input starts with a line containing a single integer  $t \leq 200$ , the number of test cases.  $t$  test cases follow. Each test case begins with a line containing integer  $n$  ( $1 \leq n \leq 500$ ). The next  $n$  lines contain  $n$  integers  $P_{i,j}$  each, forming a bitmap matrix representing the colours of the blocks in their initial configuration ( $1 \leq P_{i,j} \leq n^2$ ). The following  $n$  lines contain  $n$  integers  $Q_{i,j}$  each, corresponding to the matrix for the final configuration ( $1 \leq Q_{i,j} \leq n^2$ ).

#### Output

For each test case output a line with a single non-negative integer corresponding to the number of minutes required to transform matrix  $P$  into matrix  $Q$ , or the word `no` if no such transformation is possible.

#### Example

**Input :**

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

7 8 3  
2  
1 2  
1 2  
1 3  
1 2

**Output :**

2  
1  
no

The actions taken in the first test case are illustrated below.

2 step transformation: 134 213 255 -> 413 312 255 -> 313 212 455

**Warning: enormous Input/Output data, be careful with certain languages**

---

Added by: Adrian Kosowski

Date: 2004-12-09

Time limit: 17s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004, problemset 4

## SPOJ Problem Set (classical)

### 243. Stable Marriage Problem

#### Problem code: STABLEMP

There are given  $n$  men and  $n$  women. Each woman ranks all men in order of her preference (her first choice, her second choice, and so on). Similarly, each man sorts all women according to his preference. The goal is to arrange  $n$  marriages in such a way that if a man  $m$  prefers some woman  $w$  more than his wife, then  $w$  likes her husband more than  $m$ . In this way, no one leaves his partner to marry somebody else. This problem always has a solution and your task is to find one.

#### Input

The first line contains a positive integer  $t \leq 100$  indicating the number of test cases. Each test case is an instance of the stable marriage problem defined above. The first line of each test case is a positive integer  $n \leq 500$  (the number of marriages to find). The next  $n$  lines are the woman's preferences:  $i$ th line contains the number  $i$  (which means that this is the list given by the  $i$ th woman) and the numbers of men (the first choice of  $i$ th woman, the second choice,...). Then, the men's preferences follow in the same format.

#### Output

For each test case print  $n$  lines, where each line contains two numbers  $m$  and  $w$ , which means that the man number  $m$  and the woman number  $w$  should get married.

#### Example

Input :

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

7 1 7 4 2 6 5 3

**Output :**

1 3  
2 2  
3 1  
4 4  
1 4  
2 5  
3 1  
4 3  
5 7  
6 6  
7 2

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Darek Dereniowski

Date: 2004-12-13

Time limit: 1s-3s

Source limit:50000B

Languages: All

Resource: problem known as the *Stable Marriage Problem*

## SPOJ Problem Set (classical)

### 245. Square Root

#### Problem code: SQRROOT

In this problem you have to find the Square Root for given number. You may assume that such a number exist and it will be always an integer.

**Solutions to this problem can be submitted in C, C++, Pascal, Algol, Fortran, Ada, Ocaml, Prolog, Whitespace, Brainf\*\*k and Intercal only.**

#### Input

$t$  - the number of test cases [ $t \leq 50$ ]  
then  $t$  positive numbers follow, each of them have up to 800 digits in decimal representation.

#### Output

Output must contain exactly  $t$  numbers equal to the square root for given numbers. See sample input/output for details.

#### Example

**Input :**

3  
36  
81  
226576

**Output :**

6  
9  
476

---

Added by: Roman Sol  
Date: 2004-12-15  
Time limit: 5s  
Source limit: 50000B  
Languages: C C99 strict C++ PAS gpc PAS fpc ASM D FORT ADA SCM guile CAML PRLG WSPC BF ICK  
Resource: ZCon 2005



## SPOJ Problem Set (classical)

### 247. Chocolate

#### Problem code: CHOCOLA

We are given a bar of chocolate composed of  $m*n$  square pieces. One should break the chocolate into single squares. Parts of the chocolate may be broken along the vertical and horizontal lines as indicated by the broken lines in the picture.

A single break of a part of the chocolate along a chosen vertical or horizontal line divides that part into two smaller ones. Each break of a part of the chocolate is charged a cost expressed by a positive integer. This cost does not depend on the size of the part that is being broken but only depends on the line the break goes along. Let us denote the costs of breaking along consecutive vertical lines with  $x_1, x_2, \dots, x_{m-1}$  and along horizontal lines with  $y_1, y_2, \dots, y_{n-1}$ .

The cost of breaking the whole bar into single squares is the sum of the successive breaks. One should compute the minimal cost of breaking the whole chocolate into single squares.

[IMAGE]

For example, if we break the chocolate presented in the picture first along the horizontal lines, and next each obtained part along vertical lines then the cost of that breaking will be  $y_1 + y_2 + y_3 + 4*(x_1 + x_2 + x_3 + x_4 + x_5)$ .

#### Task

Write a program that for each test case:

- Reads the numbers  $x_1, x_2, \dots, x_{m-1}$  and  $y_1, y_2, \dots, y_{n-1}$
- Computes the minimal cost of breaking the whole chocolate into single squares, writes the result.

#### Input

One integer in the first line, stating the number of test cases, followed by a blank line. There will be not more than 20 tests.

For each test case, at the first line there are two positive integers  $m$  and  $n$  separated by a single space,  $2 \leq m, n \leq 1000$ . In the successive  $m-1$  lines there are numbers  $x_1, x_2, \dots, x_{m-1}$ , one per line,  $1 \leq x_i \leq 1000$ . In the successive  $n-1$  lines there are numbers  $y_1, y_2, \dots, y_{n-1}$ , one per line,  $1 \leq y_i \leq 1000$ .

The test cases will be separated by a single blank line.

## Output

For each test case : write one integer - the minimal cost of breaking the whole chocolate into single squares.

## Example

**Input :**

1

6 4

2

1

3

1

4

4

1

2

**Output :**

42

---

Added by: Thanh-Vy Hua

Date: 2004-12-23

Time limit: 3s

Source limit:50000B

Languages: All

Resource: 10th Polish Olympiad in Informatics, stage 1

## SPOJ Problem Set (classical)

### 260. Containers

#### Problem code: CTAIN

We are given  $n$  containers, where  $1 \leq n \leq 4$ . At the beginning all of them are full of water. The liter capacity of the  $i$ -th container is a natural number  $o_i$  satisfying inequalities  $1 \leq o_i \leq 49$ .

Three kinds of moves can be made:

1. Pouring the whole content of one container into another. This move can be made unless there is too little room in the second container.
2. Filling up one container with part of the water from another one.
3. Pouring away the whole content of one container into a drain.

#### Task

Write a program that for each test case:

- Reads the number of containers  $n$ , the capacity of each container and the requested final amount of water in each container.
- Verifies, whether there exist a series of moves which leads to the requested final situation, and if there is one, the program computes the minimal number of moves leading to the requested situation,
- Writes the result. The result should be the minimal number of moves leading to the requested final situation, or one word "NO" if there is no such a sequence of moves.

#### Input

One integer in the first line, stating the number of test cases, followed by a blank line. There will be not more than 20 tests.

For each test case, at the first line, one positive integer  $n$  is written,  $n \leq 4$ , this is the number of containers. There are  $n$  positive integers written in the second line. These are the capacities of the containers (the  $i$ -th integer  $o_i$  denotes the capacity of the  $i$ -th container,  $1 \leq o_i \leq 49$ ). In the third line there are written  $n$  numbers. These are the requested final volumes of water in the containers (the  $i$ -th integer  $w_i$  denotes the requested final volume of water in the  $i$ -th container,  $0 \leq w_i \leq o_i$ ). All integers in the second and the third line are separated by single spaces.

The test cases will be separated by a single blank line.

#### Output

For each test case : write one integer - the minimal number of moves which lead to the requested final situation or write only one word "NO" if it is not possible to reach the requested final situation making only allowed moves.

## Example

**Input :**

2

3

3 5 5

0 0 4

2

20 25

10 16

**Output :**

6

NO

---

Added by: Thanh-Vy Hua

Date: 2004-12-24

Time limit: 5s

Source limit:50000B

Languages: All

Resource: 3rd Polish Olympiad in Informatics, stage 1

## SPOJ Problem Set (classical)

### 261. Triangle Partitioning

#### Problem code: TRIPART

A triangle can be divided into two equal triangles by drawing a median on its largest edge (in the figure below such a division is shown with the red line). Then the smaller two triangles can be divided in similar fashion into equal triangles (shown in the picture below with blue lines). This process can continue forever.

[IMAGE]

Some mathematicians have found that when we split a triangle into smaller ones using the method specified above we have only some "styles" of triangles that only differ in size. So now given the lengths of the sides of the triangle your job is to find out how many different styles of small triangles we have. (Two triangles are of same style if they are similar.)

#### Input

First line of the input file contains an integer  $N$  ( $0 < N < 35$ ) that indicates how many lines of input there are.

Each line contains three integers  $a, b, c$  ( $0 < a, b, c < 100$ ) which indicate the sides of a valid triangle. (A valid triangle means a real triangle with positive area.)

#### Output

For each line of input you should produce an integer  $T$ , which indicates the number of different styles of small triangles, formed for the triangle at input. Look at the example for details. You can safely assume that for any triangle  $T$  will be less than 100.

#### Example

**Input :**

```
2
3 4 5
12 84 90
```

**Output :**

```
3
41
```

---

Added by: Thanh-Vy Hua

Date: 2004-12-24

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Thanh Vy Hua Le, special thanks to my friends in EPS

## SPOJ Problem Set (classical)

### 262. Connections

#### Problem code: CONNECT

Byteotian Ministry of Infrastructure has decided to create a computer program that helps to find quickly the lengths of routes between arbitrary towns. It would be small wonder if the inhabitants of Byteotia always wanted to find the shortest route. However, it happens that they want to know the  $k$ -th shortest route. Moreover, cycles in routes are possible, i.e. routes that have recurring towns.

For example, if there are 4 routes between two towns and their lengths are 2, 4, 4 and 5, then the length of the shortest connection is 2, the second shortest is 4, the third is 4, and the fourth is 5.

#### Task

Write a program that for each test case:

- Reads a description of Byteotian road network and queries concerning lengths of journey routes.
- Computes and writes answers to the queries read.

#### Input

One integer in the first line, stating the number of test cases, followed by a blank line. There will be not more than 15 tests.

For each test case, at the first line, there are two positive integers  $n$  and  $m$ , separated by a single space,  $1 \leq n \leq 100$ ,  $0 \leq m \leq n^2 - n$ . They are the number of towns in Byteotia and the number of roads connecting the towns, respectively. The towns are numbered from 1 to  $n$ .

In each of  $m$  successive lines there are three integers separated by single spaces:  $a$ ,  $b$  and  $l$ ,  $a \neq b$ ,  $1 \leq l \leq 500$ . Each triple describes one one-way road of length  $l$  enabling to move from the town  $a$  to  $b$ . For each two towns there exist at most one road that enables to move in the given direction.

In the following line there is one integer  $q$ ,  $1 \leq q \leq 10000$ , denoting the number of queries. In the successive  $q$  lines there are queries written, one per line. Each query has a form of three integers separated by single spaces:  $c$ ,  $d$  and  $k$ ,  $1 \leq k \leq 100$ . Such a query refers to the length of the  $k$ -th shortest route from the town  $c$  to the town  $d$ .

The test cases will be separated by a single blank line.

#### Output

For each test case, your program should write the answers to the queries read, one answer per line. In the  $i$ -th line the answer to the  $i$ -th query should be written: one integer equal to the length of the route being sought or -1, when such a route does not exist.

Each test case should be separated by a single blank line.

## Example

**Input :**

```
1

5 5
1 2 3
2 3 2
3 2 1
1 3 10
1 4 1
8
1 3 1
1 3 2
1 3 3
1 4 2
2 5 1
2 2 1
2 2 2
1 1 2
```

**Output :**

```
5
8
10
-1
-1
3
6
-1
```

---

Added by: Thanh-Vy Hua

Date: 2004-12-25

Time limit: 5s

Source limit:50000B

Languages: All

Resource: 10th Polish Olympiad in Informatics, stage 2

## SPOJ Problem Set (classical)

### 263. Period

#### Problem code: PERIOD

For each prefix of a given string  $S$  with  $N$  characters (each character has an ASCII code between 97 and 126, inclusive), we want to know whether the prefix is a periodic string. That is, for each  $i$  ( $2 \leq i \leq N$ ) we want to know the largest  $K > 1$  (if there is one) such that the prefix of  $S$  with length  $i$  can be written as  $A^K$ , that is  $A$  concatenated  $K$  times, for some string  $A$ . Of course, we also want to know the period  $K$ .

#### Input

The first line of the input file will contains only the number  $T$  ( $1 \leq T \leq 10$ ) of the test cases.

Each test case consists of two lines. The first one contains  $N$  ( $2 \leq N \leq 1\,000\,000$ ) - the size of the string  $S$ . The second line contains the string  $S$ .

#### Output

For each test case, output "Test case #" and the consecutive test case number on a single line; then, for each prefix with length  $i$  that has a period  $K > 1$ , output the prefix size  $i$  and the period  $K$  separated by a single space; the prefix sizes must be in increasing order. Print a blank line after each test case.

#### Example

##### Input :

```
2
3
aaa
12
aabaabaabaab
```

##### Output :

```
Test case #1
2 2
3 3

Test case #2
2 2
6 2
9 3
12 4
```

---



Added by: Thanh-Vy Hua  
Date: 2004-12-26  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: ACM South Eastern European Region 2004

## SPOJ Problem Set (classical)

### 264. Corporative Network

#### Problem code: CORNET

A very big corporation is developing its corporate network. At the beginning, each of the  $N$  enterprises of the corporation, numbered from 1 to  $N$ , organized its own computing and telecommunication center. Soon, for amelioration of the services, the corporation started to collect some enterprises in clusters, each of them served by a single computing and telecommunication center as follows. The corporation chose one of the existing centers  $I$  (serving the cluster  $A$ ) and one of the enterprises  $J$  in some other cluster  $B$  (not necessarily the center) and linked them with a telecommunication line. The length of the line between the enterprises  $I$  and  $J$  is  $|I - J|(\text{mod } 1000)$ . In such a way two old clusters are joined to form a new cluster, served by the center of the old cluster  $B$ . Unfortunately after each join the sum of the lengths of the lines linking an enterprise to its serving center could be changed and the end users would like to know what is the new length.

Write a program to keep trace of the changes in the organization of the network that is able at each moment to answer the questions of the users.

#### Input

The first line of the input file will contains only the number  $T$  of the test cases ( $1 \leq T \leq 5$ ). Each test will start with the number  $N$  of enterprises ( $5 \leq N \leq 20000$ ). Then some number of lines (no more than 200000) will follow with one of the commands:

**E I** - asking the length of the path from the enterprise  $I$  to its serving center at the moment; **I I J** - informing that the serving center  $I$  is linked to the enterprise  $J$ . The test case finishes with a line containing the word **O**. There are fewer **I** commands than **N** commands.

#### Output

The output should contain as many lines as the number of **E** commands in all test cases. Each line must contain a single number - the requested sum of lengths of lines connecting the corresponding enterprise with its serving center.

#### Example

##### Input :

```
1
4
E 3
I 3 1
E 3
I 1 2
E 3
I 2 4
E 3
O
```

##### Output :

0  
2  
3  
5

---

Added by: Thanh-Vy Hua  
Date: 2004-12-27  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: ACM South Eastern European Region 2004

## SPOJ Problem Set (classical)

### 272. Cave Exploration

#### Problem code: CAVE

A long time ago one man said that he had explored the corridors of one cave. This means that he was in all corridors of the cave. Corridors are really horizontal or vertical segments. A corridor is treated as visited if he was in at least one point of the corridor.

Now you want to know if this is true. You have a map of the cave, and you know that the explorer used the following algorithm: he turns left if he can, if he can't he goes straight, if he can't he turns right, if he can't he turns back. Exploration ends when the man reaches the entry point for the second time. Your task is to count how many corridors weren't visited by explorer.

#### Input

In the first line there is an integer **T** ( $T \leq 20$ ) - the number of different maps. For each map in the first line there is an integer **N** ( $N \leq 1000$ ) - the number of corridors. It is known that no two vertical corridors have a common point and no two horizontal corridors have a common point. The next **N** lines contain the following information: the line starts with one of the characters 'V' or 'H' - vertical or horizontal corridor. Then one Y-coordinate and two X-coordinates are given for a horizontal corridor or one X-coordinate and two Y-coordinates for a vertical corridor. The last line for each map contains the X and Y coordinates of the entry point (start and end point of travel) and the direction ('W' - left, 'E' - right, 'N' - up and 'S' - down). You may assume that: the entry point is not located at the cross-point of two corridors, and the explorer can always move forward in the direction given in the input. All coordinates are integers and do not exceed 32767 by absolute value and there are no more than 500 vertical corridors and no more than 500 horizontal corridors.

#### Output

For each map the program has to print the number of unvisited corridors (in a separate line).

#### Example

**Input :**

```
2
6
H 0 6 0
H 2 1 6
V 1 0 4
V 5 3 0
V 3 0 2
H 1 2 4
6 0 W
1
V 0 -5 5
0 0 S
```

**Output :**

1  
0

An example of a cave

---

Added by: Thanh-Vy Hua

Date: 2004-12-31

Time limit: 3s

Source limit:50000B

Languages: All

Resource: ACM South Eastern European Region 2004

## SPOJ Problem Set (classical)

### 274. Johnny and the Watermelon Plantation

#### Problem code: WMELON

Shortly after his abdication from the Bytelandian throne Johnny decided to go into farming. Water melons were a natural choice as his first crop ever, since they seemed easy enough to grow and look after. So, he sold all his beer bottles and for the money he purchased a 1km x 1km square field. Here it was that he planted the water melon seeds. (The word 'planted' is really a bit of a euphemism for walking across a field gorging on a water melon and spitting out the pips but, for the sake of politeness, let us leave it this way).

To everyone's surprise a lot of the seeds sprouted stems, and soon enough many of the plants showed signs of fruit (and some had even more than one!). Then quite unexpectedly, when the water melons were still a little too unripe to eat, winter set in. Johnny knows that he has to construct a green house to protect the field but, with his rather limited budget, he cannot afford the glass to cover the whole area. He has decided that it is enough that  $k$  fruit survive the ordeal under a glazed roof. For reasons of architectural planning in Byteland it is necessary that the green house be a rectangle with sides parallel to the edges of the plot.

You have been requested to help Johnny minimise investment costs. Since glass is paid for by the square meter, design a green house with the smallest possible area fulfilling the imposed conditions.

#### Input

The first line of input contains the integer  $t \leq 100$ , the number of test cases.  $t$  test cases follow.

Every test case begins with a line containing two integers  $n$   $k$ , denoting the total number of plants and the number of water melon fruit to be protected, respectively ( $1 \leq n \leq 1000$ ,  $1 \leq k \leq 10^6$ ,  $k$  doesn't exceed the total number of fruit in the plantation). Each of the next  $n$  lines describes a single plant, the  $i$ -th line containing three integers  $x_i$   $y_i$   $f_i$  - the X and Y coordinates of the plant, and the number of water melon fruit on it, respectively ( $1 \leq x_i, y_i, f_i \leq 1000$ ).

#### Output

For each test case output a single integer, denoting the area of the smallest possible rectangular glass house with horizontal and vertical edges, sufficient to cover at least  $k$  fruit of the plantation.

#### Example

Input :

```
1
6 11
1 1 2
1 2 2
3 1 2
3 2 3
4 2 5
```

3 3 2

**Output :**

2

Illustration of sample test data

---

Added by: Adrian Kosowski

Date: 2005-01-03

Time limit: 17s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004, problemset 5 (acknowledgement to Thanh Vy Hua Le)

## SPOJ Problem Set (set5)

### 275. The Water Ringroad

#### Problem code: WATERWAY

There is a land far, far away where the entire population dwells in walled cities at the peaks of mountains on the circumference of a plateau known as The Circle. The High Councillors of the cities developed an intricate system of communication: the cities were connected into a cycle by a perfectly round waterway. If need arose, a small paper boat with a message tied to its sail was released into the waterway and was guided by its solitary crew member (a small tin soldier) from one city to the next, and so on, until it reached its destination. Some segments of the waterway were only passable in one direction (due to waterfalls), and so there may have been pairs of cities for which communication was impossible.

As the centuries went by, the system slowly began to show its weaknesses. The waterway was so narrow that two boats going in opposite directions could never pass each other. To make matters worse, some of the more enterprising cities replaced the tin soldier by a plastic one to increase the speed of the boat, and the faster boats had to queue up behind the slower ones, and everyone got very angry indeed. The councillors gathered to address the problem and found that the best course of action would be to construct two separate channels between every pair of communicating cities A and B: one for carrying messages from A to B, the other from B to A (if communication was impossible in some direction in the old waterway, it needn't be enabled in the new one).

The High Priests of the Circle were the first to protest against the plan. They insisted that any waterway ever built should be circular and go round all the cities in the same manner as the original one, and the route of any boat must always be a perfect arc between any two adjacent cities. So the newly designed channels would in fact have to be composed of sets of adjacent fragments of circles, without any two channels sharing an arc.

The engineers have quite rightly pointed out that the new circles will be prone to the same problem of waterfalls on the same sections as the original waterway. Bearing this in mind, given a map of the old waterway, calculate the smallest possible number of circles the new waterway may consist of.

#### Input

Input begins with integer  $t \leq 100$ , the number of test cases.  $t$  test cases follow.

Each test case consists of two lines. The first contains a single integer  $n$  ( $3 \leq n \leq 100000$ ), the number of cities around the Circle. The second line is a description of the old waterway - a sequence of exactly  $n$  characters 'A', 'B' or 'C', without separating spaces, terminated by a new line. These characters correspond to the state of the arcs between cities 1 and 2, 2 and 3, ...,  $n-1$  and  $n$ ,  $n$  and 1, respectively, and mean: 'A' - the arc is passable when going anticlockwise, 'B' - the arc is passable in both directions, 'C' - the arc is passable when going clockwise.



## Output

For each test case output a line, containing a single integer - the number of circles required for the new waterway.

## Example

**Input :**

```
2
3
AAA
4
BACB
```

**Output :**

```
3
5
```

A solution to the first test case which requires 3 circles is presented below.

Illustration to test case 1

---

Added by: Adrian Kosowski

Date: 2005-01-03

Time limit: 17s

Source limit: 50000B

Languages: All except: C99 strict

Resource: DASM Programming League 2004, problemset 5

## SPOJ Problem Set (classical)

### 277. City Game

#### Problem code: CTGAME

Bob is a strategy game programming specialist. In his new city building game the gaming environment is as follows: a city is built up by areas, in which there are streets, trees, factories and buildings. There is still some space in the area that is unoccupied. The strategic task of his game is to win as much rent money from these free spaces. To win rent money you must erect buildings, that can only be rectangular, as long and wide as you can. Bob is trying to find a way to build the biggest possible building in each area. But he comes across some problems - he is not allowed to destroy already existing buildings, trees, factories and streets in the area he is building in.

Each area has its width and length. The area is divided into a grid of equal square units. The rent paid for each unit on which you're building stands is 3\$.

Your task is to help Bob solve this problem. The whole city is divided into **K** areas. Each one of the areas is rectangular and has a different grid size with its own length **M** and width **N**. The existing occupied units are marked with the symbol **R**. The unoccupied units are marked with the symbol **F**.

#### Input

The first line of the input contains an integer **K** - determining the number of datasets. Next lines contain the area descriptions. One description is defined in the following way: The first line contains two integers-area length **M** ≤ 1000 and width **N** ≤ 1000, separated by a blank space. The next **M** lines contain **N** symbols that mark the reserved or free grid units, separated by a blank space. The symbols used are:

**R** - reserved unit

**F** - free unit

In the end of each area description there is a separating line.

#### Output

For each data set in the input print on a separate line, on the standard output, the integer that represents the profit obtained by erecting the largest building in the area encoded by the data set.

#### Example

Input :

```
2
5 6
R F F F F F
F F F F F F
R R R F F F
F F F F F F
F F F F F F
```

```
5 5
R R R R R
R R R R R
R R R R R
R R R R R
R R R R R
```

**Output :**

```
45
0
```

---

Added by: Thanh-Vy Hua

Date: 2005-01-08

Time limit: 3s

Source limit:50000B

Languages: All

Resource: ACM South Eastern European Region 2004

## SPOJ Problem Set (classical)

### 278. Bicycle

#### Problem code: BICYCLE

Peter likes to go to school by bicycle. But going by bicycle on sidewalks is forbidden and going along roads is dangerous. That's why Peter travels only along special bicycle lanes. Fortunately Peter's home and school are in the immediate proximity of such paths. In the city where Peter lives there are only two bicycle lanes. Both lanes have the form of a circle. At the points where they cross it is possible to move from one path to the other. Peter knows the point where he enters the road and the point at which it is necessary to leave to enter the school. Peter is interested in the question: "What is the minimal distance he needs to cover along the lanes to get to school?"

#### Input

$t$  - the number of test cases [ $t \leq 100$ ], then  $t$  test cases follow.

The first 2 lines of each test case contain the description of the bicycle lanes:

$x1\ y1\ r1$  - 3 integers ( $x1, y1$  - coordinates of the center of the 1st circle,  $r1$  - radius of 1st circle)

$x2\ y2\ r2$  - 3 integers ( $x2, y2$  - coordinates of the center of the 2nd circle,  $r2$  - radius of 2nd circle)

$-200 \leq x1, x2, y1, y2 \leq 200$

$0 \leq r1, r2 \leq 200$

Next 2 lines contain the coordinates of Peter's home and school:

$px1, py1$  - 2 real numbers

$px2, py2$  - 2 real numbers

You may assume that this points lie on the circle with high accuracy ( $10^{-8}$ ). Both points may lie on the same circle.

#### Output

For each test case output the minimum distance that Peter needs to go from home to get to school. The precision of the answer must be under 0.0001. If it's impossible to get to school using the bicycle lanes output -1.

#### Example

**Input :**

3

0 0 5

4 0 3

3.0 4.0

1.878679656440357 -2.121320343559643

0 0 5

4 0 3

4.0 3.0

4.0 -3.0

0 0 4

```
10 0 4
4.0 0.0
6.0 0.0
```

**Output :**

```
8.4875540166
6.4350110879
-1
```

Illustration of sample test data

---

Added by: Roman Sol

Date: 2005-01-13

Time limit: 1s

Source limit:50000B

Languages: All

Resource: 5th Russian National Command Olympiad for schoolboys in programming

## SPOJ Problem Set (classical)

### 279. Interesting number

#### Problem code: INUMBER

For the given number  $n$  find the minimal positive integer divisible by  $n$ , with the sum of digits equal to  $n$ .

#### Input

$t$  - the number of test cases, then  $t$  test cases follow. ( $t \leq 50$ )

Test case description:

$n$  - integer such that  $0 < n \leq 1000$

#### Output

For each test case output the required number (without leading zeros).

#### Example

**Input :**

2  
1  
10

**Output :**

1  
190

---

Added by: Roman Sol

Date: 2005-01-13

Time limit: 7s

Source limit: 4096B

Languages: All

Resource: XII team championship of St.-Petersburg in programming

## SPOJ Problem Set (classical)

### 280. Lifts

#### Problem code: LIFTS

Serj likes old games very much. Recently he has found one arcade game in his computer. When controlling the hero it is necessary to move on a map and collect various items. At a certain stage of the game Serj has faced an unexpected problem. To continue his adventures the hero should get past over a chasm. For this purpose it is possible to use consistently located lifts which look like horizontal platforms. Each lift moves up-down vertically between some levels. The hero can pass between the next adjacent platform, however it can be done only at the moment when they are at the same level. Similarly, passing from the edge of a chasm onto the lift and vice versa is only possible at the moment when the lift appears on the level of the edge.

Each lift has a width equal to 4 meters. At the beginning the hero is in at a distance of two meters from the edge of a chasm. He should finish travel two meters after the opposite edge of the chasm. The hero moves at a speed of 2 meters a second. Thus, if the hero is in the initial position or in the center of the lift and wishes to pass to the next lift (or to descend from last lift onto the opposite edge of a chasm), he should begin movement exactly one second before they meet at one level. In two seconds the hero appears in the center of the next lift (or in the final position on the other side).

The edges of the chasm are at the same level. For each lift the range of heights between which it moves, its initial position and the direction of movement at the initial moment are given. All lifts move with a speed of one meter a second. Find out whether the hero can get over to the opposite edge of the chasm, and if so what the minimal time required for this purpose is.

A sample illustration

#### Input

$t$  - the number of test cases, then  $t$  test cases follows.

[empty line]

A test case begins with  $n$  - the number of lifts, a positive integer ( $n \leq 100$ ), then  $n$  lines follow. The  $i$ -th line ( $0 < i \leq n$ ) contains four integers  $li\ ui\ si\ di$ , where:  $li$  - lowest position of the lift,  $ui$  - highest position of the lift,  $si$  - initial position of the lift,  $di$  - initial direction of movement (1 means up, -1 means down); ( $-100 \leq li \leq si \leq ui \leq 100$ ,  $li < ui$ ).

#### Output

For each test case output the minimal time in seconds, required to get to the opposite edge of the chasm. If it is impossible output -1.

#### Example

Input :

1

4

```
-1 2 1 -1
0 3 0 1
-4 0 0 -1
-2 1 0 -1
```

**Output:**

29

---

Added by: Roman Sol

Date: 2005-01-17

Time limit: 3s

Source limit: 10000B

Languages: All

Resource: 5th Russian National Command Olympiad for schoolboys in programming



## SPOJ Problem Set (classical)

### 282. Muddy Fields

#### Problem code: MUDDY

Rain has pummeled on the cows' field, a rectangular grid of  $R$  rows and  $C$  columns ( $1 \leq R \leq 50$ ,  $1 \leq C \leq 50$ ). While good for the grass, the rain makes some patches of bare earth quite muddy. The cows, being meticulous grazers, don't want to get their hooves dirty while they eat.

To prevent those muddy hooves, Farmer John will place a number of wooden boards over the muddy parts of the cows' field. Each of the boards is 1 unit wide, and can be any length long. Each board must be aligned parallel to one of the sides of the field.

Farmer John wishes to minimize the number of boards needed to cover the muddy spots, some of which might require more than one board to cover. The boards may not cover any grass and deprive the cows of grazing area but they can overlap each other.

Compute the minimum number of boards FJ requires to cover all the mud in the field.

#### Input

$t$  - the number of test cases, then  $t$  test cases follows.

Each test case is of the following form:

Two space-separated integers:  $R$  and  $C$ , then  $R$  lines follows

Each line contains a string of  $C$  characters, with '\*' representing a muddy patch, and '.' representing a grassy patch. No spaces are present.

#### Output

For each test case output a single integer representing the number of boards FJ needs.

#### Example

**Input :**

```
1
4 4
*.*.
.***
***.
..*.
```

**Output :**

```
4
```

**Output details:**

Boards 1, 2, 3 and 4 are placed as follows:

```
1.2.
.333
444.
..2.
```

Board 2 overlaps boards 3 and 4.

---

Added by: Roman Sol  
Date: 2005-01-19  
Time limit: 5s  
Source limit: 30000B  
Languages: All  
Resource: USACO January 2005 Gold Division

## SPOJ Problem Set (classical)

### 283. Naptime

#### Problem code: NAPTIME

Goneril is a very sleep-deprived cow. Her day is partitioned into  $N$  ( $3 \leq N \leq 3,830$ ) equal time periods but she can spend only  $B$  ( $2 \leq B < N$ ) not necessarily contiguous periods in bed. Due to her bovine hormone levels, each period has its own utility  $U_i$  ( $0 \leq U_i \leq 200,000$ ), which is the amount of rest derived from sleeping during that period. These utility values are fixed and are independent of what Goneril chooses to do, including when she decides to be in bed.

With the help of her alarm clock, she can choose exactly which periods to spend in bed and which periods to spend doing more critical items such as writing papers or watching baseball. However, she can only get in or out of bed on the boundaries of a period.

She wants to choose her sleeping periods to maximize the sum of the utilities over the periods during which she is in bed. Unfortunately, every time she climbs in bed, she has to spend the first period falling asleep and gets no sleep utility from that period.

The periods wrap around in a circle; if Goneril spends both periods  $N$  and  $1$  in bed, then she does get sleep utility out of period  $1$ .

What is the maximum total sleep utility Goneril can achieve?

#### Input

$t$  - the number of test cases, then  $t$  test cases follow.

Each test case takes the following form:

Two space-separated integers:  $N$  and  $B$ , then  $N$  lines follows

Each line contains a single integer,  $U_i$ , between 0 and 200,000 inclusive

#### Output

For each test case output a single integer, the maximum total sleep utility Goneril can achieve.

#### Example

**Input :**

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

**Output :**

```
6
```

**Input/Output details:**

The day is divided into 5 periods, with utilities 2, 0, 3, 1, 4 in that order. Goneril must pick 3 periods.

Goneril can get total utility 6 by being in bed during periods 4, 5, and 1, with utilities 0 [getting to sleep], 4, and 2 respectively.

---

Added by: Roman Sol

Date: 2005-01-19

Time limit: 5s

Source limit:50000B

Languages: All

Resource: USACO January 2005 Gold Division

## SPOJ Problem Set (classical)

### 286. Selfish Cities

#### Problem code: SCITIES

Far, far away there is a world known as Selfishland because of the nature of its inhabitants. Hard times have forced the cities of Selfishland to exchange goods among each other. C1 cities are willing to sell some goods and the other C2 cities are willing to buy some goods (each city can either sell or buy goods, but not both). There would be no problem if not for the selfishness of the cities. Each selling city will sell its goods to one city only, and each buying city will buy goods from one city only. Your goal is to connect the selfish cities in such a way that the amount of exchanged goods is maximized.

#### Input

The first line contains a positive integer  $t \leq 1000$  indicating the number of test cases. Each test case is an instance of the problem defined above. The first line of each test case is a pair of positive integers C1 and C2 (the number of cities wanting to sell their goods  $C1 \leq 100$  and the number of cities wanting to buy goods  $C2 \leq 100$ ). The lines that follow contain a sequence of (c1,c2,g) trios ending with three zeros. (c1,c2,g) means that the city c1 can offer the city c2 the amount of  $g \leq 100$  goods.

#### Output

For each test case print the maximal amount of goods exchanged.

#### Example

**Input :**

```
3
3 2
1 1 10
2 1 19
2 2 11
3 2 1
0 0 0
4 4
1 1 6
1 2 6
2 1 8
2 3 9
2 4 8
3 2 8
4 3 7
0 0 0
3 2
1 1 10
2 1 21
2 2 11
3 2 1
0 0 0
```

**Output :**

21  
29  
22

---

Added by: Tomasz Niedzwiecki

Date: 2005-01-22

Time limit: 8s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 287. Smart Network Administrator

#### Problem code: NETADMIN

The citizens of a small village are tired of being the only inhabitants around without a connection to the Internet. After nominating the future network administrator, his house was connected to the global network. All users that want to have access to the Internet must be connected directly to the admin's house by a single cable (every cable may run underground along streets only, from the admin's house to the user's house). Since the newly appointed administrator wants to have everything under control, he demands that cables of different colors should be used. Moreover, to make troubleshooting easier, he requires that no two cables of the same color go along one stretch of street.

Your goal is to find the minimum number of cable colors that must be used in order to connect every willing person to the Internet.

#### Input

$t$  [the number of test cases,  $t \leq 500$ ]  
 $n \ m \ k$  [ $n \leq 500$  the number of houses (the index of the admin's house is 1)]  
[ $m$  the number of streets,  $k$  the number of houses to connect]  
 $h_1 \ h_2 \ \dots \ h_k$  [a list of  $k$  houses wanting to be connected to the network,  $2 \leq h_i \leq n$ ]  
[The next  $m$  lines contain pairs of house numbers describing street ends]  
 $e_{11} \ e_{12}$   
 $e_{21} \ e_{22}$   
...  
 $e_{m1} \ e_{m2}$   
[next cases]

#### Output

For each test case print the minimal number of cable colors necessary to make all the required connections.

#### Example

**Input :**

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

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

**Output :**

2  
1

Illustration to the first example

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Tomasz Niedzwiecki

Date: 2005-01-23

Time limit: 17s

Source limit: 50000B

Languages: All

Resource: DASM Programming League 2004, problemset 6



## SPOJ Problem Set (classical)

### 288. Prime or Not

#### Problem code: PON

Given the number, you are to answer the question: "Is it prime?"

**Solutions to this problem can be submitted in C, C++, Pascal, Perl, Python, Ruby, Lisp, Hask, Ocaml, Prolog, Whitespace, Brainf\*\*k and Intercal only.**

#### Input

$t$  - the number of test cases, then  $t$  test cases follows. [ $t \leq 500$ ]

Each line contains one integer:  $N$  [ $2 \leq N \leq 2^{63}-1$ ]

#### Output

For each test case output string "YES" if given number is prime and "NO" otherwise.

#### Example

**Input :**

5  
2  
3  
4  
5  
6

**Output :**

YES  
YES  
NO  
YES  
NO

---

Added by: Roman Sol

Date: 2005-01-24

Time limit: 21s

Source  
limit: 5000B

Languages: C C99 strict C++ PAS gpc PAS fpc PERL PYTH RUBY SCM guile SCM qobi LISP sbcl  
LISP clisp HASK CAML PRLG WSPC BF ICK

Resource: ZCon 2005

## SPOJ Problem Set (classical)

### 290. Polynomial Equations

#### Problem code: POLYEQ

You are given the polynomial  $F(x)$  as the sum of monomials. Each monomial has the form:  $[coefficient]*x[^{degree}]$  or  $[coefficient]$ , where  $coefficient$  and  $degree$  are integers such that  $-30000 \leq coefficient \leq 30000$ ,  $0 \leq degree \leq 6$ . The parameters given in  $[]$  can be skipped. In this problem you have to find all solutions of the equation:  $F(x)=0$ .

#### Input

$t$  - the number of test cases, then  $t$  test cases follow. [ $t \leq 100$ ]  
Each line contains one polynomial  $F(x)$  given as string  $s$  in the form described above.  
The length of string  $s$  is not more than 300 characters.

#### Output

For each test case output all solutions (including repeated) of the given equation in non-decreasing order. All solutions lie within the interval  $[-100.0; 100.0]$ . Each solution must be given with an error of not more than 0.01. It's guaranteed that all solutions are real, not complex.

#### Example

**Input :**

```
2
x^4-6*x^3+11*x^2-6*x
-x^2+2*x-1
```

**Output :**

```
0.00 1.00 2.00 3.00
1.00 1.00
```

---

Added by: Roman Sol  
Date: 2005-01-27  
Time limit: 13s  
Source limit: 50000B  
Languages: All  
Resource: ZCon 2005

## SPOJ Problem Set (classical)

### 291. Cube Root

#### Problem code: CUBERT

Your task is to calculate the cube root of a given positive integer. We can not remember why exactly we need this, but it has something in common with a princess, a young peasant, kissing and half of a kingdom (a huge one, we can assure you).

Write a program to solve this crucial task.

#### Input

The input starts with a line containing a single integer  $t \leq 20$ , the number of test cases.  $t$  test cases follow.

The next lines consist of large positive integers of up to 150 decimal digits. Each number is on its own separate line of the input file. The input file may contain empty lines. Numbers can be preceded or followed by whitespaces but no line exceeds 255 characters.

#### Output

For each number in the input file your program should output a line consisting of two values separated by single space. The second value is the cube root of the given number, truncated (not rounded!) after the 10th decimal place. First value is a checksum of all printed digits of the cube root, calculated as the sum of the printed digits modulo 10.

#### Example

**Input :**

5  
1

8

1000

2

33076161

**Output :**

1 1.0000000000  
2 2.0000000000  
1 10.0000000000  
0 1.2599210498  
6 321.0000000000

---

Added by: Thanh-Vy Hua  
Date: 2005-01-29  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: ACM South Eastern European Region 2004

## SPOJ Problem Set (classical)

### 292. Alibaba

#### Problem code: ALIBB

Alibaba the famous character of our childhood stories would like to be immortal in order to keep bringing happiness to children. In order to reach this status he needs to prove that he is still able to do some unusual things. There are  $n$  treasures, ( $n \leq 10000$ ) each in a different place located along a straight road. Each treasure has a time limit, after that it vanishes. Alibaba must take all the  $n$  treasures, and he must do it quickly. So he needs to figure out the order in which he should take the treasures before their deadlines starting from the most favorable position. Alibaba has the list of places and deadlines of the treasures. A place  $i$  is located at distance  $d_i$  from the leftmost end of the road. The time it takes to take a treasure is instantaneous.

Alibaba must find **the smallest time** by which he can take all the treasures.

#### Input

The first line of the input contains an integer  $K \leq 10$  - determining the number of datasets

Each data set in the input stands for a particular set of treasures. For each set of treasures the input contains the number of treasures, and the list of pairs place - deadline in increasing order of the locations. White spaces can occur freely between the numbers in the input. The input data are correct.

#### Output

For each set of data the program prints the result to the standard output on a separate line. The solution is represented by the smallest time by which Alibaba can take all the treasures before they vanish. If this is not possible then the output is "No solution".

#### Example

**Input :**

```
2
5
1 3
3 1
5 8
8 19
10 15
5
1 5
2 1
3 4
4 2
5 3
```

**Output :**

```
11
No solution
```

---

Added by: Thanh-Vy Hua  
Date: 2005-01-29  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: ACM South Eastern European Region 2004

## SPOJ Problem Set (classical)

### 293. Officers on the Beat

#### Problem code: OFBEAT

In the Middle Ages the capital of Byteland was surrounded by stout walls to protect the citizens from intruders. The gates of the city were well guarded and the drawbridge was lifted for the night, and everyone felt pretty happy and secure. At least, for a while.

With time the usual disadvantages of a walled city became apparent. As the population increased, crime flourished in the cramped living space. Eventually it all became so bad that the mayor decided to intervene. Some of the guards were reassigned from their usual occupation of reading newspapers in the guard posts near the gates, and told to start patrolling the city. Many of the officers were rather unhappy about all this, especially after the first men to go on the beat returned with bleeding noses and bumps on their heads. Sensing the low morale of the men, the Captain of the Guard, a bright young individual, decided to reinterpret the order he had received from the mayor. He decided that patrol officers would only go out in large groups and armed to the teeth, and would only move along a few carefully chosen streets from which they could see everything that was going on in the city without actually getting involved.

The city is laid out on a regular grid, with each street running North-South or East-West from one end of the city to the other (as far as the walls allow). Every point with integer coordinates is at an intersection of two streets, one leading North-South, the other East-West. The walls that surround the city form a simple polygon whose sides run directly alongside sections of some streets of the city.

Every street in the set of 'patrolled streets' chosen by the Captain intersects with at least one other patrolled street. Furthermore, if a point belongs to one of the streets of the city then it is visible from some point of one of the patrolled street (points see each other iff the line segment connecting them is a fragment of a street). Finally, the set of patrolled streets chosen by the Captain consists of the minimum possible number of streets.

Given a description of the capital of Byteland, find out how many of its streets were actually patrolled by guards after the Captain issued his order.

#### Input

The first line of input contains  $t$  - the number of test cases.  $t$  test cases follow.

For each test case, the first line contains a single integer  $n$  - the number of sections the city wall consists of ( $4 \leq n \leq 2000$ ). The second line contains exactly  $n$  integers  $a_1, \dots, a_n$  describing successive sections of wall ( $1 \leq |a_i| \leq 100000$ ). Any two successive sections of wall are perpendicular to each other. The length of the  $i$ -th section is the absolute value of  $a_i$ , while its direction is described by the sign of  $a_i$  (positive means northbound or eastbound, negative - southbound or westbound when traversing the walls clockwise).

## Output

For each test case output a single integer k - the number of elements of the patrolled set of streets selected by the Captain.

## Example

**Input :**

```
1
14
+2 +2 +2 +2 -4 +2 +1 +2 -3 +2 -2 -8 +4 -2
```

**Output :**

```
4
```

Illustration of the sample test data. Blue lines indicate the set of patrolled streets

---

Added by: Adrian Kosowski

Date: 2005-02-05

Time limit: 17s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004, problemset 6



## SPOJ Problem Set (classical)

### 296. Teamwork is Crucial

#### Problem code: **TWORK**

In the late Middle Ages the University of Byteland was no different than any other university of the day. One of those gloomy places where philosophers brooded over the essence of life, theologians did likewise and quaralled with philosophers, while alchemists developed new caustic types of green shampoo in their futile search for gold. The thing that worried the Chancellor most was that none of the staff seemed to be in the least capable of making money in any form. When he complained about this to the Director of Human Resources, the Director came up with a brilliantly simple theory. He claimed that this lack of productivity was the direct consequence of the isolated model of work, and that wonders could be achieved by promoting teamwork.

The Director intends to assign every scientist to some 3-person workgroup. The members of the workgroup should then select which of them is to act as the group leader. And this of course is the root of the problem. Every scientist will tolerate either himself or one of his acquaintances as the leader of his group, but will never allow anyone else to have this privilege. So when creating workgroups it is necessary to bear in mind that every group should have at least one suitable candidate for the role of group leader, accepted by all its members.

Although everyone at the University knows *of* everyone else indirectly (as acquaintances of acquaintances of acquaintances of...), the number of direct acquaintances that every scientist has is relatively small - either equal to 2, or to 3. Even so, it ought to be possible to assign the vast majority of scientists to workgroups. Quite naturally, the dubious pleasure of performing this task has been left to you, the Acting University Algorithmist.

#### Input

Input starts with a single integer  $t$ , the number of test cases ( $t \leq 100$ ).  $t$  test cases follow.

Each test case begins with a line containing two integers  $n$   $m$  ( $4 \leq n \leq m \leq 20000$ ,  $n$  is the number of scientists and is divisible by 4). Exactly  $m$  lines follow containing a pair of integers  $a_i$   $b_i$  each which denote that scientists  $a_i$  and  $b_i$  are acquaintances ( $1 \leq a_i, b_i \leq n$ , each scientist has either 2 or 3 acquaintances). Acquaintanceship is mutual.

#### Output

For each test case, output a line containing a single integer  $k$  - the number of workgroups you have formed. In each of the next  $k$  lines output exactly 3 integers, representing the numbers of scientists belonging to respective workgroups.

Your solution will be regarded as incorrect if for some test case more than 25% of all scientists are left without a valid assignment to a workgroup.

## Example

### Input :

```
1
8 10
1 2
1 3
2 5
4 6
3 7
2 3
5 6
6 7
7 8
8 4
```

### Output :

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

---

Added by: Adrian Kosowski

Date: 2005-02-14

Time limit: 5s

Source limit:50000B

Languages: All

Resource: DASM Programming League 2004, problemset 7

## SPOJ Problem Set (classical)

### 297. Aggressive cows

#### Problem code: AGGRCOW

Farmer John has built a new long barn, with  $N$  ( $2 \leq N \leq 100,000$ ) stalls. The stalls are located along a straight line at positions  $x_1, \dots, x_N$  ( $0 \leq x_i \leq 1,000,000,000$ ).

His  $C$  ( $2 \leq C \leq N$ ) cows don't like this barn layout and become aggressive towards each other once put into a stall. To prevent the cows from hurting each other, FJ want to assign the cows to the stalls, such that the minimum distance between any two of them is as large as possible. What is the largest minimum distance?

#### Input

$t$  - the number of test cases, then  $t$  test cases follows.

\* Line 1: Two space-separated integers:  $N$  and  $C$

\* Lines 2.. $N+1$ : Line  $i+1$  contains an integer stall location,  $x_i$

#### Output

For each test case output one integer: the largest minimum distance.

#### Example

##### Input:

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

##### Output:

```
3
```

##### Output details:

FJ can put his 3 cows in the stalls at positions 1, 4 and 8, resulting in a minimum distance of 3.

---

Added by: Roman Sol  
Date: 2005-02-16  
Time limit: 2s  
Source limit: 10000B  
Languages: All  
Resource: USACO February 2005 Gold Division

## SPOJ Problem Set (classical)

### 300. Cable TV Network

#### Problem code: CABLETV

The interconnection of the relays in a cable TV network is bi-directional. The network is connected if there is at least one interconnection path between each pair of relays present in the network. Otherwise the network is disconnected. An empty network or a network with a single relay is considered connected. The safety factor **f** of a network with **n** relays is:

1. **n**, if the net remains connected regardless the number of relays removed from the net.
2. The minimal number of relays that disconnect the network when removed.

Exemplary illustration

For example, consider the nets from figure 1, where the circles mark the relays and the solid lines correspond to interconnection cables. The network (a) is connected regardless the number of relays that are removed and, according to rule (1),  $f=n=3$ . The network (b) is disconnected when 0 relays are removed, hence  $f=0$  by rule (2). The network (c) is disconnected when the relays 1 and 2 or 1 and 3 are removed. The safety factor is 2.

#### Input

The input starts with a line containing a single integer **t**  $\leq 20$ , the number of test cases. **t** test cases follow.

Write a program that computes the safety factor for the cable networks encoded by the data sets. Each data set starts with two integers:  $0 \leq n \leq 50$ , the number of relays in the net, and **m**, the number of cables in the net. Follow **m** data pairs (u,v),  $u < v$ , where u and v are relay identifiers (integers in the range  $0..n-1$ ). The pair (u,v) designates the cable that interconnects the relays u and v. The pairs may occur in any order. Except the (u,v) pairs, which do not contain white spaces, white spaces can occur freely in input. Input data terminate with an end of file and are correct.

#### Output

For each data set, prints from the beginning of a line, the safety factor of the encoded net.

#### Example

**Input :**

```
5
0 0
1 0
3 3 (0,1) (0,2) (1,2)
2 0
5 7 (0,1) (0,2) (1,3) (1,2) (1,4) (2,3) (3,4)
```

**Output :**

```
0
```

1  
3  
0  
2

---

Added by: Thanh-Vy Hua  
Date: 2005-02-27  
Time limit: 5s  
Source limit:50000B  
Languages: All  
Resource: ACM South Eastern European Region 2004

## SPOJ Problem Set (classical)

### 301. Booklets

#### Problem code: BOOK

Bob has a difficult job. He must distribute advertising booklets for extra school activities in different schools. The booklets have different number of pages. Bob has a list with the number of pages of each booklet and the number of schools that he must visit. He has to distribute the booklets such that each school gets a number of booklets equal to either the lower integer part (LIP), or the upper integer part (UIP) of the number of booklets divided by the number of schools. Poor Bob must obey other rules too. He must distribute all the **UIP** number of booklets first and then the **LIP** number of booklets.

Any booklet **A** that is distributed to a school **S<sub>i</sub>** must have fewer or at most an equal number of pages that any other booklet **B** that is distributed to a school **S<sub>j</sub>**, if **S<sub>i</sub>** gets the booklets before **S<sub>j</sub>** (i.e if **i < j** then **pages(A) <= pages(B)**). When Bob distributes the booklets to a school he must distribute them in the same relative order in which they are on his list.

Moreover, he must distribute them very fast. When he comes back to the advertising company his boss verifies if he accomplished well his task, by asking him the number of pages of the first booklet distributed to a specific school, following the order in which Bob visited the schools (starting with 0). Difficult job, isn't it? Can you help him?

#### Input

The input starts with a line containing a single integer **t**  $\leq 20$ , the number of test cases. **t** test cases follow.

Each data set in the input stands for a particular set of booklets. For each set of booklets the input contains the number of schools, the school specified by Bob's boss, the number of booklets (**less than 3000**), the number of pages of each booklet (fits in integer). White spaces can occur freely between the numbers in the input. The input data are correct.

#### Output

For each set of data the program prints the result to the standard output on a separate line. The solution is represented by the number of pages of the first booklet distributed to the specified school.

#### Example

**Input :**

```
1
3
2
7
3 5 9 1 11 14 2
```

**Output :**

```
11
```

---

Added by: Thanh-Vy Hua  
Date: 2005-02-27  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: ACM South Eastern European Region 2004



## SPOJ Problem Set (classical)

### 302. Count on Cantor

#### Problem code: CANTON

One of the famous proofs of modern mathematics is Georg Cantor's demonstration that the set of rational numbers is enumerable. The proof works by using an explicit enumeration of rational numbers as shown in the diagram below.

```
1/1 1/2 1/3 1/4 1/5 ...
2/1 2/2 2/3 2/4
3/1 3/2 3/3
4/1 4/2
5/1
```

In the above diagram, the first term is 1/1, the second term is 1/2, the third term is 2/1, the fourth term is 3/1, the fifth term is 2/2, and so on.

#### Input

The input starts with a line containing a single integer  $t \leq 20$ , the number of test cases.  $t$  test cases follow.

Then, it contains a single number per line.

#### Output

You are to write a program that will read a list of numbers in the range from 1 to  $10^7$  and will print for each number the corresponding term in Cantor's enumeration as given below.

#### Example

**Input :**

```
3
3
14
7
```

**Output :**

```
TERM 3 IS 2/1
TERM 14 IS 2/4
TERM 7 IS 1/4
```

---

Added by: Thanh-Vy Hua

Date: 2005-02-27

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM South Eastern European Region 2004

## SPOJ Problem Set (classical)

### 303. The Unstable Cube

#### Problem code: UCUBE

A large cube (of size  $N \times N \times N$ ) is given. At the beginning it consists of small blocks ( $1 \times 1 \times 1$ ) and each block is painted in some color (different blocks may have the same color). But in the process of exploitation some blocks have disappeared. Given 6 photos of the unstable cube you have to calculate the maximum possible number of blocks that still remain in the unstable cube. It is possible that the unstable cube consists of more than one part.

#### Input

$t$  - the number of test cases, then  $t$  test cases follow.

$N$  - size of the big cube [ $1 \leq N \leq 10$ ]

In the next  $N$  lines views of the cube from 6 sides are described (in the following order: from the front, left, back, right, from above, from below). Each such view is represented by a table of size  $N \times N$  in which different letters denote different colors, and the symbol "." (point) means that it is possible to see all the way through the cube at this point. Consecutive views are separated by exactly one space.

The bottom border of the top view corresponds to the top border of the front view, and the top border of the bottom view - to the bottom border of the front view. For the front, back, left and right views the top and bottom sides of a view correspond to the top and bottom of the cube.

The input file is correct, i.e. each test case describes a possible configuration.

#### Output

For each test case output one integer: the required maximum number of blocks remaining in the unstable cube.

#### Example

**Input :**

```
2
3
.R. YYR .Y. RYY .Y. .R.
GRB YGR BYG RBY GYB GRB
.R. YRR .Y. RRY .R. .Y.
2
ZZ ZZ ZZ ZZ ZZ ZZ
ZZ ZZ ZZ ZZ ZZ ZZ
```

**Output :**

```
11
8
```

---

Added by: Roman Sol

Date: 2005-03-01

Time limit: 1s

Source limit:20000B

Languages: All

Resource: The Moscow Olympiad on computer science 2004/05. Correspondence round.

## SPOJ Problem Set (classical)

### 309. The Room Pattern

#### Problem code: RATTERN

It was decided to make a parquet floor in a room of size  $N \times M$ . The idea is to lay out some pattern on the floor. The parquet tiles with which the floor of the room looks best consist of squares  $1 \times 1$ , each of which can be either white or black. The required color of each square of the room is specified on the map of the room.

There are four different forms of parquet tiles:

Illustration of parquet tiles

Squares of one parquet tile can be painted differently. Some types of tiles can be of identical shape, but painted differently. Tiles of different types can have different cost. The number of available tiles of each type is not limited. Tiles are allowed to be turned around somehow (by an angle which is a multiple of 90 degrees), but it is not permitted to break a tile or to put it face sheet downwards. Initially, any part of the floor can be already laid out by tiles. You are requested to calculate the minimal cost of the tiles necessary to pave the remaining part of the room.

#### Input

$t$  - the number of test cases, then  $t$  test cases follow.

In the first line of each test case three numbers are written:  $N$ ,  $M$  (the sizes of the room) and  $K$  (number of accessible types of tiles).  $[1 \leq N, M \leq 8]$ ,  $[1 \leq K \leq 10]$ . Next there is a description of the desired painting of the floor. The description is given in the form of  $N$  lines of  $M$  numbers each, where 0 denotes the color white, 1 - the color black, 2 - a square which has already been covered by a tile. In the last  $K$  lines the descriptions of available types of tiles are given in the following format:

[Form] [cost] [painting] where:

[Form] is a number from 1 to 4, describing the form of a tile (see figure above)

[Cost] is an integer not larger than 10000, describing the cost of one tile of the type.

[Painting] is a sequence of between one and three numbers 0 or 1. Its length is the same as the number of squares of which the tile consists, and the respective numbers describe colors of square tiles in the order in which the squares are numbered in the figure.

#### Output

For each test case output one integer: the minimal cost of laying the remaining part of the parquet, or -1 if the task cannot be performed.

#### Example

Input:

```
1
4 3 3
2 2 2
2 0 0
2 1 2
2 2 2
2 10 0 0
1 5 1
4 6 0 0 1
```

**Output:**

15

---

Added by: Roman Sol

Date: 2005-03-05

Time limit: 17s

Source limit:20000B

Languages: All

Resource: The Moscow Olympiad on computer science 2004/05. Correspondence round.

## SPOJ Problem Set (classical)

### 318. Pythagorean Legacy

#### Problem code: PITPAIR

It is necessary to find a minimal integer value  $R$  which is equal to the length of the hypotenuse (the side opposite the right angle) of  $N$  non-identical rectangular triangles with integer lengths of sides.

#### Input

$t$  - number of test cases [ $t \leq 100$ ], then  $t$  lines follow, each line contains one integer -  $N$ , equal to the required number of different rectangular triangles. [ $1 \leq N \leq 2000$ ]

#### Output

For each test case your program should output a number  $R$  in a separate line ( $R$  fits in a 64-bit integer), equal to the minimal integer value of a hypotenuse for which exactly  $N$  different rectangular triangles can be constructed; then in separate lines follow exactly  $N$  numbers equal to the shorter cathetus (side adjacent to the right angle) of each of the rectangular triangles, in ascending order.

#### Example

**Input :**

```
2
1
2
```

**Output :**

```
5
3
25
7
15
```

---

Added by: Roman Sol  
Date: 2005-03-01  
Time limit: 9s  
Source limit: 8192B  
Languages: All  
Resource: ZCon 2005

## SPOJ Problem Set (set9)

### 325. The Tall Windmills

#### Problem code: WINDMILL

In the later days of his career Johnny purchased a long and narrow strip of land on which he intended to erect a row of windmills, and live off the electrical energy produced by his little power plant. To his dismay, he soon discovered that he had been badly cheated - throughout most of the year the wind blew lengthwise through the strip, rather than in a perpendicular direction. As a result, the wind was certain to lose most of its force on the first windmill it encountered, leaving all the others idle. Johnny could only see one way of coping with this problem, namely - to vary the height of windmills situated relatively close to each other. More precisely, Johnny intends to build exactly  $n$  windmills along a straight line, with equal spacing (of one Bytelandian furlong) between adjacent windmills. It has been established by a team of experts that if two windmills are  $k$  Bytelandian furlongs apart from each other, their height must differ by at least  $n-k$  Bytelandian yards. No windmill may ever be lower than 1 Bytelandian yard, and some, obviously, may need to be considerably higher. But tall windmills are far more expensive to construct, and thus you have been asked to choose the heights of Johnny's windmills in such a way as to guarantee that the tallest windmill has the minimum possible height.

#### Input

Input starts with a single integer  $t$ , the number of test cases ( $t \leq 100$ ).  $t$  test cases follow.

Each test case consists of exactly one integer  $n$  ( $1 \leq n \leq 100$ ) - the number of windmills Johnny intends to construct.

#### Output

For each test case output a line with exactly  $n$  numbers, denoting the heights of successive windmills given in the order in which they are arranged along the road.

#### Example

**Input :**

```
3
1
2
3
```

**Output :**

```
1
1 2
2 4 1
```

---

Added by: Adrian Kosowski  
Date: 2005-04-13  
Time limit: 17s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: DASM Programming League 2004, problemset 9



## SPOJ Problem Set (classical)

### 327. Platon and Socrates

#### Problem code: PLATON

Platon and Socrates one day decided to play a new game. They asked their friend to think of two numbers between 1 and 5000, not equal. Then they asked him to tell the product to Platon and the sum to Socrates. After that they tried to figure out what these numbers are. They played a lot of times but none of them could guess these numbers. Finally they made it!! Here is the dialogue:

- [P] : I don't know the answer.
- [S] : I knew you wouldn't know, I don't know it either.
- [P] : Now I know it.
- [S] : I know it too.

Your task is to find all pairs Platon and Socrates could have been thinking about. Numbers are limited to the given range.

#### Input

Input starts with a single integer  $t$ , the number of test cases ( $t \leq 2000$ ).  $t$  test cases follow. Each test case consists of one line containing two integers  $l$   $r$  separated by a single space, denoting the range of numbers ( $1 \leq l < r \leq 5000$ ,  $r - l < 200$ ).

#### Output

For the  $i$ -th test case output a line with the text *case i*. In the next line print  $n$  - number of pairs from range  $(l, r)$ . Then exactly  $n$  lines follow with two numbers separated by single space. The first number is not greater than the second. Pairs are printed in increasing sum order.

#### Example

##### Input

```
2
1 10
2 8
```

##### Output

```
case 1
0
case 2
0
```

---

Added by: Bogusław K. Osuch  
Date: 2005-04-14  
Time limit: 15s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: :P

## SPOJ Problem Set (classical)

### 328. Bishops

#### Problem code: BISHOPS

Yesterday was Sam's birthday. The most interesting gift was definitely the chessboard. Sam quickly learned the rules of chess and defeated his father, all his friends, his little sister, and now no one wants to play with him any more.

So he decided to play with another birthday gift - a Book of Math Problems for Young Mathematicians. He opened the book somewhere in the middle and read the following problem: "How many knights can be placed on a chessboard without threatening each other?" After a while he realized that this was trivial and moved on to the next problem: "How many bishops can be placed on a chessboard without threatening each other?". Sam is in trouble here. He is not able to solve this problem and needs your help.

Sam's chessboard has size  $N \times N$ . A bishop can move to any distance in any of the four diagonal directions. A bishop threatens another bishop if it can move to the other bishop's position. Your task is to compute the maximum number of bishops that can be placed on a chessboard in such a way that no two bishops threaten each other.

#### Input

The input file consists of several lines. The line number  $i$  contains a single number  $N$  representing the size of the  $i$ -th chessboard. [ $N \leq 10^{100}$ ]

#### Output

The output file should contain the same number of lines as the input file. The  $i$ -th line should contain one number - the maximum number of bishops that can be placed on  $i$ -th chessboard without threatening each other.

#### Example

Input :

2  
3

Output :

2  
4

---

Added by: Roman Sol  
Date: 2005-04-17  
Time limit: 1s  
Source limit: 10000B  
Languages: All  
Resource: IPSC 2004

## SPOJ Problem Set (classical)

### 329. Calls

#### Problem code: CALLS

A young archeologist Senoj Anaidni recently made a very important discovery which will make him famous (or at least he thinks so). He found several scraps of paper resembling advertisement flyers of an ancient phone company. His research showed that modern phone companies follow a few basic rules to compose their flyers (and there is no reason to assume that old companies were an exception). Each company operates certain number of phone lines. Each phone line connects a pair of cities, and it can be used in both directions. The cost of using each line is a fixed positive number. A call from city A to city B may be routed through one or more other cities, in which case the cost of the call is the sum of the costs of all lines used. (In fact, sometimes it is cheaper to route the call through several other cities than to use the direct connection, even if there exists one.)

To make the information comprehensible to the customer, the phone company lists the cost of the cheapest possible call between every pair of cities serviced by the company. To impress the customer even more, the company also lists the number of lines it operates.

Indeed, each of Senoj's ancient flyers start like this: "Using our 47 telephone lines, we serve 10 most important cities of the world! A call from Sparta to Troja costs 12 dennario, Sparta to Athens is 15 dennario, ...". The list of all pairs of cities and the respective costs of the cheapest possible call between them follows.

This supports Senoj's hypothesis about the origin of the papers, but he is not sure whether they are really genuine. Other archeologists often play dirty jokes on him by making ridiculous forgeries in a hope, that he will make a fool of himself. Luckily, they are often not very meticulous, so we can safely assume, that a flyer is a forgery if and only if it could not have been published by any phone company.

#### Input

The first line of the input file gives the number  $t$  of flyers found by Senoj. [ $t \leq 50$ ] Each flyer is described in a separate block starting with a line containing two integers -  $N$  and  $K$  - where  $N$  is the number of cities and  $K$  is the number of phone lines. [ $N \leq 300$   $K \leq 1200$ ] The block continues with  $N-1$  lines giving the costs of the cheapest calls between all pairs of cities. In particular, the  $i$ -th line contains  $(N-i)$  numbers, where  $j$ -th number represents the cost of a call between the cities  $i$  and  $(i+j)$ .

#### Output

For every input block, output a line containing either "YES" or "NO". "YES" should be printed, if it is possible to assign costs to the phone lines operated by the company so that the cheapest calls are as advertised in the flyer. "NO" should be printed if this is not possible.

#### Example

Input :

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

1 2  
2

**Output :**

YES

NO

---

Added by: Roman Sol

Date: 2005-04-17

Time limit: 3s

Source limit:10000B

Languages: All

Resource: IPSC 2004

## SPOJ Problem Set (classical)

### 332. Hard Question

#### Problem code: HARDQ

Students of computer science in Bratislava enjoy hiking and camping during their long summer breaks. They love walking silently in the groves, visiting sparkling waterfalls, exploring dark caves, climbing steep hills, or just sleeping in a tent. Some of them already visited all the national parks in Slovakia and nearby countries.

With no more new national parks to visit, frustrated students decided to set up a new national park (NP) by themselves. After long arguing, they finally agreed on the boundary of the NP. Now they want to purchase all the land needed for NP from present owners. Their funds are limited (after all, they are only students), therefore they do not want to buy any land outside the NP.

The NP can be described as a polygon with  $N$  vertices. There is a set  $P$  of  $M$  rectangular plots of land available for sale by their owners. The rectangles are mutually disjoint and axis-parallel. Your task is to decide whether it is possible to purchase subset of plots  $P$  exactly covering the proposed NP.

#### Input

Input file consists of several test cases separated by a blank line. Each test case starts with two integers  $N$  and  $M$ . Next  $N$  lines contain the coordinates of the vertices of the NP. Each of the following  $M$  lines describes one plot. For each plot, the coordinates of two opposite corners of the rectangle are given. The values  $N=0$ ,  $M=0$  end the input and should not be processed. [ $N, M \leq 3000$ ]

#### Output

For each test case output either 'YES' or 'NO' depending on whether it is possible to set up the NP using  $P$  or not.

#### Example

**Input :**

```
4 2
0 0
0 2
2 2
2 0
1 0 0 2
1 0 2 2
```

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

```
0 0
```

**Output :**

```
YES
NO
```

---

Added by: Roman Sol  
Date: 2005-04-17  
Time limit: 5s  
Source limit: 30000B  
Languages: All  
Resource: IPSC 2004

## SPOJ Problem Set (classical)

### 334. The Philosophical Dispute

#### Problem code: PHDISP

One day, mathematician and philosopher were engaged in a heated dispute.

Philosopher said:

- Ideal line has only length and no width, therefore, no line can have an area.

Mathematician replied:

- That's as it may be, but still you can ll a square with a line in such a way that there will be no gaps.

And you can't deny that a square has an area, and he grinned.

But Philosopher still wasn't convinced:

- Show me this line, then.

- With pleasure... - responded Mathematician and scribbled some equations on a piece of paper:

[IMAGE]

- With  $t$  increasing, the point  $(x, y)$  will move around the square, forming a line.

- So what? - asked Philosopher. How is it going to ll the entire square?

- Indeed, it will, - said Mathematician, - Whichever point inside the square you draw, the line will eventually cross that point.

- No, - replied Philosopher indignantly, - Anyway, I don't believe. When will the line cross this point?

- and he put a thick dot inside the square.

Give Philosopher an answer.

#### Input

$t$  - number of tests [ $t \leq 150$ ], than  $t$  test cases follows.

The first line of each test case contains the coordinates  $(x_0, y_0)$  of the dot center ( $-1 \leq x_0, y_0 \leq 1$ ).

The second line contains  $\text{eps} \leq 0.0001$  - the radius of the dot (the dot is essentially a small circle).

#### Output

For each test case output any value of  $t$  in the segment  $[0, 10^{12}]$ , which corresponds to the line crossing the dot, or "FAIL", if the line doesn't cross the dot.

#### Example

**Sample input:**

```
1
0.744 0.554
0.01
```

**Sample output:**

```
5.3
```

---



Added by: Roman Sol  
Date: 2005-04-25  
Time limit: 3s  
Source limit: 20000B  
Languages: All  
Resource: IX Ural Championship (Round II)

## SPOJ Problem Set (classical)

### 336. Exchange Operations

#### Problem code: EOPERA

Given a sequence of 12 numbers consisting of 0 and the first 11 natural numbers. Suppose number 0 is in the  $i$ -th position of the sequence (positions are numbered from 0 to 11). You can swap it with the number in the  $j$ -th position if the following conditions hold:

- $|i - j| = d_k$ , where  $k=1..3$  and  $(d_1, d_2, d_3, d_4) = (1; 3; 6; 12)$
- $\text{floor}(i/d_{k+1}) = \text{floor}(j/d_{k+1})$

Your task is to find the minimum number of exchange operations required to sort the sequence in increasing order.

#### Input

The first line of the input file contains an integer representing the number of test cases to follow. Each test case contains a sequence of twelve numbers consisting of 0,1,2,...,11, separated by single space. You can assume that the given sequence can always be sorted in increasing order by using the exchange operations

#### Output

For each test case, output the minimum number of exchange operations required to sort the given sequence in increasing order.

#### Example

**Input :**

2

1 10 2 3 0 5 7 4 8 6 9 11  
6 4 1 0 3 5 9 7 2 10 11 8

**Output :**

8

9

---

Added by: Walrus

Date: 2005-04-28

Time limit: 19s

Source limit: 50000B

Languages: All

Resource: Based on a problem from acm.uva.es

## SPOJ Problem Set (classical)

### 339. Recursive Sequence

#### Problem code: SEQ

Sequence  $(a_i)$  of natural numbers is defined as follows:

$$a_i = b_i \text{ (for } i \leq k)$$

$$a_i = c_1 a_{i-1} + c_2 a_{i-2} + \dots + c_k a_{i-k} \text{ (for } i > k)$$

where  $b_j$  and  $c_j$  are given natural numbers for  $1 \leq j \leq k$ . Your task is to compute  $a_n$  for given  $n$  and output it modulo  $10^9$ .

#### Input

On the first row there is the number  $C$  of test cases (equal to about 50).

Each test contains four lines:

$k$  - number of elements of  $(c)$  and  $(b)$  ( $1 \leq k \leq 10$ )

$b_1, \dots, b_k$  -  $k$  natural numbers where  $0 \leq b_j \leq 10^9$  separated by spaces  $c_1, \dots, c_k$  -  $k$  natural numbers where  $0 \leq c_j \leq 10^9$  separated by spaces

$n$  - natural number ( $1 \leq n \leq 10^9$ )

#### Output

Exactly  $C$  lines, one for each test case:  $a_n$  modulo  $10^9$

#### Example

**Input :**

```
3
3
5 8 2
32 54 6
2
3
1 2 3
4 5 6
6
3
24 354 6
56 57 465
98765432
```

**Output :**

```
8
714
257599514
```

---

Added by: Paweł Dobrzycki  
Date: 2005-04-29  
Time limit: 2s  
Source limit: 8196B  
Languages: All  
Resource: IV Podlasian Contest in Team Programming

# SPOJ Problem Set (classical)

## 344. Poker

### Problem code: POKER

In poker, you have 5 cards. There are 10 kinds of poker hands (from highest to lowest):

- royal flush - ace, king, queen, jack and ten, all in the same suit
- straight flush - five cards of the same suit in sequence, such as 10,9,8,7,6 of clubs; ace can be counted both as the highest card or as the lowest card - A,2,3,4,5 of hearts is a straight flush. But 4,3,2,A,K of hearts is not a straight flush - it's just a flush.
- four of a kind - four cards of the same rank, such as four kings.
- full house - three cards of one rank plus two cards of another rank
- flush - five cards of the same suit (but not a straight flush)
- straight - five cards in order - just like the straight flush, but mixed suits
- three of a kind - three cards of one rank and two other cards
- two pairs - two cards of one rank, two cards of another rank, and one more card
- pair - two cards of the same rank
- high card - none of the above

Write a program that will help you play poker by telling you what kind of hand you have.

### Input

The first line of input contains the number of test cases (no more than 20). Each test case consists of one line - five space separated cards. Each card is represented by a two-letter (or digit) word. The first character is the rank (A,K,Q,J,T,9,8,7,6,5,4,3 or 2), the second character is the suit (S,H,D,C standing for spades, hearts, diamonds and clubs). The cards can be in any order (but they will not repeat).

### Output

For each test case output one line describing the type of a hand, exactly like in the list above.

### Example

**Input :**

```
3
AH KH QH TH JH
KH 5S 3C 5C 7D
QH QD 2S QC 2C
```

**Output :**

```
royal flush
pair
full house
```

---

Added by: Tomek Czajka  
Date: 2005-05-03  
Time limit: 7s  
Source limit: 50000B  
Languages: All  
Resource: Purdue Programming Contest Training

## SPOJ Problem Set (classical)

### 345. Mixtures

#### Problem code: MIXTURES

Harry Potter has  $n$  mixtures in front of him, arranged in a row. Each mixture has one of 100 different colors (colors have numbers from 0 to 99).

He wants to mix all these mixtures together. At each step, he is going to take two mixtures that stand next to each other and mix them together, and put the resulting mixture in their place.

When mixing two mixtures of colors  $a$  and  $b$ , the resulting mixture will have the color  $(a+b) \bmod 100$ .

Also, there will be some smoke in the process. The amount of smoke generated when mixing two mixtures of colors  $a$  and  $b$  is  $a*b$ .

Find out what is the minimum amount of smoke that Harry can get when mixing all the mixtures together.

#### Input

There will be a number of test cases in the input.

The first line of each test case will contain  $n$ , the number of mixtures,  $1 \leq n \leq 100$ .

The second line will contain  $n$  integers between 0 and 99 - the initial colors of the mixtures.

#### Output

For each test case, output the minimum amount of smoke.

#### Example

**Input :**

```
2
18 19
3
40 60 20
```

**Output :**

```
342
2400
```

In the second test case, there are two possibilities:

- first mix 40 and 60 (smoke: 2400), getting 0, then mix 0 and 20 (smoke: 0); total amount of smoke is 2400
- first mix 60 and 20 (smoke: 1200), getting 80, then mix 40 and 80 (smoke: 3200); total amount of smoke is 4400

The first scenario is a much better way to proceed.

---

Added by: Tomek Czajka

Date: 2005-05-03

Time limit: 9s

Source limit: 50000B

Languages: All

Resource: Purdue Programming Contest Training



## SPOJ Problem Set (classical)

### 346. Bytelandian gold coins

#### Problem code: COINS

In Byteland they have a very strange monetary system.

Each Bytelandian gold coin has an integer number written on it. A coin  $n$  can be exchanged in a bank into three coins:  $n/2$ ,  $n/3$  and  $n/4$ . But these numbers are all rounded down (the banks have to make a profit).

You can also sell Bytelandian coins for American dollars. The exchange rate is 1:1. But you can not buy Bytelandian coins.

You have one gold coin. What is the maximum amount of American dollars you can get for it?

#### Input

The input will contain several test cases (not more than 10). Each testcase is a single line with a number  $n$ ,  $0 \leq n \leq 1\,000\,000\,000$ . It is the number written on your coin.

#### Output

For each test case output a single line, containing the maximum amount of American dollars you can make.

#### Example

**Input :**

12  
2

**Output :**

13  
2

You can change 12 into 6, 4 and 3, and then change these into  $\$6 + \$4 + \$3 = \$13$ . If you try changing the coin 2 into 3 smaller coins, you will get 1, 0 and 0, and later you can get no more than \$1 out of them. It is better just to change the 2 coin directly into \$2.

---

Added by: Tomek Czajka

Date: 2005-05-03

Time limit: 9s

Source limit: 50000B

Languages: All

Resource: Purdue Programming Contest Training

## SPOJ Problem Set (classical)

### 348. Expedition

#### Problem code: EXPEDI

A group of cows grabbed a truck and ventured on an expedition deep into the jungle. Being rather poor drivers, the cows unfortunately managed to run over a rock and puncture the truck's fuel tank. The truck now leaks one unit of fuel every unit of distance it travels.

To repair the truck, the cows need to drive to the nearest town (no more than 1,000,000 units distant) down a long, winding road. On this road, between the town and the current location of the truck, there are  $N$  ( $1 \leq N \leq 10,000$ ) fuel stops where the cows can stop to acquire additional fuel (1..100 units at each stop).

The jungle is a dangerous place for humans and is especially dangerous for cows. Therefore, the cows want to make the minimum possible number of stops for fuel on the way to the town. Fortunately, the capacity of the fuel tank on their truck is so large that there is effectively no limit to the amount of fuel it can hold. The truck is currently  $L$  units away from the town and has  $P$  units of fuel ( $1 \leq P \leq 1,000,000$ ).

Determine the minimum number of stops needed to reach the town, or if the cows cannot reach the town at all.

#### Input

The first line of the input contains an integer  $t$  representing the number of test cases. Then  $t$  test cases follow. Each test case has the following form:

- Line 1: A single integer,  $N$
- Lines 2.. $N+1$ : Each line contains two space-separated integers describing a fuel stop: The first integer is the distance from the town to the stop; the second is the amount of fuel available at that stop.
- Line  $N+2$ : Two space-separated integers,  $L$  and  $P$

#### Output

For each test case, output a single integer giving the minimum number of fuel stops necessary to reach the town. If it is not possible to reach the town, output -1.

#### Example

Input :

```
1
4
4 4
5 2
11 5
15 10
25 10
```

**Output:**

2

**Input details**

The truck is 25 units away from the town; the truck has 10 units of fuel. Along the road, there are 4 fuel stops at distances 4, 5, 11, and 15 from the town (so these are initially at distances 21, 20, 14, and 10 from the truck). These fuel stops can supply up to 4, 2, 5, and 10 units of fuel, respectively.

**Output details:**

Drive 10 units, stop to acquire 10 more units of fuel, drive 4 more units, stop to acquire 5 more units of fuel, then drive to the town.

---

Added by: Walrus

Date: 2005-05-03

Time limit: 15s

Source limit: 50000B

Languages: All

Resource: US Open International 2005 Gold Division

## SPOJ Problem Set (classical)

### 349. Around the world

#### Problem code: AROUND

Over the years, FJ has made a huge number of farmer friends all around the world. Since he hasn't visited 'Farmer Ted' from England and 'Boer Harms' from Holland for a while, he'd like to visit them.

He knows the longitude of the farm where each of his worldwide friends resides. This longitude is an angle (an integer in the range 0..359) describing the farm's location on the Earth, which we will consider to be a circle instead of the more complex and traditional spherical representation. Except for the obvious discontinuity, longitudes increase when traveling clockwise on this circle.

FJ plans to travel by airplane to visit his  $N$  ( $1 \leq N \leq 5,000$ ) friends (whose farms are uniquely numbered 1.. $N$ ). He knows the schedules for  $M$  ( $1 \leq M \leq 25,000$ ) bidirectional flights connecting the different farms. Airplanes always travel shortest paths on the Earth's surface (i.e., on the shortest arc of a circle).

There will always be a unique shortest path between two farms that are directly connected. No pair of antipodal farms (exactly opposite each other on the circle) is ever directly connected.

Each airplane flight can be described as traveling in clockwise or counterclockwise direction around the Earth's surface. For example, a flight from longitude 30 to longitude 35 would be clockwise, as would be a flight from longitude 350 to longitude 10. However, a flight from longitude 350 to longitude 200 follows a shortest path counterclockwise around the circle.

FJ would find it very cool if he could make a trip around the world, visiting some of his friends along the way. He'd like to know if this is possible and if so, what is the minimum number of flights he can take to do so.

He wants to start and finish his journey at the location of his best friend (the one listed first in the input below). In order to make sure he actually circles the Earth, he wants to ensure that the clockwise distance he travels is different from the counterclockwise distance he travels.

#### Input

The first line of the input contains an integer  $t$  representing the number of test cases. Then  $t$  test cases follow. Each test case has the following form:

- Line 1: Two space-separated integers:  $N$  and  $M$
- Lines 2.. $N+1$ : Line  $i+1$  contains one integer: the longitude of the  $i$ -th farm. Line 2 contains the location of the farm of his best friend.
- Lines  $N+2$ .. $N+M+1$ : Line  $i+N+1$  contains two integers giving the indices of two farms that are connected by a flight.

## Output

For each test case, output a single integer specifying the minimum number of flights FJ needs to visit to make a trip around the world. Every time FJ moves from one farm to another counts as one flight. If it is impossible to make such a trip, output the integer -1.

## Example

### Input :

```
1
3 3
0
120
240
1 2
2 3
1 3
```

### Output :

```
3
```

### Input details

Farmer John has three friends at longitudes 0, 120, and 240. There are three flights: 0<->120, 120<->240, and 0<->240. The journey must start and finish at longitude 0.

### Output details

FJ must visit all 3 friends to make a full trip around the world.

---

Added by: Walrus

Date: 2005-05-03

Time limit: 9s

Source limit:50000B

Languages: All

Resource: US Open International 2005 Gold Division

## SPOJ Problem Set (classical)

### 350. Landscaping

#### Problem code: LANDSCAP

Farmer John is making the difficult transition from raising mountain goats to raising cows. His farm, while ideal for mountain goats, is far too mountainous for cattle and thus needs to be flattened out a bit. Since flattening is an expensive operation, he wants to remove the smallest amount of earth possible.

The farm is long and narrow and is described in a sort of two-dimensional profile by a single array of  $N$  ( $1 \leq N \leq 1000$ ) integer elevations (range 1..1,000,000) like this:

1 2 3 3 3 2 1 3 2 2 1 2,

which represents the farm's elevations in profile, depicted below with asterisks indicating the heights:

```
      * * *      *
    * * * * *  * * * *
  * * * * * * * * * * *
1 2 3 3 3 2 1 3 2 2 1 2
```

A contiguous range of one or more equal elevations in this array is a "peak" if both the left and right hand sides of the range are either the boundary of the array or an element that is lower in elevation than the peak. The example above has three peaks.

Determine the minimum volume of earth (each unit elevation reduction counts as one unit of volume) that must be removed so that the resulting landscape has no more than  $K$  ( $1 \leq K \leq 25$ ) peaks. Note well that elevations can be reduced but can never be increased.

If the example above is to be reduced to 1 peak, the optimal solution is to remove  $2 + 1 + 1 + 1 = 5$  units of earth to obtain this set of elevations:

```
      * * *      -
    * * * * *  - - - -
  * * * * * * * * * * *
1 2 3 3 3 2 1 1 1 1 1 1
```

where '-'s indicate removed earth.

## Input

The first line of the input contains integer  $t$  representing the number of test cases. Then  $t$  test cases follow. Each test case has the following form:

- Line 1: Two space-separated integers:  $N$  and  $K$
- Lines 2.. $N+1$ : Each line contains a single integer elevation. Line  $i+1$  contains the elevation for index  $i$ .

## Output

For each test case, output the minimum volume of earth that must be removed to reduce the number of peaks to K.

## Example

**Input :**

```
1
12 1
1
2
3
3
3
2
1
3
2
2
1
2
```

**Output :**

```
5
```

**Input details**

This is the example used above.

---

Added by: Walrus

Date: 2005-05-03

Time limit: 9s

Source limit: 50000B

Languages: All

Resource: US Open International 2005 Gold Division

## SPOJ Problem Set (classical)

### 359. Alpha Centauri Tennis

#### Problem code: ACT

As you may know, planets of Alpha Centauri (if they indeed do exist) would provide excellent conditions for intelligent life forms.

It is indeed true that there is a small Earthlike planet near Alpha Centauri, inhabited by a population of no particular significance. These humanlike creatures have much in common with us. Living in similar communities and having similar body structure and behavioral patterns, they unsurprisingly appreciate (approximately) the same time-killing activities as we do. One of these, the second most popular after Alpha Centauri Croquet, is the Alpha Centauri Tennis.

Although its rules differ from Earth Tennis, the two player version of Alpha Centauri Tennis resembles it in many ways. Same as Earth Tennis, it is played on a rectangular court divided into two parts by a net. Two players, standing on opposite sides of it, use a stringed racket to hit a ball back and forth to each other. There are certain rules how to hit the ball. The player who forces his opponent to violate one of these rules wins the current ball. The aim of both players is to win enough balls to win a game, enough games to win a set and enough sets to win the whole match. In the N player version of the Alpha Centauri Tennis a ball can be won by any one of the N players. Although technical details of this can be difficult to imagine, Alpha Centaurians are extremely inventive.

In the general N-player version, players serve in turns, following order determined before the match. Moreover, they shift when starting individual games and sets. For example, the players are A, B and C. They are ordered alphabetically. Player A serves the first ball of the first game. When the ball is won by one of the players, its B's turn to serve. After the game is won by one of the players, player B starts the second game. Finally, when the first set is won by someone, player B starts the second set. This repeats, always shifted by one player, until the match ends.

For three players the serving order looks as follows:

Set 1:

Game 1: A,B,C,A,B,C...

Game 2: B,C,A,....

Game 3: C,A,B,....

Game 4: A,B,C,....

...

Set 2:

Game 1: B,C,A,B,....

Game 2: C,A,B,....

Game 3: A,B,C,A,...

...

There are exact rules for counting the number of balls/games/sets won by a player.

#### **RULES FOR WINNING A GAME**

The state of a game can be described by assigning a non-negative number of points to each of the players. At the beginning of a game, the score of each player is zero.

Note: In Earth terminology, 0 points is called "love", 1 point is a "fifteen", 2 points is a "thirty", 3 points is a "forty" and 4 points is an "advantage". Be glad that you don't have to learn the Centaurian terminology :)

When a player P just won a ball, the new score is determined by using the first rule from the list that applies to the situation.



If P currently has 3 points and no other player has more than 2 points, P wins the current game.

If P currently has 4 points, he wins the game.

If any other player currently has 4 points, that player loses one point. P gains a point.

#### **RULES FOR WINNING A SET**

The set is won by the first player that at the same time:

won at least 6 games in this set

won at least 2 games more than any other player

#### **RULES FOR WINNING A MATCH**

The winner is the first player to win at least three sets. A set in which no other player won a game counts as two won sets.

#### **Problem specification**

An observer from the Intergalactic Tennis Federation was watching a tournament in Alpha Centauri Tennis. Being unable to understand Alpha Centaurian language, he only managed to write down the winner of each ball. Now, for each match, knowing the sequence in which the players were winning the balls, he would like to somehow determine its winner.

## **Input**

t - the number of test cases [ $t \leq 150$ ] than t test cases follows, each corresponding to one match. Each line contains the number of players N [ $N \leq 10$ ] and a string S consisting of uppercase letters [ $2 \leq |S| \leq 50000$ ]. The players are represented by the first N letters of the English alphabet. If the i-th letter of S is X, it means the player X won the i-th ball from the beginning of the match. You may assume that the match transcripts are correct and complete.

The order in which the players serve is the same as the order of their letters in the English alphabet.

## **Output**

For each line, output a single character, being the letter of the player who won the corresponding match.

## **Example**

**Input :**

```
1
3 BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
```

**Output :**

B

(B has won two sets, each of them by winning 6 games, while A and C won none. Thus each of these sets counts as two and B has won the match.)

---

Added by: Roman Sol

Date: 2005-05-13

Time limit: 1s

Source limit: 10000B

Languages: All

Resource: IPSC 2005

## SPOJ Problem Set (classical)

### 362. Ignore the Garbage

#### Problem code: IGARB

Fred works as an IT consultant in an insurance company. As they always had a large amount of customers waiting and arguing at the front desk, management decided to deploy a ticket machine. Each customer would get a ticket with a number and there will be fancy LCD display over each desk showing the number of the next person. Fred was appointed to get this new enhancement working.

Because Fred is lazy when it comes to manual labor and as an IT consultant he wouldn't lower himself to the level of some hardware technician (except when upgrading his own computer), he asked few technicians to install the displays and prepared himself just to plug in the ticket machine and try it out. Unfortunately (for Fred) the technicians, either inspired by Mr.Bean or because of their carelessness, installed the display upside-down.

Being a software guy, Fred decided that the hardware should not be tampered with after it is installed (except for the case if he would be able to get back the technicians to repair it, but they were already angry at him for his nagging). Then he noted that from time to time the display shows a correct number even when it is upside-down. And hey, the ticket machine is an embedded device and contains a small processor! It would be just a sin for an IT guy not to try to meddle with it and try running an own version of Linux. Now we just need to figure out which readable numbers will the display show.

#### Task specification

In the beginning the display shows the number 1 on its display. Each second the number shown is increased by 1. We see the display upside-down and thus not everything we see will make sense. Your task is to compute the K-th valid number we will see on the display. The digits the display uses are shown on the images below. An upside-down 1 still count as 1. The number we see may have leading zeroes - e.g. turning the number 600 upside down leads to a valid number.

[IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE] [IMAGE]  
[IMAGE] [IMAGE]

#### Input

t - the number of test cases [ $t \leq 2200$ ], then t test cases follow. Each test case consists of one integer  $K_i$  [ $0 < K_i \leq 10^{200}$ ].

#### Output

For each  $K_i$  from the input file, output the  $K_i$ -th number shown on the display (including the leading zeroes, if there are some).

#### Example

Input :

8  
1  
2  
3

4  
5  
6  
8  
98

**Output :**

1  
2  
5  
9  
8  
6  
11  
002

---

Added by: Roman Sol  
Date: 2005-05-15  
Time limit: 3s  
Source limit:30000B  
Languages: All  
Resource: IPSC 2005

## SPOJ Problem Set (classical)

### 365. Phidias

#### Problem code: PHIDIAS

Famous ancient Greek sculptor Phidias is making preparations to build another marvelous monument. For this purpose he needs rectangular marble plates of sizes  $W_1 \times H_1$ ,  $W_2 \times H_2$ , ...,  $W_N \times H_N$ .

Recently, Phidias has received a large rectangular marble slab. He wants to cut the slab to obtain plates of the desired sizes. Any piece of marble (the slab or the plates cut from it) can be cut either horizontally or vertically into two rectangular plates with integral widths and heights, cutting completely through that piece. This is the only way to cut pieces and pieces cannot be joined together. Since the marble has a pattern on it, the plates cannot be rotated: if Phidias cuts a plate of size  $A \times B$  then it cannot be used as a plate of size  $B \times A$  unless  $A = B$ . He can make zero or more plates of each desired size. A marble plate is wasted if it is not of any of the desired sizes after all cuts are completed. Phidias wonders how to cut the initial slab so that as little of it as possible will be wasted.

As an example, assume that in the figure below the width of the original slab is 21 and the height of the original slab is 11, and the desired plate sizes are  $10 \times 4$ ,  $6 \times 2$ ,  $7 \times 5$ , and  $15 \times 10$ . The minimum possible area wasted is 10, and the figure shows one sequence of cuts with total waste area of size 10.

#### [IMAGE]

Your task is to write a program that, given the size of the original slab and the desired plate sizes, calculates the minimum total area of the original slab that must be wasted.

#### Input

$t$  - the number of test cases, then  $t$  test cases follow [ $t \leq 20$ ]. The first line of each test case contains two integers: first  $W$ , the width of the original slab, and then  $H$ , the height of the original slab. The second line contains one integer  $N$ : the number of desired plate sizes. The following  $N$  lines contain the desired plate sizes. Each of these lines contains two integers: first the width  $W_i$  and then the height  $H_i$  of that desired plate size ( $1 \leq i \leq N$ ). [ $1 \leq W \leq 600$ ,  $1 \leq H \leq 600$ ,  $0 < N \leq 200$ ,  $1 \leq W_i \leq W$ , and  $1 \leq H_i \leq H$ .]

#### Output

For each test case output one line with a single integer: the minimum total area of the original slab that must be wasted.

#### Example

Input :

```
1
21 11
4
10 4
6 2
7 5
```

15 10

**Output :**

10

---

Added by: Roman Sol

Date: 2005-05-20

Time limit: 21s

Source limit:30000B

Languages: All

Resource: IOI 2004

## SPOJ Problem Set (classical)

### 366. Farmer

#### Problem code: FARMER

A farmer has a set of fields, each of which is surrounded by cypress trees. Also, the farmer has a set of strips of land, each of which has a row of cypress trees. In both fields and strips, between every two consecutive cypress trees is a single olive tree. All of the farmer's cypress trees either surround a field or are in a strip and all of the farmer's olive trees are between two consecutive cypress trees in a field or in a strip.

One day the farmer became very ill and he felt that he was going to die. A few days before he passed away he called his eldest son and told him, "I give you any  $Q$  cypress trees of your choice and all the olive trees which are between any two consecutive cypress trees you have chosen." >From each field and from each strip the son can pick any combination of cypress trees. Since the eldest son loves olives he wants to pick the  $Q$  cypress trees which will allow him to inherit as many olive trees as possible.

#### [IMAGE]

In Figure 1, assume that the son is given  $Q=17$  cypress trees. To maximize his olive inheritance he should choose all the cypress trees in Field 1 and Field 2, inheriting 17 olive trees.

You are to write a program which, given the information about the fields and the strips and the number of cypress trees the son can pick, determines the largest possible number of olive trees the son may inherit.

#### Input

$t$  - the number of test cases [ $t \leq 20$ ], then  $t$  test cases follow. The first line of each test case contains first the integer  $Q$ : the number of cypress trees the son is to select; then the integer  $M$ , the number of fields; and then the integer  $K$ , the number of strips. The second line contains  $M$  integers  $N_1, N_2, \dots, N_M$ : the numbers of cypress trees in fields. The third line contains  $K$  integers  $R_1, R_2, \dots, R_K$ : the numbers of cypress trees in strips.

In all test cases,  $0 \leq Q \leq 150000$ ,  $0 \leq M \leq 2000$ ,  $0 \leq K \leq 2000$ ,  $3 \leq N_1 \leq 150$ ,  $3 \leq N_2 \leq 150, \dots, 3 \leq N_M \leq 150$ ,  $2 \leq R_1 \leq 150$ ,  $2 \leq R_2 \leq 150, \dots, 2 \leq R_K \leq 150$ . The total number of cypress trees in the fields and strips is at least  $Q$ . Additionally, in 50% of the test cases,  $Q \leq 1500$ .

#### Output

For each test case output one integer: largest possible number of olive trees the son may inherit.

#### Example

Input :

```
1
17 3 3
13 4 8
4 8 6
```

**Output :**

17

---

Added by: Roman Sol  
Date: 2005-05-22  
Time limit: 50s  
Source limit:30000B  
Languages: All  
Resource: IOI 2004

## SPOJ Problem Set (classical)

### 367. Empodia

#### Problem code: EMPODIA

The ancient mathematician and philosopher Pythagoras believed that reality is mathematical in nature. Present-day biologists study properties of biosequences. A biosequence is a sequence of  $M$  integers, which

- \* contains each of the numbers  $0, 1, \dots, M-1$ ,
- \* starts with 0 and ends with  $M-1$ , and
- \* has no two elements  $E, E+1$  in adjacent positions in this order.

A subsequence consisting of adjacent elements of a biosequence is called a segment..

A segment of a biosequence is called a framed interval if it includes all integers whose values are between the value of the first element, which must be the smallest element in the segment, and the last element, which must be the largest and different from the first. A framed interval is called an empodio if it does not contain any shorter framed intervals.

As an example, consider the biosequence (0,3,5,4,6,2,1,7). The whole biosequence is a framed interval. However, it contains another framed interval (3,5,4,6) and therefore it is not an empodio. The framed interval (3,5,4,6) does not contain a shorter framed interval, so it is an empodio. Furthermore, it is the only empodio in that biosequence.

You are to write a program that, given a biosequence, finds all empodia (plural for empodio) in that biosequence.

#### Input

$t$  - the number of test cases [ $t \leq 20$ ], then  $t$  test cases follow. The first line of each test case contains a single integer  $M$ : the number of integers in the input biosequence. The following  $M$  lines contain the integers of the biosequence in the order of the sequence. Each of these  $M$  lines contains a single integer. In one test case,  $1000000 \leq M \leq 1100000$ . In all other test cases,  $1 \leq M \leq 60000$ . Additionally, in 50% of the test cases,  $M \leq 2600$ .

#### Output

The first line for each test case is to contain one integer  $H$ : the number of empodia in the input biosequence. The following  $H$  lines describe all empodia of the input biosequence in the order of appearance of the starting point in the biosequence. Each of these lines is to contain two integers  $A$  and  $B$  (in that order) separated by a space, where the  $A$ th element of the input biosequence is the first element of the empodio and the  $B$ th element of the input biosequence is the last element of the empodio.

#### Example

Input :

```
1
8
0
3
5
```



4  
6  
2  
1  
7

**Output :**

1  
2 5

---

Added by: Roman Sol  
Date: 2005-05-22  
Time limit: 40s  
Source limit:50000B  
Languages: All  
Resource: IOI 2004

## SPOJ Problem Set (classical)

### 369. Math I

#### Problem code: MATH1

You are given  $n$  integers  $a_1, a_2, \dots, a_n$  ( $0 \leq a_i \leq n$ ). The sum  $a_1 + a_2 + \dots + a_n$  does not exceed  $n$ . Your task is to find  $n$  other integers  $x_1, x_2, \dots, x_n$  (note that  $x_i$  may be negative numbers) satisfying the following conditions:

- $(x_i - x_{i+1} + a_{i+1} = 0)$  or  $(x_i - x_{i+1} + a_{i+1} = 1)$  for  $i=1..n-1$
- $(x_n - x_1 + a_1 = 0)$  or  $(x_n - x_1 + a_1 = 1)$
- $|x_1| + |x_2| + \dots + |x_n|$  is minimized

#### Input

The first line of the input file contains an integer  $t$  representing the number of test cases ( $t \leq 20$ ). Then  $t$  test cases follow. Each test case has the following form:

- The first line contains  $n$  ( $1 \leq n \leq 1000$ )
- The second line contains  $n$  integers  $a_1, a_2, \dots, a_n$  separated by single spaces

#### Output

For each test case output a single value: the minimum value of  $|x_1| + |x_2| + \dots + |x_n|$

#### Example

**Input :**

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

**Output :**

```
1
3
```

**Output Details:**

In the former case, the optimal solution is  $(x_1=0, x_2=0, x_3=0, x_4=-1)$

In the latter case, the optimal solution is  $(x_1=-1, x_2=-1, x_3=0, x_4=1, x_5=0)$

---

Added by: Walrus  
Date: 2005-05-25  
Time limit: 20s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 370. Ones and zeros

#### Problem code: ONEZERO

Certain positive integers have their decimal representation consisting only of ones and zeros, and having at least one digit one, e.g. 101. If a positive integer does not have such a property, one can try to multiply it by some positive integer to find out whether the product has this property.

#### Input

Number  $K$  of test cases ( $K$  is approximately 1000);  
in each of the next  $K$  lines there is one integer  $n$  ( $1 \leq n \leq 20000$ )

#### Output

For each test case, your program should compute the smallest multiple of the number  $n$  consisting only of digits 1 and 0 (beginning with 1).

#### Example

**Input :**

```
3
17
11011
17
```

**Output :**

```
11101
11011
11101
```

---

Added by: Paweł Dobrzycki

Date: 2005-05-26

Time limit: 8s

Source limit: 4096B

Languages: All

Resource: II Polish Olympiad in Informatics, 1st Stage

## SPOJ Problem Set (classical)

### 373. Greedy island

#### Problem code: GREED

Gon is on Greedy island. He wants to go home. But to get the ticket to leave the game, he has to get N cards labeled in a sequence from 1 to N (the order of the cards in his hand is irrelevant). He already has N cards, but not forming a sequence from 1 to N. So he wants you to help him. For some cards, he can change one card for another for one piece of gold. Help him to get the ticket at the minimum cost (using the minimum number of exchanges).

#### Input

The first line contains t, the number of tests ( $1 \leq t \leq 10$ ). For each test case:

- the number of cards N is given in the first line ( $2 \leq N \leq 500$ ).
- the next N lines contain the N cards owned by Gon.
- the following line contains e, the number of different allowed types of exchanges.
- the next e lines contain two integers  $x_i, y_i$  each which mean that we can exchange and replace the card marked x by the card marked y and vice versa.

There is a blank line after each test case.

#### Output

For each test case, output a line denoting the minimum required cost.

#### Example

**Input :**

```
1
4
1
2
2
2
2
2 3
3 4
```

**Output :**

```
3
```

---

Added by: Le Trong Dao  
Date: 2005-06-08  
Time limit: 50s  
Source limit:50000B  
Languages: All  
Resource: Mr.Tran Minh Quan

## SPOJ Problem Set (classical)

### 374. Count maximum matrices

#### Problem code: MATRIX

You are given a matrix A of M rows and N columns, consisting of numbers 0 and 1. For a rectangle in A (sides  $\geq 1$ ), X1 is the number of ones on its sides, X0 is the number of zeros on its sides, and its *value* is defined as  $X1 - X0$ . Let us consider W, the maximum value taken over submatrices of A, and S, the number of submatrices with value W. Your task is to find W and S.

#### Input

The first line of input contains the number of testcases t ( $t \leq 15$ ). The first line of each testcase contains the numbers M, N ( $1 \leq M, N \leq 200$ ) Then M lines follow. In each line, there are N numbers 0 or 1.

#### Output

For each testcase, you should output a single line with numbers W and S.

#### Example

**Input :**

```
1
5 6
1 1 1 1 1 1
1 0 0 0 0 1
1 0 0 0 0 1
1 0 0 0 0 1
1 1 1 1 1 1
```

**Output :**

```
18 1
```

---

Added by: Le Đôn Khue

Date: 2005-06-08

Time limit: 10s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 375. Query on a tree

#### Problem code: QTREE

You are given a tree (an acyclic undirected connected graph) with  $N$  nodes, and edges numbered 1, 2, 3... $N-1$ .

We will ask you to perform some instructions of the following form:

- **CHANGE  $i$   $t_i$**  : change the cost of the  $i$ -th edge to  $t_i$   
or
- **QUERY  $a$   $b$**  : ask for the maximum edge cost on the path from node  $a$  to node  $b$

#### Input

The first line of input contains an integer  $t$ , the number of test cases ( $t \leq 20$ ).  $t$  test cases follow.

For each test case:

- In the first line there is an integer  $N$  ( $N \leq 10000$ ),
- In the next  $N-1$  lines, the  $i$ -th line describes the  $i$ -th edge: a line with three integers  $a$   $b$   $c$  denotes an edge between  $a$ ,  $b$  of cost  $c$  ( $c \leq 1000000$ ),
- The next lines contain instructions "**CHANGE  $i$   $t_i$** " or "**QUERY  $a$   $b$** ",
- The end of each test case is signified by the string "**DONE**".

There is one blank line between successive tests.

#### Output

For each "**QUERY**" operation, write one integer representing its result.

#### Example

**Input :**

```
1
3
1 2 1
2 3 2
QUERY 1 2
CHANGE 1 3
QUERY 1 2
DONE
```

**Output :**

```
1
3
```

---

Added by: Thanh-Vy Hua  
Date: 2005-06-08  
Time limit: 5s  
Source limit: 15000B  
Languages: All except: C99 strict



## SPOJ Problem Set (classical)

### 376. A concrete simulation

#### Problem code: ACS

You are given a matrix  $M$  of type  $1234 \times 5678$ . It is initially filled with integers  $1 \dots 1234 \times 5678$  in row major order. Your task is to process a list of commands manipulating  $M$ . There are 4 types of commands:

"R x y" swap the x-th and y-th row of  $M$  ;

"C x y" swap the x-th and y-th column of  $M$  ;

"Q x y" write out  $M(x,y)$  ;

"W z" write out x and y where  $z=M(x,y)$ .

#### Input

A list of valid commands. Input terminated by EOF.

#### Output

For each "Q x y" write out one line with the current value of  $M(x,y)$ , for each "W z" write out one line with the value of x and y ( interpreted as above ) separated by a space.

##### Input :

```
R 1 2
Q 1 1
Q 2 1
W 1
W 5679
C 1 2
Q 1 1
Q 2 1
W 1
W 5679
```

##### Output :

```
5679
1
2 1
1 1
5680
2
2 2
1 2
```

---

Added by: Noszály Csaba

Date: 2005-06-10

Time limit: 7s

Source limit: 7777B

Languages: All

Resource: Folklore

## SPOJ Problem Set (classical)

### 379. Ambiguous Permutations

#### Problem code: PERMUT2

Some programming contest problems are really tricky: not only do they require a different output format from what you might have expected, but also the sample output does not show the difference. For an example, let us look at permutations.

A **permutation** of the integers  $1$  to  $n$  is an ordering of these integers. So the natural way to represent a permutation is to list the integers in this order. With  $n = 5$ , a permutation might look like 2, 3, 4, 5, 1.

However, there is another possibility of representing a permutation: You create a list of numbers where the  $i$ -th number is the position of the integer  $i$  in the permutation. Let us call this second possibility an **inverse permutation**. The inverse permutation for the sequence above is 5, 1, 2, 3, 4.

An **ambiguous permutation** is a permutation which cannot be distinguished from its inverse permutation. The permutation 1, 4, 3, 2 for example is ambiguous, because its inverse permutation is the same. To get rid of such annoying sample test cases, you have to write a program which detects if a given permutation is ambiguous or not.

#### Input Specification

The input contains several test cases.

The first line of each test case contains an integer  $n$  ( $1 \leq n \leq 100000$ ). Then a permutation of the integers  $1$  to  $n$  follows in the next line. There is exactly one space character between consecutive integers. You can assume that every integer between  $1$  and  $n$  appears exactly once in the permutation.

The last test case is followed by a zero.

#### Output Specification

For each test case output whether the permutation is ambiguous or not. Adhere to the format shown in the sample output.

#### Sample Input

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

#### Sample Output

```
ambiguous
not ambiguous
ambiguous
```

---

Added by: Adrian Kuegel

Date: 2005-06-24

Time limit: 10s

Source limit: 50000B

Languages: All

Resource: own problem, used in University of Ulm Local Contest 2005

## SPOJ Problem Set (classical)

### 380. Bullshit Bingo

#### Problem code: BINGO

Bullshit Bingo is a game to make lectures, seminars or meetings less boring. Every player has a card with 5 rows and 5 columns. Each of the 25 cells contains a word (the cell in the middle has always the word "BINGO" written in it). Whenever a player hears a word which is written on his card, he can mark it. The cell in the middle is already marked when the game starts. If a player has marked all the words in a row, a column or a diagonal, he stands up and shouts "BULLSHIT". After this, the game starts over again.

Sitting in a lecture, you observe that some students in the audience are playing Bullshit Bingo. You wonder what the average number of different words is until "BULLSHIT" is exclaimed. For the purpose of this problem, a word consists of letters of the English alphabet ('a' to 'z' or 'A' to 'Z'). Words are separated by characters other than letters (for example spaces, digits or punctuation). Do the comparison of words case-insensitively, i.e. "Bingo" is the same word as "bingo". When counting the number of different words, ignore the word BULLSHIT (indicating the end of the game), and consider only the words of the current game, i.e., if a word has already occurred in a previous game, you may still count it in the current game. If the last game is unfinished, ignore the words of that game.

#### Input Specification

The input file consists of the text of the lecture, with "BULLSHIT" occurring occasionally. The first game starts with the first word in the input. Each occurrence of "BULLSHIT" indicates the end of one game.

You may assume, that

- the word "BULLSHIT" occurs only in uppercase letters
- every word has at most 25 characters, and each line has at most 100 characters
- there are at most 500 different words before a game ends
- the players follow the rules, so there is no need to check if a game is valid or not
- at least one game is completed

#### Output Specification

The output consists of one number: the average number of different words needed to win a game. Write the number as a reduced fraction in the format shown below. Reduced fraction means that there should be no integer greater than 1 which divides both the numerator and denominator. For example if there were 10 games, and the number of different words in each game summed up to 55, print "11 / 2".

#### Sample Input

```
Programming languages can be classified BULLSHIT into following types:
- imperative and BULLSHIT procedural languages
- functional languages
- logical BULLSHIT programming languages
- object-oriented BULLSHIT languages
```

## Sample Output

9 / 2

---

*In the sample input, there are 4 completed games. The number of different words is 5, 5, 4 and 4, respectively.*

---

Added by: Adrian Kuegel

Date: 2005-06-24

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: University of Ulm Local Contest 2005

## SPOJ Problem Set (classical)

### 382. Decorate the wall

#### Problem code: DECORATE

After building his huge villa, Mr. Rich cannot help but notice that the interior walls look rather blank. To change that, he starts to hang paintings from his wonderful collection. But soon he realizes that it becomes quite difficult to find a place on the wall where a painting can be placed without overlapping other paintings. Now he needs a program which would tell him, given the already placed paintings, where to place the next painting without moving any other paintings (or indicating that this is impossible). Paintings have a rectangular shape and are to be placed parallel to the side of the wall. If you do not mind a nice reward from Mr. Rich, go on and solve the problem.

#### Input Specification

The first line of the input file contains a number representing the number of test cases to follow. Each test case starts with a line containing three numbers  $n$ ,  $w$  and  $h$ .  $n$  is the number of paintings already hanging on the wall,  $w$  is the width of the wall and  $h$  is the height of the wall.

The next  $n$  lines contain 4 integers  $x_1, y_1, x_2, y_2$  each ( $0 \leq x_1 < x_2 \leq w, 0 \leq y_1 < y_2 \leq h$ ); the x-coordinates give the distance to the left end of the wall, the y-coordinates give the distance to the bottom of the wall.  $(x_1, y_1)$  is the position of the lower left corner of a painting,  $(x_2, y_2)$  is the position of the upper right corner. The last line of each test case contains the dimensions of the next painting to be placed, first its width  $w'$ , then its height  $h'$  ( $1 \leq w' \leq w, 1 \leq h' \leq h$ ). You are not allowed to rotate the painting.

You can assume that  $0 \leq n \leq 200$  and  $1 \leq w, h \leq 1000000$ . Moreover, all paintings already hanging do not overlap.

#### Output Specification

Produce one line of output for each test case. Write "Fail!" if there is no place left on the wall where the painting could be placed without overlapping other paintings. Otherwise, write the coordinates where the lower left corner of the painting should be placed. In case there is more than one solution, select the solution with a minimum y-coordinate, and break ties using the minimum x-coordinate.

## Sample Input

```
2
1 10 9
5 4 10 9
9 5
2 10 10
5 5 10 10
0 0 4 3
3 4
```

The following image illustrates the second sample test case:  
[IMAGE]

## Sample Output

```
Fail!
4 0
```

---

Added by: Adrian Kuegel  
Date: 2005-06-24  
Time limit: 6s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2005

## SPOJ Problem Set (classical)

### 383. European railroad tracks

#### Problem code: EUROPEAN

As you may already know, different countries in Europe use different railroad systems. Not only do they use different voltages for their trains, but also the distance between the two rails (gauge) differs. The following table shows some railway gauges used:

<b>Broad gauge (Spain):</b>	<b>1674 mm</b>
<b>Broad gauge (Portugal):</b>	<b>1665 mm</b>
<b>Broad gauge (Ireland):</b>	<b>1600 mm</b>
<b>Broad gauge (Finland):</b>	<b>1524 mm</b>
<b>Broad gauge (former USSR):</b>	<b>1520 mm</b>
<b>Standard gauge:</b>	<b>1435 mm</b>
<b>Narrow gauge (meter gauge):</b>	<b>1000 mm</b>

A museum has trains from several countries. It needs tracks for every train type in order to show visitors the trains in use. However, since only one train is used at a time, a rail can be used by trains of different types. It follows that for  $n$  trains, each requiring a different railway gauge,  $n + 1$  rails are sufficient (each train uses the leftmost rail and a rail that has exactly the required distance to it). But sometimes it is possible to save even more rails.

Given the required railway gauges, your task is to construct a railway track that can be used by every train and requires the least number of rails. Note that a train can use any two rails, provided the distance between them is right.

#### Input Specification

The first line of the input file contains a number representing the number of test cases to follow. Each test case starts with an integer  $n$  (the number of different railway gauges required). The next line contains  $n$  integers between 1000 and 5000, each defining one required railway gauge.

You can assume that  $1 \leq n \leq 8$ . Moreover, for every test case in the input file, there will be a solution requiring at most 5 rails.

#### Output Specification

The output for each test case consists of three lines:

The first line is of the form "Scenario #X", where X is the test case number starting with 1. The second line describes the solution your program has found; first your program should print how many rails are needed, followed by a colon, then the positions of each rail in increasing order (the first rail should be at position 0). The third line should be blank. If there are several solutions with the minimum number of rails, any one will do.



## Sample Input

```
3
4
1524 1520 1609 1435
3
1000 1520 1600
6
1000 2000 3000 4000 1500 2500
```

## Sample Output

```
Scenario #1
4: 0 1520 1609 3044

Scenario #2
4: 0 1000 1520 1600

Scenario #3
5: 0 1500 3000 4000 5000
```

---

Added by: Adrian Kuegel  
Date: 2005-06-24  
Time limit: 1s-10s  
Source limit: 50000B  
Languages: All except: PERL 6  
Resource: University of Ulm Local Contest 2005

## SPOJ Problem Set (classical)

### 384. Any fool can do it

#### Problem code: FOOL

Surely you know someone who thinks he is very clever. You decide to let him down with the following problem:

- "Can you tell me what the syntax for a set is?", you ask him.
- "Sure!", he replies, "a set encloses a possibly empty list of elements within two curly braces. Each element is either another set or a letter of the given alphabet. Elements in a list are separated by a comma."
- "So if I give you a word, can you tell me if it is a syntactically correct representation of a set?"
- "Of course, any fool can do it!" is his answer.

Now you got him! You present him with the following grammar, defining formally the syntax for a set (which was described informally by him):

```
Set          ::= "{" Elementlist "}"
Elementlist  ::= <empty> | List
List         ::= Element | Element "," List
Element      ::= Atom | Set
Atom         ::= "{" | "}" | ","
```

<empty> stands for the empty word, i.e. the list in a set can be empty.

Soon he realizes that this task is much harder than he has thought, since the alphabet consists of the characters which are also used for the syntax of the set. So he claims that it is not possible to decide efficiently if a word consisting of "{", "}" and "," is a syntactically correct representation of a set or not.

To disprove him, you need to write an efficient program that will decide this problem.

#### Input Specification

The first line of the input file contains a number representing the number of lines to follow.

Each line consists of a word, for which your program has to decide if it is a syntactically correct representation of a set. You may assume that each word consists of between 1 and 200 characters from the set { "{", "}", "," }.

#### Output Specification

Output for each test case whether the word is a set or not. Adhere to the format shown in the sample output.

#### Sample Input

```
{ }  
{ { } }  
{ { } }, { , }  
{ , , }
```

## Sample Output

```
Word #1: Set  
Word #2: Set  
Word #3: Set  
Word #4: No Set
```

---

Added by: Adrian Kuegel  
Date: 2005-06-24  
Time limit: 10s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2005

## SPOJ Problem Set (classical)

### 385. Game schedule required

#### Problem code: GAME

Sheikh Abdul really loves football. So you better don't ask how much money he has spent to make famous teams join the annual tournament. Of course, having spent so much money, he would like to see certain teams play each other. He worked out a complete list of games he would like to see. Now it is your task to distribute these games into rounds according to following rules:

- In each round, each remaining team plays at most one game
- If there is an even number of remaining teams, every team plays exactly one game
- If there is an odd number of remaining teams, there is exactly one team which plays no game (it advances with a wildcard to the next round)
- The winner of each game advances to the next round, the loser is eliminated from the tournament
- If there is only one team left, this team is declared the winner of the tournament

As can be proved by induction, in such a tournament with  $n$  teams, there are exactly  $n - 1$  games required until a winner is determined.

Obviously, after round 1, teams may already have been eliminated which should take part in another game. To prevent this, for each game you also have to tell which team should win.

#### Input Specification

The input file contains several test cases.

Each test case starts with an integer  $n$  ( $2 \leq n \leq 1000$ ), the number of teams participating in the tournament. The following  $n$  lines contain the names of the teams participating in the tournament. You can assume that each team name consists of up to 25 letters of the English alphabet ('a' to 'z' or 'A' to 'Z').

Then follow  $n - 1$  lines, describing the games the sheikh would like to see (in any order). Each line consists of the two names of the teams which take part in that game. You can assume that it is always possible to find a tournament schedule consisting of the given games.

The last test case is followed by a zero.

#### Output Specification

For each test case, write the game schedule, distributed in rounds.

For each round, first write "Round #X" (where X is the round number) in a line by itself. Then write the games scheduled in this round in the form: "A defeats B", where A is the name of the advancing team and B is the name of the team being eliminated. You may write the games of a round in any order. If a wildcard is needed for the round, write "A advances with wildcard" after the last game of the round, where A is the name of the team which gets the wildcard. After the last round, write the winner in the format shown below. Print a blank line after each test case.

## Sample Input

```
3
A
B
C
A B
B C
5
A
B
C
D
E
A B
C D
A E
C E
0
```

## Sample Output

```
Round #1
B defeats A
C advances with wildcard
Round #2
C defeats B
Winner: C
```

```
Round #1
A defeats B
C defeats D
E advances with wildcard
Round #2
E defeats A
C advances with wildcard
Round #3
E defeats C
Winner: E
```

---

*Note that there is always more than one possible game schedule; you may print any of them.*

---

Added by: Adrian Kuegel

Date: 2005-06-24

Time limit: 10s

Source limit: 50000B

Languages: All

Resource: own problem, used in University of Ulm Local Contest 2005

## SPOJ Problem Set (classical)

### 386. Help the problem setter

#### Problem code: HELP

Preparing a problem for a programming contest takes a lot of time. Not only do you have to write the problem description and write a solution, but you also have to create difficult input files. In this problem, you get the chance to help the problem setter to create some input for a certain problem.

For this purpose, let us select the problem which was not solved during last year's local contest. The problem was about finding the optimal binary search tree, given the probabilities that certain nodes are accessed. Your job will be: given the desired optimal binary search tree, find some access probabilities for which this binary search tree is the unique optimal binary search tree. Don't worry if you have not read last year's problem, all required definitions are provided in the following.

Let us define a **binary search tree** inductively as follows:

- The empty tree which has no node at all is a binary search tree
- Each non-empty binary search tree has a root, which is a node labelled with an integer, and two binary search trees as left and right subtree of the root
- A left subtree contains no node with a label  $\geq$  than the label of the root
- A right subtree contains no node with a label  $\leq$  than the label of the root

Given such a binary search tree, the following **search procedure** can be used to locate a node in the tree:

Start with the root node. Compare the label of the current node with the desired label. If it is the same, you have found the right node. Otherwise, if the desired label is smaller, search in the left subtree, otherwise search in the right subtree.

The **access cost** to locate a node is the number of nodes you have to visit until you find the right node. An **optimal binary search tree** is a binary search tree with the minimum expected access cost.

#### Input Specification

The input file contains several test cases.

Each test case starts with an integer  $n$  ( $1 \leq n \leq 50$ ), the number of nodes in the optimal binary search tree. For simplicity, the labels of the nodes will be integers from 1 to  $n$ . The following  $n$  lines describe the structure of the tree. The  $i$ -th line contains the labels of the roots of the left and right subtree of the node with label  $i$  (or -1 for an empty subtree). You can assume that the input always defines a valid binary search tree.

The last test case is followed by a zero.

#### Output Specification

For each test case, write one line containing the access frequency for each node in increasing order of the labels of the nodes. To avoid problems with floating point precision, the frequencies should be written as integers, meaning the access probability for a node will be the frequency divided by the sum of all frequencies. Make sure that you do not write any integer bigger than  $2^{63} - 1$  (the maximum value fitting in the C/C++ data type *long long* or the Java data type *long*). Otherwise, you may produce any solution ensuring that there is exactly one optimal binary search tree: the binary search tree given

in the input.

## Sample Input

```
3
-1 -1
1 3
-1 -1
10
-1 2
-1 3
-1 4
-1 5
-1 6
-1 7
-1 8
-1 9
-1 10
-1 -1
0
```

## Sample Output

```
1 1 1
512 256 128 64 32 16 8 4 2 1
```

---

*Note that the first test case in the sample input describes a tree looking like*

```
  2
 / \
1   3
```

---

Added by: Adrian Kuegel

Date: 2005-06-24

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: own problem, used in University of Ulm Local Contest 2005

## SPOJ Problem Set (classical)

### 387. Travelling tours

#### Problem code: TOURS

In Hanoi, there are  $N$  beauty-spots ( $2 \leq N \leq 200$ ), connected by  $M$  one-way streets. The length of each street does not exceed 10000. You are the director of a travel agency, and you want to create some tours around the city which satisfy the following conditions:

- Each of the  $N$  beauty-spots belongs to exactly one tour.
- Each tour is a cycle which consists of at least 2 places and visits each place once (except for the place we start from which is visited twice).
- The total length of all the streets we use is minimal.

#### Input

The first line of input contains the number of testcases  $t$  ( $t \leq 15$ ). The first line of each testcase contains the numbers  $N, M$ . The next  $M$  lines contain three integers  $U V W$  which mean that there is one street from  $U$  to  $V$  of length  $W$ .

#### Output

For each test case you should output the minimal total length of all tours.

#### Example

**Input :**

```
2
6 9
1 2 5
2 3 5
3 1 10
3 4 12
4 1 8
4 6 11
5 4 7
5 6 9
6 5 4
5 8
1 2 4
2 1 7
1 3 10
3 2 10
3 4 10
4 5 10
5 3 10
5 4 3
```

**Output :**

```
42
40
```



**Detailed explanation:**

Test 1:

Tour #1: 1 - 2 - 3 - 1 --> Length = 20

Tour #2: 6 - 5 - 4 - 6 --> Length = 22

Test 2:

Tour #1: 1 - 3 - 2 - 1 --> Length = 27

Tour #2: 5 - 4 - 5 --> Length = 13

---

Added by: Le Đôn Khue

Date: 2005-06-25

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: 2nd round VOI 2004

## SPOJ Problem Set (classical)

### 388. Menu

#### Problem code: MENU

Alfred wants to plan what to cook in the next days. He can cook various dishes. For each dish the costs of the ingredients and the benefit value is known. If a dish is cooked the second time in a row, the benefit value for the second time is 50 percent of the benefit value of first time, if it is prepared for the third or higher time in a row, the benefit value is 0. For example cooking a dish with benefit value  $v$  three times in a row leads to a total benefit value of  $1.5 \cdot v$ .

Help him to build the menu which maximizes the benefit value under the constraint that his budget is not exceeded.

#### Input

The input consists of several test cases. Each test case begins with 3 integers in a line: The number of days  $k$  ( $1 \leq k \leq 21$ ) Alfred wants to plan for, the number of dishes  $n$  ( $1 \leq n \leq 50$ ) he can cook and his budget  $m$  ( $0 \leq m \leq 100$ ). The following  $n$  lines describe the dishes Alfred can cook. The  $i$ -th line contains two integers: the costs  $c$  ( $1 \leq c \leq 50$ ) and the benefit value  $v$  ( $1 \leq v \leq 10000$ ) of the  $i$ -th dish.

The end of the input is signaled by a test case with  $k = n = m = 0$ . You don't need to process this test case.

#### Output

For each output, print the maximum benefit value reachable with 1 digit after the decimal point. Then print  $k$  integers with  $i$ -th integer being the number of the dish to cook on day  $i$ . Dishes are numbered from 1 to  $n$ . Print at least one space or new line character after each integer.

If there are several possible menus reaching the maximum benefit value, select the one with minimum costs, if there are several with minimum costs, you can print any of them.

If every menu exceeds the budget, print only the benefit value of 0.

#### Example

**Input :**

```
2 1 5
3 5
3 5 20
2 5
18 6
1 1
3 3
2 3
0 0 0
```

**Output :**

```
0.0

13.0
1 5 1
```

---

Added by: Adrian Kuegel  
Date: 2005-07-04  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: own problem

## **SPOJ Problem Set (classical)**

### **389. Use of Hospital Facilities**

#### **Problem code: HOSPITAL**

County General Hospital is trying to chart its course through the troubled waters of the economy and shifting population demographics. To support the planning requirements of the hospital, you have been asked to develop a simulation program that will allow the hospital to evaluate alternative configurations of operating rooms, recovery rooms and operations guidelines. Your program will monitor the usage of operating rooms and recovery room beds during the course of one day.

County General Hospital has several operating rooms and recovery room beds. Each surgery patient is assigned to an available operating room and following surgery the patient is assigned to one of the recovery room beds. The amount of time necessary to transport a patient from an operating room to a recovery room is fixed and independent of the patient. Similarly, both the amount of time to prepare an operating room for the next patient and the amount of time to prepare a recovery room bed for a new patient are fixed.

All patients are officially scheduled for surgery at the same time, but the order in which they actually go into the operating rooms depends on the order of the patient roster. A patient entering surgery goes into the lowest numbered operating room available. For example, if rooms 2 and 4 become available simultaneously, the next patient on the roster not yet in surgery goes into room 2 and the next after that goes into room 4 at the same time. After surgery, a patient is taken to the available recovery room bed with the lowest number. A recovery room bed is only available if the preparation is already finished when the patient leaves surgery. If two patients emerge from surgery at the same time, the patient with the lower surgery room number will be the first assigned to a recovery room bed.

#### **Input**

The input file contains data for several simulation runs. Each run is separated by a blank line. All numeric data in the input file are integers, and successive integers on the same line are separated by blanks. The first line of each run is the set of hospital configuration parameters to be used for this run. The parameters are, in order:

- Number of operating rooms (maximum of 10)
- Number of recovery room beds (maximum of 30)
- Starting hour for 1st surgery of day (based on a 24-hour clock)
- Minutes to transport patient from operating room to recovery room
- Minutes to prepare operating room for next patient
- Minutes to prepare recovery room bed for next patient
- Number of surgery patients for the day (maximum of 100)

This initial configuration data will be followed by pairs of lines of patient data as follows:

- Line 1: Last name of patient (maximum of 8 characters)
- Line 2: Minutes required for surgery Minutes required in the recovery room

Patient records in the input file are ordered according to the patient roster, which determines the order in which patients are scheduled for surgery. The number of recovery room beds specified in any configuration will be sufficient to handle patients arriving from surgery (No queuing of patients for recovery room beds will be required). Computed times will not extend past 24:00.

## Output

Correct output shows which operating room and which recovery room bed is used by each patient, and the time period that the patient uses the room and bed along with a summary of the utilization of hospital facilities for that day. The output file consists of several sets of two tables each describing the results of the simulation run. The first table is in columnar form with appropriate column labels to show the number of each patient (in the order the patient roster), the patient's last name, the operating room number, the time surgery begins and ends, the recovery bed number and the time the patient enters and leaves the recovery room bed.

The second table will also be in columnar form with appropriate column labels summarizing the utilization of operating rooms and recovery room beds. This summary indicates the facility type (room or bed), the facility number, the number of minutes used and percentage of available time utilized. Available time is defined as the time in minutes from the starting time for 1st surgery of day to the ending time of the last patient in a recovery room bed. Print a blank line after each run. Follow the output format shown on sample output.

## Example

### Input :

```
5 12 07 5 15 10 16
Jones
28 140
Smith
120 200
Thompson
23 75
Albright
19 82
Poucher
133 209
Comer
74 101
Perry
93 188
Page
111 223
Roggio
69 122
Brigham
42 79
Nute
22 71
Young
38 140
Bush
26 121
Cates
120 248
Johnson
86 181
```

White  
92 140

**Output :**

Patient		Operating Room			Recovery Room		
#	Name	Room#	Begin	End	Bed#	Begin	End
1	Jones	1	7:00	7:28	3	7:33	9:53
2	Smith	2	7:00	9:00	1	9:05	12:25
3	Thompson	3	7:00	7:23	2	7:28	8:43
4	Albright	4	7:00	7:19	1	7:24	8:46
5	Poucher	5	7:00	9:13	5	9:18	12:47
6	Comer	4	7:34	8:48	4	8:53	10:34
7	Perry	3	7:38	9:11	2	9:16	12:24
8	Page	1	7:43	9:34	6	9:39	13:22
9	Roggio	4	9:03	10:12	9	10:17	12:19
10	Brigham	2	9:15	9:57	8	10:02	11:21
11	Nute	3	9:26	9:48	7	9:53	11:04
12	Young	5	9:28	10:06	3	10:11	12:31
13	Bush	1	9:49	10:15	10	10:20	12:21
14	Cates	3	10:03	12:03	8	12:08	16:16
15	Johnson	2	10:12	11:38	4	11:43	14:44
16	White	5	10:21	11:53	7	11:58	14:18

Facility Utilization

Type	#	Minutes	% Used
Room	1	165	29.68
Room	2	248	44.60
Room	3	258	46.40
Room	4	162	29.14
Room	5	263	47.30
Bed	1	282	50.72
Bed	2	263	47.30
Bed	3	280	50.36
Bed	4	282	50.72
Bed	5	209	37.59
Bed	6	223	40.11
Bed	7	211	37.95
Bed	8	327	58.81
Bed	9	122	21.94
Bed	10	121	21.76
Bed	11	0	0.00
Bed	12	0	0.00

---

Added by: Adrian Kuegel

Date: 2005-07-04

Time limit: 3s

Source limit:50000B

Languages: All

Resource: ACM ICPC World Finals 1991

## SPOJ Problem Set (classical)

### 390. Billiard

#### Problem code: BILLIARD

In a billiard table with horizontal side **a** inches and vertical side **b** inches, a ball is launched from the middle of the table. After  $s > 0$  seconds the ball returns to the point from which it was launched, after having made **m** bounces off the vertical sides and **n** bounces off the horizontal sides of the table. Find the launching angle **A** (measured from the horizontal), which will be between 0 and 90 degrees inclusive, and the initial velocity of the ball.

Assume that the collisions with a side are elastic (no energy loss), and thus the velocity component of the ball parallel to each side remains unchanged. Also, assume the ball has a radius of zero. Remember that, unlike pool tables, billiard tables have no pockets.

#### Input

Input consists of a sequence of lines, each containing five nonnegative integers separated by whitespace. The five numbers are: **a**, **b**, **s**, **m**, and **n**, respectively. All numbers are positive integers not greater than 10000.

Input is terminated by a line containing five zeroes.

#### Output

For each input line except the last, output a line containing two real numbers (accurate to two decimal places) separated by a single space. The first number is the measure of the angle **A** in degrees and the second is the velocity of the ball measured in inches per second, according to the description above.

#### Example

**Input :**

```
100 100 1 1 1
200 100 5 3 4
201 132 48 1900 156
0 0 0 0 0
```

**Output :**

```
45.00 141.42
33.69 144.22
3.09 7967.81
```

---

Added by: Adrian Kuegel

Date: 2005-07-04

Time limit: 3s

Source limit:50000B

Languages: All

Resource: University of Waterloo Local Contest (Spring 1999)



## SPOJ Problem Set (classical)

### 391. Railroads

#### Problem code: RAILROAD

It's Friday evening and Jill hates two things which are common to all trains:

1. They are always late.
2. The schedule is always wrong.

Nevertheless, tomorrow in the early morning hours Jill will have to travel from Hamburg to Darmstadt in order to get to the regional programming contest. Since she is afraid of arriving too late and being excluded from the contest she is looking for the train which gets her to Darmstadt as early as possible. However, she dislikes to get to the station too early, so if there are several schedules with the same arrival time then she will choose the one with the latest departure time.

Jill asks you to help her with her problem. You are given a set of railroad schedules from which you must compute the train with the earliest arrival time and the fastest connection from one location to another. One good thing: Jill is very experienced in changing trains. She can do this instantaneously, i.e., in zero time!!!

#### Input

The very first line of the input gives the number of scenarios. Each scenario consists of three parts.

Part one lists the names of all cities connected by the railroads. It starts with a number  $I < C \leq 100$ , followed by  $C$  lines containing city names. These names consist of letters.

Part two describes all the trains running during a day. It starts with a number  $T \leq 1000$  followed by  $T$  train descriptions. Each of them consists of one line with a number  $t_i \leq 100$  and  $t_i$  more lines with a time and a city name, meaning that passengers can get on or off the train at that time at that city.

Part three consists of three lines: Line one contains the earliest journey's starting time, line two the name of the city where she starts, and line three the destination city. The two cities are always different.

#### Output

For each scenario print a line containing "Scenario i", where i is the number of the scenario starting at 1.

If a connection exists then print the two lines containing zero padded timestamps and locations as shown in the sample. Use blanks to achieve the indentation. If no connection exists on the same day (i.e., arrival before midnight) then print a line containing "No connection".

After each scenario print a blank line.

## Example

### Input :

```
2
3
Hamburg
Frankfurt
Darmstadt
3
2
0949 Hamburg
1006 Frankfurt
2
1325 Hamburg
1550 Darmstadt
2
1205 Frankfurt
1411 Darmstadt
0800
Hamburg
Darmstadt
2
Paris
Tokyo
1
2
0100 Paris
2300 Tokyo
0800
Paris
Tokyo
```

### Output :

```
Scenario 1
Departure 0949 Hamburg
Arrival 1411 Darmstadt

Scenario 2
No connection
```

---

Added by: Adrian Kuegel

Date: 2005-07-04

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Southwestern European Regional Contest 2000



7  
357  
1073741823

---

Added by: Adrian Kuegel  
Date: 2005-07-04  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: ACM Northwestern European Regional Contest 1993 (UVA problem 279)

## SPOJ Problem Set (classical)

### 394. Alphacode

#### Problem code: ACODE

Alice and Bob need to send secret messages to each other and are discussing ways to encode their messages:

Alice: "Let's just use a very simple code: We'll assign 'A' the code word 1, 'B' will be 2, and so on down to 'Z' being assigned 26."

Bob: "That's a stupid code, Alice. Suppose I send you the word 'BEAN' encoded as 25114. You could decode that in many different ways!"

Alice: "Sure you could, but what words would you get? Other than 'BEAN', you'd get 'BEAAD', 'YAAD', 'YAN', 'YKD' and 'BEKD'. I think you would be able to figure out the correct decoding. And why would you send me the word 'BEAN' anyway?"

Bob: "OK, maybe that's a bad example, but I bet you that if you got a string of length 5000 there would be tons of different decodings and with that many you would find at least two different ones that would make sense."

Alice: "How many different decodings?"

Bob: "Jillions!"

For some reason, Alice is still unconvinced by Bob's argument, so she requires a program that will determine how many decodings there can be for a given string using her code.

#### Input

Input will consist of multiple input sets. Each set will consist of a single line of at most 5000 digits representing a valid encryption (for example, no line will begin with a 0). There will be no spaces between the digits. An input line of '0' will terminate the input and should not be processed.

#### Output

For each input set, output the number of possible decodings for the input string. All answers will be within the range of a 64 bit signed integer.

#### Example

**Input :**

```
25114
1111111111
3333333333
0
```

**Output :**

6  
89  
1

---

Added by: Adrian Kuegel

Date: 2005-07-09

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ACM East Central North America Regional Programming Contest 2004

## SPOJ Problem Set (classical)

### 395. Anti-prime Sequences

#### Problem code: APRIME

Given a sequence of consecutive integers  $n, n+1, n+2, \dots, m$ , an anti-prime sequence is a rearrangement of these integers so that each adjacent pair of integers sums to a composite (non-prime) number. For example, if  $n = 1$  and  $m = 10$ , one such anti-prime sequence is 1, 3, 5, 4, 2, 6, 9, 7, 8, 10. This is also the lexicographically first such sequence.

We can extend the definition by defining a degree  $d$  anti-prime sequence as one where all consecutive subsequences of length 2, 3, ...,  $d$  sum to a composite number. The sequence above is a degree 2 anti-prime sequence, but not a degree 3, since the subsequence 5, 4, 2 sums to 11. The lexicographically first degree 3 anti-prime sequence for these numbers is 1, 3, 5, 4, 6, 2, 10, 8, 7, 9.

#### Input

Input will consist of multiple input sets. Each set will consist of three integers,  $n, m$ , and  $d$  on a single line. The values of  $n, m$  and  $d$  will satisfy  $1 \leq n < m \leq 1000$ , and  $2 \leq d \leq 10$ . The line 0 0 0 will indicate end of input and should not be processed.

#### Output

For each input set, output a single line consisting of a comma-separated list of integers forming a degree  $d$  anti-prime sequence (do not insert any spaces and do not split the output over multiple lines). In the case where more than one anti-prime sequence exists, print the lexicographically first one (i.e., output the one with the lowest first value; in case of a tie, the lowest second value, etc.). In the case where no anti-prime sequence exists, output:

No anti-prime sequence exists.

#### Example

##### Input :

```
1 10 2
1 10 3
1 10 5
40 60 7
0 0 0
```

##### Output :

```
1,3,5,4,2,6,9,7,8,10
1,3,5,4,6,2,10,8,7,9
No anti-prime sequence exists.
40,41,43,42,44,46,45,47,48,50,55,53,52,60,56,49,51,59,58,57,54
```

---

Added by: Adrian Kuegel

Date: 2005-07-09

Time limit: 15s

Source limit:50000B

Languages: All

Resource: ACM East Central North America Regional Programming Contest 2004



## SPOJ Problem Set (classical)

### 396. Hit or Miss

#### Problem code: HITOMISS

One very simple type of solitaire game known as "Hit or Miss" (also known as "Frustration," "Harvest," "Roll-Call," "Talkative", and "Treize") is played as follows: take a standard deck of 52 playing cards -- four sets of cards numbered 1 through 13 (suits do not matter in this game) which have been shuffled -- and start counting through the deck 1, 2, 3, . . . , and so on. When your count reaches 13, start over at 1. Each time you count, look at the top card of the deck and do one of two things: if the number you count matches the value of the top card, discard it from the deck; if it does not match it, move that card to the bottom of the deck. You win the game if you are able to remove all cards from the deck (which may take a very long time).

A version of this game can be devised for two or more players. The first player starts as before with a 52 card deck, while the other players have no cards initially. As the first player removes cards from her deck, she gives them to the second player, who then starts playing the same game, starting at count 1. When that player gets a match, he passes his card to the third player, and so on. The last player discards matches rather than passing them to player 1. All players who have cards to play with perform the following 2-step cycle of moves in lockstep:

1. Each player says his or her current count value and checks for a match. If there is no match, the top card is moved to the bottom of the deck; otherwise it is passed to the next player (or discarded if this is the last player).
2. Each player except the first takes a passed card (if there is one) and places it at the bottom of his or her deck.

These rules are repeated over and over until either the game is won (all the cards are discarded by the last player) or an unwinnable position is reached. If any player ever runs out of cards, he waits until he is passed a card and resumes his count from where he left off (e.g., if player 3 passes his last card on a count of 7, he waits until he receives a card from player 2 and resumes his count with 8 at the beginning of the next 2-step cycle).

#### Input

Input will consist of multiple input sets. The first line of the file will contain a single positive integer  $n$  indicating the number of input sets in the file. Each input set will be a single line containing 53 integers: the first integer will indicate the number of players in the game and the remaining 52 values will be the initial layout of the cards in the deck, topmost card first. These values will all lie in the range 1 . . . 13, and the number of players will lie in the range 1 . . . 10.

#### Output

For each input set, output the input set number (as shown below, starting with 1) and either the phrase "unwinnable" or a list showing the last card discarded by each player. Use a single blank to separate all outputs.

## Example

**Input:** (note that the line break is only in the sample input for displaying purposes)

```
2
4 1 2 3 4 5 6 7 8 9 10 11 12 13 1 2 3 4 5 6 7 8 9 10 11 12 13
  1 2 3 4 5 6 7 8 9 10 11 12 13 1 2 3 4 5 6 7 8 9 10 11 12 13
4 2 3 4 5 6 7 8 9 10 11 12 13 1 2 3 4 5 6 7 8 9 10 11 12 13 1
  2 3 4 5 6 7 8 9 10 11 12 13 1 2 3 4 5 6 7 8 9 10 11 12 13 1
```

**Output:**

```
Case 1: 13 13 13 13
Case 2: unwinnable
```

---

Added by: Adrian Kuegel

Date: 2005-07-09

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: ACM East Central North America Regional Programming Contest 2004

## SPOJ Problem Set (classical)

### 397. I Conduit

#### Problem code: CONDUIT

Irv Kenneth Diggit works for a company that excavates trenches, digs holes and generally tears up people's yards. Irv's job is to make sure that no underground pipe or cable is underneath where excavation is planned. He has several different maps, one for each utility company, showing where their conduits lie, and he needs to draw one large, consolidated map combining them all. One approach would be to simply draw each of the smaller maps one at a time onto the large map. However, this often wastes time, not to mention ink for the pen-plotter in the office, since in many cases portions of the conduits overlap with each other (albeit at different depths underground). What Irv wants is a way to determine the minimum number of line segments to draw given all the line segments from the separate maps.

#### Input

Input will consist of multiple input sets. Each set will start with a single line containing a positive integer  $n$  indicating the total number of line segments from all the smaller maps. Each of the next  $n$  lines will contain a description of one segment in the format

$x_1 \ y_1 \ x_2 \ y_2$

where  $(x_1, y_1)$  are the coordinates of one endpoint and  $(x_2, y_2)$  are the coordinates of the other. Coordinate values are floating point values in the range 0 ...1001 specified to at most two decimal places. The maximum number of line segments will be 10000 and all segments will have non-zero length. Following the last input set there will be a line containing a 0 indicating end of input; it should not be processed.

#### Output

For each input set, output on a single line the minimum number of line segments that need to be drawn on the larger, consolidated map.

#### Example

Input :

```
3
1.0 10.0 3.0 14.0
0.0 0.0 20.0 20.0
10.0 28.0 2.0 12.0
2
0.0 0.0 1.0 1.0
1.0 1.0 2.15 2.15
2
0.0 0.0 1.0 1.0
1.0 1.0 2.15 2.16
0
```

**Output :**

2  
1  
2

---

Added by: Adrian Kuegel

Date: 2005-07-09

Time limit: 3s

Source limit:50000B

Languages: All

Resource: ACM East Central North America Regional Programming Contest 2004

## SPOJ Problem Set (classical)

### 398. Roll Playing Games

#### Problem code: RPGAMES

Phil Kropotnik is a game maker, and one common problem he runs into is determining the set of dice to use in a game. In many current games, non-traditional dice are often required, that is, dice with more or fewer sides than the traditional 6-sided cube. Typically, Phil will pick random values for all but the last die, then try to determine specific values to put on the last die so that certain sums can be rolled with certain probabilities (actually, instead of dealing with probabilities, Phil just deals with the total number of different ways a given sum can be obtained by rolling all the dice). Currently he makes this determination by hand, but needless to say he would love to see this process automated. That is your task.

For example, suppose Phil starts with a 4-sided die with face values 1, 10, 15, and 20 and he wishes to determine how to label a 5-sided die so that there are a) 3 ways to obtain a sum of 2, b) 1 way to obtain a sum of 3, c) 3 ways to obtain 11, d) 4 ways to obtain 16, and e) 1 way to obtain 26. To get these results he should label the faces of his 5-sided die with the values 1, 1, 1, 2, and 6. (For instance, the sum 16 may be obtained as 10 + 6 or as 15 + 1, with three different "1" faces to choose from on the second die, for a total of 4 different ways.) Note that he sometimes only cares about a subset of the sums reachable by rolling all the dices (like in the previous example).

#### Input

Input will consist of multiple input sets. Each input set will start with a single line containing an integer  $n$  indicating the number of dice that are already specified. Each of the next  $n$  lines describes one of these dice. Each of these lines will start with an integer  $f$  (indicating the number of faces on the die) followed by  $f$  integers indicating the value of each face. The last line of each problem instance will have the form

$$r \ m \ v_1 \ c_1 \ v_2 \ c_2 \ v_3 \ c_3 \ \dots \ v_m \ c_m$$

where  $r$  is the number of faces required on the unspecified die,  $m$  is the number of sums of interest,  $v_1, \dots, v_m$  are these sums, and  $c_1, \dots, c_m$  are the counts of the desired number of different ways in which to achieve each of the respective sums.

Input values will satisfy the following constraints:  $1 \leq n \leq 20$ ,  $3 \leq f \leq 20$ ,  $1 \leq m \leq 10$ , and  $4 \leq r \leq 6$ . Values on the faces of all dice, both the specified ones and the unknown die, will be integers in the range 1 ... 50, and values for the  $v_i$ 's and  $c_i$ 's are all non-negative and are strictly less than the maximum value of a 32-bit signed integer.

The last input set is followed by a line containing a single 0; it should not be processed.

## Output

For each input set, output a single line containing either the phrase "Final die face values are" followed by the  $r$  face values in non-descending order, or the phrase "Impossible" if no die can be found meeting the specifications of the problem. If there are multiple dice which will solve the problem, choose the one whose lowest face value is the smallest; if there is still a tie, choose the one whose second-lowest face value is smallest, etc.

## Example

**Input :**

```
1
4 1 10 15 20
5 5 2 3 3 1 11 3 16 4 26 1
1
6 1 2 3 4 5 6
6 3 7 6 2 1 13 1
4
6 1 2 3 4 5 6
4 1 2 2 3
3 3 7 9
8 1 4 5 9 23 24 30 38
4 4 48 57 51 37 56 31 63 11
0
```

**Output :**

```
Final die face values are 1 1 1 2 6
Impossible
Final die face values are 3 7 9 9
```

---

Added by: Adrian Kuegel

Date: 2005-07-09

Time limit: 15s

Source limit: 50000B

Languages: All

Resource: ACM East Central North America Regional Programming Contest 2004

## SPOJ Problem Set (classical)

### 399. Team Rankings

#### Problem code: TRANK

It's preseason and the local newspaper wants to publish a preseason ranking of the teams in the local amateur basketball league. The teams are the Ants, the Buckets, the Cats, the Dribblers, and the Elephants. When Scoop McGee, sports editor of the paper, gets the rankings from the selected local experts down at the hardware store, he's dismayed to find that there doesn't appear to be total agreement and so he's wondering what ranking to publish that would most accurately reflect the rankings he got from the experts. He's found that finding the median ranking from among all possible rankings is one way to go.

The median ranking is computed as follows: Given any two rankings, for instance ACDBE and ABCDE, the distance between the two rankings is defined as the total number of pairs of teams that are given different relative orderings. In our example, the pair B, C is given a different ordering by the two rankings. (The first ranking has C above B while the second ranking has the opposite.) The only other pair that the two rankings disagree on is B, D; thus, the distance between these two rankings is 2. The median ranking of a set of rankings is that ranking whose sum of distances to all the given rankings is minimal. (Note we could have more than one median ranking.) The median ranking may or may not be one of the given rankings.

Suppose there are 4 voters that have given the rankings: ABDCE, BACDE, ABCED and ACBDE. Consider two candidate median rankings ABCDE and CDEAB. The sum of distances from the ranking ABCDE to the four voted rankings is  $1 + 1 + 1 + 1 = 4$ . We'll call this sum the value of the ranking ABCDE. The value of the ranking CDEAB is  $7 + 7 + 7 + 5 = 26$ . It turns out that ABCDE is in fact the median ranking with a value of 4.

#### Input

There will be multiple input sets. Input for each set is a positive integer  $n$  on a line by itself, followed by  $n$  lines ( $n$  no more than 100), each containing a permutation of the letters A, B, C, D and E, left-justified with no spaces. The final input set is followed by a line containing a 0, indicating end of input.

#### Output

Output for each input set should be one line of the form:

*ranking* is the median ranking with value *value*.

Of course ranking should be replaced by the correct ranking and value with the correct value. If there is more than one median ranking, you should output the one which comes first alphabetically.

## Example

**Input :**

```
4
ABDCE
BACDE
ABCED
ACBDE
0
```

**Output :**

```
ABCDE is the median ranking with value 4.
```

---

Added by: Adrian Kuegel

Date: 2005-07-09

Time limit: 3s

Source limit:50000B

Languages: All

Resource: ACM East Central North America Regional Programming Contest 2004



## SPOJ Problem Set (classical)

### 400. To and Fro

#### Problem code: TOANDFRO

Mo and Larry have devised a way of encrypting messages. They first decide secretly on the number of columns and write the message (letters only) down the columns, padding with extra random letters so as to make a rectangular array of letters. For example, if the message is "There's no place like home on a snowy night" and there are five columns, Mo would write down

```
t o i o y
h p k n n
e l e a i
r a h s g
e c o n h
s e m o t
n l e w x
```

Note that Mo includes only letters and writes them all in lower case. In this example, Mo used the character 'x' to pad the message out to make a rectangle, although he could have used any letter. Mo then sends the message to Larry by writing the letters in each row, alternating left-to-right and right-to-left. So, the above would be encrypted as

```
toioynnkphelaigshareconhtomesnlewx
```

Your job is to recover for Larry the original message (along with any extra padding letters) from the encrypted one.

#### Input

There will be multiple input sets. Input for each set will consist of two lines. The first line will contain an integer in the range 2...20 indicating the number of columns used. The next line is a string of up to 200 lower case letters. The last input set is followed by a line containing a single 0, indicating end of input.

#### Output

Each input set should generate one line of output, giving the original plaintext message, with no spaces.

#### Example

**Input :**

```
5
toioynnkphelaigshareconhtomesnlewx
3
ttyohhieneesiaabss
0
```

**Output :**

```
theresno placelikehomeonasnowynightx  
thisistheeasyoneab
```

---

Added by: Adrian Kuegel

Date: 2005-07-09

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ACM East Central North America Regional Programming Contest 2004

## SPOJ Problem Set (classical)

### 401. Translations

#### Problem code: TRANSL

Bob Roberts is in charge of performing translations of documents between various languages. To aid him in this endeavor his bosses have provided him with translation files. These files come in twos -- one containing sample phrases in one of the languages and the other containing their translations into the other language. However, some over-zealous underling, attempting to curry favor with the higher-ups with his initiative, decided to alphabetically sort the contents of all of the files, losing the connections between the phrases and their translations. Fortunately, the lists are comprehensive enough that the original translations can be reconstructed from these sorted lists. Bob has found this is most usually the case when the phrases all consist of two words. For example, given the following two lists:

Language 1 Phrases	Language 2 Phrases
arlo zym	bus seat
flub pleve	bus stop
pleve dourm	hot seat
pleve zym	school bus

Bob is able to determine that arlo means hot, zym means seat, ub means school, pleve means bus, and dourm means stop. After doing several of these reconstructions by hand, Bob has decided to automate the process. And if Bob can do it, then so can you.

#### Input

Input will consist of multiple input sets. Each input set starts with a positive integer  $n$ ,  $n \leq 250$ , indicating the number of two-word phrases in each language. This is followed by  $2n$  lines, each containing one two-word phrase: the first  $n$  lines are an alphabetical list of phrases in the first language, and the remaining  $n$  lines are an alphabetical list of their translations into the second language. Only upper and lower case alphabetic characters are used in the words. No input set will involve more than 25 distinct words. No word appears as the first word in more than 10 phrases for any given language; likewise, no word appears as the last word in more than 10 phrases. A line containing a single 0 follows the last problem instance, indicating end of input.

#### Output

For each input set, output lines of the form

word1/word2

where word1 is a word in the first language and word2 is the translation of word1 into the second language, and a slash separates the two. The output lines should be sorted according to the first language words, and every first language word should occur exactly once. There should be no white space in the output, apart from a single blank line separating the outputs from different input sets. Imitate the format of the sample output, below. There is guaranteed to be a unique correct translation corresponding to each input instance.

## Example

### Input :

```
4
arlo zym
flub pleve
pleve dourm
pleve zym
bus seat
bus stop
hot seat
school bus
2
iv otas
otas re
ec t
eg ec
0
```

### Output :

```
arlo/hot
dourm/stop
flub/school
pleve/bus
zym/seat

iv/eg
otas/ec
re/t
```

---

Added by: Adrian Kuegel

Date: 2005-07-09

Time limit: 15s

Source limit: 50000B

Languages: All

Resource: ACM East Central North America Regional Programming Contest 2004

## SPOJ Problem Set (classical)

### 402. Hike on a Graph

#### Problem code: HIKE

"Hike on a Graph" is a game that is played on a board on which an undirected graph is drawn. The graph is complete and has all loops, i.e. for any two locations there is exactly one arrow between them. The arrows are coloured. There are three players, and each of them has a piece. At the beginning of the game, the three pieces are in fixed locations on the graph. In turn, the players may do a move. A move consists of moving one's own piece along an arrow to a new location on the board. The following constraint is imposed on this: the piece may only be moved along arrows of the same colour as the arrow between the two opponents' pieces.

In the sixties ("make love not war") a one-person variant of the game emerged. In this variant one person moves all the three pieces, not necessarily one after the other, but of course only one at a time. Goal of this game is to get all pieces onto the same location, using as few moves as possible. Find out the smallest number of moves that is necessary to get all three pieces onto the same location, for a given board layout and starting positions.

#### Input

The input file contains several test cases. Each test case starts with the number  $n$ . Input is terminated by  $n=0$ . Otherwise,  $1 \leq n \leq 50$ . Then follow three integers  $p_1, p_2, p_3$  with  $1 \leq p_i \leq n$  denoting the starting locations of the game pieces. The colours of the arrows are given next as a  $n \times n$  matrix  $m$  of whitespace-separated lower-case letters. The element  $m_{ij}$  denotes the colour of the arrow between the locations  $i$  and  $j$ . Since the graph is undirected, you can assume the matrix to be symmetrical.

#### Output

For each test case output on a single line the minimum number of moves required to get all three pieces onto the same location, or the word "impossible" if that is not possible for the given board and starting locations.

#### Example

**Input :**

```
3 1 2 3
r b r
b b b
r b r
2 1 2 2
y g
g y
0
```

**Output :**

```
2
impossible
```

---

Added by: Adrian Kuegel  
Date: 2005-07-10  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2000

## SPOJ Problem Set (classical)

### 403. Sort fractions

#### Problem code: FRACTION

You are given a positive integer  $N$ . Let us consider set  $A$  of fractions  $x/y$  where  $0 \leq x/y \leq 1$ ,  $y \leq N$  and the maximum common divisor of  $x$  and  $y$  is 1.

For example  $N = 5$ . Set  $A$  in increasing order consists of elements  $0/1$ ;  $1/5$ ;  $1/4$ ;  $1/3$ ;  $2/5$ ;  $1/2$ ;  $3/5$ ;  $2/3$ ;  $3/4$ ;  $4/5$ ;  $1/1$ .

Your task is to find the  $i$ -th smallest fraction in set  $A$ .

#### Input

The first line of input contains the number of testcases  $t$  ( $t \leq 15$ ). The first line of each testcase contains numbers  $N$  and  $M$  ( $N \leq 5000$ ,  $M \leq 10000$ ). The next  $M$  lines contain one question each.

#### Output

For each testcase, you should output  $M$  lines which are the answers to the  $M$  questions.

#### Example

**Input :**

```
1
5 4
1
3
5
8
```

**Output :**

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

---

Added by: Le Đôn Khue

Date: 2005-07-12

Time limit: 2s

Source limit: 10000B

Languages: All

Resource: Mr Nguyen Duc Thinh

# SPOJ Problem Set (classical)

## 404. Scanner

### Problem code: SCANNER

A body scanner works by scanning a succession of horizontal slices through the body; the slices are imaged one at a time. The image slices can be reassembled to form a three dimensional model of the object. Write a program to construct a two dimensional image slice using data captured during the scan.

epsfbox{p229.eps}

The scanner consists of four arrays of sensors arranged around a 10×15 matrix. Array 1 consists of 10 sensors pointing to the right, array 2 has 24 sensors pointing diagonally to the top right, array 3 has 15 sensors pointing to the top and array 4 has 24 sensors pointing to the top left. Each sensor records the thickness of that portion of the object directly in front of that sensor.

Readings from the arrays of sensors are recorded in counterclockwise order. Within an array of sensors, data are also recorded counterclockwise. A complete scan consists of 73 readings.

### Input

The input file begins with a line with an integer indicating the number of image slices to follow. For each image slice, there are separate lines with 10, 24, 15, and 24 integers representing sensor data from sensor arrays 1 through 4 respectively. The order of the readings is indicated in the diagram. You can assume that there exist at least one image for the given sensor data.

### Output

For each slice, your program should print 10 lines of 15 cells. To indicate that the cell represents a part of the object, print a hash character (#) for the cell; to indicate that the cell is not a part of the object, print a period (.). Between successive output image slices, print a blank line.

It is possible for the result of a scan to be ambiguous, in that case you can print any solution.

### Example

Input :

```
1
10 10 6 4 6 8 13 15 11 6
0 1 2 2 2 2 4 5 5 6 7 6 5 6 6 3 2 2 1 0
2 4 5 5 7 6 7 10 10 10 7 3 3 5 5
0 0 1 3 4 4 4 4 3 4 5 7 8 8 9 9 6 4 4 2 0 0 0 0
```

Output :

```
.#####....
.#####....
....#####....
```



.....####.....  
.....####..##  
.....#####  
#####..  
#####  
#####  
..#####..  
.....#####.....

---

Added by: Adrian Kuegel  
Date: 2005-07-26  
Time limit: 42s  
Source limit:50000B  
Languages: All  
Resource: ACM ICPC World Finals 1993

## SPOJ Problem Set (classical)

### 405. Tin Cutter

#### Problem code: TCUTTER

In a Tin Cutting factory there is a machine for cutting parts from tin plates. It has an extraordinarily sharp knife able to make horizontal or vertical segment cuts in the tin plates. Each cutting process consists of a sequence of such cuts. Each segment cut is given by its endpoints that are always located inside the tin plate. During the cutting process some parts of tin plate can fall out and so some holes in the plate can emerge.

Factory management needs to predict the number of holes in the plate at the end of the given sequence of cuts. Write a program that answers this question. Single segment cuts are not considered to be holes.

Here there are examples of some situations that can arise after cutting:

[IMAGE]

two holes two holes one hole one hole

#### Input

The input file consists of blocks of lines. Each block except the last describes one cutting process. In the first line of the block there is a number  $N$  indicating the number of segment cuts in the cutting process. These cuts are defined by the following  $N$  lines. The line defining one segment cut has the form  $x_1 y_1 x_2 y_2$  where  $x_1 y_1$  and  $x_2 y_2$  are the co-ordinates of the end points of the segment cut. They are separated by one space. The co-ordinates are integers and always define horizontal or vertical segment (i.e. segment parallel with  $x$  or  $y$  axis).

The last block consists of just one line containing 0.

#### Output

The output file contains the lines corresponding to the blocks in the input file. Each such line contains the number of holes that remain in the tin plate after the execution of the corresponding cuts.

There is no line in the output file corresponding to the last "null" block of the input file.

#### Example

Input :

```
4
0 1 1 1
1 1 1 0
1 0 0 0
0 0 0 1
2
0 1 2 1
```

1 2 1 0  
0

**Output :**

1  
0

---

Added by: Adrian Kuegel

Date: 2005-07-26

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Central European Regional Contest 1996

# SPOJ Problem Set (classical)

## 406. Logic

### Problem code: LOGIC

Consider a 10x10 grid. Cells in this grid can contain one of five logic operations (AND, OR, NOT, Input, Output). These can be joined together to form a logic circuit. Given a description of a circuit and a set of boolean values, build the logic circuit and execute the input stream against it.

### Input

The first line of the input contains a single integer  $n$ , which specifies the number of circuits to be processed. There will then be  $n$  groups of circuit descriptions and test values.

A circuit is made up of a number of operations. Each line describing an operation begins with three characters: the co-ordinates for a cell, 0-9 on the X-axis then 0-9 on the Y-axis, followed by a single character to represent the operation of that cell ('&' for AND, '|' for OR, '!' for NOT, 'i' for Input and 'o' for Output). Optionally following each triple is a set of co-ordinate pairs which represent the  $x$  and  $y$  co-ordinates of cells that take the output of this cells operation as an input for theirs. This (possibly empty) output list is terminated by '...'. The list of operations is terminated by a line containing the word 'end'.

Next, for each circuit, comes the set of test values. The first line contains an integer  $t$  which gives the number of test cases your program must run. Next, there are  $t$  lines, each line containing a sequence of '0' and '1' characters symbolising the input values for one test case. The number of inputs will always correspond to the number of inputs defined by the circuit description. The input values are to be applied to the inputs in the order in which the input operations were defined in the circuit description.

The next circuit description, if any, will then follow.

### Output

For each circuit, your program should output one line for each test case given in the input. The line should contain one '0' or '1' character for each output defined by the circuit description in the order in which the outputs were defined.

Your program should output a blank line after each set of test cases.

### Example

Input :

```
1
00i 11 13 ..
02i 11 13 ..
11& 21 ..
21o ..
13| 23 ..
23o ..
end
```

4  
00  
01  
10  
11

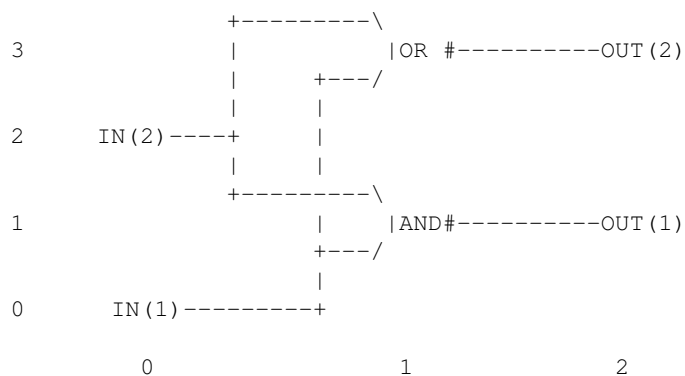
**Output :**

00  
01  
01  
11

**Notes:**

- i, o and ! operations will always have exactly one input.
- & and | operations will always have exactly two inputs.
- Even if an operation can feed others, it does not have to.
- No recursive circuits.
- o can also be an input for another gate

**Hint:** Sample input specifies a circuit consisting of an 'AND' and an 'OR' operation in parallel both fed from the same two inputs:



In grid terms this is two inputs at 0,0 and 1,0. The first input feeds the AND operation at 1,1 and the OR operation at 1,3. The second input operation feeds the second input for the same AND and OR operations. The AND operation then feeds an output operation at 2,1. The OR operation also feeds an output operation, this one at 2,3.

---

Added by: Adrian Kuegel

Date: 2005-07-26

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Northwestern European Regional Contest 1993

## SPOJ Problem Set (classical)

### 407. Random Number

#### Problem code: RNUMBER

A Black Box algorithm supposes that natural number sequence  $u(1), u(2), \dots, u(N)$  is sorted in non-descending order,  $N \leq M$  and for each  $p$  ( $1 \leq p \leq N$ ) an inequality  $p \leq u(p) \leq M$  is valid.

Making tests for this algorithm we have met with the following problem. For setting a random sequence  $\{u(i)\}$  a usual random data generator did not fit. As the sequence itself had been imposed certain restrictions, the method of choosing the next random element (in the interval defined by restrictions) did not give the random sequence as a whole.

We have come to a conclusion that the problem can be solved in the following way. If we arrange all possible sequences in certain order (for example, in lexicographical order) and assign each sequence its number, after choice of the random number it is possible to take the correspondent sequence for the random one. At the first glance it seems enough to make up a program generating all these sequences in such order. Alas! Even having not great values of  $M$  and  $N$  it would have taken any powerful modern computer centuries to enumerate all such sequences. It turned out it was possible to avoid generating all sequences if we managed to create required sequence according to its number immediately. But even this statement does not cover all. As the amount of sequences is quite large, the number can be a long one, composed of hundreds decimal digits, though our random data generator could give only normal numbers. We decided to produce a long random number from a real random number distributed in  $[0,1]$ . Namely, present the number in binary notation:  $0.b(1)b(2)\dots$ , where all  $b(i) = 0$  or  $1$ . Let us set a regulation to associate such real number to an integer from  $[A,B]$  segment:

#### Formula

$$\begin{aligned} G(A,B,0.b_1b_2\dots b_p) = \left\{ \begin{array}{l} A, \text{ if } b_1=1 \\ \dots \\ p, \text{ if } b_1=1 \end{array} \right. \end{aligned}$$

Here we suppose, that  $A \leq B$ ,  $p \geq 0$ , and "div 2" is an integer division by 2.

Let  $M, N$  ( $1 \leq N \leq M \leq 200$ ) and a binary real number  $0.b(1)b(2)\dots b(p)$  ( $1 \leq p \leq 400$ ) be given. Write a program to find out the corresponding  $u(1), u(2), \dots, u(N)$  sequence, i.e. to find a sequence with  $G(1, T, 0.b(1)b(2)\dots b(p))$  number in lexicographical order of all possible  $\{u(i)\}$  for the given  $M$  and  $N$  ( $T$  is the quantity of such sequences). Numeration begins with 1. Keep in mind that in lexicographical order  $\{l(i)\}$  proceeds  $\{h(i)\}$  if after omitting equal beginnings, the first number of  $\{l(i)\}$  tail is smaller than the first number or  $\{h(i)\}$  tail. Following example illustrates the list of all possible sequences for  $M = 4$  and  $N = 3$  in lexicographical order.

#### A note (it does not concern the solution of this task):

The choice of random binary vector  $0.b(1)b(2)\dots b(p)$  does not give an absolute uniform random data generator if we use the Formula. However, taking into account the fact that  $[A,B]$  interval is big we shall obtain a distribution applicable in most cases.

## Example

```
1, 2, 3
1, 2, 4
1, 3, 3
1, 3, 4
1, 4, 4
2, 2, 3
2, 2, 4
2, 3, 3
2, 3, 4
2, 4, 4
3, 3, 3
3, 3, 4
3, 4, 4
4, 4, 4
```

(here  $T=14$ )

## Input

The first line of the input is an integer  $K \leq 10$ , followed by  $K$  datasets.

The first line of each dataset contains  $M$  and  $N$ . The second line contains binary real number  $0.b(1)b(2)\dots b(p)$  (without leading, trailing and other spaces).

## Output

For each dataset, write into the output data file the corresponding sequence  $u(1), u(2), \dots, u(N)$ . The sequence numbers should be separated with spaces and end-of-line characters. There should be up to 20 numbers in each line. If necessary, the numbers will have leading blanks to occupy 3 characters.

## Example

**Input :**

```
1
4 3
0.01101101011110010001101010001011010
```

**Output :**

```
  2   2   4
```

---

Added by: Adrian Kuegel

Date: 2005-07-26

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Northeastern European Regional Contest 1996

## SPOJ Problem Set (classical)

### 408. Jill Rides Again

#### Problem code: JRIDE

Jill likes to ride her bicycle, but since the pretty city of Greenhills where she lives has grown, Jill often uses the excellent public bus system for part of her journey. She has a folding bicycle which she carries with her when she uses the bus for the first part of her trip. When the bus reaches some pleasant part of the city, Jill gets off and rides her bicycle. She follows the bus route until she reaches her destination or she comes to a part of the city she does not like. In the latter event she will board the bus to finish her trip.

Through years of experience, Jill has rated each road on an integer scale of niceness. Positive niceness values indicate roads Jill likes; negative values are used for roads she does not like. There are not zero values. Jill plans where to leave the bus and start bicycling, as well as where to stop bicycling and re-join the bus, so that the sum of niceness values of the roads she bicycles on is maximized. This means that she will sometimes cycle along a road she does not like, provided that it joins up two other parts of her journey involving roads she likes enough to compensate. It may be that no part of the route is suitable for cycling so that Jill takes the bus for its entire route. Conversely, it may be that the whole route is so nice Jill will not use the bus at all.

Since there are many different bus routes, each with several stops at which Jill could leave or enter the bus, she feels that a computer program could help her identify the best part to cycle for each bus route.

#### Input

The input file contains information on several bus routes. The first line of the file is a single integer  $b$  representing the number of route descriptions in the file. The identifier for each route ( $r$ ) is the sequence number within the data file,  $1 \leq r \leq b$ . Each route description begins with the number of stops on the route: an integer  $s$ ,  $2 \leq s \leq 100000$  on a line by itself. The number of stops is followed by  $s - 1$  lines, each line  $i$  ( $1 \leq i < s$ ) is an integer  $n_i$  with absolute value  $\leq 1000$  representing Jill's assessment of the niceness of the road between the two stops  $i$  and  $i+1$ .

#### Output

For each route in the input file, your program should identify the beginning bus stop  $i$  and the ending bus stop  $j$  that identify the segment of the route which yields the maximal sum of niceness,  $m = n_i + n_{i+1} + \dots + n_{j-1}$ . If more than one segment is maximally nice, choose the one with the longest cycle ride (largest  $j-i$ ). To break ties in longest maximal segments, choose the segment that begins with the earliest stop (lowest  $i$ ). For each route  $r$  in the input file, print a line in the form:

The nicest part of route  $r$  is between stops  $i$  and  $j$

However, if the maximal sum is not positive, your program should print:



Route  $r$  has no nice parts

## Example

**Input :**

```
3
3
-1
6
10
4
-5
4
-3
4
4
-4
4
-5
4
-2
-3
-4
```

**Output :**

```
The nicest part of route 1 is between stops 2 and 3
The nicest part of route 2 is between stops 3 and 9
Route 3 has no nice parts
```

---

Added by: Adrian Kuegel

Date: 2005-07-27

Time limit: 4s

Source limit: 50000B

Languages: All

Resource: ACM ICPC World Finals 1997

## SPOJ Problem Set (classical)

### 409. DEL Command

#### Problem code: DELCOMM

It is required to find out whether it is possible to delete given files from MS-DOS directory executing the DEL command of MS-DOS operation system only once. There are no nested subdirectories.

#### A note

DEL command has the following format: `DEL wildcard`

The actual wildcard as well as a full file name can be made up either of a name containing 1 up to 8 characters or of a name and extension, containing up to 3 characters. The point character '.' separates the extension from the file name. The extension can be empty and this is equivalent to a name without any extension (in this case a wildcard ends with a point). In a wildcard the characters '?' and '\*' can be used. A question mark substitutes exactly one character of the full file name excluding a point, an asterisk any sequence of characters (containing no points) even empty one. An asterisk can appear only at the last position of the name and the extension.

MS-DOS system can permit maybe other wildcards but they can not be used in this task. File names and extensions consist only of Latin capitals and digits.

#### Input

The first line of the input is an integer M, then a blank line followed by M datasets. There is a blank line between datasets.

Input data for each dataset contains a list of full file names without empty lines and spaces. Each name is written in a separate line of input data file and preceded with a control sign: '-' for delete or '+' for keep. Full file names are not repeated. The list comprises at least one file, and at least one file is marked to be deleted. There are no more than 1000 files.

#### Output

For each dataset, write to the first line of output the required DEL command (only one proposal) or IMPOSSIBLE if there is no solution. A space should separate "DEL" from wildcard. **Print a blank line between datasets.**

#### Example

Input :

```
1
-BP.EXE
-BPC.EXE
+TURBO.EXE
```

**Output :**

DEL ?P\*.\*

---

Added by: Adrian Kuegel

Date: 2005-07-27

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM Northeastern European Regional Contest 1996

## SPOJ Problem Set (classical)

### 410. Variable Radix Huffman Encoding

#### Problem code: VHUFFM

Huffman encoding is a method of developing an optimal encoding of the symbols in a *source alphabet* using symbols from a *target alphabet* when the frequencies of each of the symbols in the source alphabet are known. Optimal means the average length of an encoded message will be minimized. In this problem you are to determine an encoding of the first  $N$  uppercase letters (the source alphabet, `tex2html_wrap_inline87` through `tex2html_wrap_inline89` , with frequencies `tex2html_wrap_inline91` through `tex2html_wrap_inline93` ) into the first  $R$  decimal digits (the target alphabet, `tex2html_wrap_inline97` through `tex2html_wrap_inline99` ).

Consider determining the encoding when  $R=2$ . Encoding proceeds in several passes. In each pass the two source symbols with the lowest frequencies, say `tex2html_wrap_inline87` and `tex2html_wrap_inline105` , are grouped to form a new “combination letter” whose frequency is the sum of `tex2html_wrap_inline91` and `tex2html_wrap_inline109` . If there is a tie for the lowest or second lowest frequency, the letter occurring earlier in the alphabet is selected. After some number of passes only two letters remain to be combined. The letters combined in each pass are assigned one of the symbols from the target alphabet.

The letter with the lower frequency is assigned the code 0, and the other letter is assigned the code 1. (If each letter in a combined group has the same frequency, then 0 is assigned to the one earliest in the alphabet. For the purpose of comparisons, the value of a “combination letter” is the value of the earliest letter in the combination.) The final code sequence for a source symbol is formed by concatenating the target alphabet symbols assigned as each combination letter using the source symbol is formed.

The target symbols are concatenated in the reverse order that they are assigned so that the first symbol in the final code sequence is the last target symbol assigned to a combination letter.

The two illustrations below demonstrate the process for  $R=2$ .

`tabular23`

When  $R$  is larger than 2,  $R$  symbols are grouped in each pass. Since each pass effectively replaces  $R$  letters or combination letters by 1 combination letter, and the last pass must combine  $R$  letters or combination letters, the source alphabet must contain  $k*(R-1)+R$  letters, for some integer  $k$ .

Since  $N$  may not be this large, an appropriate number of fictitious letters with zero frequencies must be included. These fictitious letters are not to be included in the output. In making comparisons, the fictitious letters are later than any of the letters in the alphabet.

Now the basic process of determining the Huffman encoding is the same as for the  $R=2$  case. In each pass, the  $R$  letters with the lowest frequencies are grouped, forming a new combination letter with a frequency equal to the sum of the letters included in the group. The letters that were grouped are assigned the target alphabet symbols 0 through  $R-1$ . 0 is assigned to the letter in the combination with the lowest frequency, 1 to the next lowest frequency, and so forth. If several of the letters in the group have the same frequency, the one earliest in the alphabet is assigned the smaller target symbol, and so

forth.

The illustration below demonstrates the process for  $R=3$ .

tabular63

## Input

The input will contain one or more data sets, one per line. Each data set consists of an integer value for  $R$  (between 2 and 10), an integer value for  $N$  (between 2 and 26), and the integer frequencies `tex2html_wrap_inline91` through `tex2html_wrap_inline93`, each of which is between 1 and 999.

The end of data for the entire input is the number 0 for  $R$ ; it is not considered to be a separate data set.

## Output

For each data set, display its number (numbering is sequential starting with 1) and the average target symbol length (rounded to two decimal places) on one line. Then display the  $N$  letters of the source alphabet and the corresponding Huffman codes, one letter and code per line.

Print a blank line after each test case.

The examples below illustrate the required output format.

## Example

**Input :**

```
2 5 5 10 20 25 40
2 5 4 2 2 1 1
3 7 20 5 8 5 12 6 9
4 6 10 23 18 25 9 12
0
```

**Output :**

```
Set 1; average length 2.10
  A: 1100
  B: 1101
  C: 111
  D: 10
  E: 0
```

```
Set 2; average length 2.20
  A: 11
  B: 00
  C: 01
  D: 100
  E: 101
```

```
Set 3; average length 1.69
  A: 1
  B: 00
  C: 20
  D: 01
  E: 22
  F: 02
  G: 21
```

Set 4; average length 1.32

A: 32

B: 1

C: 0

D: 2

E: 31

F: 33

---

Added by: Adrian Kuegel

Date: 2005-07-27

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ACM ICPC World Finals 1995

## SPOJ Problem Set (classical)

### 411. Number of quite different words

#### Problem code: NUMQDW

Let's consider the alphabet consisting of the first  $c$  roman uppercase letters, i.e. {A, B, C, D, E, F} if  $c$  is 6.

We will call two words *quite different*, if there is no common subsequence of length more than one between those two words. For example ABC and CBA are quite different, but ABBA and CADDCAD aren't, because AA is a subsequence of both words.

Given a word  $w$  you are to find the number of words of length  $n$  that are quite different from  $w$ .

#### Input

The first line will contain the number of test cases (at most 20). Then there will be pairs of lines, the first one containing the numbers  $n$  ( $n$  will fit into a 32-bit signed integer and will be non-negative) and  $c$  ( $1 \leq c \leq 6$ ), the second one the word  $w$ .  $w$  will only consist of the first  $c$  letters of the roman alphabet and will have at most 10000 characters.

#### Output

Print one line for each test case, consisting only of the number of words that are quite different from  $w$ . As this number can be quite large, you just have to output its remainder when dividing by 4242.

#### Example

**Input :**

```
3
3 3
ABC
4 4
CADDCAD
100 3
A
```

**Output :**

```
10
13
2223
```

---

Added by: Robin Nittka

Date: 2005-08-04

Time limit: 20s

Source limit: 50000B

Languages: All

Resource: self-invented

## SPOJ Problem Set (classical)

### 412. K-path cover

**Problem code: COVER**

#### Problem

K-path cover of a directed graph is a set of exactly  $k$  of its edges chosen in such way that every two of them have different start vertices and every two of them have different end vertices. Assuming that for each vertex we know its cost we can define cost of the edge as a sum of costs of its start and end. We can also define cost of a  $k$ -path cover as a sum of costs of its edges. Your task is to find cheapest  $k$ -path cover for given directed graph with known costs of the vertices.

[IMAGE]

A graph and its cheapest 4-path cover.

#### Input

First line of input contains number of test cases  $c$  ( $1 \leq c \leq 20$ ). Each test case begins with  $k$ , number of vertices  $n$  and number of edges  $m$  ( $1 \leq k \leq 100$ ,  $1 \leq n \leq 10000$ ,  $0 \leq m \leq 1000000$ ). Next  $n$  lines contain costs of the vertices, each of them is an integer from  $[-100000, 100000]$ . Then  $m$  lines describing edges follow, each of them containing exactly two numbers representing its start and end vertices. Vertices are numbered from 1 to  $n$ .

#### Output

For each test case output cost of the cheapest  $k$ -path cover. When given graph has no  $k$ -path cover output NONE.

#### Example

Input :

```
1
4 6 9
5
4
6
10
2
3
1 2
1 4
2 4
3 2
4 3
5 4
6 3
5 6
```



6 5

Output :  
33

---

Added by: Pawel Gawrychowski  
Date: 2005-08-08  
Time limit: 10s  
Source limit: 50000B  
Languages: All  
Resource: ONTAK 05

## SPOJ Problem Set (classical)

### 413. Word Puzzles

#### Problem code: WPUZZLES

Word puzzles are usually simple and very entertaining for all ages. They are so entertaining that Pizza-Hut company started using table covers with word puzzles printed on them, possibly with the intent to minimise their client's perception of any possible delay in bringing them their order.

Even though word puzzles may be entertaining to solve by hand, they may become boring when they get very large. Computers do not yet get bored in solving tasks, therefore we thought you could devise a program to speedup (hopefully!) solution finding in such puzzles.

The following figure illustrates the PizzaHut puzzle. The names of the pizzas to be found in the puzzle are: MARGARITA, ALEMA, BARBECUE, TROPICAL, SUPREMA, LOUISIANA, CHEESEHAM, EUROPA, HAVAIANA, CAMPONESA.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0	Q	W	S	P	I	L	A	A	T	I	R	A	G	R	A	M	Y	K	E	I
1	A	G	T	R	C	L	Q	A	X	L	P	O	I	J	L	F	V	B	U	Q
2	T	Q	T	K	A	Z	X	V	M	R	W	A	L	E	M	A	P	K	C	W
3	L	I	E	A	C	N	K	A	Z	X	K	P	O	T	P	I	Z	C	E	O
4	F	G	K	L	S	T	C	B	T	R	O	P	I	C	A	L	B	L	B	C
5	J	E	W	H	J	E	E	W	S	M	L	P	O	E	K	O	R	O	R	A
6	L	U	P	Q	W	R	N	J	O	A	A	G	J	K	M	U	S	J	A	E
7	K	R	Q	E	I	O	L	O	A	O	Q	P	R	T	V	I	L	C	B	Z
8	Q	O	P	U	C	A	J	S	P	P	O	U	T	M	T	S	L	P	S	F
9	L	P	O	U	Y	T	R	F	G	M	M	L	K	I	U	I	S	X	S	W
10	W	A	H	C	P	O	I	Y	T	G	A	K	L	M	N	A	H	B	V	A
11	E	I	A	K	H	P	L	B	G	S	M	C	L	O	G	N	G	J	M	L
12	L	D	T	I	K	E	N	V	C	S	W	Q	A	Z	U	A	O	E	A	L
13	H	O	P	L	P	G	E	J	K	M	N	U	T	I	I	O	R	M	N	C
14	L	O	I	U	F	T	G	S	Q	A	C	A	X	M	O	P	B	E	I	O
15	Q	O	A	S	D	H	O	P	E	P	N	B	U	Y	U	Y	O	B	X	B
16	I	O	N	I	A	E	L	O	J	H	S	W	A	S	M	O	U	T	R	K
17	H	P	O	I	Y	T	J	P	L	N	A	Q	W	D	R	I	B	I	T	G
18	L	P	O	I	N	U	Y	M	R	T	E	M	P	T	M	L	M	N	B	O
19	P	A	F	C	O	P	L	H	A	V	A	I	A	N	A	L	B	P	F	S

## Problem

Your task is to produce a program that given the word puzzle and words to be found in the puzzle, determines, for each word, the position of the first letter and its orientation in the puzzle.

You can assume that the left upper corner of the puzzle is the origin, (0,0). Furthermore, the orientation of the word is marked clockwise starting with letter A for north (note: there are 8 possible directions in total).

## Input

The first line of the input contains a number  $T \leq 10$  which indicates the number of test cases to follow. Each test case starts with a line consisting of three positive numbers: The number of lines of the word puzzle,  $0 < L \leq 1000$ , the number of columns,  $0 < C \leq 1000$ , and the number of words to be found,  $0 < W \leq 1000$ . The following  $L$  input lines, each consisting of  $C$  uppercase letters, contain the word puzzle. Then at last the  $W$  words are input one per line. You can assume that each word can be found exactly once in the word puzzle.

## Output

For each test case your program should output  $W$  lines: For each word (using the same order as the words were input) print a triplet defining the coordinates, line and column, where the first letter of the word appears, followed by a letter indicating the orientation of the word according to the rules defined above. Each value in the triplet must be separated by one space only.

**Print one blank line between test cases.**

## Example

**Input :**

```
1
20 20 10
QWSPILAATIRAGRAMYKEI
AGTRCLQAXLPOIJLFVBUQ
TQTKAZXVMRWALEMAPKCW
LIEACNKAZXKPOTPIZCEO
FGKLSTCBTROPICALBLBC
JEWHJEEWSMLPOEKORORA
LUPQWRNJOAAGJKMUSJAE
KRQEIOLOAOQPRTVILCBZ
QOPUCAJSPPOUTMTSLPSF
LPOUYTRFGMMLKIUISXSW
WAHCPOIYTGAKLMNAHBVA
EIAKHPLBGSMCLOGNGJML
LDTIKENVCWQAZUAOEAL
HOPLPGEJKNUTIIORMNC
LOIUFTGSQACAXMOPBEIO
QOASDHOPEPNBUYUYOBXB
IONIAELOJHSWASMOUTRK
HPOIYTJPLNAQWDRIBITG
LPOINUYMRTMPMLMNBO
PAFCOPLHAVAIAIANALBPFS
MARGARITA
ALEMA
BARBECUE
```

TROPICAL  
SUPREMA  
LOUISIANA  
CHEESEHAM  
EUROPA  
HAWAIANA  
CAMPONESA

**Output :**

0 15 G  
2 11 C  
7 18 A  
4 8 C  
16 13 B  
4 15 E  
10 3 D  
5 1 E  
19 7 C  
11 11 H

---

Added by: Adrian Kuegel

Date: 2005-08-10

Time limit: 15s

Source limit:50000B

Languages: All

Resource: ACM Southwestern European Regional Contest 2002

## SPOJ Problem Set (classical)

### 414. Equatorial Bonfire

#### Problem code: BONFIRE

Some great ideas are never implemented. This was the case with the equatorial bonfire planned for the millennial celebration. Maybe the plan will be rediscovered for the next turn of millenia. Before it is completely forgotten we will tell you about it: The idea was to put tarred logs and gun powder contiguously along the equator and then ignite bonfires at various points of this gun powder belt at various times. The fire would spread in both directions along the equator and in the end, the whole equator would burn.

One concern of the architects of this celebration was what would be the last place to catch fire and when would it happen?

#### Input

The input file consists of at most 10 blocks, each specifying a separate proposal for the equatorial bonfire. The first line of each block specifies the speed of fire's advance in the degrees of longitude per hour. The next line contains the number of bonfires  $N \leq 5000$  along the equator. Each of the next  $N$  lines contains two numbers specifying the time and the location of a bonfire.

The time is given in hours from 12:00am GMT (all times are positive), the location is given in the degrees of longitude (greater than -180 and less than or equal to 180). All numbers except  $N$  are given with precision of at most 2 decimal places. Every block is followed by an empty line. The last block is followed by an empty line and then a line containing  $-1$ .

#### Output

For every block in the input file, output a single line containing the time and coordinate of the last place to catch fire. The time and the coordinate should be in the same units and from the same range as input, but with precision of 3 decimal places. If there are multiple solutions, output the one which is the closest if you travel from the zero meridian east (i.e. in the positive direction).

#### Example

Input :

```
2
2
1 90
1 -90

10.0
3
1 40
2 45
6 -80

-1
```

**Output :**

```
46.000 0.000
15.500 -175.000
```

Note that in the second case, the fire at 45 degrees actually starts 1.5 hours after 12:00am. This of course does not prevent anybody from igniting it again 2 hours after 12:00am.

---

Added by: Adrian Kuegel

Date: 2005-08-11

Time limit: 10s

Source limit:50000B

Languages: All

Resource: IPSC 2002

## SPOJ Problem Set (classical)

### 416. Divisibility by 15

#### Problem code: DIV15

There is a string containing only decimal digit characters. The length of the string is between 1 and 1000. Using characters of the string, you have to construct the maximum number which divides by fifteen without remainder. Each character of the string may not be used more than once.

#### Input

First line of input contains an integer  $t$  ( $1 \leq t \leq 90$ ), equal to the number of testcases. Then descriptions of  $t$  testcases follow.

Each testcase is described in a single line representing the source string.

#### Output

For each testcase output one line with the decimal representation of the maximum number. Leading zeroes should be omitted. If no number can be constructed, output a single word *"impossible"*.

#### Example

**Input :**

1  
02041

**Output :**

4200

---

Added by: Ivan Metelsky

Date: 2005-08-25

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: NEERC Western Subregion QF 2004

## SPOJ Problem Set (classical)

### 417. The lazy programmer

#### Problem code: LAZYPROG

A new web-design studio, called SMART (Simply Masters of ART), employs two people. The first one is a web-designer and an executive director at the same time. The second one is a programmer. The director is so a nimble guy that the studio has already got  $N$  contracts for web site development. Each contract has a deadline  $d_i$ .

It is known that the programmer is lazy. Usually he does not work as fast as he could. Therefore, under normal conditions the programmer needs  $b_i$  of time to perform the contract number  $i$ . Fortunately, the guy is very greedy for money. If the director pays him  $x_i$  dollars extra, he needs only  $(b_i - a_i * x_i)$  of time to do his job. But this extra payment does not influence other contracts. This means that each contract should be paid separately to be done faster. The programmer is so greedy that he can do his job almost instantly if the extra payment is  $(b_i/a_i)$  dollars for the contract number  $i$ .

The director has a difficult problem to solve. He needs to organize programmer's job and, may be, assign extra payments for some of the contracts so that all contracts are performed in time. Obviously he wishes to minimize the sum of extra payments. Help the director!

#### Input

First line of the input contains an integer  $t$  ( $1 \leq t \leq 45$ ), equal to the number of testcases. Then descriptions of  $t$  testcases follow.

First line of description contains the number of contracts  $N$  ( $1 \leq N \leq 100000$ , integer). Each of the next  $N$  lines describes one contract and contains integer numbers  $a_i, b_i, d_i$  ( $1 \leq a_i, b_i \leq 10000$ ;  $1 \leq d_i \leq 1000000000$ ) separated by spaces.

At least 90% of testcases will have  $1 \leq N \leq 10000$ .

#### Output

For each testcase in the input your program should output one line with a single real number  $S$ . Here  $S$  is the minimum sum of money which the director needs to pay extra so that the programmer could perform all contracts in time. The number must have two digits after the decimal point.

#### Example

**Input :**

```
1
2
20 50 100
10 100 50
```

**Output :**

```
5.00
```



---

Added by: Ivan Metelsky  
Date: 2005-08-25  
Time limit: 10s  
Source limit:50000B  
Languages: All  
Resource: NEERC Western Subregion QF 2004

## SPOJ Problem Set (classical)

### 418. Necklace

#### Problem code: NECKLACE

There are  $N$  points marked on a surface, pair  $(x_i, y_i)$  is coordinates of a point number  $i$ . Let's call a *necklace* a set of  $N$  figures which fulfills the following rules.

- The figure  $\#i$  consists of all such points  $(x, y)$  that  $(x - x_i)^2 + (y - y_i)^2 \leq r_i^2$ , where  $r_i \geq 0$ .
- Figures  $\#i$  and  $\#(i+1)$  intersect ( $1 \leq i < N$ ).
- Figures  $\#1$  and  $\#N$  intersect.
- All the rest pairs of figures do not intersect.

Write a program which takes points and constructs a necklace.

#### Input

First line of input contains an integer  $t$  ( $1 \leq t \leq 45$ ), equals to the number of testcases. Then descriptions of  $t$  testcases follow.

The first line of the description contains one integer number  $N$  ( $2 \leq N \leq 100$ ). Each of the next  $N$  lines contains two real numbers  $x_i, y_i$  ( $-1000 \leq x_i, y_i \leq 1000$ ), separated by one space. It is guaranteed that at least one necklace exists for each testcase.

#### Output

For each testcase your program should output exactly  $N$  lines. A line  $\#i$  should contain real number  $r_i$  ( $0 \leq r_i < 10000$ ). To avoid potential accuracy problems, a checking program uses the following rules.

- Figures  $\#i$  and  $\#j$  definitely do not intersect if  $r_i + r_j \leq d_{ij} - 10^{-5}$ .
- Figures  $\#i$  and  $\#j$  definitely intersect if  $d_{ij} + 10^{-5} \leq r_i + r_j$ .
- The case when  $d_{ij} - 10^{-5} < r_i + r_j < d_{ij} + 10^{-5}$  is decided in favour of a contestant.
- $d_{ij}$  equals  $\sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$  in the rules above.

#### Example

Input :

```
1
4
0 0
10 0
10 10
0 10
```

Output :

7  
7  
7  
7

---

Added by: Ivan Metelsky  
Date: 2005-08-25  
Time limit: 10s  
Source limit: 50000B  
Languages: All  
Resource: NEERC Western Subregion QF 2004

## SPOJ Problem Set (classical)

### 419. Transposing is Fun

**Problem code: TRANSP**

#### Problem

Suppose you are given a  $2^a \times 2^b$  array. It is stored sequentially in memory in the usual way, first values in the first row, then values in the second one and so on. You would like to transpose it, but you don't have any additional memory. The only operation that you can perform is swapping contents of two memory cells. What is the minimal number of such operations required for transposition?

#### Input

The first line of input contains the number of test cases  $c$  ( $1 \leq c \leq 100$ ). Each test case consists of two integers  $a, b$  ( $0 \leq a+b \leq 500000$ ).

#### Output

For each test case output the minimal number of swaps required to transpose an  $2^a \times 2^b$  array. As it can be quite large, you have to output its remainder when divided by 1000003 (yes, it's a prime number :).

#### Example

Input :

```
3
1 1
2 2
5 7
```

Output :

```
1
6
3744
```

---

Added by: Pawel Gawrychowski

Date: 2005-09-03

Time limit: 30s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 421. Another Road Problem

#### Problem code: AROAD

#### Problem

Let's say you are given a set of cities (numbered from 1 to  $n$ ) and possible bidirectional roads between them. You would like to build cheapest road network that will make getting from the capital (which has number 1) to every other city possible, where the cost of the network is just sum of its roads' costs. Seems easy? Well, it certainly would be too easy and boring, so this time you should satisfy one additional constraint: you must consider only networks in which there are at most  $d$  roads outgoing from the capital.

#### Input

First line of input contains number of test cases  $c$  ( $1 \leq c \leq 40$ ). Each test case begins with number of cities  $n$ , number of possible roads  $m$  and maximum degree  $d$  ( $1 \leq n \leq 1000$ ,  $0 \leq m \leq 100000$ ,  $0 \leq d \leq 100$ ). Then  $m$  lines describing roads follow, each of them containing road endpoints  $x, y$  and its cost  $c$  ( $1 \leq x, y \leq n$ ,  $0 \leq c \leq 10000$ ).

#### Output

For each test case output the cost of building cheapest road network or NONE if it is impossible.

#### Example

```
Input :
4
4 5 0
1 2 1
1 3 1
1 4 2
2 3 2
3 4 1000

4 5 1
1 2 1
1 3 1
1 4 2
2 3 2
3 4 1000

4 5 2
1 2 1
1 3 1
1 4 2
2 3 2
3 4 1000

4 5 3
```

```
1 2 1
1 3 1
1 4 2
2 3 2
3 4 1000
```

Output:

```
NONE
1003
5
4
```

---

Added by: Pawel Gawrychowski

Date: 2005-10-07

Time limit: 6s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 422. Transposing is Even More Fun

**Problem code: TRANSP2**

#### Problem

Suppose you are given a  $2a \times 2b$  array. It is stored sequentially in memory in the usual way, first values in the first row, then values in the second one and so on. You would like to transpose it, but you don't have any additional memory. The only operation that you can perform is swapping contents of two memory cells. What is minimal number of such operations required for transposition?

#### Input

First line of input contains number of test cases  $c$  ( $1 \leq c \leq 400000$ ). Each test case consists of two integers  $a, b$  ( $0 \leq a+b \leq 1000000$ ).

#### Output

For each test case output minimal number of swaps required to transpose an  $2a \times 2b$  array. As it can be quite large, you have to output its remainder when divided by 1000003 (yes, it's a prime number :).

#### Example

Input :

```
3
1 1
2 2
5 7
```

Output :

```
1
6
3744
```

---

Added by: Pawel Gawrychowski

Date: 2005-10-08

Time limit: 8s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 423. Assignments

**Problem code: ASSIGN**

#### Problem

Your task will be to calculate number of different assignments of  $n$  different topics to  $n$  students such that everybody gets exactly one topic he likes.

#### Input

First line of input contains number of test cases  $c$  ( $1 \leq c \leq 80$ ). Each test case begins with number of students  $n$  ( $1 \leq n \leq 20$ ). Each of the next  $n$  lines contains  $n$  integers describing preferences of one student. 1 at the  $i$ th position means that this student likes  $i$ th topic, 0 means that he definitely doesn't want to take it.

#### Output

For each test case output number of different assignments (it will fit in a signed 64-bit integer).

#### Example

Input :

```
3
3
1 1 1
1 1 1
1 1 1
11
1 0 0 1 0 0 0 0 0 1 1
1 1 1 1 1 0 1 0 1 0 0
1 0 0 1 0 0 1 1 0 1 0
1 0 1 1 1 0 1 1 0 1 1
0 1 1 1 0 1 0 0 1 1 1
1 1 1 0 0 1 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 1
1 0 1 1 0 0 0 0 0 0 1
0 0 1 0 1 1 0 0 0 1 1
1 1 1 0 0 0 1 0 1 0 1
1 0 0 0 1 1 1 1 0 0 0
11
0 1 1 1 0 1 0 0 0 1 0
0 0 1 1 1 1 1 1 1 1 1
1 1 0 1 0 0 0 0 0 1 0
0 1 0 1 0 1 0 1 0 1 1
1 0 0 1 0 0 0 0 1 0 1
0 0 1 0 1 1 0 0 0 0 1
1 0 1 0 1 1 1 0 1 1 0
1 0 1 1 0 1 1 0 0 1 0
0 0 1 1 0 1 1 1 1 1 1
0 1 0 0 0 0 0 0 0 1 1
```



0 1 1 0 0 0 0 0 1 0 1

Output:

6

7588

7426

---

Added by: Pawel Gawrychowski

Date: 2005-10-08

Time limit: 20s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 425. Kill evil instantly

#### Problem code: HAJIME

This problem tests your knowledge of the C programming language. Your task is to submit a snippet of C code that consists of two declarations defining a type called "zan", which should be a struct containing two members: first an unsigned int called "aku", then a constant pointer to char called "soku".

To make things more interesting, you can't use any whitespace in either declaration, and the two declarations must be sufficiently dissimilar (basically, you have to use two different tricks to get around the lack of whitespace).

#### Input

There is no input.

#### Output

Your submission should consist of exactly two declarations as described above, separated by whitespace.

*Update:* "Exactly two" means exactly two. Your code isn't allowed to define any other types; anything containing `struct foo` or `typedef unsigned int` is rejected.

"Whitespace" includes newlines. NUL (`'\0'`) is not whitespace, but it isn't a valid token separator either.

#### Example

**Output :**

```
typedef:struct{unsigned*aku;char*soku;}zan;  
typedef:struct{unsigned*aku;char*soku;}zan;
```

This example is invalid for the following reasons:

- `typedef:` is a syntax error
- `aku` and `soku` have the wrong type
- the two declarations are too similar

---

Added by: Lukas Mai  
Date: 2005-10-17  
Time limit: 20s  
Source limit:512B  
Languages: TEXT

## SPOJ Problem Set (classical)

### 428. Particular Palindromes

#### Problem code: PARTPALI

A palindromic decimal integer reads the same forward and backward. For example, the following numbers are palindromic.

6, 55, 282, 5005, 78187, 904409, 3160613, 11111111

Palindromic integers are plentiful. In fact, any integer not divisible by 10 has an infinite number of multiples that are palindromic. (The standard representation of a nonzero multiple of 10 cannot be palindromic since its reversal would have a leading 0.)

Write a program to determine, for a given positive integer, how many of its positive multiples are palindromes of a given length.

#### Input

The first line of the input will specify an integer  $n$  indicating the number of problem instances to follow, one to a line. Each of the ensuing  $n$  lines will specify a pair of positive integers  $m, s$  separated by a single space, with  $1 < m < 1000$ ,  $s < 20$ . (For  $m, s$  in this range, there are fewer than  $2^{32}$  palindromes among the  $s$ -digit multiples of  $m$ .) Each line will terminate with an end-of-line.

#### Output

The output should indicate for each  $m, s$ , exactly how many  $s$ -digit positive palindromes are divisible by  $m$ , with one problem instance per line.

#### Example

**Input :**

```
5
3 1
25 3
12 4
30 3
81 6
```

**Output :**

```
3
2
7
0
0
```

**Explanation:** There are three positive 1-digit multiples of 3, namely, 3, 6, and 9; all 1-digit numbers are trivially palindromes. Among the 3-digit palindromes, 525 and 575 are multiples of 25. The 4-digit multiples of 12 that are palindromes are 2112, 2772, 4224, 4884, 6336, 6996, 8448. There are no

positive palindromic numbers ending in 0 (since we do not allow leading 0's). No 6-digit palindromes are divisible by 81.

---

Added by: Sebastian Kanthak

Date: 2005-10-26

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: ACM Pacific Northwest Regional Contest 2003

## 515. Collatz

Let N be a positive integer, Consider the following recurrence:  $f(1) = N$  and  $f(K) = (0.5 + 2.5 * (f(K-1) \bmod 2)) * f(K-1) + (f(K-1) \bmod 2)$  if  $K > 1$ . For a given N you have to compute the smallest L for which  $f(L)=1$  (such an L always exists for N's in the input).

Each line contains a positive integer N in decimal notation. You can be sure that N and all intermediate results are not bigger than  $10^{1888}$ . Input terminated by EOF.

For each number N in the input print one line with the value of L in decimal notation.

[illegible]

1  
2  
25  
261  
1296

Resource: Folklore

## SPOJ Problem Set (classical)

### 518. Zig-Zag Permutation

#### Problem code: ZZPERM

In the following we will deal with nonempty words consists only of lower case letters 'a', 'b', ..., 'j' and we will use the natural 'a' < 'b' < ... < 'j' ordering. Your task is to write a program that generates almost all zig-zag words (zig-zag permutations) from a given collection of letters. We say that a word  $W=W(1)W(2)...W(n)$  is zig-zag iff  $n = 1$  or  $W(i) > W(i+1)$  and  $W(j) < W(j+1)$  for all odd  $0 < i < n$  and for all even  $0 < j < n$  or  $W(i) > W(i+1)$  and  $W(j) < W(j+1)$  for all even  $0 < i < n$  and for all odd  $0 < j < n$ . For example: "aabcc" is not zig-zag, "acacb" is zig-zag, "cac" is zig-zag, "abababc" is not zig-zag. If you imagine all possible zig-zag permutations of a word in increasing lexicographic order, you can assign a serial number (rank) to each one. For example: the word "aabcc" generates the sequence: 1  $\leftrightarrow$  "acacb", 2  $\leftrightarrow$  "acbca", 3  $\leftrightarrow$  "bacac", 4  $\leftrightarrow$  "bcaca", 5  $\leftrightarrow$  "cabac", 6  $\leftrightarrow$  "cacab".

#### Input

The input file consists several test cases. Each case contains a word (W) not longer than 64 letters and one positive number (D). The letters of each word are in increasing order. Input terminated by EOF.

#### Output

For each case in the input file, the output file must contain all of the zig-zag permutations of W whose zig-zag serial is divisible by D, in increasing lexicographic order - one word per line. In the next line you have to print the total number of zig-zag permutations of W. There is no case that produces more than 365 lines of output. Print an empty line after each case.

#### Example

##### Input :

```
j 1
abc 2
aaabc 1
aaabb 2
aaaaaaaaaaaaaaaaabbbbbbbbbbbbbbbccdd 123456
```

##### Output :

```
j
1

bac
cab
4

abaca
acaba
2
```

babacbcabacabadabababababababababadab  
213216

Added by: Noszály Csaba  
Date: 2005-05-05  
Time limit: 8s  
Source limit: 12345B  
Languages: All  
Resource: Folklore

## SPOJ Problem Set (classical)

### 526. Divisors

#### Problem code: DIV

Let  $N$  be a positive integer. In theory it is easy to decide if  $d(N)$  (the number of positive divisors of  $N$  including 1 and  $N$ ) is prime or not. Your task is just a little bit harder: compute all  $N$  in  $[1, 10^6]$  for which  $d(N)=p*q$  where  $p$  and  $q$  distinct primes.

#### Input

There is no input for this problem.

#### Output

To make the problem less io related write out only every 9-th of them, one per line.

##### Output :

```
50
99
162
...
999524
999728
999927
```

---

Added by: Noszály Csaba

Date: 2005-05-16

Time limit: 4s

Source limit: 3333B

Languages: All

Resource: Folklore.



## SPOJ Problem Set (classical)

### 530. Divisors 2

#### Problem code: DIV2

Let  $N$  be a positive integer and  $d(N)$  be the number of positive divisors of  $N$  including 1 and  $N$ . Your task is to compute all  $N$  in  $[1, 10^6]$  for which  $d(N) > 3$  and if  $M$  divides  $N$  then  $d(M)$  divides  $d(N)$  too.

#### Input

None.

#### Output

To make the problem less output related write out only every 108-th of them, one per line.

#### Example

**Output :**

267  
511  
753  
...  
999579  
999781  
999977

---

Added by: Noszály Csaba

Date: 2005-05-24

Time limit: 9s

Source limit: 3333B

Languages: All

Resource: Folklore

## SPOJ Problem Set (classical)

### 598. Increasing Subsequences

#### Problem code: INCR

A sequence  $p(1), p(2), \dots, p(N)$  consisting of numbers  $1, 2, \dots, N$  is called a permutation if all elements in the sequence are different.

It is said that a permutation  $p$  contains increasing subsequence of  $k$  elements when there are numbers  $1 \leq i_1 < i_2 < \dots < i_k \leq N$  such that  $p(i_1) < p(i_2) < \dots < p(i_k)$ .

When a permutation  $p$  contains an increasing subsequence consisting of  $B$  elements and does not contain an increasing subsequence consisting of  $B+1$  elements then the number  $B$  is called the degree of increase of this permutation.

You need to write a program which being given a number  $N$  calculates the number of permutations whose degree of increase is  $B$ . Since the number of such permutations might be quite big, it is necessary to calculate its remainder of integer division by 1 000 000 000.

#### Input

First line of input contains integer  $T$  ( $1 \leq T \leq 60$ ) - the number of testcases. Then descriptions of  $T$  testcases follow.

The description of the testcase consists of one line. The line contains two integer numbers  $N$  and  $B$  ( $1 \leq N \leq 40, 1 \leq B \leq 5$ ) separated by one or more spaces.

#### Output

For each testcase in the input your program should output one line. This line should contain one integer number which is the remainder of integer division by 1 000 000 000 of the number of permutations whose degree of increase is  $B$ .

#### Example

Input :

1  
3 2

Output :

4

---

Added by: Ivan Metelsky  
Date: 2005-11-07  
Time limit: 15s  
Source limit: 50000B  
Languages: All  
Resource: NEERC Western Subregion QF 2005

## SPOJ Problem Set (classical)

### 660. Dungeon of Death

#### Problem code: QUEST4

To reach the treasure, **Jones** has to pass through the "**Room of Death**". The floor of this room is a square with side **120** units. It is laid with square tiles of dimensions **{1 X 1}** arranged into a grid. But, at some places in the grid tiles are missing. As soon as the door to this room is opened poisonous gas starts coming out of these missing grid locations. The only escape from this gas is to completely cover these locations with planks lying outside the room. Each plank has dimensions **{120 X 1}** and can only be placed parallel to either sides of the floor. Now **Jones** wants to minimize the damage to his health so that he has enough of it left for the treasure. He figures out that in order to achieve this he has to use the minimum number of planks possible. He also realises that even if the planks overlap, poisonous gas from the missing tiles can still be successfully blocked. Please help **Jones** in this task.

Dungeon of Death: Tiles Uncovered

Dungeon of Death: Tiles Covered

#### Input

- The first line of the input is a positive integer **t** (**t** ≤ **20**), denoting the number of rooms.
- The descriptions for the **t** rooms follow one after the other.
- **Room Description:**
  - The first line of the room description is a positive integer **n** (**n** ≤ **10010**), denoting the number of missing tile locations.
  - This is followed by the **n** lines, one for each missing tile location.
  - Each line contains two integers **x y** (**0** ≤ **x, y** < **120**), separated by a single space, representing the co-ordinates of the missing tile location.

#### Output

The output should consist of **t** lines, one for each room. The **k<sup>th</sup>** line in the output should be an integer **m<sub>k</sub>**, the minimum number of planks needed for the **k<sup>th</sup>** room.

#### Example

**Input :**

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

3 3  
4 4

**Output :**

1  
4

---

Added by: Kashyap KBR  
Date: 2005-12-08  
Time limit: 8s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 661. Nail Them

#### Problem code: QUEST5

To get to the treasure, **Jones** must complete one more task. He comes across a table, where there are a number of wooden planks lying along the length of the table. He notices that the width of the table is exactly equal to the width of every plank on it. The planks are so heavy that they cannot be manually moved in any way. Some of these wooden planks are overlapping. **Jones** has a hammer and the Gods grant him infinite nails. The planks have to be joined to the table with nails such that every plank is connected to the table through at least one nail. The nails are of sufficient length, and have to be hammered vertically into the table. One or more planks can be joined to the table through a single nail provided they have a common overlap. Find out the minimum number of nails he needs to nail all planks to the table.

Planks

#### Input

- The first line of the input is a positive integer  $t \leq 20$ , denoting the number of tables.
- The descriptions of the table follow one after the other.
- **Table description:**
  - The first line of the description of the  $k^{\text{th}}$  table contains a positive integer  $n$  ( $n \leq 10010$ ), the number of planks on it.
  - This is followed by  $n$  lines containing the description of the planks.
  - The description of each plank is a pair of integers  $a$  and  $b$  ( $0 \leq a \leq b \leq 10000010$ ), denoting the distance of the left end and right end of the plank from the left end of the table.

#### Output

The output must contain  $t$  lines, the  $k^{\text{th}}$  line corresponding to the  $k^{\text{th}}$  table. The output on the  $k^{\text{th}}$  line must be an integer  $i_k$ , the minimum number of nails required.

#### Example

**Input :**

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

**Output :**

1

1

---

Added by: Kashyap KBR

Date: 2005-12-08

Time limit: 2s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 665. String it out

#### Problem code: SUBS

Let **A** and **B** be two strings made up of alphabets such that  $A = A_{[1..n]}$ ,  $B = B_{[1..m]}$ . We say **B** is a subsequence of **A** if there exists a sequence of indices  $i_1 < i_2 < \dots < i_m$  of **A** such that  $A[i_k] = B[k]$ .

Given  $B_{[1..m]}$ , a string of characters from some alphabets,  $B^i$  is defined as string with the characters of **B** each repeating **i** times. For example,  $(abbacc)^3 = aaabbbbbbaaacccecc$ . Also,  $B^0$  is the empty string.

Given strings **X**, **Y** made up of characters from 'a' - 'z' find the maximum value of **M** such that  $X^M$  is a subsequence of **Y**.

#### Input

- The first line of the input contains a positive integer  $t \leq 20$ , denoting the no. of test cases.
- The following  $2t$  lines contain the value of **X** and **Y** for the cases.
- The description of the test cases follow one after the other.
  - Line  $2k$  contains the value of **X** for case **k**; ( $1 \leq k \leq t$ )
  - Line  $2k+1$  contains the value of **Y** for case **k**; ( $1 \leq k \leq t$ ).
  - The no. of characters in **X**, **Y** will be  $\leq 500010$ .

#### Output

The output must contain **t** lines, each line corresponding to a test case. The value on the  $k^{th}$  line should be the value of **M** for the  $k^{th}$  pair of **X** and **Y**.

#### Example

##### Input :

```
3
abc
aabbcc
abc
bbccc
abcdef
abc
```

##### Output :

```
2
0
0
```

---



Added by: Kashyap KBR  
Date: 2005-12-12  
Time limit: 8s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 666. Con-Junctions

#### Problem code: VOCV

The city of **Y-O** is a network of two-way streets and junctions with the following properties:

1. There is no more than one street between each pair of junctions.
2. Every junction is connected to every other junction either directly via a street or through other junctions by a unique path.
3. When a light is placed at a junction, all the streets meeting at this junction are also lit.

A valid lighting is a set of junctions such that if lights were placed at these, all the streets would be lit. An optimal lighting is a valid lighting such that it contains the least number of junctions.

The task is divided into two subtasks:

1. Find the number of lights in an optimal lighting.
2. Find the total number of such optimal lightings in the city.

#### Input

- The first line of the input contains a positive integer  $t \leq 20$ , denoting the number of test cases.
- The description of the test cases follows one after the other.
- **Network Description:**
  - The first line of description of a network consists of a positive integer  $n \leq 100010$  denoting the number of junctions in the network.
  - Each junction is numbered with a unique integer between 1 and  $n$ .
  - The following  $n-1$  lines contain a pair of integers  $u\ v$  ( $1 \leq u, v \leq n$ ) separated by a single space denoting that there is a street between junction  $u$  and junction  $v$ .

#### Output

The output must consist of  $t$  lines, the  $k^{\text{th}}$  line corresponding to the  $k^{\text{th}}$  network; ( $1 \leq k \leq t$ ). The  $k^{\text{th}}$  line must contain two integers separated by a single space. The first integer on the  $k^{\text{th}}$  line must be the number of junctions in an optimal lighting of network  $k$ . The second integer must be  $N \% 10007$ , which is the remainder left by the number of optimal lightings when divided by 10007.

#### Example

Input :

```
2
4
1 2
2 3
3 4
3
```

1 2  
1 3

**Output:**

2 3  
1 1

---

Added by: Kashyap KBR

Date: 2005-12-12

Time limit: 10s

Source limit:50000B

Languages: All except: NICE JAR NEM ST SCM qobi

## SPOJ Problem Set (classical)

### 676. Sorting is not easy

#### Problem code: LSORT

An N-element permutation is an N-element sequence of distinct numbers from the set  $\{1, 2, \dots, n\}$ . For example the sequence 2,1,4,5,3 is a 5-element permutation. P is an N-element permutation. Your task is to sort P in ascending order. But because it is very simple, I have a new rule for you. You have two sequences P and Q. P is an N-element permutation and Q is initially empty and formed by sorting P (i.e. finally  $Q = 1, 2, 3, \dots, N$ ). You have to implement N steps to sort P. In the i-th step, P has N-i+1 remaining elements, Q has i-1 elements and you have to choose some x-th element (from the N-i+1 available elements) of P and put it to the left or to the right of Q. The cost of this step is equal to  $x * i$ . The total cost is the sum of costs of individual steps. After N steps, Q must be an ascending sequence. Your task is to minimize the total cost.

#### Input

The first line of the input file is T ( $T \leq 10$ ), the number of test cases. Then descriptions of T test cases follow. The description of each test case consists of two lines. The first line contains a single integer N ( $1 \leq N \leq 1000$ ). The second line contains N distinct integers from the set  $\{1, 2, \dots, N\}$ , the N-element permutation P.

#### Output

For each test case your program should write one line, containing a single integer - the minimum total cost of sorting.

#### Example

N = 4

P = {4,1,3,2}

Step 1, Choose 3-rd, P={4,1,2}, Q={3} , Cost=3

Step 2, Choose 1-st, P={1,2}, Q={3,4} , Cost=2

Step 3, Choose 2-nd, P={1}, Q={2,3,4} , Cost=6

Step 4, Choose 1-st, P={}, Q={1,2,3,4}, Cost=4

The total cost is 15.

Another way to sort:

Step 1, Choose 4-th, P={4,1,3}, Q={2} , Cost=4

Step 2, Choose 2-nd, P={4,3}, Q={1,2} , Cost=4

Step 3, Choose 2-nd, P={4}, Q={1,2,3} , Cost=6

Step 4, Choose 1-st, P={}, Q={1,2,3,4}, Cost=4

The total cost is 18.

**Input :**

1

4

4 1 3 2

**Output :**

15

---

Added by: Nguyen Minh Hieu

Date: 2005-12-20

Time limit: 2s

Source limit:10000B

Languages: All except: C99 strict

Resource: Romanian National Contest

## SPOJ Problem Set (classical)

### 677. A place for the brewery

#### Problem code: BROW

The dwellers of the island Abstinence are very fond of alkoholfree beer. Hitherto alcohol-free beer was imported from Poland, but this year one of the cities on Abstinence is going to build a brewery. All the cities of this island lie on the coast and are connected by a highway running around the island along its shore. The investor building the brewery collected information about the demand for beer, i.e. how many tanks of beer are needed daily in each city. He has also a table of distances between cities. The cost of transporting one tank is 1 thaler per mile. A daily cost of transport is the amount of money, which has to be spent on transporting a necessary number of tanks of beer from the brewery to each city. The daily cost depends on the location of the brewery. The investor wants to find a location that minimizes the daily cost.

#### Task

Write a program which

- reads the number of cities, distances between them and daily requests for beer,
- computes the minimal daily cost of transport,
- writes the result.

#### Input

There are multiple test cases. Their number is given in the first line of input. In the first line of each test case there is one integer  $n$  - the number of cities,  $5 \leq n \leq 10\,000$ . (We assume that cities are numbered along the highway, so that the neighbouring cities have subsequent numbers. Cities 1 and  $n$  are neighbours too.) In each of the following  $n$  lines there are two non-negative numbers separated by a single space. Numbers  $z_i$   $d_i$  written in the line  $(i+1)$  are respectively the demand for beer in the city  $i$  and the distance (in miles) from city  $i$  to the next city on the highway. The entire length of the highway is not greater than 1 000 000 miles. The demand for beer in each city is not greater than 1 000 tanks.

#### Output

For each test case your program should write only one line - exactly one integer equal to the minimal daily cost of transport.

#### Example

Input :

```
1
6
1 2
2 3
1 2
5 2
1 10
```

2 3

**Output :**

41

---

Added by: Paweł Dobrzycki

Date: 2005-12-21

Time limit: 1s

Source limit:50000B

Languages: All

Resource: VII Polish Olympiad in Informatics, Ist Stage

## SPOJ Problem Set (classical)

### 681. Building the Tower

#### Problem code: HANOI07

There are  $N$  cubes in a toy box which has 1-unit height, the width is double the height. The teacher organizes a tower-building game. The tower is built by the cubes. The height of the tower is  $H$  ( $h$  levels). The bottom of the tower contains  $M$  cubes; and for all above level, each must contains a number of cubes which is exactly 1 less than or greater than the number of cubes of the level right below it. Your task is to determine how many different towers can be there. Two towers are considered different if there is at least one number  $i$  ( $1 < i \leq H$ ) so that the  $i$ 'th level of one tower contains a different number of cubes to the  $i$ 'th level of the other tower.

#### Input

The first line of input file is the integer number  $t$  ( $0 < t < 1002$ ), the number of test cases. Each test case in one line, the line contains three positive number  $N$ ,  $H$  and  $M$  ( $N \leq 32767$ ,  $H \leq 60$ ,  $M \leq 10$ ).

#### Output

With each test case, write in one line, the total of different towers that can be founded.

#### Example

**Input :**

2

7 3 2

22 5 4

**Output :**

2

10

(\* In the first test case, all the towers are : 2-1-2, 2-3-2 . \*)

---

Added by: Nguyen Minh Hieu

Date: 2005-12-30

Time limit: 7s

Source limit: 7777B

Languages: All

Resource: ACM



## SPOJ Problem Set (classical)

### 682. Pairs of Integers

#### Problem code: PAIRINT

You are to find all pairs of integers such that their sum is equal to the given integer number  $N$  and the second number results from the first one by striking out one of its digits. The first integer always has at least two digits and starts with a non-zero digit. The second integer always has one digit less than the first integer and may start with a zero digit.

#### Input

The first line of the input file is the integer number  $t$  ( $1 \leq t \leq 20$ ), the number of test cases. Then  $t$  lines follow, each test case in one line; the line consists of a single integer  $N$  ( $10 \leq N \leq 10^9$ ).

#### Output

For each test case:

On the first line write the total number of different pairs of integers that satisfy the problem statement. On the following lines write all those pairs. Write one pair on a line in ascending order of the first integer in the pair. Each pair must be written in the following format

$X + Y = N$

Here  $X$ ,  $Y$ , and  $N$ , must be replaced with the corresponding integer numbers. There should be exactly one space on both sides of '+' and '=' characters.

#### Example

**Input :**

```
2
302
11
```

**Output :**

```
5
251 + 51 = 302
275 + 27 = 302
276 + 26 = 302
281 + 21 = 302
301 + 01 = 302
1
10 + 1 = 11
```

---

Added by: Nguyen Minh Hieu

Date: 2006-01-01

Time limit: 1s

Source limit:10000B

Languages: All except: C99 strict

Resource: 2001-2002 ACM Northeastern European Regional Programming Contest

## SPOJ Problem Set (classical)

### 684. Another Assignment Problem

#### Problem code: ASSIGN4

Assume that you are a manager and there are  $m$  types of worker (numbered from 1 to  $m$ ) and  $n$  types of task (numbered from 1 to  $n$ ). There are  $a(i)$  workers of type  $\#i$  and  $b(j)$  positions for task  $\#j$ .  $C(i, j)$  is the cost of hiring a worker of type  $\#i$  to do the task of type  $\#j$ . Your job is to minimize the cost of hiring workers to fill all the positions given that the total number of workers is equal to the total number of positions.

#### Input

The first line of input contains the number of test cases  $nTest$  ( $1 \leq nTest \leq 10$ ). Each test case contains:

- The first line contains the number of worker types -  $m$  and number of task types -  $n$ .
- The second line contains  $m$  positive integers:  $a(1), a(2), \dots, a(m)$ .
- The third line contains  $n$  positive integers:  $b(1), b(2), \dots, b(n)$ .
- Each of the next  $m$  lines contains  $n$  integers describing matrix  $C(i, j)$ .

Notes:

$1 \leq m, n \leq 200$ ;

$1 \leq a(i), b(i) \leq 30000$ ;

$1 \leq C(i, j) \leq 10000$ .

Sum of  $a(i)$  equals to sum of  $b(j)$ .

#### Output

For each test case write the minimum cost in a separate line (it will fit in a signed 32-bit integer).

#### Example

**Input :**

```
2
3 4
3 6 7
2 5 1 8
1 2 3 4
8 7 6 5
9 12 10 11
4 4
1 3 5 7
2 4 2 8
1 4 7 3
4 7 5 3
```

5 7 8 3  
5 3 6 8

**Output :**

110  
54

---

Added by: Nguyen Dinh Tu

Date: 2006-01-02

Time limit: 5s

Source limit:50000B

Languages: All

Resource: Tran Quang Khai

## SPOJ Problem Set (classical)

### 685. Partition the sequence

#### Problem code: SEQPAR

Given an integer sequence containing  $n$  elements (numbered from 1 to  $n$ ), your task is to find the minimum value  $M$  so that we can find  $k + 1$  integers  $0 = p(0) < p(1) < p(2) < \dots < p(k-1) < p(k) = n$ , such that for any  $i$  from 0 to  $k - 1$ , the sum of elements from position  $p(i)+1$  to position  $p(i+1)$  is not greater than  $M$ .

#### Input

The first line of input contains the number of test cases  $nTest$  ( $1 \leq nTest \leq 10$ ).

Each test case contains:

The first line contains  $n, k$ . ( $1 \leq k \leq n \leq 15000$ )

Each of the next  $n$  lines contains an integer of the sequence with value range from -30000 to 30000.

#### Output

For each test case write the minimum number  $M$  in a separate line.

#### Example

**Input :**

```
1
9 4
1
1
1
3
2
2
1
3
1
```

**Output :**

```
5
```

---

Added by: Nguyen Dinh Tu

Date: 2006-01-02

Time limit: 44s

Source limit: 50000B

Languages: All

Resource: Viet Nam Olympiad in Informatic 2005, Day I

## SPOJ Problem Set (classical)

### 687. Repeats

#### Problem code: REPEATS

A string  $s$  is called an  $(k,l)$ -repeat if  $s$  is obtained by concatenating  $k \geq 1$  times some seed string  $t$  with length  $l \geq 1$ . For example, the string

$s = \text{abaabaabaaba}$

is a  $(4,3)$ -repeat with  $t = \text{aba}$  as its seed string. That is, the seed string  $t$  is 3 characters long, and the whole string  $s$  is obtained by repeating  $t$  4 times.

Write a program for the following task: Your program is given a long string  $u$  consisting of characters 'a' and/or 'b' as input. Your program must find some  $(k,l)$ -repeat that occurs as substring within  $u$  with  $k$  as large as possible. For example, the input string

$u = \text{babbabaabaabaabab}$

contains the underlined  $(4,3)$ -repeat  $s$  starting at position 5. Since  $u$  contains no other contiguous substring with more than 4 repeats, your program must output the maximum  $k$ .

#### Input

In the first line of the input contains  $H$  - the number of test cases ( $H \leq 20$ ).  $H$  test cases follow. First line of each test cases is  $n$  - length of the input string ( $n \leq 50000$ ). The next  $n$  lines contain the input string, one character (either 'a' or 'b') per line, in order.

#### Output

For each test cases, you should write exactly one interger  $k$  in a line - the repeat count that is maximized.

#### Example

**Input :**

```
1
17
b
a
b
b
a
b
a
a
b
a
a
b
a
a
b
a
```

a  
b  
a  
b

**Output :**

4

since a (4, 3)-repeat is found starting at the 5th character of the input string.

---

Added by: Hoang Hong Quan

Date: 2006-01-05

Time limit: 18s

Source limit: 50000B

Languages: All

Resource: BOI 2004

## SPOJ Problem Set (classical)

### 688. Toy Cars

#### Problem code: SAM

Jasio is a little boy - he is only three years old and enjoys playing with toy cars very much. Jasio has  $n$  different cars. They are kept on a shelf so high, that Jasio cannot reach it by himself. As there is little space in his room, at no moment may there be more than  $k$  toy cars on the floor. Jasio plays with one of the cars on the floor. Jasio's mother remains in the room with her son all the time. When Jasio wants to play with another car that is on the floor, he reaches it by himself. But when the toy is on the shelf, his mummy has to hand it to him. When she gives Jasio one car, she can at the same time pick any car from the floor and put it back on the shelf (so that there remains sufficient space on the floor). The mother knows her child very well and therefore can predict perfectly which cars Jasio will want to play with. Having this knowledge, she wants to minimize the number of times she has to hand Jasio a toy from the shelf. Keeping that in mind, she has to put the toys off on the shelf extremely thoughtfully.

#### Task

Write a programme that:

- 1.reads from the standard input the sequence of toy cars in order in which Jasio will want to play with them,
- 2.calculates the minimal number of times the mother has to pick cars from the shelf,
- 3.writes the result to the standard output.

#### Input

In the first line of the standard input is  $H$ - the number of test case ( $H \leq 16$ ). For each test case follow contains some lines, start with three integers:  $n, k, p$  ( $1 \leq k \leq n \leq 100000, 1 \leq p \leq 500000$ ), separated by single spaces. These denote respectively: the total number of cars, the number of cars that can remain on the floor at once and the length of the sequence of cars which Jasio will want to play with. Each of the following  $p$  lines contains one integer. These integers are the numbers of cars Jasio will want to play with (the cars are numbered from 1 to  $n$ ).

#### Output

For each test case, you should write only one integer - the minimal number of times his mother has to pick a car from the shelf.

#### Example

##### Input :

For the following input data:

```
3 2 7
1
2
```



3  
1  
3  
1  
2

**Output:**

the correct answer is:  
4

---

Added by: Hoang Hong Quan

Date: 2006-01-08

Time limit: 8s

Source limit:50000B

Languages: All

Resource: 12th Polish Olympiad in Informatics, stage 1

## SPOJ Problem Set (classical)

### 693. Lethal Warfare

#### Problem code: LWAR

A major cosmic battle was getting over. The InterGalactic SuperPower had been under attack, but it had defended itself quite well. It was about to launch its final retaliatory assault. But the number of enemy ships was quite large and they could scatter very easily. Their only hope, or so their Space Warfare expert said, was to bomb the enemies (who happened to be lined up in a long line!) using the strategy described below.

Because the number of ships will be a power of 2, to bomb all the ships (numbered 0 to  $2^N - 1$ ), the strategy to be used, which we will call **BombStrat**, goes like this:

1. Bomb it's first half,  $[0 \text{ to } 2^{N-1} - 1]$ , in the left to right direction.
2. Of the remaining half, bomb its latter half part in reverse direction, i.e., bomb ships  $2^N - 1, 2^N - 2, \dots, 2^{N-1} + 2^{N-2}$  in that order.
3. Then use **BombStrat** on the remaining ships:  $[2^{N-1} \text{ to } 2^{N-1} + 2^{N-2} - 1]$

For example, when  $N=3$ , i.e., with ships numbered from 0 to  $2^3 - 1$ , this is what happens:

Step 1: Ships 0,1,2,3 get bombed in that order.

Step 2: Ships 7, 6 go down next.

Step 3: Now, the remaining ships [4, 5] are destroyed using the same strategy.

So the bombing is done in the order  $0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 7 \rightarrow 6 \rightarrow 4 \rightarrow 5$ . To make the job easier for the InterGalactic SuperPower's ships' pilots, they want to find which ship should be bombed when. This is your task. Given  $N$ , and the description of a ship, return the 0-based serial number of the bomb will blast it.

#### Input

$T$  - the number of test cases,  $T \leq 50$ .

For each test case:

One line containing a binary number, describing the number of the place. The length of this string will equal  $N$  (it will be padded with leading zeroes if necessary).  $N \leq 30000$ .

#### Output

For each test case, output the index of a bomb, represented in the same format, as binary digits, whose length is exactly  $N$ .

#### Example

Sample Input:

```
3
111
100
1100
```

Sample Output:

100  
110  
1011

---

Added by: Prasanna

Date: 2006-01-13

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ByteCode '06

## SPOJ Problem Set (classical)

### 694. Distinct Substrings

#### Problem code: DISUBSTR

Given a string, we need to find the total number of its distinct substrings.

#### Input

T- number of test cases.  $T \leq 20$ ;

Each test case consists of one string, whose length is  $\leq 1000$

#### Output

For each test case output one number saying the number of distinct substrings.

#### Example

##### Sample Input:

```
2
CCCCC
ABABA
```

##### Sample Output:

```
5
9
```

Explanation for the testcase with string ABABA:

len=1 : A,B

len=2 : AB,BA

len=3 : ABA,BAB

len=4 : ABAB,BABA

len=5 : ABABA

Thus, total number of distinct substrings is 9.

---

Added by: Prasanna

Date: 2006-01-13

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: ByteCode '06

## SPOJ Problem Set (classical)

### 695. Unite Fast

#### Problem code: UFAST

The Agents need to unite. They are on a road and each of them possess a special device which can both send and receive signals, in both directions upto a maximal distance of  $D$  units. Apart from this small limitation, the devices work very efficiently so that the time taken for interdevice communication is practically zero. Now that the agents are at different points on the road, for them to be able to communicate with each other at will, every agent should be connected to every other agent through one or more intermediate devices. For example: agent  $A$  may communicate to agent  $C$  via agent  $B$ 's device, when  $A$  and  $C$  are not close enough. This happens when  $\text{dist}(A,C) > D$ , but  $\text{dist}(A,B) \leq D$  and  $\text{dist}(B,C) \leq D$ .

Getting the line ready, is the process of agents moving from their current positions in order to get the network fully connected. That is, from every agent to every other agent, there is a communication path.

The agent's final positions (in two cases that are going to follow) are decided by a programmer, who watches the scene from above and instructs each agent of the time to move and the final position to move to. Each agent moves a unit distance in unit time.

We need to find the minimal time taken for the programmer to "get the line ready" if he moves the agents:

1. Independently: In other words, every agent moves to their final position without waiting for any other agent; all agents are told of their final positions at time zero.
2. Sequentially: In this the agents form a definite sequence of movement. No two agents are moving at the same time.

#### Input

$T$  - number of test cases. For each test case :

$N$   $D$  - where  $N$  is the number of agents,  $D$  is the maximal communication distance

The  $i$ -th line, of the  $N$ -lines that follow gives the position of the  $i$ -th agent on the road currently.

#### Output

For each test case, output two integers;

1st - minimal time taken to unite if they move independently

2nd - minimal time taken to unite if they move sequentially

#### Constraints:

$T \leq 20$

$1 \leq N, D \leq 100$  ;

Each agent's initial position is between 0 and 1000.

## Example

### Sample Input:

```
2
4 3
10 20 30 35
5 3
1 2 3 4 30
```

### Sample Output:

```
8 23
12 23
```

---

Added by: Prasanna

Date: 2006-01-13

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: ByteCode '06

## SPOJ Problem Set (classical)

### 696. Liar Liar

#### Problem code: LIAR

Professor Millman hates us, and worse, characterizes us as liars. We don't care if he means it or not, but we (more professional than him!) planned to give the lower and upper bound on the number of liars in the class (so that you know what happens the next time he scolds us! ).

To start with we took a survey of all students in the class. Each student gave a reply about every student saying whether that student is a liar or not. These answers are in the form of a Matrix A, where  $A[i][j]$  represents the reply given by the i-th student about the j-th student. If that character is 'L' - it means he/she is a liar; if it's 'T' - then it means that, that student is a truth speaker.

We take the following as our definition of the terms Truth-Speaker, and Liar:

Truth-Speaker ('T'): All his/her replies are true.

Liar ('L') : (S)he has made at least one false reply.

#### Input

T - the number of test cases; For each test case :

N - total number of students in the class

Matrix A of NxN characters, without space separation;

#### Output

For i-th test case output one line of the form "Class Room#i contains atleast A and atmost B liars", where A and B are the lower and the upper bounds on the number of liars respectively. If there is a paradoxical class room, instead of the above line, print "Class Room#i is paradoxical".

#### Constraints:

$T \leq 50$ ; Our class rooms contain atmost 70 students.

#### Example

##### Sample Input:

```
4
2
LL
TT
3
TTT
TTT
TTT
4
TLLL
LTLL
```

LLTL  
LLLT  
5  
TLTLT  
TTTTT  
LLTLL  
LLLLL  
TLTLT

**Sample Output:**

Class Room#1 is paradoxical  
Class Room#2 contains atleast 0 and atmost 3 liars  
Class Room#3 contains atleast 3 and atmost 4 liars  
Class Room#4 contains atleast 4 and atmost 4 liars

Here a paradox occurs if a person can't be classified as a liar or a truth-speaker.

---

Added by: Prasanna  
Date: 2006-01-13  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ByteCode '06



## SPOJ Problem Set (classical)

### 697. Matrix Words

#### Problem code: MWORDS

Given an  $N \times N$  matrix of characters. We start at position (1,1) and want to reach (N,N) in exactly  $2N-1$  moves. Each move consists of movement in one of the four standard directions. As we move, we collect the characters found in our positions forming a string. We now constrain our attention to all paths that do not cross the diagonal of the matrix. However the parts of the path can be on the diagonal line. These paths can be classified into two partitions; the paths that lie above and paths that lie below the diagonal. Each path is represented by a string of characters formed by the ordered concatenation of characters found on the way. If we consider the set of all valid paths, (both upper and lower) get their corresponding strings, sort them all in alphabetical order, we obtain the (ordered) master set. Note that the master set might contain duplicates, and all strings in the master set consist of exactly  $2N-1$  characters. Let  $M$  be the total number of strings in the master set, given an integer  $I$ , we need to find the string with index =  $I$  (modulo  $M$ ) within the master set.

If Master Set = { "A","B","B","C" } (although this set can never be a master set!)

$I=0$  produces "A", while  $I=2$  and  $I=5$ , produces "B".

#### Constraints:

$N \leq 30$ .

$I \leq 10^{18}$ . 'I' will fit into a 64-bit integer.

#### Input

T-number of test cases

N I

Next is the  $N \times N$  matrix of characters, N characters per line.

All characters are between 'A'-'Z' (only uppercase).

#### Output

For each test case output the corresponding string sought for in the master set.

#### Example

##### Sample Input:

```
2
3 18
DAA
BDA
BBD
3 18
DAA
ADA
AAD
```

**Sample Output:**

DBBBB

DADAD

**Explanation:**

Test case I: Master Set = { "DAAAD", "DADAD", "DBBBB", "DBDBD" }

Test case II: Master Set = { "DAAAD", "DAAAD", "DADAD", "DADAD" }

---

Added by: Prasanna

Date: 2006-01-13

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: ByteCode '06

## SPOJ Problem Set (classical)

### 698. Plane Hopping

#### Problem code: PLHOP

This man has grown so rich that, when he travels between any two locations he always takes atleast K flights. In a region of N cities, we need to find the minimal cost required for the man to travel between every pair of cities. There are provisions (especially for this type of rich men,) to fly from i-th city to the i-th city itself!

#### Input

T - The number of test cases.

In each test case :

K N

NxN matrix representing the costs of the tickets. The i-th line, j-th column's entry represents the cost of a ticket from city i to city j. The numbers are of course space separated.

#### Constraints :

$T \leq 20$

$N \leq 50$

$K \leq 10^9$

The cost of each ticket  $\leq 100$

Each element of the output matrix will fit into a 64-bit integer.

#### Output

For the i-th test case , 1st line is of the form "Region #i:".

In the following N lines, output an NxN matrix where the j-th element of the i-th line represents the minimal cost to travel from city i to city j with taking atleast K flights. The numbers on a line must be separated by atleast one space. Output a blank line after each testcase (including the last one).

#### Example

##### Sample Input:

```
2
3 4
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
10999 4
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
```

**Sample Output:**

Region #1:

3 4 5 6

7 8 9 10

11 12 13 14

15 16 17 18

Region #2:

10999 11000 11001 11002

11003 11004 11005 11006

11007 11008 11009 11010

11011 11012 11013 11014

---

Added by: Prasanna

Date: 2006-01-13

Time limit: 2.5s

Source limit:50000B

Languages: All

Resource: ByteCode '06

## SPOJ Problem Set (classical)

### 699. Huge Knap Sack

#### Problem code: HKNAP

Our King has won the brutal battle and this whole land is now ours. The special thing about this land is that it has many beautiful golden statues. Our King wants to take back as much gold as possible to his palace. We have found that there are  $N$  types of statues and -- almost unbelievably -- that there is an unlimited number of each type of statue. Each statue of type  $i$  has a weight of  $W[i]$  units and occupies  $V[i]$  units of volume. Our King wants to maximize the amount of gold he carries back to his palace. We may use  $S$  sacks for this purpose, each of volume  $Y$ . All sacks are filled up independently by golden statues. However, there is a provision to stitch two sacks together, at the cost of  $C$  units of gold. Stitching three sacks costs  $2 \cdot C$  because it requires two stitchings, and so on. Your task is to find how much gold our King can possibly gain, i.e. the total weight of the statues brought back, minus the stitching charges.

#### Input

$T$  - The number of test cases.

For each test case :

$N$   $S$   $Y$   $C$  // 1st line

Next  $N$  lines two numbers  $W[i]$  and  $V[i]$  each.

#### Output

One integer, the maximum gain in gold for our King.

This gain is the total amount of gold transported minus stitching charges.

#### Constraints :

$1 \leq S \leq 1000$

$1 \leq Y \leq 1000\,000\,000$

$1 \leq N \leq 1000$

$1 \leq W[i] \leq 100$ ; (for all  $i$ )

$1 \leq V[i] \leq 18$ ;

The Output will fit into a 64-Bit integer.

$1 \leq T \leq 20$

All  $W[i]$  &  $V[i]$  are guaranteed to be either prime or equal to 1.

#### Example

##### Sample Input:

```
2
2 5 3 1
1 2
5 7
2 5 3 1
1 2
```

7 5

**Sample Output:**

6

17

---

Added by: Prasanna

Date: 2006-01-13

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ByteCode '06

# SPOJ Problem Set (classical)

## 700. Branch Prediction

### Problem code: BPRED

As most of you might already know, the Intel-class hi-tech processors of today do a series of parallel tasks to help speedup instruction execution. The most complicated of those tasks is branch prediction. Since the instruction chunks on a modern processor are broken down into independent chunks and executed for a speed up, there is always a requirement to predict what branch an execution path will take (before the actual operands required for the condition to be evaluated to select the branch, are available). This complex task, is not addressed to fullest level today, but heuristics (as always) have helped.

The task we are going to consider now is much more simple compared to the actual branch prediction task. For our modelling, let us suppose that every instruction has the following syntax:

All labels are strings of alphabets only. Labels are case-sensitive.

Moreover the probability that a certain branch will be taken is **P** (it is equal for all branches). If a branch is taken, the point of execution (control) goes to the branched-label. Otherwise the next statement in that order is executed. Control starts at the "**start**" (lowercase) label and control ends at the "**end**" (lowercase) label. The branch-label of start and end are themselves, and when start is executed, the control goes to the next instruction, and when end is executed, processing ends, with 100% probability. The last statement in the program is always an "**end**".

It is required to find the expected number of times a statement executes.

### Input

T - the number of test cases;

For each test case:

1st line contains one integer N (the number of lines to follow), one real P and one label L.

Each of the N lines that follow consist of instructions (two labels).

### Output

For each test case, output one line containing:

"Expected number of times label L is executed is R",

where L - is the label given in the input

R - is the number of times the label is expected to be executed. It must be printed with exactly five decimal places.

### Constraints:

$T \leq 20$

$3 \leq N \leq 120$ .

P lies between 0.01 and 0.99, i.e. no jump is 100% sure.

Also you can assume no label occurs on the jump side, without being defined throughout the program.

Each label is less than 10 characters in length.

Also each line has a distinct label associated with it.

## Example

### Sample Input:

```
3
5 .5 B
C start
start start
B C
D C
end end
5 .99 C
start start
A B
B A
C end
end end
3 .5 label
start start
label label
end end
```

### Sample Output:

```
Expected number of times label B is executed is 4.00000
Expected number of times label C is executed is 1.00000
Expected number of times label label is executed is 2.00000
```

---

Added by: Prasanna  
Date: 2006-01-13  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ByteCode '06



## SPOJ Problem Set (classical)

### 702. Barn Expansion

#### Problem code: EXPAND

Farmer John has  $N$  ( $1 \leq N \leq 25,000$ ) rectangular barns on his farm, all with sides parallel to the  $X$  and  $Y$  axes and integer corner coordinates in the range  $0..1,000,000$ . These barns do not overlap although they may share corners and/or sides with other barns. Since he has extra cows to milk this year, FJ would like to expand some of his barns. A barn has room to expand if it does not share a corner or a wall with any other barn. That is, FJ can expand a barn if all four of its walls can be pushed outward by at least some amount without bumping into another barn. If two barns meet at a corner, neither barn can expand. Please determine how many barns have room to expand.

#### Input

$t$  - the number of test cases, then  $t$  test cases follow.

Each test case takes the following form:

The first line contains the number of rectangular barns -  $n$ .

Each of the next  $n$  lines contains:

Four space-separated integers  $A$ ,  $B$ ,  $C$ , and  $D$ , describing one barn. The lower-left corner of the barn is at  $(A,B)$  and the upper right corner is at  $(C,D)$ .

#### Output

For each test case write a single integer that is the number of barns that can be expanded in a separate line

#### Example

**Input :**

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

**Output :**

```
2
```

#### Input/Output details:

There are 5 barns. The first barn has its lower-left corner at  $(0,2)$  and its upper-right corner at  $(2,7)$ , and so on.

Only two barns can be expanded --- the first two listed in the input. All other barns are each in contact with at least one other barn.

---

Added by: Nguyen Dinh Tu

Date: 2006-01-17

Time limit: 4s

Source limit:50000B

Languages: All

Resource: USACO December 2005 Gold Division

## SPOJ Problem Set (classical)

### 703. Mobile Service

#### Problem code: SERVICE

A company provides service for its partners that are located in different towns. The company has three mobile service staff employees. If a request occurs at some location, an employee of the service staff must move from his current location to the location of the request (if no employee is there) in order to satisfy the request. Only one employee can move at any moment. They can move only on request and are not allowed to be at the same location. Moving an employee from location  $p$  to location  $q$  incurs a given cost  $C(p,q)$ . The cost function is not necessarily symmetric, but the cost of not moving is 0, i.e.  $C(p,p)=0$ . The company must satisfy the received requests in a strict first-come, first-serve basis. The goal is to minimize the total cost of serving a given sequence of requests.

#### Task

You are to write a program that decides which employee of the service staff is to move for each request such that the total cost of serving the given sequence of requests is as small as possible.

#### Input

The first line of input contains the number of test cases -  $n_{\text{Test}}$ . Each test case contains:

The first line of each test cases contains two integers,  $L$  and  $N$ .  $L$  ( $3 \leq L \leq 200$ ) is the number of locations and  $N$  ( $1 \leq N \leq 1000$ ) is the number of requests. Locations are identified by the integers from 1 to  $L$ . Each of the next  $L$  lines contains  $L$  non-negative integers. The  $j$ th number in the line  $i+1$  is the cost  $C(i,j)$ , and it is less than 2000.

The last of each test cases contains  $N$  integers, the list of the requests. A request is identified by the identifier of the location where the request occurs. Initially, the three service staff employees are located at location 1, 2 and 3, respectively.

#### Output

For each test case write the minimal total cost in a separate line.

#### Example

##### Input :

```
1
5 9
0 1 1 1 1
1 0 2 3 2
1 1 0 4 1
2 1 5 0 1
4 2 3 4 0
4 2 4 1 5 4 3 2 1
```

##### Output :

```
5
```

---

Added by: Nguyen Dinh Tu  
Date: 2006-01-17  
Time limit: 10s  
Source limit:50000B  
Languages: All  
Resource: CEOI 2005, Day 1

## SPOJ Problem Set (classical)

### 704. Remove The String

#### Problem code: PSTRING

Given two strings X and Y, your task is find the minimum number of characters to be removed from X in order to obtain a string X' that does not contain Y as a substring.

#### Input

Input contains some test cases. Each test cases contains two lines, First is X and second is Y. Length of X  $\leq$  10000, Length of Y  $\leq$  1000.

#### Output

For each test cases, You should output exactly one integer is the minimum number of characters to be remove

#### Example

**Input :**

ababaa

aba

**Output :**

1

---

Added by: Hoang Hong Quan

Date: 2006-01-17

Time limit: 3s

Source limit:50000B

Languages: All

Resource: A contest of Romanian

## SPOJ Problem Set (classical)

### 705. New Distinct Substrings

#### Problem code: SUBST1

Given a string, we need to find the total number of its distinct substrings.

#### Input

T- number of test cases.  $T \leq 20$ ; Each test case consists of one string, whose length is  $\leq 50000$

#### Output

For each test case output one number saying the number of distinct substrings.

#### Example

**Input :**

2  
CCCC  
ABABA

**Output :**

5  
9

---

Added by: Hoang Hong Quan

Date: 2006-01-18

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Base on a problem in ByteCode06

## SPOJ Problem Set (classical)

### 707. Triple-Free Sets

#### Problem code: TFSETS

A set  $S$  of positive integers is called *strongly triple-free* if, for any integer  $x$ , the sets  $\{x, 2x\}$  and  $\{x, 3x\}$  are not subsets of  $S$ . Let's define  $F(n)$  as a number of strongly triple-free subsets of  $\{1, 2, \dots, n\}$ , where  $n$  is a natural number.

You need to write a program which being given a number  $n$  calculates the number  $F(n)$  modulo 1 000 000 001.

#### Input

The first line of input contains integer  $T$  ( $1 \leq T \leq 500$ ) - the number of testcases. Then descriptions of  $T$  testcases follow.

The description of the testcase consists of one line. The line contains an integer number  $n$  ( $1 \leq n \leq 100\,000$ ).

#### Output

For each testcase in the input your program should output one line. This line should contain one integer number which is the number  $F(n)$  modulo 1 000 000 001.

#### Example

**Input :**

```
5
3
1
10
20
39
```

**Output :**

```
5
2
198
43776
971827200
```

---

Added by: Ivan Metelsky

Date: 2006-01-19

Time limit: 15s

Source limit: 50000B

Languages: All

Resource: Based on a problem from [www.test-the-best.by](http://www.test-the-best.by)

## SPOJ Problem Set (classical)

### 709. The day of the competitors

#### Problem code: Niceday

The International Olympiad in Informatics is coming and the leaders of the Vietnamese Team have to choose the best contestants all over the country. Fortunately, the leaders could choose the members of the team among  $N$  very good contestants, numbered from 1 to  $N$  ( $3 \leq N \leq 100000$ ). In order to select the best contestants the leaders organized three competitions. Each of the  $N$  contestants took part in all three competitions and there were no two contestants with equal results on any of the competitions. We say that contestant  $A$  is better than another contestant  $V$  when  $A$  is ranked before  $V$  in all of the competitions. A contestant  $A$  is said to be excellent if no other contestant is better than  $A$ . The leaders of the Vietnamese Team would like to know the number of excellent contestants.

#### Input

First line of the input contains an integer  $t$  ( $1 \leq t \leq 10$ ), equal to the number of testcases. Then descriptions of  $t$  testcases follow. First line of description contains the number of competitors  $N$ . Each of the next  $N$  lines describes one competitor and contains integer numbers  $a_i, b_i, c_i$  ( $1 \leq a_i, b_i, c_i \leq N$ ) separated by spaces, the order of  $i$ -th competitor's ranking in the first competition, the second competition and the third competition.

#### Output

For each test case in the input your program should output the number of excellent contestants in one line.

**Note :** Because the input is too large so we have 4 input files and the total time limit is 4s ( not 1s ).

#### Example

**Input :**

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

**Output :**

```
3
```

---



Added by: Nguyen Minh Hieu  
Date: 2006-01-20  
Time limit: 1s  
Source limit: 10000B  
Languages: All  
Resource: Base on a problem from BOI

## SPOJ Problem Set (classical)

### 726. Promotion

#### Problem code: PRO

A large Bytelandian supermarket chain has asked you to write a program for the simulating costs of a promotion being prepared.

The promotion has to follow the following rules:

- A customer who wants to participate in the promotion, writes on the receipt, paid by himself, his personal details and throws it into a special ballot box.
- At the end of every day of the promotion, two bills are taken out from the ballot box:
  - first, the receipt amounting to the largest sum is chosen,
  - then the receipt amounting to the smallest sum is chosen;The customer who has paid the largest sum gets a money prize equal to the difference between the sum on his bill and the sum on the bill amounting to the smallest sum.
- To avoid multiple prizes for one purchase, both bills selected according to the above rules are not returned to the ballot box, but all remaining bills still participate in the promotion.

The turnover of the supermarket is very big, thus an assumption can be made, that at the end of every day, before taking out receipts amounting to the largest and the smallest sum, there are at least 2 receipts in the ballot box.

Your task is to compute (on the basis of information about prices on receipts thrown into the ballot box on each day of promotion) what the total cost of prizes during the whole promotion will be.

Write a program, which: reads from the standard input a list of prices on receipts thrown into the ballot box on each day of the promotion, computes the total cost of prizes paid in consecutive days of promotion, then writes the result to the standard output.

#### Input

The first line of the input contains one positive integer  $n$  ( $1 \leq n \leq 5000$ ), which is the duration of promotion in days. Each of the next  $n$  lines consists of a sequence of non-negative integers separated by single spaces. Numbers in the  $(i+1)$ -th line of the file represent prices on receipts thrown into the ballot box on the  $i$ -th day of promotion. The first integer in the line is  $k$ ,  $0 \leq k \leq 10^5$ , the number of receipts on the day, and the next  $k$  numbers are positive integers standing for the sums on receipts; none of these numbers is larger than  $10^6$ .

The total number of bills thrown into the ballot box during the whole promotion does not exceed  $10^6$ .

#### Output

The output should contain exactly one integer, equal to the total cost of prizes paid during the whole promotion.

## Example

**Input :**

```
5
3 1 2 3
2 1 1
4 10 5 5 1
0
1 2
```

**Output :**

```
19
```

---

Added by: Walrus

Date: 2006-01-24

Time limit: 1s-4s

Source limit:50000B

Languages: All

Resource: VII Polish Olympiad In Informatics 2000, stage III

## SPOJ Problem Set (classical)

### 729. Move your armies

#### Problem code: MAXIMUS

Commodus has discovered with your help that the traitor is Maximus. Commodus has gathered  $N$  prestigious armies  $A_1 A_2 \dots A_N$  and asked you to lead them to kill Maximus. A brave warrior like you must now act intelligently to lead the armies to victory.

There are three countries which are considered here, for simplicity let's name them  $C_0$ ,  $C_1$  and  $C_2$ . You have moved the armies to  $C_0$  and you know that Maximus is in  $C_2$ . You are wise enough to know that without all your  $N$  armies you stand no chance against great Maximus. The problem is that your armies are too egoistic in nature (after all they were organized by Commodus). Only the biggest army can leave any country  $C_y$  (Army  $A_x$  can leave  $C_y$ , if there is no army  $A_i$  in  $C_y$  with  $i > x$ ). Also, the army  $A_x$  will go into  $C_y$  only if it is the biggest army to get there, i. e. there is no army  $A_i$  in  $C_y$  with  $i > x$ .

There is another confusion here, all the armies  $A_m$  have been trained by a different commander and they march differently. Each army  $A_m$  where  $m$  is either 1 or prime can only move from  $C_i$  to  $C_{(i+1)\%3}$ , while your armies  $A_m$  where  $m > 1$  is composite will march only from  $C_i$  to  $C_{(i+2)\%3}$ .

Commodus is impatient and he is asking you to find the number of moves you need to reach Maximus. You are planning to reach there with the shortest possible number of moves; tell your answer to Commodus.

Example for  $N = 2$ :

The required number of steps would be 7

initially

$C_0$  -  $A_1, A_2$

$C_1$  -

$C_2$  -

after step 1

$C_0$  -  $A_1$

$C_1$  -  $A_2$

$C_2$  -

after step 2

$C_0$  -  $A_1$

$C_1$  -

$C_2$  -  $A_2$

after step 3

$C_0$  -

$C_1$  -  $A_1$

$C_2$  -  $A_2$

after step 4

$C_0$  -  $A_2$

$C_1$  -  $A_1$

$C_2$  -

after step 5  
C0 - A2  
C1 -  
C2 - A1  
after step 6  
C0 -  
C1 - A2  
C2 - A1  
after step 7  
C0 -  
C1 -  
C2 - A1, A2

## Input

The input will consist of at most 100 test cases. Each test case consists of a number  $N$  (the number of armies,  $1 \leq N \leq 5000$ ). The last test case is followed by a line containing 0.

## Output

For each number  $N$ , you have to output the number of moves needed to move the armies to  $C_2$  with the minimum number of steps.

## Example

**Input :**

1  
2  
3  
4  
100  
0

**Output :**

2  
7  
21  
49  
1299510268586153115889930564780511199231

---

Added by: Adrian Kuegel  
Date: 2006-01-29  
Time limit: 10s  
Source limit: 10000B  
Languages: All  
Resource: Codearena 2006

## SPOJ Problem Set (classical)

### 734. Ivan and his interesting game

#### Problem code: IVAN

Little Ivan likes to play games in his spare time. Unfortunately, he cannot always enjoy the company of his friends and sometimes he is a little bored when he is alone. Therefore, he makes up games, where he is the only player. He is especially proud of his last game and likes to tell you about it.

You are given two finite sequences of positive integers. The game consists of making consecutive moves. You are allowed to make the following move. You remove the last  $K_1$  numbers ( $K_1 \geq 1$ ) from the first sequence (possibly the whole sequence) and find their sum  $S_1$  and the last  $K_2$  numbers ( $K_2 \geq 1$ ) from the second sequence (again you can remove the whole sequence) and find their sum  $S_2$ . Then you calculate the cost of the move to be  $(S_1 - K_1) * (S_2 - K_2)$ . You continue to make moves until you remove all the numbers in both sequences. The total cost of the game is the sum of the costs of all moves. Your goal is to minimize this total cost. You are not allowed to leave one of the sequences empty, while the other is not.

As Ivan has told you the rules of the game, you realize that it is easily solvable with the help of a computer, so you decide to write a program GAME, that computes the minimum total cost of the game.

#### Input

Input data is read from the standard input and consists of three lines. The first line contains two space-separated integers,  $L_1$  and  $L_2$  ( $1 \leq L_1, L_2 \leq 2000$ ), which denote the lengths of the two sequences. The second line contains  $L_1$  space-separated integers, which are the elements of the first sequence. The third line contains  $L_2$  space-separated integers, which are the elements of the second sequence. The elements of the sequences do not exceed 1000.

#### Output

Your program has to output one line on the standard output that contains only one number - the minimum total cost of the game as described above.

#### Example

**Input :**

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

**Output :**

```
2
```

---

Added by: VOJ problem setters

Date: 2006-02-08

Time limit: 1s-2s

Source limit:10000B

Languages: All

Resource: unknown

## SPOJ Problem Set (classical)

### 735. Minimum Diameter Spanning Tree

#### Problem code: MDST

Solve the minimum diameter spanning tree problem for the simple graphs.

For a given list of adjacent vertices of a graph  $G$  find the minimum diameter spanning tree  $T$  and write down the diameter of this tree  $\text{diam}(T)$ .

Each graph has only one connected component, so there is at least one spanning tree, which connects all the vertices.

#### Input

$t$  [the number of test graphs]

> Graph:

>  $n$  [ $1 \leq n \leq 1000$  the number of graph vertices]

>  $i \ m \ v_1 \dots v_m$  [*the list of  $m$  adjacent vertices to vertex  $i$* ]

#### Output

For each test case output:

>  $d_i$  [*diameter of the minimum diameter spanning tree*]

#### Example

**Input :**

6

10

1 3 2 3 4

2 3 1 5 7

3 3 1 5 6

4 3 1 6 8

5 3 2 3 9

6 3 3 4 10

7 1 2

8 1 4

9 1 5

10 1 6

10

1 4 4 5 7 9

2 1 8

3 4 4 7 8 10

4 3 1 3 9

5 2 1 9

6 2 8 9

7 4 1 3 8 9

8 5 2 3 6 7 9

9 7 1 4 5 6 7 8 10



10 2 3 9

1  
1 0

2  
1 1 2  
2 1 1

3  
1 1 2  
2 2 1 3  
3 1 2

5  
1 2 2 4  
2 3 1 3 4  
3 1 2  
4 3 2 5 1  
5 1 4

**Output :**

5  
3  
0  
1  
2  
3

---

*Added by: Bartłomiej Kowalski*

*Date: 2006-02-09*

*Time limit: 1s-25s*

*Source limit: 50000B*

*Languages: All*

*Resource:*

## SPOJ Problem Set (classical)

### 738. Another Counting Problem

#### Problem code: TREE

Tree is an important data structure in Computer Science. Of all trees we work with, Binary Tree is probably the most popular one. A Binary Tree is called a **Strictly Binary Tree** if every nonleaf node in a binary tree has nonempty left and right subtrees. Let us define a **Strictly Binary Tree of depth  $d$** , as a Strictly Binary Tree that has at least one root to leaf path of length  $d$ , and no root to leaf path in that tree is longer than  $d$ . So let us use a similar reasoning to define a generalized structure.

An  $n$ -ary Tree is called a **Strictly  $n$ -ary Tree** if every nonleaf node in an  $n$ -ary tree has  $n$  children each. A **Strictly  $n$ -ary Tree of depth  $d$**  can now be defined as a Strictly  $n$ -ary Tree that has at least one root to leaf path of length  $d$ , and no root to leaf path in that tree is longer than  $d$ .

Given the value of  $n$  and depth  $d$ , your task is to find the number of different strictly  $n$ -ary trees of depth  $d$ .

The figure below shows the 3 different strictly binary trees of depth 2.

[IMAGE]

#### Input

Input consists of several test cases. Each test case consists of two integers  $n$  ( $0 < n \leq 32$ ),  $d$  ( $0 \leq d \leq 16$ ). Input is terminated a test case where  $n=0$  and  $d=0$ , you must not process this test case.

#### Output

For each test case, print three integers,  $n$ ,  $d$  and the number of different strictly  $n$ -ary trees of level  $d$ , in a single line. There will be a single space in between two integers of a line. You can assume that you would not be asked about cases where you had to consider trees that may have more than  $2^{10}$  nodes in a level of the tree. You may also find it useful to know that the answer for each test case will always fit in a 200 digit integer.

#### Example

**Input :**

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

**Output :**

```
2 0 1
```

2 1 1  
2 2 3  
2 3 21  
3 5 58871587162270592645034001

---

Added by: Nguyen Van Quang Huy  
Date: 2006-02-14  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: acm.uva.es

## SPOJ Problem Set (classical)

### 739. The Moronic Cowmpouter

#### Problem code: NEG2

Inexperienced in the digital arts, the cows tried to build a calculating engine (yes, it's a cowmpouter) using binary numbers (base 2) but instead built one based on base negative 2! They were quite pleased since numbers expressed in base -2 do not have a sign bit.

You know number bases have place values that start at 1 (base to the 0 power) and proceed right-to-left to  $\text{base}^1$ ,  $\text{base}^2$ , and so on. In base -2, the place values are 1, -2, 4, -8, 16, -32, ... (reading from right to left). Thus, counting from 1 goes like this: 1, 110, 111, 100, 101, 11010, 11011, 11000, 11001, and so on.

Eerily, negative numbers are also represented with 1's and 0's but no sign. Consider counting from -1 downward: 11, 10, 1101, 1100, 1111, and so on.

Please help the cows convert ordinary decimal integers (range -2,000,000,000 .. 2,000,000,000) to their counterpart representation in base -2.

#### Input

A single integer to be converted to base -2

#### Output

A single integer with no leading zeroes that is the input integer converted to base -2. The value 0 is expressed as 0, with exactly one 0.

#### Example

**Input :**  
-13

**Output :**  
110111

---

Added by: Nguyen Van Quang Huy  
Date: 2006-02-15  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: USACO FEB06 Bronze Division

## SPOJ Problem Set (classical)

### 740. Treats for the Cows

#### Problem code: TRT

FJ has purchased  $N$  ( $1 \leq N \leq 2000$ ) yummy treats for the cows who get money for giving vast amounts of milk. FJ sells one treat per day and wants to maximize the money he receives over a given period time. The treats are interesting for many reasons:

- The treats are numbered  $1..N$  and stored sequentially in single file in a long box that is open at both ends. On any day, FJ can retrieve one treat from either end of his stash of treats.
- Like fine wines and delicious cheeses, the treats improve with age and command greater prices.
- The treats are not uniform: some are better and have higher intrinsic value. Treat  $i$  has value  $v(i)$  ( $1 \leq v(i) \leq 1000$ ).
- Cows pay more for treats that have aged longer: a cow will pay  $v(i)*a$  for a treat of age  $a$ .

Given the values  $v(i)$  of each of the treats lined up in order of the index  $i$  in their box, what is the greatest value FJ can receive for them if he orders their sale optimally?

The first treat is sold on day 1 and has age  $a=1$ . Each subsequent day increases the age by 1.

#### Input

Line 1: A single integer,  $N$

Lines 2.. $N+1$ : Line  $i+1$  contains the value of treat  $v(i)$

#### Output

The maximum revenue FJ can achieve by selling the treats

#### Example

**Input :**

5  
1  
3  
1  
5  
2

**Output :**

43

---

Added by: Nguyen Van Quang Huy  
Date: 2006-02-15  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: USACO FEB06 Gold Division

## SPOJ Problem Set (classical)

### 741. Steady Cow Assignment

#### Problem code: STEAD

Farmer John's  $N$  ( $1 \leq N \leq 1000$ ) cows each reside in one of  $B$  ( $1 \leq B \leq 20$ ) barns which, of course, have limited capacity. Some cows really like their current barn, and some are not so happy.

FJ would like to rearrange the cows such that the cows are as equally happy as possible, even if that means all the cows hate their assigned barn.

Each cow gives FJ the order in which she prefers the barns. A cow's happiness with a particular assignment is her ranking of her barn. Your job is to find an assignment of cows to barns such that no barn's capacity is exceeded and the size of the range (i.e., one more than the positive difference between the the highest-ranked barn chosen and that lowest-ranked barn chosen) of barn rankings the cows give their assigned barns is as small as possible.

#### Input

Line 1: Two space-separated integers,  $N$  and  $B$

Lines 2.. $N+1$ : Each line contains  $B$  space-separated integers which are exactly  $1..B$  sorted into some order. The first integer on line  $i+1$  is the number of the cow  $i$ 's top-choice barn, the second integer on that line is the number of the  $i$ 'th cow's second-choice barn, and so on.

Line  $N+2$ :  $B$  space-separated integers, respectively the capacity of the first barn, then the capacity of the second, and so on. The sum of these numbers is guaranteed to be at least  $N$ .

#### Output

One integer, the size of the minimum range of barn rankings the cows give their assigned barns, including the endpoints

#### Example

**Input :**

```
6 4
1 2 3 4
2 3 1 4
4 2 3 1
3 1 2 4
1 3 4 2
1 4 2 3
2 1 3 2
```

**Output :**

```
2
```

---

Added by: Nguyen Van Quang Huy  
Date: 2006-02-16  
Time limit: 2s  
Source limit: 50000B  
Languages: All  
Resource: USACO FEB06 Gold Division



## SPOJ Problem Set (classical)

### 744. Longest Permutation

#### Problem code: LPERMUT

You are given a sequence  $A$  of  $n$  integer numbers ( $1 \leq A_i \leq n$ ). A subsequence of  $A$  has the form  $A_u, A_{u+1} \dots, A_v$  ( $1 \leq u \leq v \leq n$ ). We are interested in subsequences that are permutations of  $1, 2, \dots, k$  ( $k$  is the length of the subsequence).

Your task is to find the longest subsequence of this type.

#### Input

- Line 1:  $n$  ( $1 \leq n \leq 100000$ )
- Line 2:  $n$  numbers  $A_1, A_2, \dots, A_n$  ( $1 \leq A_i \leq n$ )

#### Output

A single integer that is the length of the longest permutation

#### Example

Input :

5

4 1 3 1 2

Output :

3

---

Added by: Walrus

Date: 2006-02-20

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: A problem put forward by Mr Mircea Pasoi

## SPOJ Problem Set (classical)

### 757. Thermal Luminescence

#### Problem code: TEM

After many years of hard work a group of scientists developed a shiny new state-of-the-art processor with a 3D configuration. Due to the high clock frequency at which this processor works, the silicon cube uses up too much energy. Even with its powerful cooling system, the processor is unable to cope with the heat discharge in some of its cubical blocks. With the help of special analysis methods, scientists have developed the overheat rate for each of the cubical blocks of the system. As it conveniently happens, this overheat rate is an integer value, either positive or negative depending on many factors (such as the proximity of ventilators, refrigerators, etc.).

Science can do no more, so now the developers of the processor need your support. For a given three-dimensional matrix representing the overheat rate of elements of the processor, you have to find a submatrix for which the sum of overheat rates coming from all its elements is maximal.

#### Input

$t$  - number of test cases [ $t \leq 99$ ], then  $t$  tests follow.

Each test begins with 3 integers:  $x, y, z$  - the width, length and height of matrix [ $5 \leq x, y, z \leq 50$ ]. Then there follows the description of  $x$  rectangular 2D matrixes of height  $y$  and width  $z$ . In total there are  $x*y*z$  integers, which absolute value does not exceed 10000.

#### Output

For each test case you should output 6 integers:  $x_1, y_1, z_1, x_2, y_2, z_2$ , where each triple  $(x_i, y_i, z_i)$  defines one of the two opposite corners of submatrix, resulting in the maximum overheat. [ $1 \leq x_1 \leq x_2 \leq x$ ] [ $1 \leq y_1 \leq y_2 \leq y$ ] [ $1 \leq z_1 \leq z_2 \leq z$ ]

#### Example

Input :

```
1
5 5 5
1 1 1 1 1
1 1 1 1 1
1 1 1 1 1
1 1 1 1 1
1 1 1 1 1
-1 -1 -10 -1 -1
-1 -1 -10 -1 -1
-1 -1 -10 -1 -1
-1 -1 -10 -1 -1
-1 -1 -10 -1 -1
20 2 2 2 20
20 2 2 2 20
20 2 2 2 20
20 2 2 2 20
20 2 2 2 20
5 5 5 5 5
```

```
5 5 5 5 5
1 1 1 1 1
1 1 1 1 1
1 1 1 1 1
-10 10 -10 10 -10
-10 10 -10 10 -10
-10 10 -10 10 -10
-10 10 -10 10 -10
-10 10 -10 10 -10
```

**Output:**

```
3 1 1 4 5 5
```

**Note:**

The maximum overheat for the example is equal to 295.

---

Added by: Roman Sol

Date: 2005-04-11

Time limit: 15s

Source limit:50000B

Languages: All

Resource: ZCon 2006

## SPOJ Problem Set (classical)

### 760. Convex Hull 3D

#### Problem code: CH3D

Bytelandian scientists have developed a brand new method for determining the volume of a person's lungs. The idea is simple: the patient is asked to inhale a sufficiently large number of nanobots, which then transmit their exact 3D-coordinates to an external sensor. Early clinical tests proved rather fun (especially for the scientists who were watching the process of nanobot inhalation), but gave rise to several problems of an algorithmic nature. In other words, nobody had any idea of how the volume of the lungs should be determined afterwards. A lung consists of a large number of disjoint alveoli (which can for our purposes be regarded as little hollows), and inhaled nanobots tend to float around aimlessly within the alveolus they happened to fall into. Whereas it is relatively simple to distinguish between different alveoli, establishing the volume of a single alveolus is a tough task.

One way to estimate the shape and volume of an alveolus is to smear all nanobots with a little liquid glue and see what they end up stuck to. Another (arguably more humane) method is to calculate the *convex hull* of the set of points representing nanobot coordinates, its volume and surface area. A convex hull of given set of points in 3D is the convex set of minimum volume which contains all these points.

Lung 1  
arrow  
Lung 2  
arrow  
Lung 3

#### Input

$t$  - number of test cases [ $t \leq 100$ ], then  $t$  tests follow.

Each test starts with integer  $N$  - the number of given points [ $10 \leq N \leq 1000$ ]. Then exactly  $N$  lines follow with 3 real numbers  $X_i, Y_i, Z_i$  in each of them, where  $[-10.0 \leq X_i, Y_i, Z_i \leq 10.0]$ .

#### Output

For each test case you should output 2 real numbers: the surface area and volume of the hull with precision 0.01.

#### Example

Input :

```
1
10
0.00000 0.00000 0.00000
1.00000 0.00000 0.00000
0.00000 1.00000 0.00000
0.00000 0.00000 1.00000
1.00000 1.00000 0.00000
1.00000 0.00000 1.00000
```

```
0.00000 1.00000 1.00000
1.00000 1.00000 1.00000
0.50000 0.50000 0.50000
0.66666 0.77777 0.88888
```

**Output:**

```
6.0000 1.0000
```

---

Added by: Roman Sol

Date: 2005-11-28

Time limit: 8s

Source limit:50000B

Languages: All

Resource: ZCon 2006

## SPOJ Problem Set (main)

### 764. Delay-noise Analysis

#### Problem code: MIS

During the development of delay-noise analysis theory, scientists have come upon the following problem. After they had conducted experiments they found out that some of the nodes of the circuit couldn't switch at the same time. For example, if we know that node  $N$  switches from 0 to 1, then node  $K$  can't switch at the same moment because of logical restrictions in circuit. Each node of the circuit injects some noise into neighboring nodes while switching, and this noise can be measured. Scientists now need some fast method to calculate the maximum delay-noise that can be injected by switching aggressor-nodes.

Scientists formalize the problem in the following way. We consider a graph  $G = (V, E, w)$  consisting of vertex set  $V$ , edges  $E$ , and weight function  $W$ , such that  $E$  and  $W$  are finite. For  $u, v \in V$ ,  $N(u)$  and  $N(v)$  denotes the set of neighboring vertices of  $u$  and  $v$  accordingly, formally defined as:

[IMAGE]

The set of vertices  $S$  satisfying  $N(u) \cap S = \emptyset$  is called *internally stable*. In this problem you should find a set of internally stable vertices  $B$  such that  $w(B) = \max\{w(S)\}$ , taken over all internally stable sets  $S$  of the given graph  $G$ .

Experiments have shown that the density of edges in considered graphs is between 20% and 90%.

#### Input

$t$  - number of test cases [ $t \leq 60$ ]

$n, k$  - [ $n$  - number of vertices ( $2 \leq n \leq 250$ ),  $k$  - number of edges ( $1 \leq k \leq n*(n-1)/2$ )]

then  $n$  integers follow ( $w_i$  - weight of vertex  $i$ ) [ $0 \leq w_i \leq 2^{31}-1$ ]

then  $k$  pairs of integers follow, representing the edges between vertices ( $s_i, s_j$  denotes an edge between vertices  $i$  and  $j$ ) [ $1 \leq s_i, s_j \leq n$ ]. It is known that the total weight of all vertices in the graph doesn't exceed  $10^9$ .

#### Output

For each test case output *MaxWeight* - the weight of a maximum internally stable set of the given graph [ $0 \leq \text{MaxWeight} \leq 10^9$ ].

#### Example

**Input :**

```
2
5 6
10 20 30 40 50
1 2
1 5
2 3
3 4
3 5
```

4 5

4 4

10 4 10 14

1 2

2 3

3 4

4 1

**Output :**

70

20

**Example illustrations:** [IMAGE]

---

Added by: Roman Sol

Date: 2005-03-22

Time limit: 35s

Source limit:50000B

Languages: All

Resource: ZCon 2006

## SPOJ Problem Set (classical)

### 780. The Archipelago

#### Problem code: ARCHPLG

Byteland is a country located in the Archipelago of Rectangular Islands. The archipelago consists of  $1 \leq n \leq 1000$  islands. A fact that each island has a rectangular shape is very nice for Bytelandian cartographers.

Bytelandian islands are rather small and none are very fertile, so each of (rectangular of course) pieces of cultivated land is under special control, simply speaking: 'never enter there to save your life'. Other areas are guaranteed to be free accessible for the people.

The communication between islands is possible by ferries. On each island there is  $0 \leq b \leq 10$  terminals, from where crossings to another terminals on other islands are possible. It is known that total number of crossing connections is  $0 \leq m \leq 100000$ . Other infrastructure is practically unknown. Specifically the only possible way of traveling through the island is to do it on foot.

Well, now we are close to a task you are requested to solve. John - one of the Bytelandian citizens is working as a sales manager. Simply speaking he is often requested to travel from one place to another, what he rather dislike and preferably (like other Bytelandian people use to do) he would like to spent more time in one of the beach clubs playing Puto (a kind of strategic game, very popular in Byteland). Please help him to find a way to spare his time.

#### Task

Find one of the fastest ways for John using ferries and foot paths on islands. Assume that while walking John is always moving one BM (Bytelandian unit of length) per BH (Bytelandian unit of time). You can also assume that the ferry departures nearly immediately after John arrives the terminal, it will be enough to round up the walking time to the nearest integer.

#### Input

In the first line  $t$  - the number of tests, then for each test: in next line  $n$  - the number of islands. Description of each island is as follows:

```
name
w h [island dimensions]
b - [number of terminals]
[description of each terminal in a form:]
name x y [name of a terminal and its coordinates]
F [number of restricted areas F<20]
xl, yd, xr, yu [coordinates of each restricted area,
0 <=xl < xr<=250 0<=yd < yu<=250.]
```

All coordinates are nonnegative integers measured in BM according to upper left corner of an island.



You can assume that any two restricted areas are disjoint. After the description of all islands all ferry connections are given (each connection is bi-directional).

```
m [number of connections]
[description of each connection]
NB1 NW1 NB2 NW2 time [name of a first terminal, its island, the second respectively
and communiaction time]
...
[description follows]
...
NBS NWS NBC NWC [start and goal terminal for John]
```

## Output

For each test describe the shortest route for John from terminal NBS on NWS island to terminal NBC on NWC island in the following format:

```
case nr Y [nr - test number]
T [travel time in BH]
NBS NWS
...
[consecutive terminals]
...
NBC NWC
[empty line]
[consecutive tests]
```

If two consecutive terminals are located on the same island and John must take some walk you must give all middle point like in an example.

[IMAGE]

## Example

### Input :

```
1
3
W1
8 7
2
Lindos 4 0
Kamejros 4 7
3
2 1 6 2
2 3 6 4
2 5 6 6
W2
14 12
2
Malia 14 1
Knossos 1 12
5
2 6 10 10
11 1 12 6
8 1 10 5
11 7 12 9
3 2 5 4
W3
1 1
```

```
1
Korkyra 0 0
0
2
Kamejros W1 Knossos W2 100
Malia W2 Korkyra W3 100
Korkyra W3 Lindos W1
```

An example of a correct answer:

**Output :**

```
case 1 Y
230
Korkyra W3
Malia W2
12 6
11 7
10 10
Knossos W2
Kamejros W1
2 6
2 1
Lindos W1
```

---

Added by: Łukasz Kuszner

Date: 2006-03-15

Time limit: 40s

Source limit:50000B

Languages: All

Resource: GUT Algorithm Analysis 2005

## SPOJ Problem Set (classical)

### 827. Trigonometric optimization

#### Problem code: TRIOPT

Many problems arising in practical applications may be stated as *optimization problems*. Usually it is necessary to maximize or minimize so called *criterion function* taking into account some *constraints*.

Let's consider a trigonometric optimization problem. It is necessary to maximize or to minimize criterion function  $F_1(x) + F_2(y) + F_3(z)$  with constraint  $x + y + z = S$ , where  $x, y, z$  - variables,  $S$  - parameter,  $x, y, z, S$  - natural numbers. Each of the functions  $F_1, F_2$  and  $F_3$  is a trigonometric function *sin* or *cos*.

You need to write a program which solves the *trigonometric optimization* problem.

#### Input

The first line of the input data contains integer  $T$  ( $1 \leq T \leq 65$ ) - the number of testcases. Then the descriptions of  $T$  testcases follow.

The description of each testcase consists of 5 lines. The first line describes function  $F_1$  and contains either **sin** or **cos**. The second and the third lines describe functions  $F_2$  and  $F_3$  respectively and have the same format as the first line. Next, the fourth line contains either **min** or **max**. If the line contains **min** then it is necessary to minimize *criterion function*, otherwise it is necessary to maximize *criterion function*. Finally, the fifth line contains parameter  $S$  value ( $3 \leq S \leq 1\,000\,000$ ).

#### Output

For each testcase you should output one line into the output data. This line should contain one real number - the found value of the *criterion function*. Absolute error of your answer must not exceed  $10^{-10}$ .

#### Example

**Input :**

```
1
sin
cos
sin
max
10
```

**Output :**

```
2.7787651403
```

---

Added by: Ivan Metelsky  
Date: 2006-04-27  
Time limit: 90s  
Source limit: 50000B  
Languages: All  
Resource: NEERC Western Subregion QF 2005

## SPOJ Problem Set (classical)

### 839. Optimal Marks

#### Problem code: OPTM

You are given an undirected graph  $G(V, E)$ . Each vertex has a mark which is an integer from the range  $[0..2^{31} - 1]$ . Different vertexes may have the same mark.

For an edge  $(u, v)$ , we define  $\text{Cost}(u, v) = \text{mark}[u] \text{ xor } \text{mark}[v]$ .

Now we know the marks of some certain nodes. You have to determine the marks of other nodes so that the total cost of edges is as small as possible.

#### Input

The first line of the input data contains integer  $T$  ( $1 \leq T \leq 10$ ) - the number of testcases. Then the descriptions of  $T$  testcases follow.

First line of each testcase contains 2 integers  $N$  and  $M$  ( $0 < N \leq 500$ ,  $0 \leq M \leq 3000$ ).  $N$  is the number of vertexes and  $M$  is the number of edges. Then  $M$  lines describing edges follow, each of them contains two integers  $u, v$  representing an edge connecting  $u$  and  $v$ .

Then an integer  $K$ , representing the number of nodes whose mark is known. The next  $K$  lines contain 2 integers  $u$  and  $p$  each, meaning that node  $u$  has a mark  $p$ . It's guaranteed that nodes won't duplicate in this part.

#### Output

For each testcase you should print  $N$  lines integer the output. The  $K$ th line contains an integer number representing the mark of node  $K$ . If there are several solutions, you have to output the one which minimize the sum of marks. If there are several solutions, just output any of them.

#### Example

**Input :**

```
1
3 2
1 2
2 3
2
1 5
3 100
```

**Output :**

```
5
4
100
```

---

Added by: Thanh-Vy Hua  
Date: 2006-05-05  
Time limit: 6s  
Source limit: 10000B  
Languages: All  
Resource: Guo HuaYang

## SPOJ Problem Set (classical)

### 861. Counting inversions

#### Problem code: SWAPS

You are given a sequence  $A$  of  $N$  ( $N \leq 250000$ ) integers between 1 and 50000. On this sequence you have to apply  $M$  ( $M \leq 10000$ ) operations of the form: modify the  $i$ -th element in the sequence and then say how many inversions are there in the sequence. The number of inversions in a sequence is given by the number of pairs  $(i, j)$  with  $i < j$  and  $A_i > A_j$ .

#### Input

The first line of input contains the number  $N$  and the next line contains the numbers that form the sequence. After that follows the number  $M$  and then  $M$  lines, each containing 2 integers  $X$  and  $Y$ , meaning that new value of the  $X$ -th element of the sequence is  $Y$  and that you should count the number of inversions in the modified sequence.

#### Output

Output must contain  $M$  lines, the  $i$ -th line of output containing the number of inversions in the sequence after the first  $i$  operations.

#### Example

**Input :**

```
10
2 6 6 4 7 6 3 5 9 1
7
8 8
5 1
5 6
10 5
7 1
10 10
4 6
```

**Output :**

```
17
18
16
13
14
8
6
```

---

Added by: Gogu Marian  
Date: 2006-05-31  
Time limit: 1s-5s  
Source limit:50000B  
Languages: All  
Resource:



## **SPOJ Problem Set (classical)**

### **866. DNA Translation**

#### **Problem code: DNA**

Deoxyribonucleic acid (DNA) is composed of a sequence of nucleotide bases paired together to form a double-stranded helix structure. Through a series of complex biochemical processes the nucleotide sequences in an organism's DNA are translated into the proteins it requires for life. The object of this problem is to write a computer program which accepts a DNA strand and reports the protein generated, if any, from the DNA strand.

The nucleotide bases from which DNA is built are adenine, cytosine, guanine, and thymine (hereafter referred to as A, C, G, and T, respectively). These bases bond together in a chain to form half of a DNA strand. The other half of the DNA strand is a similar chain, but each nucleotide is replaced by its complementary base. The bases A and T are complementary, as are the bases C and G. These two "half-strands" of DNA are then bonded by the pairing of the complementary bases to form a strand of DNA.

Typically a DNA strand is listed by simply writing down the bases which form the primary strand (the complementary strand can always be created by writing the complements of the bases in the primary strand). For example, the sequence TACTCGTAATTCCT represents a DNA strand whose complement would be ATGAGCATTAAGTGA. Note that A is always paired with T, and C is always paired with G.

From a primary strand of DNA, a strand of ribonucleic acid (RNA) known as messenger RNA (mRNA for short) is produced in a process known as transcription. The transcribed mRNA is identical to the complementary DNA strand with the exception that thymine is replaced by a nucleotide known as uracil (hereafter referred to as U). For example, the mRNA strand for the DNA in the previous paragraph would be AUGAGCAUUAAGUGA.

It is the sequence of bases in the mRNA which determines the protein that will be synthesized. The bases in the mRNA can be viewed as a collection of codons, each codon having exactly three bases. The codon AUG marks the start of a protein sequence, and any of the codons UAA, UAG, or UGA marks the end of the sequence. The one or more codons between the start and termination codons represent the sequence of amino acids to be synthesized to form a protein. For example, the mRNA codon AGC corresponds to the amino acid serine (Ser), AUU corresponds to isoleucine (Ile), and AAG corresponds to lysine (Lys). So, the protein formed from the example mRNA in the previous paragraph is, in its abbreviated form, Ser-Ile-Lys.

The complete genetic code from which codons are translated into amino acids is shown in the table below (note that only the amino acid abbreviations are shown). It should also be noted that the sequence AUG, which has already been identified as the start sequence, can also correspond to the amino acid methionine (Met). So, the first AUG in a mRNA strand is the start sequence, but subsequent AUG codons are translated normally into the Met amino acid.

<i>First base in codon</i>	<i>Second base in codon</i>				<i>Third base in codon</i>
	<b>U</b>	<b>C</b>	<b>A</b>	<b>G</b>	
<b>U</b>	Phe	Ser	Tyr	Cys	<b>U</b>
	Phe	Ser	Tyr	Cys	<b>C</b>
	Leu	Ser	---	---	<b>A</b>
	Leu	Ser	---	Trp	<b>G</b>
<b>C</b>	Leu	Pro	His	Arg	<b>U</b>
	Leu	Pro	His	Arg	<b>C</b>
	Leu	Pro	Gln	Arg	<b>A</b>
	Leu	Pro	Gln	Arg	<b>G</b>
<b>A</b>	Ile	Thr	Asn	Ser	<b>U</b>
	Ile	Thr	Asn	Ser	<b>C</b>
	Ile	Thr	Lys	Arg	<b>A</b>
	Met	Thr	Lys	Arg	<b>G</b>
<b>G</b>	Val	Ala	Asp	Gly	<b>U</b>
	Val	Ala	Asp	Gly	<b>C</b>
	Val	Ala	Glu	Gly	<b>A</b>
	Val	Ala	Glu	Gly	<b>G</b>

The input for this program consists of strands of DNA sequences, one strand per line, from which the protein it generates, if any, should be determined and output. The given DNA strand may be either the primary or the complementary DNA strand, and it may appear in either forward or reverse order, and the start and termination sequences do not necessarily appear at the ends of the strand. For example, a given input DNA strand to form the protein Ser-Ile-Lys could be any of ATACTCGTAATTCCTCC, CCTCACTTAATGCTCATA, TATGAGCATTAAGTGAGG, or GGAGTGAATTACGAGTAT. The input file will be terminated by a line containing a single asterisk character.

You may assume the input to contain only valid, upper-case, DNA nucleotide base letters (A, C, G, and T). No input line will exceed 255 characters in length. There will be no blank lines or spaces in the input. Some sequences, though valid DNA strands, do not produce valid protein sequences; the string "\*\*\* No translatable DNA found \*\*\*" should be output when an input DNA strand does not translate into a valid protein.

**Input :**

```
ATACTCGTAATTCACTCC
CACCTGTACACAGAGGTAACCTAG
TTAATACGACATAATTAT
GCCTTGATATGGAGAACTCATTAGATA
AAGTGTATGTTGAATTATATAAAACGGGCATGA
ATGATGATGGCTTGA
*
```

**Output :**

```
Ser-Ile-Lys
Cys-Leu-His
Ser-Tyr
*** No translatable DNA found ***
Leu-Asn-Tyr-Ile-Lys-Arg-Ala
Met-Met-Ala
```

---

Added by: Wanderley Guimaraes  
Date: 2006-06-01  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ACM Mid Central Regionals 1995

## SPOJ Problem Set (classical)

### 867. Perfect Cubes

#### Problem code: CUBES

For hundreds of years Fermat's Last Theorem, which stated simply that for  $n > 2$  there exist no integers  $a, b, c > 1$  such that  $a^n = b^n + c^n$ , has remained elusively unproven. (A recent proof is believed to be correct, though it is still undergoing scrutiny.) It *is* possible, however, to find integers greater than 1 that satisfy the "perfect cube" equation  $a^3 = b^3 + c^3 + d^3$  (e.g. a quick calculation will show that the equation  $12^3 = 6^3 + 8^3 + 10^3$  is indeed true). This problem requires that you write a program to find all sets of numbers  $\{a,b,c,d\}$  which satisfy this equation for  $a \leq 100$ .

The output should be listed as shown below, one perfect cube per line, in non-decreasing order of  $a$  (i.e. the lines should be sorted by their  $a$  values). The values of  $b, c$ , and  $d$  should also be listed in non-decreasing order on the line itself. There do exist several values of  $a$  which can be produced from multiple distinct sets of  $b, c$ , and  $d$  triples. In these cases, the triples with the smaller  $b$  values should be listed first.

Note that the programmer will need to be concerned with an efficient implementation. The official time limit for this problem is 2 minutes, and it is indeed possible to write a solution to this problem which executes in under 2 minutes on a 33 MHz 80386 machine. Due to the distributed nature of the contest in this region, judges have been instructed to make the official time limit at their site the greater of 2 minutes or twice the time taken by the judge's solution on the machine being used to judge this problem.

The first part of the output is shown here:

```
Cube = 6, Triple = (3,4,5)
Cube = 12, Triple = (6,8,10)
Cube = 18, Triple = (2,12,16)
Cube = 18, Triple = (9,12,15)
Cube = 19, Triple = (3,10,18)
Cube = 20, Triple = (7,14,17)
Cube = 24, Triple = (12,16,20)
```

---

Added by: Wanderley Guimaraes

Date: 2006-06-01

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: ACM Mid Central Regionals 1995

## SPOJ Problem Set (classical)

### 869. Galactic Import

#### Problem code: IMPORT

With the introduction of the new ThrustoZoom gigadimensional drive, it has become possible for HyperCommodities, the import/export conglomerate from New Jersey, to begin trading with even the most remote galaxies in the universe. HyperCommodities wants to import goods from some of the galaxies in the Plural Z sector. Planets within these galaxies export valuable products and raw materials like vacuuseal, transparent aluminum, digraphite, and quantum steel. Preliminary reports have revealed the following facts:

- Each galaxy contains at least one and at most 26 planets. Each planet within a galaxy is identified by a unique letter from A to Z.
- Each planet specializes in the production and export of one good. Different planets within the same galaxy export different goods.
- Some pairs of planets are connected by hyperspace shipping lines. If planets A and B are connected, they can trade goods freely. If planet C is connected to B but not to A, then A and C can still trade goods with each other through B, but B keeps 5% of the shipment as a shipping fee. (Thus A only receives 95% of what C shipped, and C receives only 95% of what A shipped.) In general, any two planets can trade goods as long as they are connected by some set of shipping lines, but each intermediate planet along the shipping route keeps 5% of what it shipped (which is not necessarily equal to 5% of the original shipment).
- At least one planet in each galaxy is willing to open a ThrustoZoom shipping line to Earth. A ThrustoZoom line is the same as any other shipping line within the galaxy, as far as business is concerned. For example, if planet K opens a ThrustoZoom line to Earth, then the Earth can trade goods freely with K, or it can trade goods with any planet connected to K, subject to the usual shipping fees.

HyperCommodities has assigned a relative value (a positive real number less than 10) to each planet's chief export. The higher the number, the more valuable the product. More valuable products can be resold with a higher profit margin in domestic markets. The problem is to determine which planet has the most valuable export when shipping fees are taken into account.

The input consists of one or more galaxy descriptions. Each galaxy description begins with a line containing an integer  $N$  which specifies the number of planets in the galaxy. The next  $N$  lines contain descriptions of each planet, which consist of:

1. The letter used to represent the planet.
2. A space.
3. The relative value of the planet's export, in the form  $d.dd$ .

4. A space.

5. A string containing letters and/or the character '\*'; a letter indicates a shipping line to that planet, and a '\*' indicates a willingness to open a ThrustoZoom shipping line to Earth.

For each galaxy description, output a single line which reads "Import from P" where P is the letter of the planet with the most valuable export, once shipping fees have been taken into account. (If more than one planet have the same most valuable export value then output the plant which is alphabetically first).

A sample input file is shown here:

```
1
F 0.81 *
5
E 0.01 *A
D 0.01 A*
C 0.01 *A
A 1.00 EDCB
B 0.01 A*
10
S 2.23 Q*
A 9.76 C
K 5.88 MI
E 7.54 GC
M 5.01 OK
G 7.43 IE
I 6.09 KG
C 8.42 EA
O 4.55 QM
Q 3.21 SO
```

The following output file should be produced from the above sample input:

```
Import from F
Import from A
Import from A
```

---

Added by: Wanderley Guimaraes

Date: 2006-06-01

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM Mid Central Regionals 1995

## SPOJ Problem Set (classical)

### 870. Basically Speaking

#### Problem code: BASE

The Really Neato Calculator Company, Inc. has recently hired your team to help design their Super Neato Model I calculator. As a computer scientist you suggested to the company that it would be neat if this new calculator could convert among number bases. The company thought this was a stupendous idea and has asked your team to come up with the prototype program for doing base conversion. The project manager of the Super Neato Model I calculator has informed you that the calculator will have the following neat features:

- It will have a 7-digital display.
- Its buttons will include the capital letters A through F in addition to the digits 0 through 9.
- It will support bases 2 through 16.

The input for your prototype program will consist of one base conversion per line. There will be three numbers per line. The first number will be the number in the base you are converting from. The second number is the base you are converting from. The third number is the base you are converting to. There will be one or more blanks surrounding (on either side of) the numbers. There are several lines of input and your program should continue to read until the end of file is reached.

The output will only be the converted number as it would appear on the display of the calculator. The number should be right justified in the 7-digit display. If the number is too large to appear on the display, then print "ERROR" (without the quotes) right justified in the display.

A sample input file is shown here:

```
1111000 2 10
1111000 2 16
2102101 3 10
2102101 3 15
 12312 4 2
   1A 15 2
1234567 10 16
  ABCD 16 15
```

The following output file should be produced from the above sample input:

```
  120
   78
 1765
 7CA
ERROR
11001
12D687
 D071
```

---

Added by: Wanderley Guimaraes  
Date: 2006-06-01  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: ACM Mid Central Regionals 1995



## SPOJ Problem Set (classical)

### 871. Letter Sequence Analysis

#### Problem code: SEQUENCE

Cryptographic analysis makes extensive use of the frequency with which letters and letter sequences occur in a language. If an encrypted text is known to be in english, for example, a great deal can be learned from the fact that the letters E, L, N, R, S, and T are the most common ones used in written english. Even more can be learned if common letter pairs, triplets, etc. are known.

For this problem you are to write a program which accepts as input a text file of unspecified length and performs letter sequence analysis on the text. The program will report the five most frequent letter sequences for each set of sequences from one to five letters. That is it will report the individual characters which occur with the five highest frequencies, the pairs of characters which occur with the five highest frequencies, and so on up to the letter sequences of five characters which occur with the five highest frequencies.

The program should consider contiguous sequences of alphabetic characters only, and case should be ignored (e.g. an 'a' is the same as an 'A'). A report should be produced using the format shown in the example at the end of this problem description. For each sequence length from one to five, the report should list the sequences in descending order of frequency. If there are several sequences with the same frequency then all sequences should be listed in alphabetical order as shown (list all sequences in upper case). Finally, if there are less than five distinct frequencies for a particular sequence length, simply report as many distinct frequency lists as possible.

When a text file containing simply the line "Peter Piper Picks Pickles!" is used as input, the output should appear as shown here:

```
Analysis for Letter Sequences of Length 1
-----
Frequency = 5, Sequence(s) = (P)
Frequency = 4, Sequence(s) = (E)
Frequency = 3, Sequence(s) = (I)
Frequency = 2, Sequence(s) = (C,K,R,S)
Frequency = 1, Sequence(s) = (L,T)

Analysis for Letter Sequences of Length 2
-----
Frequency = 3, Sequence(s) = (PI)
Frequency = 2, Sequence(s) = (CK,ER,IC,PE)
Frequency = 1, Sequence(s) = (ES,ET,IP,KL,KS,LE,TE)

Analysis for Letter Sequences of Length 3
-----
Frequency = 2, Sequence(s) = (ICK,PIC)
Frequency = 1, Sequence(s) = (CKL,CKS,ETE,IPE,KLE,LES,PER,PET,PIP,TER)

Analysis for Letter Sequences of Length 4
-----
Frequency = 2, Sequence(s) = (PICK)
Frequency = 1, Sequence(s) = (CKLE,ETER,ICKL,ICKS,IPER,KLES,PETE,PIPE)
```

Analysis for Letter Sequences of Length 5

-----  
Frequency = 1, Sequence(s) = (CKLES,ICKLE,PETER,PICKL,PICKS,PIPER)

When the first three paragraphs of this problem description are used as input, the output should appear as shown here:

Analysis for Letter Sequences of Length 1

-----  
Frequency = 201, Sequence(s) = (E)  
Frequency = 112, Sequence(s) = (T)  
Frequency = 96, Sequence(s) = (S)  
Frequency = 90, Sequence(s) = (R)  
Frequency = 84, Sequence(s) = (N)

Analysis for Letter Sequences of Length 2

-----  
Frequency = 37, Sequence(s) = (TH)  
Frequency = 33, Sequence(s) = (EN)  
Frequency = 27, Sequence(s) = (HE)  
Frequency = 24, Sequence(s) = (RE)  
Frequency = 23, Sequence(s) = (NC)

Analysis for Letter Sequences of Length 3

-----  
Frequency = 24, Sequence(s) = (THE)  
Frequency = 21, Sequence(s) = (ENC,EQU,QUE,UEN)  
Frequency = 12, Sequence(s) = (NCE,SEQ,TER)  
Frequency = 9, Sequence(s) = (CES,FRE,IVE,LET,REQ,TTE)  
Frequency = 8, Sequence(s) = (ETT,FIV)

Analysis for Letter Sequences of Length 4

-----  
Frequency = 21, Sequence(s) = (EQUE,QUEN)  
Frequency = 20, Sequence(s) = (UENC)  
Frequency = 12, Sequence(s) = (ENCE,SEQU)  
Frequency = 9, Sequence(s) = (FREQ,NCES,REQU)  
Frequency = 8, Sequence(s) = (ETTE,FIVE,LETT,TTER)

Analysis for Letter Sequences of Length 5

-----  
Frequency = 21, Sequence(s) = (EQUEN)  
Frequency = 20, Sequence(s) = (QUENC)  
Frequency = 12, Sequence(s) = (SEQUE,UENCE)  
Frequency = 9, Sequence(s) = (ENCES,FREQU,REQUE)  
Frequency = 8, Sequence(s) = (ETTER,LETTE)

---

Added by: Wanderley Guimaraes

Date: 2006-06-01

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM Mid Central Regionals 1995

# SPOJ Problem Set (classical)

## 872. Mark-up

### Problem code: MARKUP

Mark-up languages are computer languages that assist in the formatting of text files. Special keywords are used to mark the text to allow control of fonts, page styles, paragraph styles, etc. TeX, troff, and HTML are examples of mark-up languages.

Spell checking can be difficult to adapt to these special texts. In general, special processors or spell checkers must be created in order to accommodate mark-up languages. A special processor would recognize the mark-up language and strip it from the text so that the “plain” text could then be processed by a spell checker. For this problem, you are to write such a processor for a small mark-up language so that the output of your program will be the plain text without the mark-ups.

The mark-up language to consider is one which allows the modification of fonts within the text. Each markup command will be preceded by a `\` character. If the letter following the `\` character is not a recognized command from the table below then the character following the `\` is printed as part of the plain text. For instance, the mark-up `\\` can be used to print a single `\`.

- `\b` toggle bold font on/off (default state is off)
- `\i` toggle italics font on/off (default state is off)
- `\s` set font size; the `s` is immediately followed by an optional number; if the number is missing then the command will restore the previous size
- `\*` toggle processing of mark-ups on/off; if processing is toggle off then mark-ups are considered to be literal text (default state is on)

The number following the `\s` command can have a decimal point so 12, 9.5, 11., and .5 should all be recognized as valid numbers.

The input file will be plain text containing mark-ups from the language above. At the start, processing of mark-ups should be on. The file should be processed until the end-of-file is encountered.

A sample input file is shown here:

```
\s18.\bMARKUP sample\b\s
```

```
\*For bold statements use the \b command.\*
```

```
If you wish to \i emphasize\i something use the \i command.
```

```
For titles use \s14BIG\s font sizes, 14 points usually works well.
```

```
Remember that all of the commands toggle except for the \s command.
```

The following output file should be produced from the above sample input:

MARKUP sample

For bold statements use the \b command.

If you wish to emphasize something use the \i command.

For titles use BIG font sizes, 14 points usually works well.

Remember that all of the commands toggle except for the \s command.

---

Added by: Wanderley Guimaraes

Date: 2006-06-01

Time limit: 1s

Source limit:50000B

Languages: All

Resource: 1995 ACM Mid-Central Programming Contest

## SPOJ Problem Set (classical)

### 898. Transmitters

#### Problem code: TRANSMIT

In a wireless network with multiple transmitters sending on the same frequencies, it is often a requirement that signals don't overlap, or at least that they don't conflict. One way of accomplishing this is to restrict a transmitter's coverage area. This problem uses a shielded transmitter that only broadcasts in a semicircle.

A transmitter  $T$  is located somewhere on a 1,000 square meter grid. It broadcasts in a semicircular area of radius  $r$ . The transmitter may be rotated any amount, but not moved. Given  $N$  points anywhere on the grid, compute the maximum number of points that can be simultaneously reached by the transmitter's signal. Figure 1 shows the same data points with two different transmitter rotations.

[IMAGE]

All input coordinates are integers (0-1000). The radius is a positive real number greater than 0. Points on the boundary of a semicircle are considered within that semicircle. There are 1-150 unique points to examine per transmitter. No points are at the same location as the transmitter.

Input consists of information for one or more independent transmitter problems. Each problem begins with one line containing the (x,y) coordinates of the transmitter followed by the broadcast radius,  $r$ . The next line contains the number of points  $N$  on the grid, followed by  $N$  sets of (x,y) coordinates, one set per line. The end of the input is signalled by a line with a negative radius; the (x,y) values will be present but indeterminate. Figures 1 and 2 represent the data in the first two example data sets below, though they are on different scales. Figures 1a and 2 show transmitter rotations that result in maximal coverage.

For each transmitter, the output contains a single line with the maximum number of points that can be contained in some semicircle.

**Input :**

```
25 25 3.5
7
25 28
23 27
27 27
24 23
26 23
24 29
26 29
350 200 2.0
5
350 202
350 199
350 198
348 200
352 200
995 995 10.0
4
1000 1000
```

999 998  
990 992  
1000 999  
100 100 -2.5

**Output :**

3  
4  
4

---

Added by: Wanderley Guimaraes

Date: 2006-06-09

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM Mid Central Regionals 2001

## SPOJ Problem Set (classical)

### 899. Ws Cipher

#### Problem code: WSCIPHER

Weird Wally's Wireless Widgets, Inc. manufactures an eclectic assortment of small, wireless, network capable devices, ranging from dog collars, to pencils, to fishing bobbers. All these devices have very small memories. Encryption algorithms like Rijndael, the candidate for the Advanced Encryption Standard (AES) are demonstrably secure but they don't fit in such a tiny memory. In order to provide some security for transmissions to and from the devices, WWW uses the following algorithm, which you are to implement.

Encrypting a message requires three integer keys,  $k_1$ ,  $k_2$ , and  $k_3$ . The letters [a-i] form one group, [j-r] a second group, and everything else ([s-z] and underscore) the third group. Within each group the letters are rotated *left* by  $k_i$  positions in the message. Each group is rotated independently of the other two. Decrypting the message means doing a *right* rotation by  $k_i$  positions within each group.

Consider the message `the_quick_brown_fox` encrypted with  $k_i$  values of 2, 3 and 1. The encrypted string is `_icuo_bfnwhoq_kxert`. The figure below shows the decrypting right rotations for one character in each of the three character groups.

[IMAGE]

Looking at all the letters in the group [a-i] we see {i,c,b,f,h,e} appear at positions {2,3,7,8,11,17} within the encrypted message. After a right rotation of  $k_1=2$ , these positions contain the letters {h,e,i,c,b,f}. The table below shows the intermediate strings that come from doing all the rotations in the first group, then all rotations in the second group, then all the rotations in the third group. Rotating letters in one group will not change any letters in any of the other groups.

	[a-i], $k_1=2$	[j-r], $k_2=3$	[s-z] and _, $k_3=1$
Encrypted:	_icuo_bfnwhoq_kxert	_heuo_icnwboq_kxfrt	_heuq_ickwbro_nxfot
Decrypted:	_heuo_icnwboq_kxfrt	_heuq_ickwbro_nxfot	the_quick_brown_fox
Changes:	^^ ^ ^	^ ^ ^^ ^ ^	^ ^ ^ ^ ^ ^ ^

All input strings contain only lowercase letters and underscores(\_). Each string will be at most 80 characters long. The  $k_i$  are all positive integers in the range 1-100.

Input consists of information for one or more encrypted messages. Each problem begins with one line containing  $k_1$ ,  $k_2$ , and  $k_3$  followed by a line containing the encrypted message. The end of the input is signalled by a line with all key values of 0.

For each encrypted message, the output is a single line containing the decrypted string.

**Input :**

```
2 3 1
_icuo_bfnwhoq_kxert
1 1 1
bcalmkyyz
3 7 4
wcb_mxfep_dorul_eov_qtkrhe_ozany_dgtoh_u_eji
2 4 3
cjdksaltbmu
0 0 0
```

**Output :**

```
the_quick_brown_fox
abcklmxyz
the_quick_brown_fox_jumped_over_the_lazy_dog
ajsbktcludmv
```

---

Added by: Wanderley Guimaraes

Date: 2006-06-09

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM Mid Central Regionals 2001



## SPOJ Problem Set (classical)

### 900. Split Windows

#### Problem code: SPLIT

The Dotty Software Company makes software that is displayed on inexpensive text based terminals. One application for this system has a main window that can be subdivided into further subwindows. Your task is to take a description of the screen layout after a sequence of window splits and draw the minimum sized window grid that is consistent with the description.

In this problem we will concentrate on the boundaries of windows, so all the characters inside of windows will be left blank. Each window that is not further subdivided has a label. Each label is a distinct uppercase letter. For a text terminal the boundaries of windows must be drawn with characters, chosen as follows: A capital letter label is placed in the upper left-hand corner of each undivided window. Asterisks, '\*', appear in corners of windows where there is not a label. Dashes, '-', appear on upper and lower boundaries where there are not corners. Vertical bars, '|', appear on side boundaries where there are not corners.

For example, the sequence of splits below would generate Window 1: Initially there could be an application window labeled M, that is split next into left and right subwindows, adding label R, and the left subwindow is split into top and bottom subwindows, adding the label C.

[IMAGE]

For each pattern of splits there is a binary tree of characters that can describe it. The window splitting and tree structures are described together, building up from the simplest cases.

1. A window may be an undivided rectangle. Such a window has a capital letter as label. The tree for the window contains just the label.
2. A window may either be split into left and right subwindows or into top and bottom subwindows, and the corresponding trees have as root the boundary character for the split: a vertical line '|' or a horizontal dash '-' respectively. The root has left and right subtrees corresponding to the top and bottom or left and right subwindows respectively.

Tree 1, above, and Trees 2-4, below, would be consistent with Windows 1-4. Note that Tree 4 contains Trees 2 and 3.

[IMAGE]

[IMAGE]

The trees may be more succinctly expressed via a preorder traversal:

1. The preorder traversal of a tree with just one node (containing a letter) is that letter.
2. The preorder traversal of a tree with a left and a right subtree is the character from the root of the tree ('-' or '|') followed by the preorder traversal of the left subtree, and then the preorder traversal of the right subtree.

The preorder traversals for Trees 1 through 4 are

| -MCR      -|-ABC-D|E-FG      -P-|Q|RST      |-|-ABC-D|E-FG-P-|Q|RST

Each undivided window must have space for at least one character inside. Hence each tree of splits will be associated with a minimum window size. Windows 1-4 are minimum sized windows for Trees 1-4. Each window illustrates the fact that even in a minimum sized window, not all undivided windows contain only one character.

Consider Tree 4 and Window 4. The main window is split into a left window with Tree 2 and right window with Tree 3. The left window is like Window 2, but the right window is not just like Window 3. The heights of left and right subwindows must match, so the right window must be stretched.

The stretching rule depends on a definition of the size of windows. For dimension calculations it is easiest to imagine that a window contains its interior and a half character wide boundary on all sides, so the total dimensions of a window are one more than the dimensions of the interior. Hence the minimum dimensions of a window are 2 by 2, since a window must contain one character inside, and we add one for the boundary. This definition also means that the sum of the widths of left and right subwindows is the width of their enclosing window. The sum of the heights of top and bottom subwindows is the height of their enclosing window.

The right window in Window 4 must be stretched to match the height 10 of the left window. The right window is split into a top with tree P having minimum height 2 and a bottom with tree -|Q|RST having minimum height 4. The rule for the dimensions in the stretched window is that the heights of the subwindows expand in proportion to their minimum heights, if possible. Some symbols may help here: Let  $D = 10$  be the height of the combined stretched window. We want to determine  $D_1$  and  $D_2$ , the stretched heights of the top and bottom subwindow. Call the corresponding minimum dimensions  $d = 6$ ,  $d_1 = 2$ , and  $d_2 = 4$ . If the window were expanded from a total height  $d$  to  $D$  in proportion, we would have  $D_1 = d_1 * (D/d) = 2 * (10/6) = 3.333...$  and  $D_2 = d_2 * (D/d) = 6.666...$ . Since the results are not integers we increase  $D_1$  to 4 and decrease  $D_2$  to 6.

There is a similar calculation for the bottom window with tree -|Q|RST. It is further subdivided into a top with tree |Q|RS and a bottom with tree T, each having minimum height  $2 = d_1 = d_2$ . The heights need to add up to  $D = 6$ , so they are increased proportionally to  $D_1 = D_2 = 2 * (6/4) = 3$  (exact integers).

The final dimensions of an enclosing window are always determined before the final dimensions of its subwindows. In this example only heights needed to be apportioned. If all horizontal and vertical splits were interchanged in this example, producing a tree -|-|ABC|D-E|FG|P|-Q-RST, then widths would be apportioned correspondingly, as shown in the third part of the sample output below. If the proportion calculations do not work out to integers, it is always the top or left subwindow whose dimension is increased to the next integer.

The first line of input contains one integer, which is the total number of preorder traversals describing window structures. This line is followed by one line for each preorder traversal. Each preorder traversal will contain appropriate dividers ' | ' and ' - ' and from 1 to 26 uppercase letters.

For each preorder traversal, print the number of the preorder traversal on one line followed by the minimum sized window grid that the traversal could represent. Contrary to the general contest output conventions, there may be more than one consecutive blank in this output, but the other general rules for contest output are followed. The total number of rows or columns in output grids will be no more

than 53.

**Input :**

```
3
|-MCR
|-|-ABC-D|E-FG-P-|Q|RST
-|-|ABC|D-E|FG|P|-Q-RST
```

**Output :**

```
1
M-R-*
| | |
C-* |
| | |
*_*_*

2
A-C-P-----*
| | | |
B-* | |
| | | |
D-*Q-R-S-*
| | | | |
E-F-* | | |
| | T-*-*-*
| G-* |
| | | |
*_*_*-----*

3
A-B-D-E---*
| | | | |
C-*-* F-G-*
| | | | |
P---Q-*T*-*
| | | |
| R--* |
| | | |
| S--* |
| | | |
*---*---*---
```

---

Added by: Wanderley Guimaraes  
Date: 2006-06-09  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ACM Mid Central Regionals 2001

# SPOJ Problem Set (classical)

## 901. Index Generation

### Problem code: INDEXGEN

Most nonfiction and reference books have an *index* to help readers find references to specific terms or concepts in the text. Here is a sample index.

```
larch, 4, 237, 238, 414
+ Monty Python and, 64, 65, 66
+ planting of, 17
Lenny Kravitz, 50
+ going his way, 53
lumbago, 107
mango
+ Chris Kattan, 380
+ storage of, 87, 90
+ use in Nethack, 500, 501
+ Vitamin C content, 192
```

Each index entry contains a *primary entry* followed by zero or more *secondary entries*, which begin with a '+'. Entries will normally be followed by a list of page references, but a primary entry might not be if at least one secondary entry is present (as is the case with *mango*, above). Primary entries are sorted, and secondary entries following a primary entry are also sorted. Sorting is case-insensitive. Page references for an entry are in ascending order and do not include duplicates. (A duplicate could occur if there are two or more identical entries on the same page.)

Your task is to read a document that has index information embedded within it and produce the index. Documents consist of one or more lines of ASCII text. The page number starts at 1, and the character '&' indicates the start of a new page (which adds 1 to the current page number). Index entries are indicated by a *marker*, which in its most elaborate form has the following syntax:

`{text%primary$secondary}`

Here *text* is the text to be indexed, *primary* is an alternative primary entry, and *secondary* is a secondary entry. Both '%primary' and '\$secondary' are optional, but if both are present they must appear in the order given. If *primary* is present then it is used as the primary entry, and if not then *text* is used as the primary entry. If *secondary* is present then the marker adds a page reference for that secondary entry; otherwise it adds a page reference for the primary entry. A single marker cannot add a page reference for both a primary and secondary entry. Here are examples of each of the four possible types of marker, which correspond to four of the entries in the sample index above.

```
... his {lumbago} was acting up, so ...
... {Lenny%Lenny Kravitz} lit up the crowd with his version of ...
... Monty Python often used the {larch$Monty Python and} in ...
... when storing {mangos%mango$storage of}, be sure to ...
```

The input consists of one or more documents, followed by a line containing only '\*' that signals the end of the input. Documents are implicitly numbered starting with 1. Each document consists of one or more lines of text followed by a line containing only '\*'. Each line of text will be at most 79 characters long, not counting end-of-line characters. For document *i*, output the line 'DOCUMENT *i*'

followed by the sorted index using the exact output format shown in the examples.

Be sure to read *Notes to Teams*, which has general formatting guidelines that pertain to all problem input files, including this one. Also note:

- A document will contain at most 100 markers, with at most 20 primary entries.
- A primary entry will have at most 5 secondary entries.
- An entry will have at most 10 unique page references (not including duplicates).
- The character '&' will not appear anywhere within a marker, and will appear at most 500 times within a document.
- The character '\*' is used only to signal the end of a document or the end of the input.
- The characters '{', '}', '%', and '\$' will only be used to define markers, and will not appear in any text or entries.
- A marker may span one or more lines. Every end-of-line within a marker must be converted to a single space.
- A space within a marker (including a converted end-of-line) is normally included in the text/entry, just like any other character. However, any space that immediately follows '{', immediately precedes '}', or is immediately adjacent to '%' or '\$' must be ignored.
- The total length of a marker, measured from the opening '{' to the closing '}', and in which all embedded end-of-lines are converted to spaces, will be at most 79 characters.

**Input :**

```
Call me Ishmael.
*
One {fish $unary}, two {fish$ binary},&red {fish $ scarlet}, blue {fish$
azure}. & By { Dr. Seuss }.
*
This is a {simple } & & { document} that &{
simply %simple
$adverb
} & {illustrates %vision} &&&& one {simple-minded% simple} {Judge}'s {vision}
for what a {document } might { look % vision} like.
*
**
```

**Output :**

```
DOCUMENT 1
DOCUMENT 2
Dr. Seuss, 3
fish
+ azure, 2
+ binary, 1
+ scarlet, 2
+ unary, 1
DOCUMENT 3
document, 3, 10
Judge, 10
simple, 1, 10
+ adverb, 4
vision, 5, 10
```

---

Added by: Wanderley Guimaraes  
Date: 2006-06-09  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ACM Mid Central Regionals 2001

## SPOJ Problem Set (classical)

### 902. Hangover

#### Problem code: HANGOVER

How far can you make a stack of cards overhang a table? If you have one card, you can create a maximum overhang of half a card length. (We're assuming that the cards must be perpendicular to the table.) With two cards you can make the top card overhang the bottom one by half a card length, and the bottom one overhang the table by a third of a card length, for a total maximum overhang of  $1/2 + 1/3 = 5/6$  card lengths. In general you can make  $n$  cards overhang by  $1/2 + 1/3 + 1/4 + \dots + 1/(n + 1)$  card lengths, where the top card overhangs the second by  $1/2$ , the second overhangs the third by  $1/3$ , the third overhangs the fourth by  $1/4$ , etc., and the bottom card overhangs the table by  $1/(n + 1)$ . This is illustrated in the figure below.

[IMAGE]

#### Input

The input consists of one or more test cases, followed by a line containing the number 0.00 that signals the end of the input. Each test case is a single line containing a positive floating-point number  $c$  whose value is at least 0.01 and at most 5.20;  $c$  will contain exactly three digits.

#### Output

For each test case, output the minimum number of cards necessary to achieve an overhang of at least  $c$  card lengths. Use the exact output format shown in the examples.

**Input :**

```
1.00
3.71
0.04
5.19
0.00
```

**Output :**

```
3 card(s)
61 card(s)
1 card(s)
273 card(s)
```

---

Added by: Wanderley Guimaraes

Date: 2006-06-09

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: ACM Mid Central Regionals 2001

## SPOJ Problem Set (classical)

### 903. Double Vision

#### Problem code: DOUBLEVI

The DoubleVision company designs inks and fonts that can be easily read by both humans and machines. They design their fonts on a rectangular grid. Shown below is a very simple 5x3 design for the first five digits.

```
.o. .o. oo. oo. o.o
o.o .o. ..o ..o o.o
o.o .o. .o. oo. ooo
o.o .o. o.. ..o ..o
.o. .o. ooo oo. ..o
```

The ink appears to be normal black ink, but just underneath the surface DoubleVision adds a special polymer that can be detected by an infrared scanner. A human sees the black ink but not the polymer, and a machine sees the polymer but not the black ink. The only problem is that the polymer is much more expensive than the ink, so DoubleVision wants to use as little of it as possible. They have discovered that with many fonts, each symbol can be uniquely identified by at most two pixels. By only adding the polymer to one or two pixels per symbol, they drastically lower costs while still ensuring 100% accuracy in their scanners. The font shown above has this property; pixels that uniquely identify each letter are highlighted with '#'. (There are other choices that would work as well.)

```
.#. .o. #o. oo. o.#
#.o .#. ..o ..o o.o
o.o .o. .o. #o. ooo
o.o .o. #.. ..o ..o
.o. .o. ooo #o. ..o
```

Your job is to write a program to determine if a given font has this property, and if so highlight the pixels.

The input consists of one or more test cases, followed by a line containing '0 0 0' (three zeros) that signals the end of the input. Each test case begins with a line containing three positive integers  $n$ ,  $r$ , and  $c$ , separated by a space:  $n$  is the number of symbols in the font,  $r$  is the number of rows in each grid, and  $c$  is the number of columns in each grid. The next  $r$  lines contain the image of each symbol, using the exact format shown in the examples: a dot '.' represents an empty part of the grid, a lowercase 'o' represents a pixel, and adjacent grids are separated by a space. The total width of each line will be at most 79 characters (not counting end-of-line characters), and  $r$  will be at most 10. The test cases are implicitly numbered starting with 1.

For test case  $i$ , first output a line that says 'Test  $i$ '. Then determine if each symbol can be uniquely identified with one or two pixels. If not, output a line with the word 'impossible'. Otherwise, output the font in the same format except that the identifying pixels for each symbol are replaced with '#'.



In general there may be several different pixels or pixel pairs that uniquely identify a symbol. To ensure that the output is unique, we add the following definition and rules. When comparing two pixels, the *topmost-leftmost* pixel is the one closest to the top of the grid. If both pixels are on the same row, then the topmost-leftmost is the one closest to the left of the grid.

If one pixel will work, highlight the topmost-leftmost pixel that works. Never highlight a two-pixel solution if a one-pixel solution is possible. If two pixels are needed, highlight the pair with the topmost-leftmost pixel. If two or more pairs have the same topmost-leftmost pixel, highlight the one with the topmost-leftmost *other* pixel.

**Input :**

```
3 2 2
oo oo .o
o. .o o.
3 2 2
oo oo .o
o. .o oo
5 5 3
.o. .o. oo. oo. o.o
o.o .o. ..o ..o o.o
o.o .o. .o. oo. ooo
o.o .o. o.. ..o ..o
.o. .o. ooo oo. ..o
1 2 4
.o..
...o
0 0 0
```

**Output :**

```
Test 1
impossible
Test 2
#o #o .o
# .# ##
Test 3
.#. .o. #o. oo. o.#
#o .#. ..o ..o o.o
o.o .o. .o. #o. ooo
o.o .o. #.. ..o ..o
.o. .o. ooo #o. ..o
Test 4
.#..
...o
```

---

Added by: Wanderley Guimaraes  
Date: 2006-06-09  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ACM Mid Central Regionals 2001

## SPOJ Problem Set (classical)

### 904. Image Perimeters

#### Problem code: IMAGE

Technicians in a pathology lab analyze digitized images of slides. Objects on a slide are selected for analysis by a mouse click on the object. The perimeter of the boundary of an object is one useful measure. Your task is to determine this perimeter for selected objects.

The digitized slides will be represented by a rectangular grid of periods, '.', indicating empty space, and the capital letter 'X', indicating part of an object. Simple examples are

```
XX Grid 1 .XXX Grid 2
XX .XXX
.XXX
...X
..X.
X...
```

An X in a grid square indicates that the entire grid square, including its boundaries, lies in some object. The X in the center of the grid below is *adjacent* to the X in any of the 8 positions around it. The grid squares for any two adjacent X's overlap on an edge or corner, so they are connected.

```
XXX
XXX Central X and adjacent X's
XXX
```

An object consists of the grid squares of all X's that can be linked to one another through a sequence of adjacent X's. In Grid 1, the whole grid is filled by one object. In Grid 2 there are two objects. One object contains only the lower left grid square. The remaining X's belong to the other object.

The technician will always click on an X, selecting the object containing that X. The coordinates of the click are recorded. Rows and columns are numbered starting from 1 in the upper left hand corner. The technician could select the object in Grid 1 by clicking on row 2 and column 2. The larger object in Grid 2 could be selected by clicking on row 2, column 3. The click could not be on row 4, column 3.

[IMAGE] One useful statistic is the perimeter of the object. Assume each X corresponds to a square one unit on each side. Hence the object in Grid 1 has perimeter 8 (2 on each of four sides). The perimeter for the larger object in Grid 2 is illustrated in the figure at the left. The length is 18.

Objects will not contain any totally enclosed holes, so the leftmost grid patterns shown below could *NOT* appear. The variations on the right could appear:

**Impossible Possible**

```
XXXX XXXX XXXX XXXX
X..X XXXX X... X...
XX.X XXXX XX.X XX.X
XXXX XXXX XXXX XX.X
```

```

.....
..X.. ..X.. ..X.. ..X..
.X.X. .XXX. .X... .....
..X.. ..X.. ..X.. ..X..
.....

```

The input will contain one or more grids. Each grid is preceded by a line containing the number of rows and columns in the grid and the row and column of the mouse click. All numbers are in the range 1-20. The rows of the grid follow, starting on the next line, consisting of '.' and 'X' characters.

The end of the input is indicated by a line containing four zeros. The numbers on any one line are separated by blanks. The grid rows contain no blanks.

For each grid in the input, the output contains a single line with the perimeter of the specified object.

**Input :**

```

2 2 2 2
XX
XX
6 4 2 3
.XXX
.XXX
.XXX
...X
..X.
X...
5 6 1 3
.XXXX.
X....X
..XX.X
.X...X
..XXX.
7 7 2 6
XXXXXXX
XX...XX
X..X..X
X..X...
X..X..X
X.....X
XXXXXXX
7 7 4 4
XXXXXXX
XX...XX
X..X..X
X..X...
X..X..X
X.....X
XXXXXXX
0 0 0 0

```

**Output :**

```

8
18
40
48
8

```

---

Added by: Wanderley Guimaraes  
Date: 2006-06-09  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ACM Mid Central Regionals 2001

## SPOJ Problem Set (classical)

### 912. Submatrix of submatrix

#### Problem code: MATRIX2

You are given a matrix P of N rows and M columns. It consists of integer numbers in the range [1..100]. We define the sum of a matrix is the sum of its elements. Your task is to find a submatrix Q (of A rows and B columns) of P and a submatrix K (of C rows and D columns) of Q so that the difference between the sum of Q and the sum of K is maximal, and submatrix K is absolutely inside matrix Q (i.e no element on matrix Q's sides is also in matrix K).

Because the tests are large, we suggest a method to define matrix P:

$P[i][j] = (P[i][j-1] * 71 + 17) \bmod 100 + 1, (1 \leq i \leq N, 1 \leq j \leq M)$

With this method we only care about  $P[i][1]$ .

#### Constraints

$1 \leq N, M \leq 1000$

$1 \leq A \leq N$

$1 \leq B \leq M$

$0 \leq C \leq A - 2$

$0 \leq D \leq B - 2$

#### Input

The first line of the input contains an integer t ( $1 \leq t \leq 10$ ), equal to the number of testcases. Then descriptions of t testcases follow. The first line of the description contains 6 integer numbers N, M, A, B, C, D. Then N lines follow, line i contains one integer number  $P[i][1]$ .

#### Output

For each test case, your program should output the maximal difference between two matrices (in a separate line).

#### Example

##### Input :

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

##### Output :

```
260
```

---

Added by: Nguyen Dinh Tu  
Date: 2006-08-18  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: Base on a problem in IOI 2006 .

## SPOJ Problem Set (classical)

### 913. Query on a tree II

#### Problem code: QTREE2

You are given a tree (an undirected acyclic connected graph) with  $N$  nodes, and edges numbered 1, 2, 3... $N-1$ . Each edge has an integer value assigned to it, representing its length.

We will ask you to perform some instructions of the following form:

- **DIST a b** : ask for the distance between node **a** and node **b**  
or
- **KTH a b k** : ask for the **k**-th node on the path from node **a** to node **b**

#### Example:

**N** = 6

1 2 1 // edge connects node 1 and node 2 has cost 1

2 4 1

2 5 2

1 3 1

3 6 2

Path from node 4 to node 6 is 4 -> 2 -> 1 -> 3 -> 6

**DIST 4 6** : answer is 5 (1 + 1 + 1 + 2 = 5)

**KTH 4 6 4** : answer is 3 (the 4-th node on the path from node 4 to node 6 is 3)

#### Input

The first line of input contains an integer **t**, the number of test cases ( $t \leq 25$ ). **t** test cases follow.

For each test case:

- In the first line there is an integer **N** ( $N \leq 10000$ )
- In the next  $N-1$  lines, the *i*-th line describes the *i*-th edge: a line with three integers **a b c** denotes an edge between **a**, **b** of cost **c** ( $c \leq 100000$ )
- The next lines contain instructions "**DIST a b**" or "**KTH a b k**"
- The end of each test case is signified by the string "**DONE**".

There is one blank line between successive tests.

#### Output

For each "**DIST**" or "**KTH**" operation, write one integer representing its result.

Print one blank line after each test.

## Example

### Input :

```
1
6
1 2 1
2 4 1
2 5 2
1 3 1
3 6 2
DIST 4 6
KTH 4 6 4
DONE
```

### Output :

```
5
3
```

---

Added by: Thanh-Vy Hua

Date: 2006-08-27

Time limit: 2s

Source limit: 15000B

Languages: All

Resource: Special thanks to Ivan Krasilnikov for his alternative solution



## SPOJ Problem Set (classical)

### 944. Free Tour

#### Problem code: FTOUR

In order to celebrate the 2nd anniversary of Travel Agent SPOJ (Safe - Professional - hOspitable - Joyful), the management intend to hold free tours around cities for clients to make them more satisfied with SPOJ.

A tour is a simple cycle, starting at any city (called a source-city) visits some other cities (each city must be visited at most once) and then returns to the source-city. The number of roads in the tour should be an even number because we are celebrating a 2nd anniversary, and 2 is even! Since many tours in different areas of the country are planned, the cost of organising them could turn out quite high. Hence, the management of SPOJ hope to find at least one 'reasonable' tour, which should have as small a number of roads as possible.

You're given maps of the areas where SPOJ wants to hold free tours. For each map, help them figure out a reasonable tour.

#### Input

The first line of input contains an integer **t**, the number of maps ( $t \leq 5$ ). **t** maps follow.

For each map:

- In the first line there are 2 integers **N** - number of cities in that area, **M** - number of roads ( $1 \leq N \leq 8000$ ,  $0 \leq M \leq 10000$ )
- In the next **M** lines, the i-th line describes the i-th road: a line with two integers **a b** denotes a bidirectional road between city **a** and city **b**

There is one blank line between successive tests.

#### Output

For each map, if there is no tour satisfying the conditions, write "-1" (without quotes). Otherwise, write one integer representing the number of roads in a reasonable tour, and in the next line show out the tour with form "source-city a b c .. source-city", that means the tour is source-city -> city a -> city b -> ... -> source-city. If there are many tours satisfy in each map, any of them will be accepted.

#### Example

Input :  
2

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

```
4 4
1 2
2 3
3 4
4 1
```

**Output :**

```
-1
4
1 2 3 4 1
```

---

Added by: Thanh-Vy Hua

Date: 2006-09-16

Time limit: 1s-4s

Source limit:15000B

Languages: All

## SPOJ Problem Set (classical)

### 962. Intergalactic Map

#### Problem code: IM

Map Jedi knights, Qui-Gon Jinn and his young apprentice Obi-Wan Kenobi, are entrusted by Queen Padmé Amidala to save **Naboo** from an invasion by the Trade Federation. They must leave Naboo immediately and go to **Tatooine** to pick up the proof of the Federation's evil design. They then must proceed on to the Republic's capital planet **Coruscant** to produce it in front of the Republic's Senate. To help them in this endeavor, the queen's captain provides them with an intergalactic map. This map shows connections between planets not yet blockaded by the Trade Federation. Any pair of planets has at most one connection between them, and all the connections are two-way. To avoid detection by enemy spies, the knights must embark on this adventure without visiting any planet more than once. Can you help them by determining if such a path exists?

**Note** - In the attached map, the desired path is shown in bold.

#### Input Description

The first line of the input is a positive integer  $t \leq 20$ , which is the number of test cases. The descriptions of the test cases follow one after the other. The first line of each test case is a pair of positive integers  $n, m$  (separated by a single space).  $2 \leq n \leq 30011$  is the number of planets and  $m \leq 50011$  is the number of connections between planets. The planets are indexed with integers from 1 to  $n$ . The indices of Naboo, Tatooine and Coruscant are 1, 2, 3 respectively. The next  $m$  lines contain two integers each, giving pairs of planets that have a connection between them.

#### Output Description

The output should contain  $t$  lines. The  $i^{\text{th}}$  line corresponds to the  $i^{\text{th}}$  test case. The output for each test case should be **YES** if the required path exists and **NO** otherwise.

#### Example

##### Input

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

##### Output

```
YES
NO
```

---

Added by: Kashyap KBR  
Date: 2006-10-10  
Time limit: 6s  
Source limit: 50000B  
Languages: All  
Resource: Fair Isaac Programming Challenge - prelims 2006

## SPOJ Problem Set (classical)

### 964. Entrapment

#### Problem code: EN

Example The separatist leader General Grievous, the second in command of Count Dooku, comes to know that Chancellor Palpatine's convoy, escorted by Obi-wan and Anakin, is scheduled to depart from **Kashyyyk** in the Middle Rim of the Universe to **Alderaan**. General Grievous is aware that there are multiple paths going via different sets of planets from Kashyyyk to Alderaan. To make his abduction attempt successful, he decides to send his robots to the planet closest to Kashyyyk, other than itself, which lies on all the possible paths from Kashyyyk to Alderaan. Since you have pledged your allegiance to Count Dooku, you need to help him identify this planet. The planetary map which is given to you for this purpose consists of a set of one-way connections between planets. You also know that a pair of planets can have at most one connection between them in each direction and there is always a path from Kashyyyk to Alderaan.

**Note:** In the given example, the planet with index 5 is the required planet.

#### Input Description

The first line of the input is a positive integer  $t \leq 20$ , which is the number of test cases. The descriptions of the test cases follow one after the other. The first line of each test case is a pair of positive integers  $n, m$  (separated by a single space).  $2 \leq n \leq 30011$  is the number of planets and  $m \leq 100011$  is the number of connections between planets. The planets are indexed with integers from 1 to  $n$  and the indices of Kashyyyk and Alderaan are 1,  $n$  respectively. Each of the next  $m$  lines contains two integers  $p, q$ , meaning that there is a one-way connection from planet  $p$  to planet  $q$ .

#### Output Description

The output should contain  $t$  lines. The  $i^{\text{th}}$  line corresponds to the  $i^{\text{th}}$  test case. The output for the  $i^{\text{th}}$  test case should be the index of the planet with the required property.

#### Example

##### Input

```
2
3 2
1 3
3 2
4 4
1 3
3 4
1 2
2 4
```

##### Output

```
3
4
```

---

Added by: Kashyap KBR  
Date: 2006-10-10  
Time limit: 5s  
Source limit:50000B  
Languages: All  
Resource: Fair Isaac Programming Challenge - prelims 2006

## SPOJ Problem Set (classical)

### 967. Parking Bay

#### Problem code: PB

Illustration Luke Skywalker successfully leads the rebel starship fleet to break the Emperor's siege of the planet Endor. The rebels, jubilant in their victory, return to their base on the moon of Endor to pay their homage to Princess Leia. They fly towards the parking bay where there are  $n$  parking slots in a row. One by one  $n$  starships numbered  $S_1$  to  $S_n$  enter the parking bay. Each rebel  $R_i$  heads to his favorite parking slot  $P_i$ , and if it is free, he docks his starship there. Otherwise, he continues further to the next free slot and occupies it. But if all succeeding slots are occupied, he leaves for good. How many sequences  $P_i$  are such that every rebel can dock his starship?

#### Input Description

The first line of the input is a positive integer  $t \leq 20$ , which is the number of test cases. The descriptions of the test cases follow one after the other. The description of each test case contains exactly one line (a positive integer), containing the value of  $n \leq 1000000$ .

#### Output Description

The output consists of exactly  $t$  lines. The  $i$ th line should be  $A_i \% 10007$ , where  $A_i$  is the number of sequences in the  $i^{\text{th}}$  case, and ' $x \% y$ ' represents the remainder when  $x$  is divided by  $y$ .

#### Example

##### Input

2  
1  
2

##### Output

1  
3

**Explanation:** In the given example, 11, 12 and 21 are the possible sequences.

---

Added by: Kashyap KBR

Date: 2006-10-10

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Fair Isaac Programming Challenge - prelims 2006

## SPOJ Problem Set (classical)

### 972. Birthday

#### Problem code: BIRTHDAY

It is Byteman's birthday today. There are  $n$  children at his birthday party (including Byteman). The children are numbered from 1 to  $n$ . Byteman's parents have prepared a big round table and they have placed  $n$  chairs around the table. When the children arrive, they take seats. The child number 1 takes one of the seats. Then the child number 2 takes the seat on the left. Then the child number 3 takes the next seat on the left, and so on. Finally the child number  $n$  takes the last free seat, between the children number 1 and  $n-1$ . Byteman's parents know the children very well and they know that some of the children will be noisy, if they sit too close to each other. Therefore the parents are going to reseal the children in a specific order. Such an order can be described by a permutation  $p_1, p_2, \dots, p_n$  ( $p_1, p_2, \dots, p_n$  are distinct integers from 1 to  $n$ ) -- child  $p_i$  (for  $i = 2, 3, \dots, n$ ) should sit on child  $p_{i-1}$ 's left, and child  $p_1$  should sit on child  $p_n$ 's left. To seat all the children in the given order, the parents must move each child around the table to the left or to the right some number of seats. For each child, they must decide how the child will move -- that is, they must choose a direction of movement (left or right) and distance (number of seats). On the given signal, all the children stand up at once, move to the proper places and sit down. The reseating procedure throws the birthday party into a mess. The mess is equal to the total distance any child moves. The children can be reseated in many ways. The parents choose one with minimum mess. Help them to find such a way to reseal the children.

#### Input

The first line of standard input contains one integer  $n$  ( $1 \leq n \leq 50000$ ). The second line contains  $n$  integers  $p_1, p_2, \dots, p_n$ , separated by single spaces. Numbers  $p_1, p_2, \dots, p_n$  form a permutation of the set  $\{1, 2, \dots, n\}$  describing the desired order of the children.

#### Output

The first and the only line of standard output should contain one integer: the minimum possible mess.

#### Example

**Input :**

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

**Output :**

```
6
```

---

Added by: Le Đôn Khue

Date: 2006-10-11

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: 2nd round of Hanoi University of Science - Based on a problem from IOI 2005



## SPOJ Problem Set (classical)

### 987. Mobile

#### Problem code: MOBILE

##### Mobile

Manfred loves to build mobiles out of old CDs. For each one, he has an exact plan how it should look like: The CDs are all hanging exactly on the same height. For each pair of CDs, he writes down the height of the lowest bar such that both CDs are hanging somewhere under this bar. For example, the following mobile and distance matrix fit together:

[IMAGE]

After a while, Manfred realizes that he does not succeed to build every mobile he planned to. For example, there is no solution for the following distance matrix:

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

So, he decides to write a computer program that checks the distance matrices and tells him if there is a solution.

#### Input

Several matrices to check. The first row contains the size of the matrix (n), the next n rows contain the distances in the matrix. Then, the data of the next matrix comes, and so on. The input is terminated by a zero as matrix size.

#### Output

For each matrix, write true if Manfred can build a mobile, false otherwise.

#### Example

##### Input :

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

**Output :**

```
true  
false  
false
```

---

Added by: Martin Bader

Date: 2006-10-17

Time limit: 15s

Source limit:50000B

Languages: All

Resource: Ulm Bioinformatics Course WS 06/07

## SPOJ Problem Set (tutorial)

### 996. Continuous Fractions

#### Problem code: CFRAC

A simple continuous fraction has the form:

[IMAGE]

where the  $a_i$ 's are integer numbers.

The previous continuous fraction could be noted as  $[a_1, a_2, \dots, a_n]$ . It is not difficult to show that any rational number  $p / q$ , with integers  $p > q > 0$ , can be represented in a unique way by a simple continuous fraction with  $n$  terms, such that  $p / q = [a_1, a_2, \dots, a_{n-1}, 1]$ , where  $n$  and the  $a_i$ 's are positive natural numbers.

Your task is to find and print the simple continuous fraction that corresponds to a given rational number.

#### Input

Input will consist of a series of cases, each one in a line. A line describing a case contains  $p$  and  $q$ , two integer numbers separated by a space, with  $10^{20} > p > q > 0$ .

The end of the input is indicated by a line containing 0 0.

#### Output

Cases must be analyzed in the order that are read from the input. Output for each case will consist of several lines. The first line indicates the case number, starting at 1, using the format:

Case i:

replacing  $i$  by the corresponding case number. The second line displays the input data in the form  $p / q$ .

The remaining lines must contain the continuous fraction corresponding to the rational number,  $p / q$ , specified in the given input line. The continuous fraction must be printed accordingly to the following rules:

- Horizontal bars are formed by sequences of dashes '-'.  
• The width of each horizontal bar is exactly equal to the width of the denominator under it.  
• Blank characters should be printed using periods '.'  
• The number on a fraction numerator must be printed center justified. That is, the number of spaces at either side must be same, if possible; in other case, one more space must be added at the right side.

## Example

### Input :

```
75 34
65 60
0 0
```

### Output :

```
Case 1:
75 / 34
.....1.....
2.+-----
.....1....
....4.+-----
.....1..
.....1.+-----
.....1
.....5.+.-
.....1
Case 2:
65 / 60
.....1...
1.+-----
.....1
....11.+.-
.....1
```

---

Added by: Camilo Andrés Varela León

Date: 2006-10-24

Time limit: 1s

Source limit:50000B

Languages: All

Resource: XX Colombian National Programming ACM 2006

## SPOJ Problem Set (classical)

### 999. Generalized Matrioshkas

#### Problem code: MATRIOSH

Vladimir worked for years making matrioshkas, those nesting dolls that certainly represent truly Russian craft. A matrioshka is a doll that may be opened in two halves, so that one finds another doll inside. Then this doll may be opened to find another one inside it. This can be repeated several times, till a final doll -that cannot be opened- is reached.

Recently, Vladimir realized that the idea of nesting dolls might be generalized to nesting toys. Indeed, he has designed toys that contain toys but in a more general sense. One of these toys may be opened in two halves and it may have more than one toy inside it. That is the new feature that Vladimir wants to introduce in his new line of toys.

Vladimir has developed a notation to describe how nesting toys should be constructed. A toy is represented with a positive integer, according to its size. More precisely: if when opening the toy represented by  $m$  we find the toys represented by  $n_1, n_2, \dots, n_r$ , it must be true that  $n_1 + n_2 + \dots + n_r < m$ . And if this is the case, we say that toy  $m$  contains directly the toys  $n_1, n_2, \dots, n_r$ . It should be clear that toys that may be contained in any of the toys  $n_1, n_2, \dots, n_r$  are not considered as directly contained in the toy  $m$ .

A generalized matrioshka is denoted with a non-empty sequence of non zero integers of the form:  $a_1 a_2 \dots a_N$  such that toy  $k$  is represented in the sequence with two integers  $-k$  and  $k$ , with the negative one occurring in the sequence first than the positive one.

For example, the sequence

-9 -7 -2 2 -3 -2 -1 1 2 3 7 9

represents a generalized matrioshka conformed by six toys, namely, 1, 2 (twice), 3, 7 and 9.

Note that toy 7 contains directly toys 2 and 3. Note that the first copy of toy 2 occurs left from the second one and that the second copy contains directly a toy 1. It would be wrong to understand that the first -2 and the last 2 should be paired.

On the other hand, the following sequences do not describe generalized matrioshkas:

-9 -7 -2 2 -3 -1 -2 2 1 3 7 9

because toy 2 is bigger than toy 1 and cannot be allocated inside it.

-9 -7 -2 2 -3 -2 -1 1 2 3 7 -2 2 9

because 7 and 2 may not be allocated together inside 9.

## Input

The input file contains several test cases, each one of them in a separate line. Each test case is a sequence of non zero integers, each one with an absolute value less than  $10^7$ .

## Output

Output texts for each input case are presented in the same order that input is read. For each test case the answer must be a line of the form

:-) Matrioshka!

if the design describes a generalized matrioshka. In other case, the answer should be of the form

:- ( Try again.

## Example

### Input :

```
-9 -7 -2 2 -3 -2 -1 1 2 3 7 9
-9 -7 -2 2 -3 -1 -2 2 1 3 7 9
-9 -7 -2 2 -3 -1 -2 3 2 1 7 9
-100 -50 -6 6 50 100
-100 -50 -6 6 45 100
-10 -5 -2 2 5 -4 -3 3 4 10
-9 -5 -2 2 5 -4 -3 3 4 9
```

### Output :

```
:-) Matrioshka!
:- ( Try again.
:- ( Try again.
:-) Matrioshka!
:- ( Try again.
:-) Matrioshka!
:- ( Try again.
```

---

Added by: Camilo Andrés Varela León

Date: 2006-10-24

Time limit: 5s

Source limit:50000B

Languages: All

Resource: XX Colombian National Programming ACM 2006

## SPOJ Problem Set (classical)

### 1000. Equidivisions

#### Problem code: EQDIV

An equidivision of an  $n \times n$  square array of cells is a partition of the  $n^2$  cells in the array in exactly  $n$  sets, each one with  $n$  contiguous cells. Two cells are contiguous when they have a common side.

A good equidivision is composed of contiguous regions. The figures show a good and a wrong equidivision for a  $5 \times 5$  square:

[IMAGE]

Note that in the second example the cells labeled with 4 describe three non-contiguous regions and cells labeled with 5 describe two non-contiguous regions. You must write a program that evaluates if an equidivision of the cells in a square array is good or not.

#### Input

It is understood that a cell in an  $n \times n$  square array is denoted by a pair  $(i, j)$ , with  $1 \leq i, j \leq n$ . The input file contains several test cases. Each test case begins with a line indicating  $n$ ,  $0 < n < 100$ , the side of the square array to be partitioned. Next, there are  $n - 1$  lines, each one corresponding to one partition of the cells of the square, with some non-negative integer numbers.

Consecutive integers in a line are separated with a single blank character. A line of the form

$a_1 a_2 a_3 a_4 \dots$

means that cells denoted with the pairs  $(a_1, a_2)$ ,  $(a_3, a_4)$ , ... belong to one of the areas in the partition. The last area in the partition is defined by those cells not mentioned in the  $n - 1$  given lines. If a case begins with  $n = 0$  it means that there are no more cases to analyze.

#### Output

For each test case good must be printed if the equidivision is good, in other case, wrong must be printed. The answers for the different cases must preserve the order of the input.

#### Example

**Input :**

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

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

**Output :**

wrong  
good  
wrong

---

Added by: Camilo Andrés Varela León

Date: 2006-10-25

Time limit: 3s

Source limit:50000B

Languages: All

Resource: XX Colombian National Programming ACM 2006



## SPOJ Problem Set (classical)

### 1001. Babylonian Roulette

#### Problem code: BROUL

People of Babylon were devoted to chance games and one of the most popular was a special kind of roulette. Recently, some old Babylonian tablets were found. They described details of the roulette game.

In modern terms, the rules of the game were as follows:

- Roulette's compartments had only six labels: -1, -2, -3, 1, 2, 3.
- The game was played by turns, during a day. Turns were numerated 0, 1, 2, ...
- Players could win or lose a multiple of the bet, a quantity of money that was constant along the day.
- At turn  $t$  there was an amount of money  $P_t$ , called the pot.
- At the start, there was an initial amount of money  $P_0$  in the pot.
- $P_0$  and the bet were positive numbers arbitrarily defined by the King.
- In a turn, a player turned the roulette. A player could not play more than once in a day. Depending on the compartment where the ball came to rest, the player won (or lose, if the value was negative) an amount  $w_t = L * \text{bet}$  of money, where  $L$  corresponded to the compartment's label.
- The won money was taken from the pot (or put in it if the player lose), i.e. the value of the pot in a given turn was determined by  $P_{t+1} = P_t + w_t$ .
- If as a result of the last rule  $P_{t+1}$  was a negative number the winner won only the maximum multiple of the bet that he could win without making a negative pot.
- If at some turn the pot was less than the bet, the game was ended for that day. If that was not the case the game continued till sunset.

Beside the tablets that explained the rules some other tablets were found. These had lines with three numbers. Archeologists conjecture that each of these lines were part of a kind of accountability system for the game, where numbers represented, for a given day, the value of the pot at the beginning, the bet and the value of the pot at the end.

For example, a line with the numbers

10000 1500 11500

could mean that there was only one turn where the player won with label 1. Another possibility is that there were three turns with results 2, 1 and -2.

On the other hand, there were found other tablets with triplets of numbers that seem like the above described that, however, cannot represent results of a game day. There is no hypothesis of what they are.

Archeologists want to validate their hypothesis analyzing batches of tablets with triplets. They want to estimate the number of people that played in a day. To begin, they want to establish, for each triplet of numbers in a tablet that could represent a result of a game day, the minimal number of players that

played that day. In the above example the answer to this question is 1. Tablets that cannot represent results should be identified. You are hired to help with this task.

## Input

The input file contains several test cases, each one of them in a separate line. Each test case is a triplet of non negative integers, indicating the initial pot, the bet and the final pot for a day.

Each of the input numbers is less than  $10^8$ . The initial pot and the bet are greater than 0.

A line with a triplet of 0's denotes the end of the input.

## Output

Output texts for each input case are presented in the same order that input is read. For each test case the answer must be a printed line.

If the test case cannot represent the result of a game day, the output line has the words No accounting tablet. In other case, the printed answer is one positive integer number telling the minimal number of players that could turn the roulette for the day corresponding to the annotations.

## Example

### Input :

```
10000 1000 22000
24 13 2
5100 700 200
54 16 158
360 6 72
25 10 5
0 0 0
```

### Output :

```
4
No accounting tablet
3
No accounting tablet
16
1
```

---

Added by: Camilo Andrés Varela León

Date: 2006-10-25

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: XX Colombian National Programming ACM 2006

## SPOJ Problem Set (classical)

### 1002. Uncle Jack

#### Problem code: UJ

Dear Uncle Jack is willing to give away some of his collectable CDs to his nephews. Among the titles you can find very rare albums of Hard Rock, Classical Music, Reggae and much more; each title is considered to be unique. Last week he was listening to one of his favorite songs, Nobody's fool, and realized that it would be prudent to be aware of the many ways he can give away the CDs among some of his nephews.

So far he has not made up his mind about the total amount of CDs and the number of nephews. Indeed, a given nephew may receive no CDs at all.

Please help dear Uncle Jack, given the total number of CDs and the number of nephews, to calculate the number of different ways to distribute the CDs among the nephews.

#### Input

The input consists of several test cases. Each test case is given in a single line of the input by, space separated, integers  $N$  ( $1 \leq N \leq 1000$ ) and  $D$  ( $0 \leq D \leq 2500$ ), corresponding to the number of nephews and the number of CDs respectively. The end of the test cases is indicated with  $N = D = 0$ .

#### Output

The output consists of several lines, one per test case, following the order given by the input. Each line has the number of all possible ways to distribute  $D$  CDs among  $N$  nephews.

#### Example

**Input :**

```
1 20
3 10
0 0
```

**Output :**

```
1
59049
```

---

Added by: Camilo Andrés Varela León

Date: 2006-10-25

Time limit: 1s

Source limit: 512B

Languages: All

Resource: XX Colombian National Programming ACM 2006

## SPOJ Problem Set (classical)

### 1003. Little Quilt

#### Problem code: QUILT

*Little Quilt* is a small language introduced by Ravi Sethi in his book 'Programming Languages'.

Here, a restricted version of Little Quilt is presented. The language is defined by the following BNF grammar:

$\langle \text{QUILT} \rangle ::= A \mid B \mid \text{turn}(\langle \text{QUILT} \rangle) \mid \text{sew}(\langle \text{QUILT} \rangle, \langle \text{QUILT} \rangle)$

A and B represent the two primitive quilts. Each primitive quilt corresponds to a matricial arrangement of  $2 \times 2$  characters. `turn()` and `sew()` are operations over quilts.

The instruction `turn(x)` turns the quilt `x` 90 degrees clockwise. The following table illustrates the primitive quilts as well as examples of the effect of the `turn()` operation:

[IMAGE]

Accordingly, the instruction `sew(x,y)` sews quilt `x` to the left of quilt `y`. Both `x` and `y` must have the same height, otherwise an error will be generated. The following figure represents the result of `sew(A,turn(B))`:

[IMAGE]

while the `sew(turn(sew(B,turn(B))),A)` generates an error message.

Your job is to build an interpreter of the Little Quilt language.

#### Input

The input file will be a text file containing different Little Quilt expressions, each one ended by a semicolon character (;). Space and new line characters must be ignored; this means that an expression may span several lines.

#### Output

The output file contains the quilts produced as a result of interpreting the input expressions.

Each quilt must be preceded by a line, left aligned, with the format

Quilt i:

where `i` is the quilt number, starting at 1. If the expression interpretation generates an error, the word

error

must be printed.

## Example

### Input :

```
sew(turn(sew(B,turn(B))),  
turn(sew(turn(B),B))) ;  
sew(turn(sew(B,turn(B))),A);  
sew(turn(sew(A,turn(A))),  
turn(turn(  
turn(sew(A,turn(A))))))  
;
```

### Output :

```
Quilt 1:  
|--  
|--  
--||  
--||  
Quilt 2:  
error  
Quilt 3:  
\\//  
+\\/+  
+\\/+  
//\\
```

---

Added by: Camilo Andrés Varela León

Date: 2006-10-25

Time limit: 1s-2s

Source limit:50000B

Languages: All

Resource: XX Colombian National Programming ACM 2006

## SPOJ Problem Set (classical)

### 1004. Polygon Encoder

#### Problem code: POLYCODE

Imagine an infinite table with rows and columns numbered using the natural numbers. The following figure shows a procedure to traverse such a table assigning a consecutive natural number to each table cell:

[IMAGE]

This enumeration of cells can be used to represent complex data types using natural numbers:

- A pair of natural numbers  $(i, j)$  is represented by the number corresponding to the cell in row  $i$  and column  $j$ . For instance, the pair  $(3, 2)$  is represented by the natural number 17; this fact is noted by  $P2(3, 2) = 17$ .
- The pair representation can be used to represent  $n$ -tuples. A triplet  $(a, b, c)$  is represented by  $P2(a, P2(b, c))$ . A 4-tuple  $(a, b, c, d)$  is represented by  $P2(a, P2(b, P2(c, d)))$ . This procedure can be generalized for an arbitrary  $n$ :

$$P_n(a_1, \dots, a_n) = P2(a_1, P_{n-1}(a_2, \dots, a_n)),$$

where  $P_n$  denotes the  $n$ -tuple representation function,  $n \geq 2$ . For example  $P3(2, 0, 1) = 12$ .

- A list of arbitrary length  $ha_1, \dots, a_n$  is represented by

$$L(ha_1, \dots, a_n) = P2(n, P_n(a_1, \dots, a_n)).$$

For example,  $L(h0, 1i) = 12$ .

The Association of Convex Makers (ACM) uses this clever enumeration scheme in a polygon representation system. The system can represent a polygon, defined by integer coordinates, using a natural number as follows: given a polygon defined by a vertex sequence  $h(x_1, y_1), \dots, (x_n, y_n)i$  assign the natural number:

$$L((hP2(x_1, y_1), \dots, P2(x_n, y_n))).$$

ACM needs a program that, given a natural numbers that represents a polygon, calculates the area of the polygon. It is guaranteed that the given polygon is a simple one, i.e. its sides do not intersect.

As an example of the problem, the triangle with vertices at  $(1,1)$ ,  $(2,0)$  and  $(0,0)$  is codified with the number 2141. The area of this triangle is 1.

### Input

The input consists of several test cases. Each test case is given in a single line of the input by a natural number representing a polygon. The end of the test cases is indicated with \*.

## Output

One line per test case, preserving the input order. Each output line contains a decimal number telling the area of the corresponding encoded polygon. Areas must be printed with 1 decimal place, truncating less significative decimal places.

## Example

### Input :

```
2141
206
157895330
*
```

### Output :

```
1.0
0.5
1.0
```

---

Added by: Camilo Andrés Varela León

Date: 2006-10-25

Time limit: 5s

Source limit:50000B

Languages: All

Resource: XX Colombian National Programming ACM 2006

## SPOJ Problem Set (classical)

### 1021. Aibohphobia

#### Problem code: AIBOHP

BuggyD suffers from AIBOHPHOBIA - the fear of Palindromes. A palindrome is a string that reads the same forward and backward.

To cure him of this fatal disease, doctors from all over the world discussed his fear and decided to expose him to large number of palindromes. To do this, they decided to play a game with BuggyD. The rules of the game are as follows:

BuggyD has to supply a string **S**. The doctors have to add or insert characters to the string to make it a palindrome. Characters can be inserted anywhere in the string.

The doctors took this game very lightly and just appended the reverse of **S** to the end of **S**, thus making it a palindrome. For example, if **S** = "ff~~t~~", the doctors change the string to "ff~~t~~ttff".

Nowadays, BuggyD is cured of the disease (having been exposed to a large number of palindromes), but he still wants to continue the game by his rules. He now asks the doctors to insert the minimum number of characters needed to make **S** a palindrome. Help the doctors accomplish this task.

For instance, if **S** = "ff~~t~~", the doctors should change the string to "tff~~t~~", adding only 1 character.

#### Input

The first line of the input contains an integer **t**, the number of test cases. **t** test cases follow.

Each test case consists of one line, the string **S**. The length of **S** will be no more than 6100 characters, and **S** will contain no whitespace characters.

#### Output

For each test case output one line containing a single integer denoting the minimum number of characters that must be inserted into **S** to make it a palindrome.

#### Example

Input :

1  
ff~~t~~

Output :

1

---



Added by: Matthew Reeder  
Date: 2006-10-29  
Time limit: 8s  
Source limit: 30000B  
Languages: All  
Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1022. Angels and Devils

#### Problem code: ANGELS

It's the year 21546 AD, and due to increased population (you wouldn't believe me if I gave you the actual numbers), land has become very expensive. Because of the lack of space, Heaven and Hell were built in the same area. The area can be represented as a grid of  $X \times Y$  unit squares. Some of the squares were captured by the Devil (and thus belong to Hell) and the rest is the Almighty's property. On each square, a room has been built with transparent glass walls. However, some of the heavenly rooms are already occupied by Angels. For security purposes, rooms occupied by Angels have concrete opaque walls.

Recently many fighters were killed in a tournament. Fighting is no longer considered cruel, so all the fighters will deserve spots in heaven. However, because of the space shortage, all of them may not be able to receive a spot in heaven. The fighters still hold a grudge against each other so a fighter cannot be placed in a room from which he can see any other fighter. A fighter can only see in the four cardinal directions (North, South, East and West). He cannot look diagonally or in any other direction.

Find the maximum number of fighters who can have a heavenly room.

#### Input

The first line of the input contains an integer  $t$ , the number of test cases.  $t$  test cases follow.

The first line of each test case consists of two integers  $X \leq 300$  and  $Y \leq 300$ , separated by a single space. Next,  $X$  lines follow, each having  $Y$  letters separated by spaces. The  $j$ th letter on the  $i$ -th line is one of the following (quotes are for clarity, and do not appear in the input):

1. "H", if the room at location  $(i, j)$  is heavenly and vacant.
2. "A", if the room at location  $(i, j)$  is heavenly and is already occupied by an angel. Note that these rooms are not transparent.
3. "D", if the room at location  $(i, j)$  belongs to the Devil.

#### Output

A single line for each test case containing an integer denoting the maximum number of fighters that can fit in heaven.

#### Example

Input :

```
1
4 7
H H H H H H H
H H H H H H H
H H H H H H H
```

H H H H H H H

**Output :**

4

---

Added by: Matthew Reeder

Date: 2006-10-29

Time limit: 7s

Source limit:30000B

Languages: All

Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1024. Complete Chess Boards

#### Problem code: COMCB

BuggyD has always been fascinated with chess boards (though he really sucks at chess). He makes an observation that a chess board is complete with respect to knights and rooks and incomplete with respect to bishops (unless the dimensions are  $1 \times 1$ ). A complete chess board is one in which it is possible to traverse all the squares starting from one possible square. Knights have always been his favourite pieces and he has decided to analyze completeness with respect to knights. Given the dimensions of the chess board help BuggyD find the lexicographically first path that visits all squares of a chess board with a knight.

Each square must be traversed only once. Note that a knight can only move two squares in one direction and one square perpendicular to the previous direction.

#### Input

The first line of the input contains an integer **t**, the number of test cases. **t** test cases follow.

Each test case consists of a single line containing two integers (**X** and **Y**) separated by a single space, specifying the dimensions of the chess board. The numbers 1 to **X** denote rows and the capital letters A to Y denote the columns. Each square is represented by its column index followed by its row index - for example, B4 denotes the square in the 4th row and 2nd column.

The total number of squares on the chess board will be no more than 26.

#### Output

For each test case output one line consisting of the lexicographically first path of the knight, or "-1" (quotes for clarity) if the chess board is incomplete with respect to a knight.

#### Example

**Input :**

```
1
4 5
```

**Output :**

```
A1B3C1A2B4D3E1C2D4E2C3A4B2D1E3C4A3B1D2E4
```

---

Added by: Matthew Reeder

Date: 2006-10-29

Time limit: 3s

Source limit: 30000B

Languages: All

Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1025. Fashion Shows

#### Problem code: FASHION

A fashion show rates participants according to their level of hotness. Two different fashion shows were organized, one for men and the other for women. A date for the third is yet to be decided ;).

Now the results of both fashion shows are out. The participants of both the fashion shows have decided to date each other, but as usual they have difficulty in choosing their partners. The Maximum Match dating service (MMDS) comes to their rescue and matches them in such a way that that maximizes the hotness bonds for all couples.

If a man has been rated at hotness level  $x$  and a woman at hotness level  $y$ , the value of their hotness bond is  $x*y$ .

Both fashion shows contain  $N$  participants each. MMDS has done its job and your job is to find the sum of hotness bonds for all the couples that MMDS has proposed.

#### Input

The first line of the input contains an integer  $t$ , the number of test cases.  $t$  test cases follow.

Each test case consists of 3 lines:

- The first line contains a single integer  $N$  ( $1 \leq N \leq 1000$ ).
- The second line contains  $N$  integers separated by single spaces denoting the hotness levels of the men.
- The third line contains  $N$  integers separated by single spaces denoting the hotness levels of the women.

All hotness ratings are on a scale of 0 to 10.

#### Output

For each test case output a single line containing a single integer denoting the sum of the hotness bonds for all pairs that MMDS has proposed.

#### Example

**Input :**

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

**Output :**

5

15

---

Added by: Matthew Reeder

Date: 2006-10-29

Time limit: 2s

Source limit:30000B

Languages: All

Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1026. Favorite Dice

#### Problem code: FAVDICE

BuggyD loves to carry his favorite die around. Perhaps you wonder why it's his favorite? Well, his die is magical and can be transformed into an  $N$ -sided unbiased die with the push of a button. Now BuggyD wants to learn more about his die, so he raises a question:

What is the expected number of throws of his die while it has  $N$  sides so that each number is rolled at least once?

#### Input

The first line of the input contains an integer  $t$ , the number of test cases.  $t$  test cases follow.

Each test case consists of a single line containing a single integer  $N$  ( $1 \leq N \leq 1000$ ) - the number of sides on BuggyD's die.

#### Output

For each test case, print one line containing the expected number of times BuggyD needs to throw his  $N$ -sided die so that each number appears at least once. The expected number must be accurate to 2 decimal digits.

#### Example

**Input :**

2  
1  
12

**Output :**

1.00  
37.24

---

Added by: Matthew Reeder  
Date: 2006-10-29  
Time limit: 2s  
Source limit: 30000B  
Languages: All  
Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1027. Fool the Police

#### Problem code: FPOLICE

Dhamaka Singh (a crook) has just robbed a bank and would like to get out of the country as soon as possible. But there is a slight problem, the police! On his way out of the country he has to pass through some police stations. Each police station has a certain risk (for Dhamaka Singh) associated with it. He wants to get to the airport within a certain time **T** or else he'll miss his flight. He also wants to take a path that minimizes the total risk associated with it. Help Dhamaka Singh get out of the country.

#### Input

The first line of the input contains an integer **t**, the number of test cases. **t** test cases follow.

The first line of each test case contains 2 integers **N** ( $3 \leq N \leq 100$ ) and **T** ( $1 \leq T \leq 250$ ), denoting the number of police stations and the total time he has to reach the airport, respectively.

Dhamaka Singh has to start from the first police station and reach the **N<sup>th</sup>** one (the airport is just after the **N<sup>th</sup>** police station). You can consider the time taken between the **N<sup>th</sup>** police station and the airport to be negligible.

Next there are **N** lines with **N** numbers in each line, separated by single spaces. All numbers are separated by a single space. The **j<sup>th</sup>** integer in the **i<sup>th</sup>** line represents the time taken to reach the **j<sup>th</sup>** police station from the **i<sup>th</sup>** police station.

Next there are another **N** lines with **N** numbers in each line. All numbers are separated by a single space. The **j<sup>th</sup>** integer in the **i<sup>th</sup>** line represents the risk involved in travelling to the **j<sup>th</sup>** police station from the **i<sup>th</sup>** police station.

#### Output

For each test case output one line containing 2 integers separated by a single space.

The first integer denotes the minimum total risk to reach the airport. The second integer denotes the minimum time required to reach the airport at the minimum total risk.

If it is impossible to reach the airport within time **T** (inclusive), just print "-1" (quotes for clarity).

#### Example

Input :

```
1
4 10
0 6 2 3
6 0 2 3
3 1 0 2
3 3 2 0
0 2 2 7
2 0 1 2
```



2 2 0 5  
7 2 5 0

**Output :**  
4 9

---

Added by: Matthew Reeder  
Date: 2006-10-29  
Time limit: 3s  
Source limit:30000B  
Languages: All  
Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1028. Hubulullu

#### Problem code: HUBULLU

After duelling in quake (a multiplayer game), Airborne and Pagfloyd decide to test themselves out in another game called Hubulullu. The rules of the game are as follows:

$N$  wooden pieces (marked with numbers 1 to  $N$ ) are placed in a transparent bottle. On his turn the first player takes out some piece (numbered  $x$ ) and all the pieces numbered by divisors of  $x$  that are present in the transparent bottle. The second player picks another number and removes it and its divisors as well. Play continues in an alternating fashion until all pieces have been removed from the bottle. The player who removes the last piece from the bottle wins the game.

Both players play optimally. Given  $N$  (the number of wooden pieces in the transparent bottle initially) and the name of the player who starts the game, determine the winner.

#### Input

The first line of the input contains an integer  $t$ , the number of test cases.  $t$  test cases follow.

Each test case consists of a single line containing two integers separated by a single space. The first integer is  $N$  ( $1 \leq N \leq 2000000000$ ), indicating the number of pieces, and the second integer indicates the player who starts - "0" means Airborne starts the game and "1" means Pagfloyd starts the game (quotes for clarity).

#### Output

For each test case output one line containing either "Airborne wins." or "Pagfloyd wins."

For each  $N$ , it's possible to determine a winner if both players play optimally.

#### Example

**Input :**

```
1
1 0
```

**Output :**

```
Airborne wins.
```

---

Added by: Matthew Reeder

Date: 2006-10-29

Time limit: 7s

Source limit: 30000B

Languages: All

Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1029. Matrix Summation

#### Problem code: MATSUM

A  $N \times N$  matrix is filled with numbers. BuggyD is analyzing the matrix, and he wants the sum of certain submatrices every now and then, so he wants a system where he can get his results from a query. Also, the matrix is dynamic, and the value of any cell can be changed with a command in such a system.

Assume that initially, all the cells of the matrix are filled with 0. Design such a system for BuggyD. Read the input format for further details.

#### Input

The first line of the input contains an integer  $t$ , the number of test cases.  $t$  test cases follow.

The first line of each test case contains a single integer  $N$  ( $1 \leq N \leq 1024$ ), denoting the size of the matrix.

A list of commands follows, which will be in one of the following three formats (quotes are for clarity):

1. "SET  $x$   $y$   $num$ " - Set the value at cell  $(x, y)$  to  $num$  ( $0 \leq x, y < N$ ).
2. "SUM  $x_1$   $y_1$   $x_2$   $y_2$ " - Find and print the sum of the values in the rectangle from  $(x_1, y_1)$  to  $(x_2, y_2)$ , inclusive. You may assume that  $x_1 \leq x_2$  and  $y_1 \leq y_2$ , and that the result will fit in a signed 32-bit integer.
3. "END" - Indicates the end of the test case.

#### Output

For each test case, output one line for the answer to each "SUM" command. Print a blank line after each test case.

#### Example

**Input :**

```
1
4
SET 0 0 1
SUM 0 0 3 3
SET 2 2 12
SUM 2 2 2 2
SUM 2 2 3 3
SUM 0 0 2 2
END
```

**Output :**

1  
12  
12  
13

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Matthew Reeder  
Date: 2006-10-29  
Time limit: 7s  
Source limit: 30000B  
Languages: All  
Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1030. Triple Fat Ladies

#### Problem code: EIGHTS

Pattern Matchers have been designed for various sorts of patterns. Mr. HKP likes to observe patterns in numbers. After completing his extensive research on the squares of numbers, he has moved on to cubes. Now he wants to know all numbers whose cube ends in 888.

Given a number  $k$ , help Mr. HKP find the  $k^{\text{th}}$  number (indexed from 1) whose cube ends in 888.

#### Input

The first line of the input contains an integer  $t$ , the number of test cases.  $t$  test cases follow.

Each test case consists of a single line containing a single integer  $k$  ( $1 \leq k \leq 2000000000000$ ).

#### Output

For each test case, output a single integer which denotes the  $k^{\text{th}}$  number whose cube ends in 888. The result will be less than  $2^{63}$ .

#### Example

**Input :**

1  
1

**Output :**

192

---

Added by: Matthew Reeder

Date: 2006-10-30

Time limit: 5s

Source limit: 30000B

Languages: All

Resource: Al-Khwarizm 2006

## SPOJ Problem Set (classical)

### 1031. Up Subsequence

#### Problem code: UPSUB

If  $x = a_0 a_1 a_2 \dots a_{n-1}$  is a string where  $a_i$  denotes the character at index  $i$ , a subsequence  $a_{j_0} a_{j_1} a_{j_2} \dots a_{j_n}$  is called an upsubsequence if  $a_{j_0} \leq a_{j_1} \leq a_{j_2} \leq \dots \leq a_{j_n}$  and  $j_0 < j_1 < j_2 < \dots < j_n$ .

A maximal upsubsequence of a string is defined as the upsubsequence of maximum length. BuggyD observes that a string  $x$  can have many maximal upsubsequences. Help him find all the maximal upsubsequences in  $x$ .

#### Input

The first line of the input contains an integer  $t$ , the number of test cases.  $t$  test cases follow.

Each test case consists of a single line containing a string  $x$ , where the length of  $x$  is no more than 100.  $x$  will not contain any spaces, tabs or other whitespace characters.

#### Output

For each test case, output all of the maximal upsubsequences of  $x$  in lexicographical order. Print a blank line after each test case.

#### Example

**Input :**

```
1
abcbcbcd
```

**Output :**

```
abbbcd
abbccd
abcccd
```

---

Added by: Matthew Reeder

Date: 2006-10-30

Time limit: 3s

Source limit: 30000B

Languages: All

Resource: Al-Khawarizm 2006

## SPOJ Problem Set (classical)

### 1043. Can you answer these queries I

#### Problem code: GSS1

You are given a sequence  $A[1], A[2], \dots, A[N]$  . (  $|A[i]| \leq 15007$  ,  $1 \leq N \leq 50000$  ). A query is defined as follows:

Query(x,y) =  $\text{Max} \{ a[i]+a[i+1]+\dots+a[j] ; x \leq i \leq j \leq y \}$ .

Given M queries, your program must output the results of these queries.

#### Input

- The first line of the input file contains the integer N.
  - In the second line, N numbers follow.
  - The third line contains the integer M.
- M lines follow, where line i contains 2 numbers  $x_i$  and  $y_i$ .

#### Output

Your program should output the results of the M queries, one query per line.

#### Example

**Input :**

3

-1 2 3

1

1 2

**Output :**

2

---

Added by: Nguyen Dinh Tu

Date: 2006-11-01

Time limit: 1s-2s

Source limit:5000B

Languages: All

## SPOJ Problem Set (classical)

### 1108. Card Trick

#### Problem code: CTRICK

The magician shuffles a small pack of cards, holds it face down and performs the following procedure:

1. The top card is moved to the bottom of the pack. The new top card is dealt face up onto the table. It is the Ace of Spades.
2. Two cards are moved one at a time from the top to the bottom. The next card is dealt face up onto the table. It is the Two of Spades.
3. Three cards are moved one at a time...
4. This goes on until the  $n$ th and last card turns out to be the  $n$  of Spades.

This impressive trick works if the magician knows how to arrange the cards beforehand (and knows how to give a false shuffle). Your program has to determine the initial order of the cards for a given number of cards,  $1 \leq n \leq 20000$ .

#### Input

On the first line of the input is a single positive integer, telling the number of test cases to follow. Each case consists of one line containing the integer  $n$ .

#### Output

For each test case, output a line with the correct permutation of the values 1 to  $n$ , space separated. The first number showing the top card of the pack, etc...

#### Example

**Input :**

2  
4  
5

**Output :**

2 1 4 3  
3 1 4 5 2

---

Added by: Camilo Andrés Varela León  
Date: 2006-11-23  
Time limit: 11s  
Source limit: 50000B  
Languages: All  
Resource: Nordic Collegiate Contest 2006



## SPOJ Problem Set (classical)

### 1110. Sudoku

#### Problem code: SUDOKU

A Sudoku grid is a 16x16 grid of cells grouped in sixteen 4x4 squares, where some cells are filled with letters from A to P (the first 16 capital letters of the English alphabet), as shown in the figure. The game is to fill all the empty grid cells with letters from A to P such that each letter from the grid occurs once only in the line, the column, and the 4x4 square it occupies. The initial content of the grid satisfies the constraints mentioned above and guarantees a unique solution.

		A					C						O		I
	J			A		B		P		C	G	F		H	
		D			F		I		E					P	
	G		E	L		H					M		J		
				E					C			G			
	I			K		G	A		B				E		J
D		G	P			J		F					A		
	E				C		B			D	P			O	
E			F		M			D			L		K		A
	C									O		I		L	
H		P		C			F		A			B			
			G		O	D				J					H
K				J					H		A		P		L
		B			P			E			K			A	
	H			B			K			F	I		C		
		F				C			D			H		N	

a) Sudoku grid

F	P	A	H	M	J	E	C	N	L	B	D	K	O	G	I
O	J	M	I	A	N	B	D	P	K	C	G	F	L	H	E
L	N	D	K	G	F	O	I	J	E	A	H	M	B	P	C
B	G	C	E	L	K	H	P	O	F	I	M	A	J	D	N
M	F	H	B	E	L	P	O	A	C	K	J	G	N	I	D
C	I	L	N	K	D	G	A	H	B	M	O	P	E	F	J
D	O	G	P	I	H	J	M	F	N	L	E	C	A	K	B
J	E	K	A	F	C	N	B	G	I	D	P	L	H	O	M
E	B	O	F	P	M	I	J	D	G	H	L	N	K	C	A
N	C	J	D	H	B	A	E	K	M	O	F	I	G	L	P
H	M	P	L	C	G	K	F	I	A	E	N	B	D	J	O
A	K	I	G	N	O	D	L	B	P	J	C	E	F	M	H
K	D	E	M	J	I	F	N	C	H	G	A	O	P	B	L
G	L	B	C	D	P	M	H	E	O	N	K	J	I	A	F
P	H	N	O	B	A	L	K	M	J	F	I	D	C	E	G
I	A	F	J	O	E	C	G	L	D	P	B	H	M	N	K

b) Solution

## Input

The first line of the input contains an integer  $K$  - determining the number of datasets ( $K \leq 10$ ). Each data set encodes a grid and contains 16 strings on 16 consecutive lines as shown in the example input below. The  $i$ th string stands for the  $i$ th line of the grid, is 16 characters long, and starts from the first position of the line. String characters are from the set  $\{A, B, \dots, P, -\}$ , where  $-$  (minus) designates empty grid cells. The data sets are separated by single empty lines.

## Output

For each data set in the input print the completed  $16 \times 16$  Sudoku as specified by the rules above. The program prints the solution of the input encoded grids in the same format and order as used for input. The output for each data set should be separated by single empty lines.

## Example

Input :

```

1
--A----C-----O-I
-J--A-B-P-CGF-H-
--D--F-I-E----P-

```

```

-G-EL-H----M-J--
----E----C--G---
-I--K-GA-B---E-J
D-GP--J-F-----A--
-E---C-B--DP--O-
E--F-M--D--L-K-A
-C-----O-I-L-
H-P-C--F-A--B---
---G-OD---J-----H
K---J-----H-A-P-L
--B--P--E--K--A-
-H--B--K--FI-C--
--F---C--D--H-N-

```

**Output :**

```

FPAHMJECNLBDKOGI
OJMIANBDPKCGFLHE
LNDKGFOIJEAHMBPC
BGCELKHPOFIMAJDN
MFHBELPOACKJGNID
CILNKDGAHBMOPEFJ
DOGP I HJMFNLECAKB
JEKAF CNBGIDPLHOM
EBOFFMIJDGHLNKCA
NCJDHBAEKMOFIGLP
HMPLCGKFIAENBDJO
AKIGNODLBPJCEFMH
KDEMJIFNCHGAOPBL
GLBCDPMHEONKJIAF
PHNOBALKMJFIDCEG
IAFJOECGLDPBHMNK

```

---

Added by: P.Kasthuri Rangan-

Date: 2006-11-24

Time limit: 7s

Source limit:50000B

Languages: All

Resource: ACM Southeastern European Regional Programming Contest - 2006

## SPOJ Problem Set (classical)

### 1161. Tic-Tac-Toe ( I )

#### Problem code: TOE1

Tic Tac Toe is a child's game played on a 3 by 3 grid. One player, X, starts by placing an X at an unoccupied grid position. Then the other player, O, places an O at an unoccupied grid position. Play alternates between X and O until the grid is filled or one player's symbols occupy an entire line (vertical, horizontal, or diagonal) in the grid.

We will denote the initial empty Tic Tac Toe grid with nine dots. Whenever X or O plays we fill in an X or an O in the appropriate position. The example below illustrates each grid configuration from the beginning to the end of a game in which X wins.

[IMAGE]

Your job is to read a grid and to determine whether or not it could possibly be part of a valid Tic Tac Toe game. That is, is there a series of plays that can yield this grid somewhere between the start and end of the game?

#### Input

The first line of input contains N, the number of test cases. 4N-1 lines follow, specifying N grid configurations separated by empty lines.

#### Output

For each case print "yes" or "no" on a line by itself, indicating whether or not the configuration could be part of a Tic Tac Toe game.

#### Example

**Input :**

```
2
X.O
OO.
XXX
```

```
O.X
XX.
OOO
```

**Output :**

```
yes
no
```

---

Added by: Camilo Andrés Varela León  
Date: 2006-12-14  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Waterloo local 2002.09.21

## SPOJ Problem Set (classical)

### 1162. Tic-Tac-Toe ( II )

#### Problem code: TOE2

In the game of tic-tac-toe, two players take turns marking squares of an initially empty  $3 \times 3$  grid with either X's or O's. The first player always marks squares using X's, whereas the second player always marks squares using O's. If at any point during the game either player manages to mark three consecutive squares in a row, column, or diagonal with his/her symbol, the game terminates.

Given a board configuration, your goal is to determine whether the board configuration represents the possible final state of a valid tic-tac-toe game.

#### Input

The input test file will contain multiple cases. Each test case consists of a single line containing 9 characters, which represent the 9 squares of a tic-tac-toe grid, given one row at a time. Each character on the line will either be 'X', 'O' (the letter O), or '.' (indicating an unfilled square). The end-of-file is marked by a single line containing the word "end".

#### Output

For each input test case, write a single line containing either the word "valid" or "invalid" indicating whether the given board configuration is the final state of some possible tic-tac-toe game.

#### Example

**Input :**

```
XXXOO.XXX
XOXOXOXOX
OXOXOXOXO
XXOOOXXOX
XO.OX...X
.XXX.XOOO
OOXXXOOXO
end
```

**Output :**

```
invalid
valid
invalid
valid
valid
invalid
invalid
```

---

Added by: Camilo Andrés Varela León  
Date: 2006-12-14  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Stanford Local 2006

## SPOJ Problem Set (classical)

### 1163. Java vs C ++

#### Problem code: JAVAC

Apologists of Java and C++ can argue for hours proving each other that their programming language is the best one. Java people will tell that their programs are clearer and less prone to errors, while C++ people will laugh at their inability to instantiate an array of generics or tell them that their programs are slow and have long source code.

Another issue that Java and C++ people could never agree on is identifier naming. In Java a multiword identifier is constructed in the following manner: the first word is written starting from the small letter, and the following ones are written starting from the capital letter, no separators are used. All other letters are small. Examples of a Java identifier are `javaIdentifier`, `longAndMnemonicIdentifier`, `name`, `nEERC`.

Unlike them, C++ people use only small letters in their identifiers. To separate words they use underscore character `'_'`. Examples of C++ identifiers are `c_identifier`, `long_and_mnemonic_identifier`, `name` (you see that when there is just one word Java and C++ people agree), `n_e_e_r_c`.

You are writing a translator that is intended to translate C++ programs to Java and vice versa. Of course, identifiers in the translated program must be formatted due to its language rules -- otherwise people will never like your translator.

The first thing you would like to write is an identifier translation routine. Given an identifier, it would detect whether it is Java identifier or C++ identifier and translate it to another dialect. If it is neither, then your routine should report an error. Translation must preserve the order of words and must only change the case of letters and/or add/remove underscores.

#### Input

The input file consists of several lines that contains an identifier. It consists of letters of the English alphabet and underscores. Its length does not exceed 100.

#### Output

If the input identifier is Java identifier, output its C++ version. If it is C++ identifier, output its Java version. If it is none, output 'Error!' instead.

#### Example

**Input :**

```
long_and_mnemonic_identifier
anotherExample
i
bad_Style
```

**Output :**



```
longAndMnemonicIdentifier  
another_example  
i  
Error!
```

---

Added by: Camilo Andrés Varela León  
Date: 2006-12-14  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: Northeastern Europe 2006

## SPOJ Problem Set (classical)

### 1166. Dead Fraction

#### Problem code: DEADFR

Mike is frantically scrambling to finish his thesis at the last minute. He needs to assemble all his research notes into vaguely coherent form in the next 3 days. Unfortunately, he notices that he had been extremely sloppy in his calculations. Whenever he needed to perform arithmetic, he just plugged it into a calculator and scribbled down as much of the answer as he felt was relevant. Whenever a repeating fraction was displayed, Mike simply recorded the first few digits followed by "...". For instance, instead of  $1/3$  he might have written down "0.3333...". Unfortunately, his results require exact fractions! He doesn't have time to redo every calculation, so he needs you to write a program (and FAST!) to automatically deduce the original fractions.

To make this tenable, he assumes that the original fraction is always the simplest one that produces the given sequence of digits; by simplest, he means the one with smallest denominator. Also, he assumes that he did not neglect to write down important digits; no digit from the repeating portion of the decimal expansion was left unrecorded (even if this repeating portion was all zeroes).

#### Input

There are several test cases. For each test case there is one line of input of the form "0.dddd..." where dddd is a string of 1 to 18 digits, not all zero. A line containing 0 follows the last case.

#### Output

For each case, output the original fraction.

#### Example

**Input :**

```
0.2...
0.20...
0.474612399...
0
```

**Output :**

```
2/9
1/5
1186531/2500000
```

---

Added by: Camilo Andrés Varela León

Date: 2006-12-16

Time limit: 4s

Source limit: 50000B

Languages: All

Resource: Waterloo Local Contest Sep. 27, 2003

## SPOJ Problem Set (classical)

### 1167. Move To Invert

#### Problem code: MINCOUNT

A triangle made of coins of height  $h$  is as follows

It has  $h$  coins at the base and  $h-1$  coins one level above base and so on. (Coins are placed as shown in the figure below)

And at the top most level there will be only one coin

Now given  $h$  the task is to invert this triangle by moving minimum number of coins. For example when  $h=4$  triangle is

Invert

> For  $h=4$  at least 3 coins must be moved to invert it.

#### Input<h3>

In the first line  $N$  will be given and then  $N$  lines follow with each line having a integer which is the height of triangle in that test case.  $0 \leq h < 10^{10}$ ;

#### Output

For each test case output in a separate line the minimum number of moves required to invert the triangle. Output fits in long long data type

#### Example

Input :

1  
3

Output :

2

---

Added by: Abhilash I

Date: 2006-12-16

Time limit: 1s

Source  
limit: 50000B

Languages: All

Resource: IIIT Hyderabad Local Programming  
Contest

## SPOJ Problem Set (classical)

### 1182. Sorted bit sequence

#### Problem code: SORTBIT

Let's consider the 32 bit representation of all integers  $i$  from  $m$  up to  $n$  inclusive ( $m \leq i \leq n$ ;  $m \times n \geq 0$ ,  $-2^{31} \leq m \leq n \leq 2^{31}-1$ ). Note that a negative number is represented in 32 bit Additional Code. That is the 32 bit sequence, the binary sum of which and the 32 bit representation of the corresponding positive number is  $2^{32}$  (1 0000 0000 0000 0000 0000 0000 0000 0000 in binary).

For example, the 32 bit representation of 6 is 0000 0000 0000 0000 0000 0000 0000 0110

and the 32 bit representation of -6 is 1111 1111 1111 1111 1111 1111 1111 1010

because

$$\begin{array}{r} 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0110\ (6) \\ + \\ 1111\ 1111\ 1111\ 1111\ 1111\ 1111\ 1111\ 1010\ (-6) \\ \hline = 1\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ (2^{32}) \end{array}$$

Let's sort the 32 bit representations of these numbers in increasing order of the number of bit 1. If two 32 bit representations that have the same number of bit 1, they are sorted in lexicographical order.

For example, with  $m = 0$  and  $n = 5$ , the result of the sorting will be

No.	Decimal number	Binary 32 bit representation
1	0	0000 0000 0000 0000 0000 0000 0000 0000
2	1	0000 0000 0000 0000 0000 0000 0000 0001
3	2	0000 0000 0000 0000 0000 0000 0000 0010
4	4	0000 0000 0000 0000 0000 0000 0000 0100
5	3	0000 0000 0000 0000 0000 0000 0000 0011
6	5	0000 0000 0000 0000 0000 0000 0000 0101

with  $m = -5$  and  $n = -2$ , the result of the sorting will be

No.	Decimal number	Binary 32 bit representation
1	-4	1111 1111 1111 1111 1111 1111 1111 1100
2	-5	1111 1111 1111 1111 1111 1111 1111 1011
3	-3	1111 1111 1111 1111 1111 1111 1111 1101
4	-2	1111 1111 1111 1111 1111 1111 1111 1110

Given  $m$ ,  $n$  and  $k$  ( $1 \leq k \leq \min\{n - m + 1, 2\ 147\ 473\ 547\}$ ), your task is to write a program to find a number corresponding to  $k$ -th representation in the sorted sequence.

## Input

The input consists of several data sets. The first line of the input file contains the number of data sets which is a positive integer and is not bigger than 1000. The following lines describe the data sets.

For each data set, the only line contains 3 integers m, n and k separated by space.

## Output

For each data set, write in one line the k-th number of the sorted numbers.

## Example

**Sample input:**

```
2
0 5 3
-5 -2 2
```

**Sample output:**

```
2
-5
```

---

Added by: Le Đôn Khue

Date: 2006-12-28

Time limit: 20s

Source limit: 50000B

Languages: All

Resource: ACM ICPC 2006, Asia Regional Contest, site Hanoi

## SPOJ Problem Set (classical)

### 1183. Accomodate the palace

#### Problem code: PALACE

There is a big palace in which rooms are constructed in the form of a square matrix. Now these rooms have to be filled with people.

As there are conflicts between people to maintain the equilibrium total number of people must be odd in every row and every column.

A room can accommodate only a single person.

Given the size of palace N one has to find total number of ways people can be accommodated in that.

#### Input

First line consists of an integer K and then K test cases follow.

#### Output

For each test case you have to output the result in a separate line.

#### Example

Input :

1

3

Output :

16

---

Added by: Abhilash I

Date: 2006-12-30

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: IIIT Hyderabad Local Programming Contest

## SPOJ Problem Set (classical)

### 1267. Origin of Life

#### Problem code: ORIGLIFE

Conway's *Game of Life* is not really a game, but a *cellular automaton* -- a set of rules describing interactions among adjacent cells on a grid. In our game, we have an  $n$  by  $m$  rectangular grid of cells identified by integer coordinates  $(x, y)$ . The game progresses through a series of steps; at each step a new *generation* is computed from the current *generation*. The game begins with the *first generation*. In any given generation, which we shall call the current generation, each cell is either *live* or *dead*. In the next generation, each cell's status may change, depending on the status of its immediate neighbours in the current generation. Two distinct cells  $(x_1, y_1)$  and  $(x_2, y_2)$  are immediate neighbours if they are horizontally, vertically, or diagonally adjacent; that is, if  $|x_1 - x_2| \leq 1$  and  $|y_1 - y_2| \leq 1$ . Each cell that is not on the border of the grid has eight immediate neighbours. There are three integer parameters  $(a, b, c)$  which affect the game. The rules of the game are:

- If a live cell has fewer than  $a$  live neighbours in the current generation it dies of loneliness. That is, it is dead in the next generation.
- If a live cell has more than  $b$  live neighbours in the current generation it dies of overcrowding. That is, it is dead in the next generation.
- If a dead cell has more than  $c$  live neighbours in the current generation it is born. That is, it is live in the next generation.
- Otherwise, a cell's status is unchanged from the current generation to the next.

This process continues indefinitely. Eventually, a generation may be repeated in which case life goes on forever. Or all the cells may die. Similarly, if we explore previous generations that may have led to the current one, we may find one that is necessarily a first generation; that is, it could not have been created from a previous generation by following the rules. Such a generation is known as a Garden of Eden. Given the game parameters and the current generation, you are to determine whether or not the game might have started with a Garden of Eden. If so, output the number of steps necessary to reach the current generation from the Garden of Eden. If there are several possible answers, find the smallest. If there is none, output -1.

#### Input

Input begins with a single integer, the number of test cases. For each test case, there are  $m+1$  lines of input in total. The first line contains the game parameters, which are five integers  $m, n, a, b, c$  each separated by one space. The constraints are  $1 \leq m \leq 4$ ,  $1 \leq n \leq 5$ ,  $1 \leq a < b \leq 8$ ,  $1 \leq c \leq 8$ . The next  $m$  lines each contain a string of  $n$  characters representing a row of the current generation. In the string, an asterisk ("\*") indicates live while a period (".") indicates dead. There are no blank lines between test cases.

## Output

Output is one integer per test case denoting the minimum number of steps required to reach the input from a Garden of Eden. If there is no Garden of Eden, output -1.

## Example

**Input :**

```
1
4 5 2 3 2
. ****
. ****
. ****
. ****
. ****
```

**Output :**

```
2
```

**Output Explanation:**

Assume the sample input is the "current" generation. A possible previous generation is

```
** . **
. . * . *
. . . . *
*****
```

The above generation can be derived from the following previous generation

```
. ****
** . * .
*****
* . . * .
```

This generation cannot be derived from any other generation. Furthermore, there is no shorter series of generations that has these properties.

---

Added by: Bobby Xiao

Date: 2007-01-24

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: Canadian Computing Competition, 2006 Senior Stage 1



## SPOJ Problem Set (classical)

### 1268. CN Tower (Easy)

#### Problem code: CNEASY

Christy C. Coder is traveling to Waterloo for a programming competition. On the way, she stops in Toronto to do some sightseeing. The unfortunate thing about travelling is that everyone back home expects her to bring back pictures of everything. Christy hates taking pictures: it makes her look like such a tourist! Fortunately, Christy has a plan to make her picture-taking quite painless.

At 553 m tall, CN Tower is the world's tallest free-standing building. 351 m up the tower is the "360" rotating restaurant, which rotates a full 360 degrees every 72 minutes. From there, Christy can see the whole city, and take close-up pictures of all the landmarks using her fancy new 100x optical zoom camera. Since the restaurant itself rotates, she only needs to stand in one place to take pictures in all directions.

The waiters insist that she order something or leave, and Christy is not interested in any of the items on the menu. Therefore, she must act quickly before she gets kicked out. Given the locations of the landmarks of which Christy wants to take a picture, your task is to determine the minimum amount of time that she must spend in the restaurant in order for it to rotate enough to bring all the landmarks in view. Assume that Christy always points her camera exactly perpendicular to the window to minimize distortion due to the glass. Note that multiple landmarks may occupy the same (angular) position, and these landmarks would only require one photograph to capture them.

Since the restaurant staff only realize she is a tourist once she starts taking pictures, we begin measuring the time required once she takes her first picture. Therefore, Christy can move to any position in the restaurant without hassle from the restaurant staff and begin taking pictures from there.

#### Input

The first line of input consists of the number of test cases. For each test case, the first line is an integer  $n$  ( $2 \leq n \leq 1000$ ), the number of landmarks Christy wants to photograph. Each of the following  $n$  lines specify a landmark. Each landmark specification consists of the landmark name (a string of uppercase and lowercase letters of length at most 40 characters), a space, and the compass angle  $d$ , in degrees, to the landmark from the CN Tower ( $0 = \text{north}$ ,  $90 = \text{east}$ ,  $180 = \text{south}$ ,  $270 = \text{west}$ ). Note that  $d$  is a real number which satisfies  $0 \leq d < 360$ , with  $d$  specified to the hundredth of a degree (i.e., at most two decimal places).

#### Output

For each test case, output a single integer, the minimum number of seconds that Christy must remain in the restaurant. If the time is not an integer number of seconds, round it up to the nearest second (i.e., take the ceiling of the number).

## Example

**Input :**

```
1
5
CasaLoma 231.0
OntarioParliament 123.0
SkyDome 75.0
RoyalYorkHotel 340.0
PearsonAirport 165.0
```

**Output :**

```
3012
```

---

Added by: Bobby Xiao

Date: 2007-01-24

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Canadian Computing Competition, 2006 Senior Stage 2

## SPOJ Problem Set (classical)

### 1269. CN Tower (Hard)

#### Problem code: CNHARD

Christy C. Coder is traveling to Waterloo for a programming competition. On the way, she stops in Toronto to do some sightseeing. The unfortunate thing about travelling is that everyone back home expects her to bring back pictures of everything. Christy hates taking pictures: it makes her look like such a tourist! Fortunately, Christy has a plan to make her picture-taking quite painless.

At 553 m tall, CN Tower is the world's tallest free-standing building. 351 m up the tower is the "360" rotating restaurant, which rotates a full 360 degrees every 72 minutes. From there, Christy can see the whole city, and take close-up pictures of all the landmarks using her fancy new 100x optical zoom camera. Since the restaurant itself rotates, she only needs to stand in one place to take pictures in all directions.

The elevator normally takes 61 seconds to get from the ground up to the rotating restaurant. Unfortunately, when Christy arrives at the CN Tower, she learns that the elevator is out of service, so she has to take the stairs, which takes somewhat longer. Christy arrives at the top at 9:36 pm, by which time it is dark. She can only take pictures with a very powerful flash, which takes a long time to recharge between pictures. While the flash is charging, she cannot take any pictures. Thus, Christy needs a new program to calculate the minimum time that she must spend in the restaurant in order for it to rotate enough to bring all the landmarks in view, and taking into consideration the charging time of the flash. In addition to these difficulties, the restaurant closes at midnight. Thus, Christy may not have enough time to take pictures of all the landmarks.

As before, assume that Christy does not move around in the restaurant after choosing her initial position, but waits for it to rotate to the angle required to take each picture. As with the daytime problem (CNEASY), Christy can (very quickly) pick her initial position, since the restaurant is not that big. Christy always points her camera exactly perpendicular to the window to minimize distortion due to the glass. After taking the last picture, Christy must stay in the restaurant until her flash recharges. Since it is dark outside, if more than one landmark occupies an angular position, Christy can capture **only one one landmark per photo** (in order to keep the desired landmark in focus, blurring all others).

#### Input

The first line of input consists of the number of test cases. For each test case, the first line is an integer  $n$  ( $1 \leq n \leq 1000$ ), the number of landmarks Christy wants to photograph. Each of the following  $n$  lines specify a landmark. Each landmark specification consists of the landmark name (a string of uppercase and lowercase letters), a space, and the compass angle, in degrees (specified with a maximum of 2 decimal places), to the landmark from the CN Tower (0 = north, 90 = east, 180 = south, 270 = west). Finally, the last line contains the amount of time, in seconds, required for the flash to charge.

## Output

For each test case, output a single integer, the minimum number of seconds that Christy must remain in the restaurant. If the time is not an integer number of seconds, round it up to the nearest second. If it is not possible for Christy to take all the pictures before closing, instead output "not possible".

## Example

### Input :

```
1
5
CasaLoma 231.0
OntarioParliament 123.0
SkyDome 75.0
RoyalYorkHotel 340.0
PearsonAirport 165.0
10
```

### Output :

```
3022
```

---

Added by: Bobby Xiao

Date: 2007-01-24

Time limit: 4s

Source limit:50000B

Languages: All

Resource: Canadian Computing Competition, 2006 Senior Stage 2

## SPOJ Problem Set (classical)

### 1270. Paint By Numbers

#### Problem code: PNTBYNUM

Years ago, there was a really bad craft/hobby called *paint-by-numbers*: you were given a line drawing, with numbers in each enclosed region, and the number corresponded to a particular colour. An example is shown below (unsolved on the left; solved on the right):

[IMAGE] [IMAGE]

(images from ThisLife.org)

The problem you have to solve is much more linear, in a way.

You will be given an  $n$ -by- $m$  grid ( $1 \leq n, m \leq 32$ ) which you will "colour" in with either a dot ('.') or a star ('\*').

Of course, the grid will not be specified in the usual paint-by-numbers way, since this would be too easy.

Instead, you will have to infer which cells are blank and which contain a star. The only information you will be given are a collection of  $n + m$  sequences of numbers, one sequence for each row and column. The sequence will indicate the size of each continuous block of stars. There must be at least one dot between two consecutive blocks of stars.

An example is shown below (which is supposed to look fish-like):

[IMAGE]

You may notice that some paint-by-number patterns are not uniquely solvable. For this problem, you may assume that *any* solution which satisfies the specification is correct.

#### Input

Input begins with a line with the number of test cases. Each test case consists of a total of  $n + m + 2$  lines. The first line of the test case consists of an integer  $n$  ( $1 \leq n \leq 32$ ), the number of rows. The second line consists of an integer  $m$  ( $1 \leq m \leq 32$ ), the number of columns. On the next  $n$  lines, there will be sequences which describe each of the  $n$  rows (from top to bottom). Each line will contain some positive integers, with a space between adjacent integers, and the sequence will terminate with the integer 0. On the next  $m$  lines describe the  $m$  columns (from left to right), the same format as the rows are specified.

#### Output

Output consists of  $n$  lines for each corresponding test case, each line composed of  $m$  characters, where each character is either a dot ('.') or a star ('\*'). Separate test cases with a blank line.

## Example

**Input :**

```
2
4
7
2 2 0
5 0
5 0
2 2 0
1 1 0
1 1 0
2 0
2 0
4 0
4 0
2 0
4
4
2 1 0
3 0
3 0
1 1 0
4 0
3 0
3 0
1 0
```

**Output :**

```
**..**
..*****
..*****
**..**

**.*
***.
***.
*.*
```

---

Added by: Bobby Xiao

Date: 2007-01-24

Time limit: 5s

Source limit:50000B

Languages: All

Resource: Canadian Computing Competition, 2006 Senior Stage 2

## SPOJ Problem Set (tutorial)

### 1285. Continuous Fractions Again

#### Problem code: CFRAC2

A simple continuous fraction has the form:

[IMAGE]

where the  $a_i$ 's are integer numbers.

The previous continuous fraction could be noted as  $[a_1, a_2, \dots, a_n]$ . It is not difficult to show that any rational number  $p / q$ , with integers  $p > q > 0$ , can be represented in a unique way by a simple continuous fraction with  $n$  terms, such that  $p / q = [a_1, a_2, \dots, a_{n-1}, 1]$ , where  $n$  and the  $a_i$ 's are positive natural numbers.

Now given a simple continuous fraction, your task is to calculate a rational number which the continuous fraction most corresponds to it.

#### Input

Input for each case will consist of several lines. The first line is two integer  $m$  and  $n$ , which describe a char matrix, then followed  $m$  lines, each line contains  $n$  chars. The char matrix describes a continuous fraction. The continuous fraction is described by the following rules:

- Horizontal bars are formed by sequences of dashes '-'. The width of each horizontal bar is exactly equal to the width of the denominator under it.
- Blank characters should be printed using periods '.'.
- The number on a fraction numerator must be printed center justified. That is, the number of spaces at either side must be same, if possible; in other case, one more space must be added at the right side.

The end of the input is indicated by a line containing 0 0.

#### Output

Output will consist of a series of cases, each one in a line corresponding to the input case. A line describing a case contains  $p$  and  $q$ , two integer numbers separated by a space, and you can assume that  $10^{20} > p > q > 0$ .

#### Example

Input :

```
9 17
.....1.....
2.+-----
.....1.....
....4.+-----
.....1..
```

```

.....1.+-----
.....1
.....5.+.-
.....1
5 10
.....1...
1.+-----
.....1
....11.+.-
.....1
0 0

```

**Output :**

```

75 34
13 12

```

---

Added by: Camilo Andrés Varela León  
Date: 2007-01-31  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: HNU Contest



## SPOJ Problem Set (classical)

### 1296. 4 values whose sum is 0

#### Problem code: SUMFOUR

The SUM problem can be formulated as follows: given four lists A, B, C, D of integer values, compute how many quadruplet (a, b, c, d) belongs to  $A \times B \times C \times D$  are such that  $a + b + c + d = 0$ . In the following, we assume that all lists have the same size n

#### Input

The first line of the input file contains the size of the lists n (this value can be as large as 4000). We then have n lines containing four integer values (with absolute value as large as  $2^{28}$ ) that belong respectively to A, B, C and D.

#### Output

Output should be printed on a single line.

#### Example

**Input :**

6

-45 22 42 -16  
-41 -27 56 30  
-36 53 -37 77  
-36 30 -75 -46  
26 -38 -10 62  
-32 -54 -6 45

**Output :**

5

---

Added by: Abhilash I  
Date: 2007-02-06  
Time limit: 10s  
Source limit: 50000B  
Languages: All  
Resource: South western 05-06

## SPOJ Problem Set (classical)

### 1325. Partial Sums

#### Problem code: PARTSUM

Given a sequence of positive integers  $a_1, a_2, \dots, a_N$ , and  $1 \leq i \leq j \leq N$ , the partial sum from  $i$  to  $j$  is  $a_i + a_{i+1} + \dots + a_j$ .

In this problem, you will be given such a sequence and two integers  $P$  and  $K$ . Your task is to find the smallest partial sum modulo  $P$  that is at least  $K$ .

For example, consider the following sequence of integers:

12      13      15      11      16      26      11

Here  $N = 7$ . Suppose  $K = 2$  and  $P = 17$ . Then, the answer is 2 because  $11 + 16 + 26 = 53$  and  $53 \bmod 17$  is 2. On the other hand, if  $K = 0$  the answer is 0 since  $15 + 11 + 16 + 26 = 68$  and  $68 \bmod 17$  is 0.

You may assume  $1 \leq N \leq 100000$ .

#### Input

The first line of the input contains the number of test cases,  $T$ .

Each test case begins with a line containing three integers,  $N$ ,  $K$  and  $P$ . This is followed by the values of  $a_1, a_2, \dots, a_N$ , one per line.

#### Output

Output one line per test case, containing the smallest partial sum modulo  $P$  that is at least  $K$ , as described above.

#### Example

**Input :**

```
1
7 2 17
12
13
15
11
16
26
11
```

**Output :**

```
2
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Stephen Merriman

Date: 2007-02-22

Time limit: 7s

Source limit:50000B

Languages: All

Resource: Indian Computing Olympiad, Online Programming Contest, July 06

## SPOJ Problem Set (classical)

### 1326. A Chase In Wonderland

#### Problem code: CHASE

Alice is in Wonderland. It is March and March Hare is raving mad. It begins to chase Alice. Alice runs as fast as she can, but she comes to the the edge of a quicksand pool. Now this pool has several safe spots where she may comfortably step on without being swallowed by the quicksand. She may step onto any safe spot from solid ground, but thereafter she can jump from spot to spot only in a straight line, and she cant turn back. March Hare is still hot on her heels, so she needs to know the maximum number of jumps she can make.

#### Input

On the first line there will be a single integer  $n$ , denoting the number of test cases. Each test case will consist of a single integer  $k$  by itself on a line, followed by  $k$  lines containing the  $x$  and  $y$  co-ordinates of the safe spots, seperated by a single space. Both coordinates are integer values. There are no leading or trailing spaces or blank lines.  $0 < k \leq 2200$

#### Output

For each case print a single integer by itself on a line, with no leading or trailing spaces. Do not print blank lines.

#### Example

**Input :**

```
2
5
0 0
1 1
2 2
4 8
2 75
3
0 0
1 2
3 4
```

**Output :**

```
2
1
```

---

Added by: Abhilash I  
Date: 2007-02-22  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: Code Craft 2007

## SPOJ Problem Set (classical)

### 1329. Matrix

#### Problem code: KPMATRIX

The company you work in has got a secret job to do. Just a few persons know what it is all about. To keep a secret every programmer works on a small part of the project.

Your job is as follows. You are given a matrix of integer numbers with  $N$  rows and  $M$  columns. Also two integer numbers  $A$  and  $B$  are given. Your task is to find a number of submatrices of a given matrix with the sum of elements between  $A$  and  $B$  inclusively.

#### Input

The first line contains two integer numbers  $N$  and  $M$  ( $1 \leq N, M \leq 250$ ). After that matrix description follows.  $N$  lines with  $M$  numbers each. The last line contains two integer numbers  $A$  and  $B$  ( $-10^9 \leq A \leq B \leq 10^9$ ). All numbers separated with spaces. It's guaranteed that for every submatrix the absolute value of sum of it's elements will not exceed  $10^9$ .

#### Output

Write to the output the number of submatrices of a given matrix with sum of their elements between  $A$  and  $B$  inclusively.

#### Example

**Input :**

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

**Output :**

```
26
```

---

Added by: Pavel Kuznetsov

Date: 2007-02-23

Time limit: 1s-10s

Source limit: 50000B

Languages: All

Resource: IT Festival Arkhangelsk 2006

## SPOJ Problem Set (classical)

### 1335. Maze

#### Problem code: KPMAZE

The King of Byteland likes Greek mythology very much. The most impressive myth for him is the one about Minotaur. A creature which was imprisoned in a maze-like construction. Now The King wants to have similar maze. He ordered to his architect to build such construction.

The architect decided that maze will have rectangular form. Its floor will be made from large square plates. Also there will be many walls, each of which will separate two common floor plates. From the bird's eye whole construction will look like a grid with some cells separated by walls. The maze should be very tricky, that's why he calls the maze correct if and only if for every two plates there is exactly one path between them. Here path is a sequence of moves between plates that share a common side and are not separated by wall. Each plate can only appear once in a path.

Sooner or later, the architect started his work. After a couple of months he created a rectangular area with  $H$  rows and  $W$  columns. Also he has built  $K$  walls. Sounds perfect but he was seized with a lingering doubt about correctness of his maze.

That's why he asks you to help him. He wants to know how many different correct mazes can be built based on his current maze i.e. you can only add new walls but not to break any of the old ones.

For example (see figure 1.) the maze size is  $2 \times 2$  and there are no walls. All four ways to complete this maze are shown on the right of the figure (new walls are dashed).

Figure 1

Figure 2. illustrates maze of size  $3 \times 3$  with 3 walls. There are exactly 4 ways to complete it.

Figure 2

Figure 3. shows the maze that cannot be completed, because there is no path from lower right plate to upper left one.

Figure 3

#### Input

The first line contains two integer numbers  $W$  and  $H$  ( $1 \leq W, H \leq 5$ ). Second line contains one integer number  $K$  ( $K \geq 0$ ). Next  $K$  lines contain description of walls. Each wall is determined by two plates it separates. Thus, each line contains four integer numbers:  $R_1, C_1, R_2$  and  $C_2$ , here  $R_1$  and  $C_1$  - row and column coordinates of the first plate. Similar,  $R_2$  i  $C_2$  - are coordinates of the second plate ( $1 \leq R_1, R_2 \leq H, 1 \leq C_1, C_2 \leq W$ ). Rows are numbered from up to bottom, columns - left to right started from 1. It is guaranteed that all walls are correct and there are no duplicates. Walls that form perimeter of the maze will not be specified.

## Output

Output the number of different correct mazes that can be built based on the given one. There should be no leading zeroes.

## Example

**Input :**

2 2  
0

**Output :**

4

**Input :**

3 3  
3  
3 1 3 2  
2 2 2 3  
2 3 3 3

**Output :**

4

**Input :**

3 3  
5  
3 1 3 2  
2 2 2 3  
2 3 3 3  
2 2 2 1  
1 2 2 2

**Output :**

0

---

Added by: Pavel Kuznetsov

Date: 2007-02-24

Time limit: 1s

Source limit:50000B

Languages: All

Resource: IT Festival Arkhangelsk 2006



## SPOJ Problem Set (classical)

### 1391. Summing to a Square Prime

#### Problem code: CZ\_PROB1

$S_{P_2} = \{p \mid p = x_1^2 + x_2^2 \text{ for some } x_1, x_2 \text{ belonging to } \mathbb{Z}\}$  is the set of all primes that can be represented as the sum of any two squares. The function  $S_{P_2}(n)$  gives the  $n^{\text{th}}$  prime number from the set  $S_{P_2}$ . Now, given two integers  $n$  ( $0 < n < 501$ ) and  $k$  ( $0 < k < 4$ ), find  $p(S_{P_2}(n), k)$  where  $p(a, b)$  gives the number of unordered ways to sum to the given total 'a' with 'b' as its largest part. For example:  $p(5, 2) = 3$  {2+2+1, 2+1+1+1, and 1+1+1+1+1}. Here 5 is the total with 2 as the largest part.

#### Input

The first line gives the number of test cases  $T$  followed by  $T$  lines of integer pairs,  $n$  and  $k$ .

Scope:

$0 < T < 501$

$0 < n < 501$

$1 < S_{P_2}(n) < 7994$

$0 < k < 4$

#### Output

The  $p(S_{P_2}(n), k)$  for each  $n$  and  $k$ . Append a newline character to every test cases' answer.

#### Example

Input :

```
3
2 2
3 2
5 3
```

Output :

```
3
7
85
```

---

Added by: Rahul

Date: 2007-03-10

Time limit: 2s

Source limit: 3000B

Languages: All

Resource: Sam Collins

## SPOJ Problem Set (classical)

### 1417. University Employees

#### Problem code: EMP

On some island each inhabitant is either a knight who only tells the truth, or a liar who always lies. Also, on the island there exists a university of technology where some of the inhabitants work. All of the university employees will always tell you the following two things, no matter which employee you ask:

1. There are fewer than  $N$  employees who work more than me.
2. At least  $M$  employees of the university have a larger salary than me.

It is also known that no two employees of the university have an identical salary, and no two work equally. Write a program which will compute how many persons are employed by this university.

#### Input

The only input line contains two integers  $N$  and  $M$ , with one space between them [ $N, M \leq 1000000000$ ].

#### Output

The output must contain only one integer - the total number of employees of this university, or 0 if there is no way to find the number of employees.

#### Example

**Input :**

1 1

**Output :**

2

**Author: Filimonenkov D.O.**

---

Added by: Roman Sol

Date: 2006-04-24

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: ZCon 2007

## SPOJ Problem Set (classical)

### 1418. The Cats and the Mouse

#### Problem code: CATM

In a rectangular field of size  $n$  by  $m$  squares there is a mouse and two cats. The mouse is the first to make a move, then each of the cats makes a move, then again it's the mouse's turn, and so on. In each move both the mouse and the cats can move exactly one square vertically or horizontally. If the mouse is standing at the edge of the field then in its next move it can jump off the field and is saved from the cats. If in the next move one of the cats moves to the field with the mouse then there is no escape for the mouse ... =(

You are to write a program which, knowing the initial positions of mouse and the two cats, will find out if there is any way for the mouse to escape from the cats, assuming of course that each cat will do its best to catch the mouse.

#### Input

In the first line of input two integers  $n$  and  $m$  are given, not exceeding 100, where  $n$  is the number of rows, and  $m$  - the number of columns. The second line contains a number  $k$  [ $k \leq 10$ ], which defines the number of test cases for the given field. In the next  $k$  lines the initial positions of the mouse and the cats are given. The position in the field is given by two numbers: the first is the number of the row, the second is the number of the column. The first two integers are the coordinates of the mouse, the next four integers are the coordinates of the cats.

#### Output

You must output  $k$  lines with answers for each test case. The answer is YES, if the mouse can escape or NO otherwise.

#### Example

**Input :**

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

**Output :**

```
NO
YES
YES
```

**Author: Filimonenkov D.O.**

---

Added by: Roman Sol  
Date: 2006-05-04  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ZCon 2007

## SPOJ Problem Set (classical)

### 1419. A Game with Numbers

#### Problem code: NGM

Nikifor and Trofim play the following game: they write some integer smaller then 2000000000 and take turns one after another. Nikifor is the first to make a move. The turn is made by the following rule: from the written integer any non-zero digit is subtracted, and the new integer replaces the old one on the desk. For example for integer 40534, the next move can be: 40530, 40531 or 40529. The winner is the player who writes zero on the desk.

Write a program to decide who will win if both players do their best.

#### Input

The input contains the integer from which the game is started.

#### Output

In the first line you must write 1 if Nikifor wins and 2 otherwise. If Nikifor wins then in the second line you must output the move in the first turn which guarantees victory for him. If there are many such moves then output any of them.

#### Example

**Input :**

14

**Output :**

1

4

**Author: Filimonenkov D.O.**

---

Added by: Roman Sol

Date: 2006-05-05

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: ZCon 2007

## SPOJ Problem Set (classical)

### 1420. Geometry and a Square

#### Problem code: GEOM

Is there anyone who doesn't love geometry?! Just imagine: on the plane you are given a square ABCD, with vertices given in the clockwise direction. Also given is a point P which is different from all of A, B, C or D. Have you imagined it? Interested? Ok, let's continue!

Through vertex A a line  $a$  is drawn that is perpendicular to line BP, through vertex B a line  $b$  is drawn that is perpendicular to line CP, through vertex C a line  $c$  is drawn that is perpendicular to line DP, through vertex D a line  $d$  is drawn that is perpendicular to line AP. Do the lines  $a$ ,  $b$ ,  $c$  and  $d$  cross each other in one point? Ok, it depends on what the square is and what point P is given. Write the program that discovers if these lines cross in one point, and if so, finds the coordinates of this point.

#### Input

In the first line you are given the integer coordinates of the point in which diagonals of the square intersect. In the second line you are given one integer - the length of the side of the square. In the third line you are given the integer coordinates of point P. The integers do not exceed 100, in terms of absolute value.

#### Output

For each test case you must output YES if the sought point exists, and NO otherwise. If you answer YES then in the second line you must output the coordinates of the intersection point. Coordinates must be rounded to one digit after the point.

#### Example

**Input :**

```
10 10
20
5 12
```

**Output :**

```
YES
8.0 5.0
```

**Author: Filimonenkov D.O.**

---

Added by: Roman Sol  
Date: 2006-05-05  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: ZCon 2007

## SPOJ Problem Set (classical)

### 1421. Goods

#### Problem code: FIRM

There are  $n$  dealers in the market. Each of them has some unique goods (nobody else has the same goods). Besides, each of them wants to obtain some other goods, which exist in the market. This is rather strange, but for each kind of goods on the market there exists exactly one dealer who wants to obtain it.

To prevent fraud, only exchanges in pairs are allowed in this market. Moreover, each dealer is allowed to make at most one exchange a day. But the total number of transactions isn't limited. A transaction means that all the goods of one dealer are exchanged for all the goods of the other participating dealer (partial transactions are not allowed).

You are to write a program which outputs the minimum number of days needed for each dealer to get the goods that he wants. Also output one of the possible variants of exchanges leading to this goal.

#### Input

The first line contains an integer  $n$  [ $n \leq 5000$ ]. In the second line exactly  $n$  numbers of goods are given, which the dealers require. If integer  $j$  appears as the  $i$ -th at input, then this means that goods required by dealer  $i$  are initially owned by dealer  $j$ .

#### Output

You must output the minimum number of days  $m$  which are needed to complete the transactions. In the next  $m$  lines you must output the way these transactions should be managed by the dealers. One line corresponds to one day. At the beginning of each line you must output the number of transactions on this day. After that output the pairs of dealers who exchange their goods on this day. Dealers in pairs are separated by '-' symbol. If there are many ways to perform the exchanges then output any of them.

#### Example

**Input :**

7

2 1 3 5 6 7 4

**Output :**

2

3 1-2 4-5 7-6

1 5-7

**Author: Filimonenkov D.O.**

---

Added by: Roman Sol  
Date: 2006-05-05  
Time limit: 1s-10s  
Source limit:50000B  
Languages: All  
Resource: ZCon 2007



## SPOJ Problem Set (classical)

### 1431. Projections Of A Polygon

#### Problem code: KPPOLY

You are given a convex polygon on Cartesian coordinate system. It has projections on X and Y-axis. You can arbitrary rotate this polygon. What minimum and maximum sum of projections can you achieve?

#### Input

First line contains one integer number  $N$  ( $3 \leq N \leq 100$ ) - number of polygon's vertices. Following  $N$  lines contain vertex coordinates  $X_i$  and  $Y_i$ . All numbers are integers. Vertices are given in clockwise or anticlockwise direction. No two vertices coincide. No three consecutive vertices lie on the same line. All coordinates do not exceed 10000 by absolute value.

#### Output

Write minimum and maximum value of sum of the polygon's projections. Separate them by a space. Your answer should not differ with the correct one more than  $10^{-6}$ .

#### Example

**Input :**

```
4
0 0
0 1
1 1
1 0
```

**Output :**

```
2 2.828427124
```

---

Added by: Pavel Kuznetsov

Date: 2007-03-25

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Vologda 2007

## SPOJ Problem Set (classical)

### 1433. The Sum

#### Problem code: KPSUM

One of your friends wrote numbers 1, 2, 3, ..., N on the sheet of paper. After that he placed signs + and - between every pair of adjacent digits alternately. Now he wants to find the value of the expression he has made. Help him.

For example, if  $N=12$  then  $+1 -2 +3 -4 +5 -6 +7 -8 +9 -1+0 -1+1 -1+2 = 5$

#### Input

Each line contains one integer number N ( $1 \leq N \leq 10^{15}$ ). Last line contains 0 and shouldn't be processed. Number of lines in the input does not exceed 40.

#### Output

For every line in the input write the answer on a separate line.

#### Example

**Input :**

12  
0

**Output :**

5

---

Added by: Pavel Kuznetsov

Date: 2007-03-26

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Vologda 2007

## SPOJ Problem Set (classical)

### 1434. Equation

#### Problem code: KPEQU

You are given integer positive number  $N$ . Find the number of solutions in positive integer numbers of the following equation:

$$1/N! = 1/X + 1/Y$$

#### Input

Each line of input file contains one integer number  $N$  ( $1 \leq N \leq 10^4$ ). The last line contains 0 and shouldn't be processed. Number of lines in the input does not exceed 30.

#### Output

For every line in the input write the answer on a separate line.

#### Example

**Input :**

1  
2  
0

**Output :**

1  
3

---

Added by: Pavel Kuznetsov

Date: 2007-03-27

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Vologda 2007

## SPOJ Problem Set (main)

### 1435. Vertex Cover

#### Problem code: PT07X

You are given an unweighted, undirected tree. Write a program to find a vertex set of minimum size in this tree such that each edge has at least one of its end-points in that set.

#### Input

The first line of the input file contains one integer  $N$  --- number of nodes in the tree ( $0 < N \leq 100000$ ). Next  $N-1$  lines contain  $N-1$  edges of that tree --- Each line contains a pair  $(u, v)$  means there is an edge between node  $u$  and node  $v$  ( $1 \leq u, v \leq N$ ).

#### Output

Print number of nodes in the satisfied vertex set on one line.

#### Example 1

**Input :**

```
3
1 2
1 3
```

**Output :**

```
1
```

**Explanation:**

The set can be {1}

#### Example 2

**Input :**

```
3
1 2
2 3
```

**Output :**

```
1
```

**Explanation:**

The set can be {2}

---

Added by: Thanh-Vy Hua  
Date: 2007-03-28  
Time limit: 1.200s-8s  
Source limit: 50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1436. Is it a tree

#### Problem code: PT07Y

You are given an unweighted, undirected graph. Write a program to check if it's a tree topology.

#### Input

The first line of the input file contains two integers  $N$  and  $M$  --- number of nodes and number of edges in the graph ( $0 < N \leq 10000$ ,  $0 \leq M \leq 20000$ ). Next  $M$  lines contain  $M$  edges of that graph --- Each line contains a pair  $(u, v)$  means there is an edge between node  $u$  and node  $v$  ( $1 \leq u, v \leq N$ ).

#### Output

Print *YES* if the given graph is a tree, otherwise print *NO*.

#### Example

**Input :**

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

**Output :**

```
YES
```

---

Added by: Thanh-Vy Hua  
Date: 2007-03-28  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1437. Longest path in a tree

#### Problem code: PT07Z

You are given an unweighted, undirected tree. Write a program to output the length of the longest path (from one node to another) in that tree. The length of a path in this case is number of edges we traverse from source to destination.

#### Input

The first line of the input file contains one integer  $N$  --- number of nodes in the tree ( $0 < N \leq 10000$ ). Next  $N-1$  lines contain  $N-1$  edges of that tree --- Each line contains a pair  $(u, v)$  means there is an edge between node  $u$  and node  $v$  ( $1 \leq u, v \leq N$ ).

#### Output

Print the length of the longest path on one line.

#### Example

**Input :**

```
3
1 2
2 3
```

**Output :**

```
2
```

---

Added by: Thanh-Vy Hua  
Date: 2007-03-28  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1442. Strange Food Chain

#### Problem code: CHAIN

There are 3 kinds of animals A,B and C. A can eat B,B can eat C,C can eat A. It's interesting,isn't it?

Now we have n animals,numbered from 1 to n. Each of them is one of the 3 kinds of animals:A,B,C.

Today Mary tells us k pieces of information about these n animals. Each piece has one of the two forms below:

- 1 x y: It tells us the kind of x and y are the same.
- 2 x y: It tells us x can eat y.

Some of these k pieces are true,some are false. The piece is false if it satisfies one of the 3 conditions below, otherwise it's true.

- X or Y in this piece is larger than n.
- This piece tells us X can eat X.
- This piece conflicts to some true piece before.

#### Input

The first line contains a single integer t.t blocks follow.

To every block,the first line contains two integers n( $1 \leq n \leq 50000$ ) and k ( $1 \leq k \leq 100000$ ). k lines follow,each contains 3 positive integers D( $1 \leq D \leq 2$ ),X,Y,separated by single spaces.

#### Output

t lines,each contains a single integer - the number of false pieces in the corresponding block.

#### Example

**Sample input:**

```
1
100 7
1 101 1
2 1 2
2 2 3
2 3 3
1 1 3
2 3 1
1 5 5
```

**Sample output:**

```
3
```

**Hint:**

The false pieces are the 1st,the 4th and the 5th ones.

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2007-03-31

Time limit: 1s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2001,Day 1; translated by Blue Mary



## SPOJ Problem Set (classical)

### 1444. DEL Command II

#### Problem code: DELCOMM2

It is required to find out what's the maximum number of files that can be deleted from MS-DOS directory executing the DEL command of MS-DOS operation system only once. There are no nested subdirectories.

#### A note

DEL command has the following format: `DEL wildcard`

The actual wildcard as well as a full file name can be made up of a name containing 1 up to 8 case-sensitive characters. In a wildcard the characters '?' and '\*' can be used. A question mark substitutes exactly one character of the full file name, an asterisk any sequence of characters even empty one.

MS-DOS system can permit maybe other wildcards but they can not be used in this task. File names consist only of Latin letters and digits.

#### Input

The first line of the input is an integer M, then a blank line followed by M datasets. There is a blank line between datasets.

Input data for each dataset contains a list of full file names without any extra empty lines and spaces. Each name is written in a separate line of input data file and ended with a control sign: '+' for delete or '-' for keep. Full file names are not repeated. The list comprises at least one file, and at least one file is marked to be deleted. There are no more than 250 files.

#### Output

For each dataset, write to the first line of output the maximum number of files one DEL command can delete.

#### Example

**Input :**

2

BP +  
BPC +  
TURBO -

EXCHANGE +  
EXT +  
HARDWARE +  
MOUSE -

NETWORK -

**Output :**

2  
2

**Hint:**

For the two tests above,the corresponding DEL commands are DEL BP\* and DEL EX\*.

## **Link**

You can try problem DELCOMM first. It's far easier than this problem.

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 35s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 1997,Day 1

## SPOJ Problem Set (classical)

### 1447. A Game of Toy Bricks

#### Problem code: BRCKGAME

Blue Mary invents a game with toy bricks. The player has  $N$  cuboids numbered from 1 to  $N$ .

The rule of the game is described below:

- Choose some cuboids among the  $N$  cuboids, and divide them into  $M$  ( $1 \leq M \leq N$ ) piles, named them  $Pile_1, Pile_2 \dots Pile_M$ . There are at least 1 cuboid in each pile. To make the game easier, for any cuboid in  $Pile_K$ , its id should be greater than any one in  $Pile_{K+1}$  ( $1 \leq K < M$ ).
- For each pile of cuboids, the player will put them as a tower, and he should follow the two rules below:
- The up surface of each cuboid is touched and only touched another down surface. Luckily, to make the pile looking like a tower, the up surface of the lower cuboid should cover the down surface of the higher cuboid, i.e. the length of the lower up surface is not less than that of the higher down surface, and also to the width.
- In each pile, the lower cuboid has a less id than the higher cuboid.

Your task is to find a method, to make the sum of the height of each pile maximum.

#### Input

The very first line of the input contains the number  $t$ , then  $t$  cases follow.

For each case, the first line contains two integer numbers  $N$  and  $M$ .  $N$  ( $N \leq 100$ ) is the total number of the cuboids,  $M$  ( $M \leq N$ ) is the number of the piles, separated by a single space.

Then  $N$  lines follow, which are the description of the cuboids  $1..N$ . Each line contains three integer numbers ( $\leq 1000$ ) - the length, width and height of that cuboid, separated by spaces.

#### Output

For each case, the output contains only one line with a single integer number - the maximum sum.

#### Example

**Sample Input:**

```
1
4 2
10 5 5
8 7 7
2 2 2
6 6 6
```

**Sample Output:**

```
24
```

Added by: Blue Mary  
Date: 2007-04-01  
Time limit: 3s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Chinese National Olympiad in Informatics 1997,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1448. 3D Cover

#### Problem code: COVER2

In the 3D Cartesian coordinate system, there are  $n$  cubes. These cubes are all axis-paralleled. What's the volume of the union of these cubes?

#### Input

There is a single integer  $m$  in the very first line of the input, the number of test cases.  $m$  blocks follow.

For each test, the first line contains a single integer  $n$  ( $1 \leq n \leq 100$ ), the number of cubes.  $n$  lines follow, each contains four integers  $x, y, z, r$  ( $-1000 \leq x, y, z \leq 1000, 1 \leq r \leq 200$ ), separated by spaces.  $x, y, z$  are the X, Y, Z coordinates of the center of the cube, and  $r$  is the distance between the center and any surface of the cube.

#### Output

$m$  lines, each contains a single integer - the answer.

#### Example

**Sample Input:**

```
1
3
0 0 0 3
1 -1 0 1
19 3 5 6
```

**Sample Output:**

```
1944
```

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 2s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 1997, Day 2; description by Blue Mary

## SPOJ Problem Set (classical)

### 1451. 01 Sequence

#### Problem code: SEQ1

The input consists of exactly 5 test cases in the following format:

#### Input

N A0 B0 L0 A1 B1 L1 [3<=N<=1000, 1<=A0<=B0<=L0<=N, 1<=A1<=B1<=L1<=N]

#### Output

Exactly 5 lines, each contains:

a) A sequence (We name it S) consisting only characters '0' and '1' and no extra whitespaces, which satisfy the following conditions:

- The number of '0' in any consecutive subsequence of S whose length is L0 is not more than B0 and not less than A0.
- The number of '1' in any consecutive subsequence of S whose length is L1 is not more than B1 and not less than A1.

or

b) A single number -1, if the sequence which satisfies the conditions above doesn't exist.

#### Example

##### Input :

6 1 2 3 1 1 2  
[and 4 test cases more]

##### Output :

010101  
[and 4 test cases more]

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 1s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 1999, Day 1; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1452. Birthday Cake

#### Problem code: CAKE

Adolf wants to send a cake to Blue Mary to celebrate her birthday. The cake looks like a tower which has  $M$  floors, each floor is a cylinder. The  $i$ -th cylinder counted from downside to upside has a integer height  $h_i$  and a integer radius  $r_i$ . These numbers fulfill the following two conditions:

- $h_1 > h_2 > h_3 > \dots > h_M$
- $r_1 > r_2 > r_3 > \dots > r_M$

Adolf is interested in minimising the area of the surface of the cake, except for the underside of the lowest cylinder. He needs your help because of his poor math knowledge.

#### Input

The very first line contains a integer number  $T$ .  $T$  test cases follow.

For each test case, the first line contains a single integer number  $N$  ( $N \leq 10000$ ), the second line contains a single integer number  $M$  ( $M \leq 10$ ). The cake must be made of  $M$  cylinders and its volume must be  $N \cdot \pi$ .

#### Output

For each test case, a single line containing a single integer  $S$  must be written to output. The required minimum area must be  $S \cdot \pi$ .

#### Example

**Sample Input:**

```
1
100
2
```

**Sample Output:**

```
68
```

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 1s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 1999, Day 1; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1453. Optimal Connected Subset

#### Problem code: OPTSUB

- A point  $P(x,y)$  is called an integer point if and only if both  $x$  and  $y$  are integers.
- $W$  is the set which contains all the integer points on the plane.
- Two integer point  $P(x,y)$  and  $Q(x',y')$  are called adjacent if and only if  $|x-x'|+|y-y'|=1$ .
- $S$  is a set of integer points if and only if  $S$  is a limited subset of  $W$ .
- If  $S$  is a set of integer points,  $R$  and  $T$  belong to  $S$ , and there exist a limited integer point sequence  $Q_0(=R), Q_1, Q_2, \dots, Q_k, Q_{k+1}(=T)$  which satisfies that
  - $Q_i \neq Q_j$  iff  $i \neq j$
  - $Q_i$  and  $Q_{i+1}$  are adjacent, for each  $0 \leq i \leq k$ .
  - $Q_i$  belongs to  $S$ , for each  $0 \leq i \leq k+1$ .

we call  $R$  and  $T$  are connected and the sequence  $Q_i$  ( $0 \leq i \leq k$ ) is a path that connect  $R$  and  $T$ .

- If  $S$  is a set of integer points,  $X$  and  $Y$  are some integer points that belong to  $S$ , there exists one and only one path connected  $X$  and  $Y$ , then  $S$  is called an optimal set.

Given an optimal set  $V$ , your task is to find an optimal set  $B$ , satisfying that  $B$  is a subset of  $V$  and the sum of the weights of each integer point is maximum.

#### Input

The very first line of the input contains a single integer  $T$ , the number of test cases.  $T$  blocks follow.

For each test case, the first line contains a single integer  $N=|V|$  ( $N \leq 1000$ ).  $N$  lines follow, each contains 3 integers, the X-coordinate, the Y-coordinate and the weight (the absolute value of the weight  $\leq 100$ ) of the  $i$ th integer point, separated by single spaces.

#### Output

$T$  lines, each contains a single integer - the maximum sum of weights.

#### Example

Input :

```
1
5
0 0 -2
0 1 1
1 0 1
0 -1 1
-1 0 1
```

Output :

```
2
```



Added by: Blue Mary  
Date: 2007-04-01  
Time limit: 1s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Chinese National Olympiad in Informatics 1999,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1454. Memory Distribution

#### Problem code: MEMDIS

EMS memory (called **memory** for short) is some important resource of a computer. When a program is running, the computer must distribute the memory for it.

The classical memory distribution process is like the following:

- The basic unit of the memory is called a **cell**, each cell is assigned to a fixed integer number called its **address**. The address starts from number 0. If two cell's address numbers are two consecutive integer numbers, the two cells are called (logically) consecutive. We name the  $s$  consecutive cells starting from address  $i$  a piece whose length is  $s$  and first address is  $i$ .
- Many programs need memory during their running. For each program, we need a application time  $X$ , a number of cells needed  $M$  and a running time  $P$  to describe it. When the program is running (during it starts running (time  $T$ ) to  $T+P$ , including the left end and excluding the right end), The  $M$  cells cannot be used by other programs.
- Suppose a program apply  $M$  cells at time  $X$  and its running time is  $P$ , then
  - (A) If there is a piece in the memory at time  $X$ , each cell of which is not being used, and whose length is  $M$ , the computer will distribute these  $M$  cells to this program. If there are more pieces, the computer will choose the one whose first address is minimum.
  - (B) If such piece does not exist at time  $X$ , the program will be put into a queue. If after some time, there exist a piece whose length is  $M$  and the corresponding program is at the head of the queue, the computer will pop this program and distribute memory for it like (A) immediately. During the process of memory distribution, the programs which are not at the head of the queue cannot start to run before the one at the head of the queue.

#### Input

Ten test cases (given one after another, you have to process all!). For each test case:

The first line is a number  $N$ , which shows the number of memory cells. There addresses are  $0..n-1$ . Less than 10000 lines follow, each contains 3 integers  $X, M (M \leq N), P$  describing the programs. A line containing three zeroes denotes the end of a test case. The programs have been sorted by there application time  $X$ .

All numbers in the input and output file will be less than  $10^9$ .

#### Output

For each test case output two lines. The first line contains a single integer, which shows the time when all the programs have been run and stops normally. The second line contains a single integer, which is the number of programs which has been put into the queue.

## Example

**Input :**

```
10
1 3 10
2 4 3
3 4 4
4 1 4
5 3 4
0 0 0
[and 9 test cases more]
```

**Output :**

```
12
2
[and 9 test cases more]
```

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 17s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 1999,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1455. Program Analyser

#### Problem code: ANALYSER

#### Input

A Program which has the following format:

```
<Program>::=<sentence><line break>{<sentence><line break>}
<sentence>::=<level><space><body>
<body>::=<addition> | <output> | <goto> | <condition> | <end>
<addition>::=<variable>+<integer>
<output>::=<variable>?
<goto>::=GO<space><level>
<condition>::=IF<space><variable>=<integer><space><goto>
<end>::=END
<variable>::=<character>
<level>::=<integer>
<integer>::=<digit>{<digit>}
<character>::=A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|Q|R|S|T|U|V|W|X|Y|Z
<digit>::= 0|1|2|3|4|5|6|7|8|9
<line break>::=(ASCII 10)
<space>::=(ASCII 32)
```

The program runs following the following rules:

- Program starts from the sentence whose level is minimum, and executed by the level from low to high except that the sentence is<goto>or<condition>.
- All variables are initialized to 0.
- <Addition>means<variable>+=<integer>in C++.
- <output>means write the value of<variable>to the output file(we aren't interesting about the real output file.)
- <condition>means if and only if the value of the <variable> equals to <integer>, <goto> will be executed, otherwise the next sentence executed is as usual.
- After<goto>, the next sentence executed is the sentence with level which equals to the level in<goto>.
- Program terminates by itself when <end> is executed.
- The numbers during the program is running will fit in a signed 32-bit integer.
- The number of sentences in the program is not more than 100.
- The length of each line in the input file is not more than 20.
- The input is correct.
- The sentence with the maximum level is always <end>.
- Any level is not more than 3000.

Input terminate by EOF.

## Output

Output the number of sentences executed.If the program can not terminate by itself,output -1.

## Example

### Input :

```
10 A+1
20 IF A=5 GO 60
60 END
30 A+2
40 A?
50 GO 20
```

### Output :

```
11
```

### Hint :

```
10->20->30->40->50->20->30->40->50->20->60
```

## Note

You may try problem ANALYS\_T first. It's the same problem with this one and its time limit is not so strict.

## Log

The time limit of this problem has been changed from 0.4/0.5 second to 1 second per test on Jun.5, 2008. All the solutions have been rejudged.

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 1s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2000,Day 1; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1457. Help Blue Mary Please! (Act I)

#### Problem code: BLUEEQ

This morning Blue Mary wrote some equations on a piece of paper and left it on her desk. After solving some problems in SPOJ, she found that her classmate H.L. replaced all characters on the paper with some other ones. H.L. told her he replaced the same characters with the same ones, and different characters with different ones because of his goodness. Now Mary needs your help to get the original equations back.

In Mary's equations, only 13 characters appear: 0,1,2,3,4,5,6,7,8,9,+,\*,=. There is one and only one "=" in each equation. In H.L.'s equations, only 13 Latin letters appear: a,b,c,d,e,f,g,h,i,j,k,l,m. All the equations are correct in decimal notation.

For example. If Mary wrote down  $2+29=31$ , H.L. replaced 2 with i, + with l, 9 with k, = with e, 3 with m and 1 with a, we got *ilikema*.

#### Input

The first line contains a single integer  $t$ .  $t$  blocks follow.

To every block, the first line contains a single integer  $n$  ( $1 \leq n \leq 1000$ ).  $n$  lines follow, each contains a string whose length is more than 4 and less than 12. The string contains only a-m and doesn't contain any whitespaces.

At least 90% of test cases satisfy that  $n \leq 5$ .

At least 80% of test cases satisfy that  $n \leq 2$ .

In at least 70% of test cases, there are at most 5 different characters in all the equations.

#### Output

If there doesn't exist  $n$  equations that can be translated to H.L.'s equations, print a line contains the word *noway*. Otherwise you should output all the corresponding relations that can be fixed in lexicographic order, see the example.

#### Example

##### Input

```
1
2
abcdec
cdefe
```

##### Output

a6  
b\*  
d=  
f+

## hint

The two strings can be translated to the following equations possibly:

$6 * 2 = 12$     $2 = 1 + 1$   
 $6 * 4 = 24$     $4 = 2 + 2$   
 $6 * 8 = 48$     $8 = 4 + 4$

So the corresponding relations above can be fixed,others can not.

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 17s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2000,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1458. Help Blue Mary Please! (Act II)

#### Problem code: BLUEEQ2

Today Mary's math homework is to solve an equation.

[IMAGE]

She knows all  $k_i$  and  $p_i$ , and  $1 \leq x_i \leq M$ . All  $x_i$  must be integers. She must work out the number of different solutions of this equation this day. Can you give her a hand?

#### Input

There is a single integer  $T$  in the very first line of the input denoted the number of tests.  $T$  blocks follow.

For each test case:

The first line contains a single integer  $n$  ( $n \leq 6$ ). The second line contains a single integer  $m$  ( $m \leq 150$ ).  $n$  lines follow, each contains two space-separated integers  $k_i$  and  $p_i$ ,  $i=1,2,\dots,n$ . All  $p_i$  are positive.

[IMAGE]

#### Output

For each test case output a single line, which contains a single integer - the answer. You may assume this number is less than  $2^{31}$ .

#### Example

**Input :**

```
1
3
150
1 2
-1 2
1 2
```

**Output :**

```
178
```

**Warning: The time limit is very strict for this problem.**

Blue Mary's Note: test data were modified on Dec.4, 2007. All the solutions have been rejudged.

---



Added by: Blue Mary  
Date: 2007-04-01  
Time limit: 11s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Chinese National Olympiad in Informatics 2001,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1459. The Secret of an Aerolite

#### Problem code: AEROLITE

A huge aerolite had fallen in Antarctica!!! Many disasters happened and lots of people lost their lives, homes or even everything. Blue Mary, the well-known scientist, is to work out the secret of this aerolite for further study.

Blue Mary has found out that there are some numbers on this aerolite, 5 per line:

```
1 1 1 1 6
0 0 6 3 57
8 0 11 3 2845
```

With her genius, Blue Mary knows that the 5th number is the key to solve the problem, but in some lines the 5th numbers were destroyed and we cannot know what they are instantly.

After some days, she finds out the way to calculate the 5th number finally, which is:

- A Regular Expression(RE) is a string which only contains characters `'{','[','(',')','}','\','\''` and satisfies the rules below.
- An empty string is an RE.
- If there's no character `'[','\','\''` in RE A, then (A) is an RE.
- If there's no character `'{','\','\''` in RE A, then [A] is an RE.
- If A is an RE, {A} is an RE.
- If both A and B are REs, AB is an RE.

For example `"O(O)[]"`, `"{O[O]}"`, `"{{{[(O)]}}}"` (all without quotes) are REs and `"O([)]O"`, `"[O"` are not REs.

The deep of an RE A,  $D(A)$ , is defined as below:

- If A is an empty string,  $D(A)=0$ ;
- If A can be written as BC,  $D(A)=\max(D(B),D(C))$ ;
- If A can be written as (B) or [B] or {B},  $D(A)=D(B)+1$ .

Such as  $D("O\{O\}[]")=2$ .

Suppose the first 4 numbers in current line are  $L_1, L_2, L_3$  and D, then the 5th number in current line is the number of REs modulo 11380. Each of the REs must have a depth of D and is made of  $L_1 \{ \}$ ,  $L_2 [ ]$  and  $L_3 ( )$ .

Now Mary needs your help to work out the 5th number.

## Input

Input contains exactly 10 test cases. Each test case contains one line, which contains 4 numbers  $L_1, L_2, L_3, D$  ( $0 \leq L_1, L_2, L_3 \leq 10$ ,  $0 \leq D \leq 30$ ), separated by single spaces.

## Output

Ten lines, each contains a single integer denoted the 5th number.

## Example

**Input :**

1 1 1 1

0 0 6 3

1 1 1 2

[and 7 test cases more]

**Output :**

6

57

8

[and 7 test cases more]

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 7s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2001, Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1460. A Simple Calculator in the Galaxy

**Problem code: GALAXY**

#### Background

So if you want to survive the Earth's demise and see the galaxy, make sure you are wearing something more substantial than pajamas and a ratty bathrobe, watch the skies for flying saucers, start worrying when all the dolphins on the planet vanish, and keep your eyes peeled for an electronic gizmo with the words "Don't Panic" printed in large friendly letters on the cover.

--The Hitchhiker's Guide to the Galaxy

#### Problem

Addition, subtraction and multiplication is necessary wherever you are in the galaxy. You are to write a program to perform these operations, and you can see  $6*7=42$  or  $67-25=42$  or  $31+11=42$ , maybe one of them is the problem of Life, the Universe and Everything.

**Please note that the solution may only be submitted in Brainf\*\*k, Whitespace and Intercal, other languages like C/C++/Pascal/Java are not allowed!** If you want to use other languages to solve this problem, you may try this one.

#### Input

Multiple test cases, the number of them  $T$  is given in the very first line,  $T \leq 99$ .

Each test case contains one line which has the following form:

*num oper num*

where *num* is an integer number between 1 and 99, and **oper** is '+' or '-' or '\*' (without quotes).

There's no extra whitespace and leading zero in the input.

#### Output

For each test case you should output one line which contains the answer without any leading zeros. You may assume this number is always a positive one.

#### Example

**Input :**

```
3
6*7
67-25
31+11
```

**Output :**

42

42

42

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 17s

Source limit:17000B

Languages: WSPC BF ICK

Resource: Folklore, description and test data by Blue Mary

## SPOJ Problem Set (classical)

### 1461. Greedy Hydra

#### Problem code: DRAGON

Hydra is some very greedy animal. A hydra has 9 heads when he is born, and many more new heads will come out when he grows up. Of course, some old heads will break off because of caducity.

One day, a hydra with  $M$  heads finds a tree with  $N$  fruits on it. He is very delighted and wants to eat this tree instantly. Since he has  $M$  heads, he must divide these  $N$  fruit into  $M$  groups, each group contains at least 1 fruit, and each head will eat a group of fruits.

The biggest head among the  $M$  heads is named "Boss", it must eat neither more nor less than  $K$  fruits, and, in the nature of things, the biggest fruit included. These fruits are connected by  $N-1$  branches, and there exists a path made up with branches between each pair of fruit.

If two fruit connected by a single branch is put in different groups, the corresponding two heads will break the branch and eat the two fruits, otherwise the corresponding head will eat the two fruits without breaking the branch. Eating branches is not very comfortable of course, so every branch has a weight of illness, and the weight of illness of this hydra is the sum of the weights of illness of all branches he has eaten.

Your task is to help the hydra to minimize his weight of illness.

The picture below is an example.

[IMAGE]

$N=8, M=2, K=4$ . The bigger head eats 4 fruits(full points), the smaller head eats 4 fruits(empty points). The branch signed by a thin segment is eaten by the hydra.

#### Input

Ten test cases(Given one after another, you have to process all!). For each test case the first line contains 3 integers  $N(1 \leq N \leq 300)$ ,  $M(2 \leq M \leq N)$ ,  $K(1 \leq K \leq N)$ , separated by single spaces. The  $N$  fruits are numbered  $1..N$ , and the biggest fruit is always numbered 1.  $N-1$  lines follow, each contains 3 integers  $i, j, k$  separated by spaces denoted that there is a branch between fruit  $i(1 \leq i \leq N)$  and fruit  $j(1 \leq j \leq N)$  and the weight of illness of this branch is  $k(0 \leq k \leq 100000)$ .

#### Output

Ten lines, each contains a single integer - the minimum weight of illness of the hydra. If we can't divide the fruit into  $M$  groups, output "-1"(without quotes).

## Example

**Input :**

```
8 2 4
1 2 20
1 3 4
1 4 13
2 5 10
2 6 12
3 7 15
3 8 5
[and 9 test cases more]
```

**Output :**

```
4
[and 9 test cases more]
```

## Link

After solving this problem you can try the problem DRAGON2.

Blue Mary's Note: test data has been modified on Dec.12, 2007. All the solutions have been rejudged.

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 9s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2002,Day 1; translated by lcosvse

## SPOJ Problem Set (classical)

### 1462. Barbarians

#### Problem code: BARB

There are  $N$  Barbarians living on an unknown island. On the island there are  $M$  caves, we can number them 1, 2, ...,  $M$  clockwise. When we find the island, the barbarians are living in  $N$  distinct caves numbered  $C_1, C_2, \dots, C_N$ . Every year each barbarian walks out of his cave and goes along the road, passes  $P_i$  caves and then go into that cave. Every Barbarian has a living time:  $L_i$  years, after  $L_i$  years the  $i$ th barbarian died.

We are surprised to find out that no two barbarians live in one cave in the same year so no conflicts have happened. We are interesting about the minimum number of caves on the island.

**Please note that this problem has a somewhat strict source limit and time limit.**

#### Input

The very first line contains a single integer  $T$ , the number of test cases.  $T$  blocks follow.

For each test case, the first line contains a single integer  $N$  ( $N \leq 15$ ).  $N$  lines follow, each contains 3 integers  $C_i$  ( $1 \leq C_i \leq 100$ ),  $P_i$  ( $1 \leq P_i \leq 100$ ),  $L_i$  ( $1 \leq L_i \leq 1,000,000$ ).

#### Output

For each test case, the first and only line contains a single integer  $M$  - the answer. You may assume  $M \leq 1,000,000$ .

#### Example

**Input :**

```
1
3
1 3 4
2 7 3
3 2 1
```

**Output :**

```
6
```

**Hints**

Year	Barb. No.1	Barb. No. 2	Barb. No. 3
0	1	2	3
1	4	3	5
2	1	4	Died



	3		4		5		Died	
-----								
	4		1		Died		Died	
-----								

---

Added by: Blue Mary  
 Date: 2007-04-01  
 Time limit: 5s  
 Source limit:2048B  
 Languages: All except: C99 strict  
 Resource: Chinese National Olympiad in Informatics 2002,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1463. Robot Number M

#### Problem code: ROBOT

Blue Mary, the well-known astronaut, had sent Robot No.1 to Mars finally. Robot No.1 was so smart that he could make one robot per second.

Assume the time Robot No.1 arrived was second 1. At second  $i$ , Robot No.1 made a new Robot: Robot No. $i$ . ( $i \geq 2$ )

The new robots started work as soon as he was produced successfully. Robot No. $M$  only had a rest at second  $t$ , where  $t$  is a multiple of  $M$ . For example, Robot No.3 worked at second 4,5,7,8,... and had a rest at second 6,9,...

When a robot was having a rest, he could send his own informations to the newly produced robot. For example, when Robot No.6 was produced successfully, Robot No.2 and Robot No.3 are having a rest, so Robot No.6 would get informations from Robot No.2 and No.3. We call Robot No.2 and No.3 are teachers of Robot No.6.

We call two Robots are independent if each of them wasn't a teacher of the other one and they had no common teachers. **Please note that Robot No.1 was independent to any other robots and wasn't a teacher of any other robots**, since only Robot No.1 could make robots.

The good number of Robot No. $M$  is the number of robots who was produced earlier than No. $M$  and independent to No. $M$ . Here are some examples:

The good number of Robot No.1 is 0.

The good number of Robot No.2 is 1. No.1 was that robot.

The good number of Robot No.6 is 2. No.1 and No.5 were those robots. No.2 and No.3 were his teachers. No.4 and him had a common teacher: No.2.

The Robots had 3 kinds of occupations. To Robot No. $M$ :

- If  $M$  can be written as the multiple of an even number of distinct odd primes, he was a businessman.
- If  $M$  can be written as the multiple of an odd number (1 included) of distinct odd primes, he was a hacker.
- All other robots were doctors.

Now Blue Mary was interesting to Robot No. $M$ . She wants to know the sum of good numbers of all businessmen, hackers and doctors among Robot No. $M$  and his teachers. She comes up with the answer quickly, and so can you.

Blue Mary is so kind that she gives you the prime divisors of  $M$  and you can only tell her the answers modulo 10000.

## Input

The very first line contains a single integer  $T$ , the number of test cases.  $T$  blocks follow.

For each block, the first line contains a single integer  $K$ .  $K$  lines follow, each contains two integers  $p_i$  and  $a_i$  separated by a single space.

$$M = p_1^{a_1} * p_2^{a_2} * p_3^{a_3} * \dots * p_K^{a_K}.$$

You can assume that:

- All  $p_i$  are distinct primes and are less than 10,000.
- $p_1 < p_2 < p_3 < \dots$
- $n$ .
- All  $a_i$  are positive and no more than 1,000,000.
- $1 \leq k \leq 1000$ .

## Output

For each test case, output 3 lines.

The first line contains a single integer denotes to the sum of good numbers of all businessmen among Robot No. $M$  and his teachers modudo 10000.

The second line contains a single integer denotes to the sum of good numbers of all hackers among Robot No. $M$  and his teachers modudo 10000.

The third line contains a single integer denotes to the sum of good numbers of all doctors among Robot No. $M$  and his teachers modudo 10000.

## Example

**Input :**

```
1
3
2 1
3 2
5 1
```

**Output :**

```
8
6
75
```

## Hints

In the sample input,  $M = 2^1 * 3^2 * 5^1 = 90$ . Robot No.90 has 10 teachers. Among Robot No.90 and his teachers, Robot No.15 is a businessman; No.3 and No.5 are hackers; all others are doctors, their numbers are 2,6,9,10,18,30,45,90.

---

Added by: Blue Mary  
Date: 2007-04-01  
Time limit: 2s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Chinese National Olympiad in Informatics 2002,Day 2; translated by Blue Mary

# SPOJ Problem Set (classical)

## 1464. Editor II

### Problem code: EDIT3

#### Background

After trying to solve problem EDIT1(Editor) and being \*\*\*\*\*ed by Brainf\*\*k, Blue Mary decided to set another difficult problem about editor.

#### Description

Some definitions:

- Text: It's a sequence that consists characters whose ASCII code is in [32,126].
- Cursor: It's a sign for pointing out the current position. It can be at the start or the end of the text or between two consecutive characters of the text.

Editor is a structure. It contains one text and one cursor. The operations are listed below:

Name	Input format	function
Move(k)	Move k	Move the cursor after the kth character in the text. If k=0, you should put the cursor at the start of the text.
Insert(n,s)	Insert n s	Insert string s whose length is n(>=1) after the cursor. The cursor doesn't move.
Delete(n)	Delete n	Delete n(>=1) characters after the cursor. The cursor doesn't move.
Get(n)	Get n	Output n(>=1) characters after the cursor.
Prev()	Prev	Move the cursor one character forward.
Next()	Next	Move the cursor one character backward.

If the text of a editor is empty, we say the editor is empty.

Here is an example. \_ denotes to the cursor, \$ denotes to the start and the end. At start the editor is empty.

Operation	Text after the operation	Output
INSERT(13,"Balanced tree")	\$_Balanced tree\$	\$\$
MOVE(2)	\$Ba_lanced tree\$	\$\$
DELETE(5)	\$Ba_d tree\$	\$\$

NEXT()	\$Bad_ tree\$	\$\$	
INSERT(7," editor")	\$Bad_ editor tree\$	\$\$	
MOVE(0)	\$_Bad editor tree\$	\$\$	
GET(15)	\$_Bad editor tree\$	\$Bad editor tree\$	

Your task is:

- Build an empty editor.
- Read some operations from the standard input and operate them.
- For each Get operation, write the answer to the output.

## Input

the very first line contains the number of testcases T( $T \leq 4$ ). T tests follow.

For each test, the first line is the number of operations N. N operations follow.

Blue Mary is so depressed with the problem EDIT1 that she decides to make the problem more difficult. So she inserts many extra line breaks in the string of the Insert operation. You must ignore them.

Except line breaks, all the characters' ASCII code are in [32,126]. There's no extra space at the end of a line.

You can assume that for each test case:

- No invalid operation is in the input.
- Number of move operations is no more than 50000.
- Number of the total of insert and delete operations is no more than 4000.
- Number of the total of prev and next operations is no more than 200000.
- The characters inserted will not more than 2MB. The valid output will not more than 3MB.

## Output

The output should contain T blocks corresponding to each testcase.

For each test case, the output should contain as many lines as the get operations in the input. Each line should contain the output of each get operation.

## Example

**Input :**

```
1
15
Insert 26
abcdefghijklmnop
qrstuvwxyz
Move 15
Delete 11
```

```
Move 5
Insert 1
^
Next
Insert 1
-
Next
Next
Insert 4
.\/.
Get 4
Prev
Insert 1
^
Move 0
Get 22
```

**Output :**

```
.\/.
abcde^_f.\/.ghijklmno
```

**Warning: large Input/Output data, be careful with certain languages**

Blue Mary's note: the test case #1 has something wrong and it has been fixed on April 27th, 2007. Solutions has been rejudged. Please accept my apology.

---

Added by: Blue Mary  
Date: 2007-04-01  
Time limit: 3s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: Chinese National Olympiad in Informatics 2003, Day 1

## SPOJ Problem Set (classical)

### 1465. On the Way to Find Chris

#### Problem code: CHRIS

Do you know the famous game THE KING OF FIGHTERS? If the answer is yes, I'm sure you know THE THREE BLACK GROUP: Chris, Shermie and Yashiro. Today Chris is invited to one of his friends' home to play THE KING OF FIGHTERS. Blue Mary is now at Chris' home, she knows where Shermie's and Yashiro's home is, but she doesn't know where Chris actually is. So she decides that:

- If Yashiro's home is nearer than Shermie's, she will go to Yashiro's home first, if she doesn't find Chris, she will then go to Shermie's, and vice versa.
- The map of the city is strange. Each of the houses is assigned to a unique number in the range  $[1, n]$ , where  $n$  is the number of houses. Between some pairs of houses there are some roads. There exists one and only one path from any house to any other house. She will go along the only path between the two houses.

Unfortunately, you don't know where Chris' home actually is, and the same as Yashiro's and Shermie's. Now you are interesting in the maximum time from the time when Blue Mary starts from Chris' home to the time when Blue Mary finds Chris in the worst case.

#### Input

The number of test cases  $T$  is given in the very first line.  $T$  blocks follow.

For each test case, the first line contains 2 space-separated integers  $N$  ( $3 \leq N \leq 200000$ ) and  $M$ , which denotes the number of houses and the number of roads in the city.  $M$  lines follow, each contains 3 space-separated integers  $x, y, z$  ( $1 \leq x, y \leq n, 1 \leq z \leq 10^9$ ). It tells us there exist a road between house No.  $x$  and house No.  $y$ , and to go from  $x$  to  $y$  or from  $y$  to  $x$  along this road will take  $z$  minutes. No two roads are repeated.

#### Output

For each test case you should output a single line, which contains a single integer - the maximum time measured in minutes.

#### Example

**Input :**

```
1
4 3
1 2 1
2 3 1
3 4 1
```

**Output**

```
4
```

**Warning: large Input/Output data, be careful with certain languages**

---



Added by: Blue Mary  
Date: 2007-04-01  
Time limit: 5s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Chinese National Olympiad in Informatics 2003,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1466. Blue Mary Needs Help Again

#### Problem code: CASHIER

Blue Mary is a cashier of a big company. The boss of this company is so annoying that he always increases or decreases wage of all workers. He increases all the workers' wage with a same number when he is happy or decreases all the worker's wage with a same number when he is depressed.

All the workers are angry with the boss, especially when he decreases their wage. A worker will leave the company and never go back when he finds his wage is lower than the least wage written on his contract. Blue Mary must delete the worker's files at that time. Another task she is to do is to build a file when a new worker joins this company.

The boss usually asks Blue Mary how much money the worker who gets the  $k$ -th most wage gets. Blue Mary is very tired with her work. Could you give her a hand?

#### Input

T

[the number of tests  $\leq 10$ ]

M MIN

[M is the number of commands below, MIN is the least wage]

C K

[C is one of the 4 characters I,A,S,F. I denotes that Mary should build a new file, and the new worker's wage is  $K$  ( $0 \leq K \leq 100000$ ) at start. If  $K$  is less than MIN, the worker will not join the company. A denotes that the boss increases all the workers' wage with  $K$  ( $0 \leq K \leq 1000$ ). S denotes that the boss decreases all the workers' wage with  $K$  ( $0 \leq K \leq 1000$ ). F denotes that the boss asks Blue Mary a question: how much money does the worker who gets the  $k$ -th most wage get ( $K > 0$ )?]

[M-1 other commands]

[other tests]

You may assume that:

- The number of worker in the company at start is 0.
- The number of command I is no more than 100000.
- The total number of command A and S is no more than 100.
- The number of command F is no more than 100000.

## Output

For each test case:

For each F command you must output one line contains a single integer which is the answer or -1 if K is more than the number of workers in the company at that time.

In the last line you must output a single integer - the number of workers who leave the company(excluded the ones who don't join the company)

## Example

**Sample Input:**

```
1
9 10
I 60
I 70
S 50
F 2
I 30
S 15
A 5
F 1
F 2
```

**Sample Output:**

```
10
20
-1
2
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 7s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2004,Day 1; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1468. Outside it is now raining

#### Problem code: RAIN2

Country M is pluvian. In City P, it rains frequently and many people complain that they always have trouble crossing the streets when raining. To make people cross the streets easier, the government set many "Automatic Umbrellas" above every crosswalk, shown in the picture below.

[IMAGE]

Each of these "Automatic Umbrellas" looks like a rectangle board, and their thickness is approximate zero. They can stop the rain instantly. They are left unused when it's not raining and shuttle from one side to another in the same speed otherwise. The walkers will not be wringing-wet if he walks under the umbrella when it's raining.

When many people want to cross the street, one "Automatic Umbrella" is not enough obviously. The government set many "Automatic Umbrella" on some main crosswalks. The width of each of the "Automatic Umbrella" equals to the width of the crosswalk, and any two of these umbrellas have different height. Their length and speed may be different.

You are to write a program to calculate the total volume of the rain falling to the ground from the time when it starts to rain to T seconds later.

#### Input

The very first line comes a single integer Q, the number of test cases. Q blocks follow.

For each test case:

The first line contains 4 space-separated integers  $N$  ( $\leq 10$ ),  $W$  ( $\leq 100$ ),  $T$  ( $\leq 100$ ),  $V$  ( $\leq 50$ ), the number of "Automatic Umbrella", the length of the crosswalk in meters, the total time in seconds and the volume of rain falling to the ground per square meter per second.

To simplify the description, we can build a Cartesian coordinate system in the following way: let the left side of the street be the origin, the street be the positive Ox-axes, and the vertical line to the ground be the positive Oy-axes, see the picture below.

[IMAGE]

Each of the next N lines contains 3 integers  $x_i$ ,  $l_i$ ,  $v_i$ , the initial position (in meter), the length (in meter), the speed (in meter per second) of the i-th umbrella. If  $v_i > 0$ , the umbrella moves to the right side initially; if  $v_i < 0$ , the umbrella moves to the left side initially; if  $v_i = 0$ , the umbrella doesn't move at all.

You can assume that the width of the umbrella and the crosswalk is 1 meter, the rain falls vertically, the speed of the rain will not change and the umbrellas and the crosswalk are absolutely horizontal.

## Output

For each test case, you should output a single real number(rounded to 2 decimal places) - the answer.You can assume the total distance of all the umbrella's movement will not exceed  $550 \times W$ .

## Example

**Input :**

```
1
2 4 3 10
0 1 1
3 1 -1
```

**Output :**

```
65.00
```

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 7s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2004,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1470. Another Sequence Problem

#### Problem code: SEQ2

You are to write a program to perform some operations on a given sequence. These operations are listed below:

Name	Input format	function
Modify	MAKE-SAME i t c	Modify all the t numbers from the ith number(included) to number c.
Insert	INSERT i t s	Insert t numbers after the ith number. s is a sequence of t numbers which should be inserted one-to-one. If i=0, you should insert s in the first of the sequence.
Delete	DELETE i t	Delete t numbers after the ith number(included).
Reverse	REVERSE i t	Reverse t numbers after the ith number(included).
Get sum	GET-SUM i t	Output the sum of t numbers after the ith number(included).
Get maximum partial sum	MAX-SUM	Output the maximum partial sum in the sequence now.

See the example.

#### Input

The very first line contains a single integer T( $T \leq 4$ ), the number of test cases. T blocks follow.

For each test case:

The first line contains two integers n and m( $m \leq 20000$ ), the number of numbers in the sequence in the beginning and the number of operations.

The second line contains n integers separated by spaces, the sequence in the beginning.

Next m lines, each contains an operation listed above.

You can assume that for each test case:

- No invalid operation is in the input.
- Number of numbers in the sequence is no more than 500000 and not less than 1 at any time.
- All the numbers in the sequence is in range  $[-1000, 1000]$  at any time.
- The total number of numbers inserted will be not more than 4,000,000. The input is no more than 20MB.

## Output

For each Get sum and Get maximum partial sum operation, you should write the answer to the output, one per line.

## Example

### Input :

```
1
9 8
2 -6 3 5 1 -5 -3 6 3
GET-SUM 5 4
MAX-SUM
INSERT 8 3 -5 7 2
DELETE 12 1
MAKE-SAME 3 3 2
REVERSE 3 6
GET-SUM 5 4
MAX-SUM
```

### Output :

```
-1
10
1
10
```

### Hints :

After the 3rd op., the sequence is  
2 -6 3 5 1 -5 -3 6 -5 7 2 3

After the 4th op., the sequence is  
2 -6 3 5 1 -5 -3 6 -5 7 2

After the 5th op., the sequence is  
2 -6 2 2 2 -5 -3 6 -5 7 2

After the 6th op., the sequence is  
2 -6 6 -3 -5 2 2 2 -5 7 2

**Warning: enormous Input/Output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 7s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2005, Day 1; translated by lcosvse

## SPOJ Problem Set (classical)

### 1471. A Game of Pearls

#### Problem code: PRLGAME

The game of pearls is to use the following 12 kinds of pearl designs each one and only one time to make the big pearl design. The pearl designs can be rotated and turned over arbitrarily. See the pictures below.

The empty grids

[IMAGE]

A sample big pearl design

[IMAGE]

A sample big pearl design used characters instead of colors

[IMAGE]

Part A

[IMAGE]

Part B

[IMAGE]

Part C

[IMAGE]

Part D

[IMAGE]

Part E

[IMAGE]

Part F

[IMAGE]

Part G

[IMAGE]

Part H

[IMAGE]

Part I

[IMAGE]

Part J

[IMAGE]

Part K

[IMAGE]

Part L

[IMAGE]



## Input

Ten test cases(given one after another,you have to process all!), Each contains a big design, 'A'-'L' denote the filled grids, '.' denotes the empty grids,see the example. You can assume that the pearl designs used are completely put into the empty grids.

## Output

A big design which has no grids that haven't been filled and each pearl design is used one and only one time in it,or 'No solution'(without quotes) if there's no solution.If there are multiple solutions,output any.

## Example

**Input :**

```
.
..
...
....
.....
.....C
...CCC.
EEEEH...
E.HHH....
E.....
[and 9 test cases more]
```

**Output :**

```
B
BK
BKK
BJKK
JJJDD
GJGDDC
GGGCCCI
EEHHHIIA
ELHHHIAAF
ELLLLIFFFF
[and 9 test cases more]
```

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 20s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2005,Day 1; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1472. Tom and Jerry

#### Problem code: TOMJERRY

You may know the great American cartoon called *Tom and Jerry*. In that cartoon, Tom is a stupid cat, and Jerry is a cute mouse. They are all living in Blue Mary's house. (Maybe the name of the owner of the house they living in is not Blue Mary, but this is not important. ^\_^)

One day Jerry gets a GPS, so after that he can detect Tom's position accurately. He decides to play tricks on Tom again. The house has  $N$  ( $1 \leq N \leq 1000$ ) rooms numbered from 1 to  $n$  and  $E$  ( $1 \leq E \leq 1000$ ) corridors, each connects two different rooms, and there is at most one corridor between two rooms. When Jerry gets the GPS, he is in room No. $P$  ( $1 \leq P \leq N$ ) while Tom is in room No. $Q$  ( $1 \leq Q \leq N$ ). You may assume that room No. $P$  and room No. $Q$  is in one connected componenet and they are not the same room. Since Jerry is very cute and Tom is very stupid, if they are in the same room, Jerry can befool Tom as soon as possible. Now Jerry wants to get to Tom's room as soon as possible. At each time unit, he will detect Tom's position, and choose the room next to his room which is the nearest to Tom's position and go to that room. If there are several rooms satisfied the condition above, he will choose the one with the least room number. After that, if they are in the same room, Jerry will stay and play tricks on Tom, or he will repeat this progress one more time otherwise.

Now poor Tom doesn't know he'll be played, he is taking a walk in the house leisurely. Each time unit he will choose a room next to the room he is in and go to that room or stay in the room he is in now, with equal probability. For example, if Tom is now in room 1, room 2 and room 3 are the only neighbors of room 1 (i.e. there is a corridor between room 1 and room 2, and there is a corridor between room 1 and room 3), at the next time unit, the probability of that Tom is in room 1,2 or 3 are all  $1/3$ .

Suppose at each time unit, Jerry moves first, and Tom will move after Jerry complete his move. You task is to calculate the expected time unit from the time when Jerry gets the GPS to the time when Jerry and Tom are in the same room.

#### Input

Multiple test cases, the number of them is given in the very first line.

For each test case:

The first line contains two space-separated integers  $N$  and  $E$ . The second line contains two space-separated integers  $P$  and  $Q$ .  $E$  lines then follow, each contains 2 space-separated integers  $A$  and  $B$  which shows that there is a corridor between room  $A$  and room  $B$ .

#### Output

For each test case:

Output one line, which contains a single real number - the expected time unit, rounded to 3 decimal places.

## Example

### Input :

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

### Output :

```
1.500
2.167
```

### Hint

The calculations for the first example can be found [here](#).

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 6s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2005,Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1473. Lemon Tree in the Moonlight

#### Problem code: LEMON

Blue Mary extremely like lemon trees. When the softness moon shines the ground, she lies under the lemon tree, thinking about the true meaning of life, the universe and everything quietly.

Before long, she is shadowed by the lemon tree. Blue Mary is such a cute girl, that she soon comes up with a question: what is the area of the shadow?

She knows it's hard for her to measure the shadow directly. So that, she tries to calculate it in geometrical way.

As Mary knows well about this beautiful lemon tree, she regards it as  $N$  frustums of cones, each frustums of cone is defined as a floor, numbered  $1..N$  from the bottom to top. Of course, the  $N$ th(Top) is a cone. Each frustum has two circle surfaces. Each two adjacent frustums shares a same circle surface. All the centres of the circle surfaces are on a plumb line. Mary knows that the height of every frustums is  $h_1, h_2, \dots, h_n$ , and the undersurface of the 1st frustum has a height  $h_0$  from the ground.

Mary measures that the included angle of the moonshine and the ground is  $\text{Alpha}$ , which is an acute angle.

[IMAGE] [IMAGE]

For briefness, we suppose the moonshine is parallel and the ground is acclinic.

And we ignore the bole of the tree. Mary comes up with the answer quickly, and she wants your ideas all the same.

#### Input

The very first line of the input data contains one integer  $T$ , the number of tests.  $T$  blocks follow.

For each test:

The first line of the input data contains one integer number  $N$  ( $N \leq 500$ ) and a real number  $\text{Alpha}$  ( $\text{Alpha} > 0.3$ ).

$N$  denote the number of floors,  $\text{Alpha}$  denote the included angle of the moonshine and the ground (radian).

The second line contains  $N + 1$  real number  $h_0 h_1 h_2 \dots h_n$ . ( $h_i \leq 100$ )  $h_0$  denotes the height of the undersurface of the 1st frustum.  $h_1 \dots h_n$  denote the height of each floor.

The third line contains  $N$  real number  $r_1 r_2 \dots r_n$  ( $r_i \leq 100$ ), the radii of the undersurface in each floor.

All the data in each line is seperated by spaces.

## Output

For each data set you should output one line containing a single real number - the area of the shadow. Numbers should be rounded to two decimal places.

## Example

**Input :**

```
1
2 0.7853981633
10.0 10.00 10.00
4.00 5.00
```

**Output :**

```
171.97
```

**Time limit has been changed from 30 seconds to 13 seconds, some naive solution gets TLE.**

---

Added by: Blue Mary

Date: 2007-04-01

Time limit: 13s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2005,Day 2; translated by g201513

## SPOJ Problem Set (classical)

### 1475. VII - Act IV

#### Problem code: WORMS

#### Background

This problem is completely unrelated to its problem code ^ \_ ^.

#### Description

A natural number  $x$  is called a good number if one or two of the next two conditions is satisfied:

- 7 is a divisor of  $x$ .
- 7 is a digit of  $x$ .

#### Task

Write a program that:

- reads a number  $n$  from the standard input,
- computes the number of good numbers in range  $[1, 10^n]$ ,
- writes the result to the standard output.

Solve the problem in at most 0.5kB of source code.

#### Input

The input begins with an integer  $t$  ( $t \leq 210$ ), the number of test cases.  $t$  test cases follow.

For each test case, the first and only line contains an integer  $n$  ( $1 \leq n \leq 500$ ).

#### Output

For each test case the output consists of one line that contains the answer.

#### Example

**Sample input:**

```
3
1
2
1
```

**Sample output:**

```
1
30
1
```

---

Added by: Blue Mary  
Date: 2007-04-01  
Time limit: 2s  
Source limit: 512B  
Languages: All except: C99 strict  
Resource: Folklore, description, standard program and test data by Blue Mary

## SPOJ Problem Set (classical)

### 1476. Maximum Profit

#### Problem code: PROFIT

CS&T, the well-known cellphone company, is going to set some new service stations among  $n$  possible ones, which are numbered  $1, 2, \dots, n$ . The costs of setting these stations are known as  $P_1, P_2, \dots, P_n$ . Also the company has made a survey among the cellphone users, and now they know that there are  $m$  user groups numbered  $1, 2, \dots, m$ , which will communicate by service station  $A_i$  and  $B_i$ , and the company can profit  $C_i$ .

Now CS&T wants to know which service stations are to be set that the company will profit most.

#### Input

```
T [The number of tests]
n m [n<=5000 m<=50000]
P1 P2 P3 ... Pn [Pi<=100]
A1 B1 C1
A2 B2 C2
...
Am Bm Cm [1<=Ai,Bi<=n, Ci<=100]
[other tests]
```

At least 80% of the tests satisfy that  $n \leq 200$ ,  $m \leq 1000$ .

#### Output

```
MaximumProfit
[other tests]
```

#### Example

##### Input :

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

##### Output :

```
4
```

##### Hints :

The service stations to be set are 1,2,3.

---



Added by: Blue Mary  
Date: 2007-04-01  
Time limit: 7s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: Chinese National Olympiad in Informatics 2006, Day 2; translated by Blue Mary

## SPOJ Problem Set (classical)

### 1477. Play with a Tree

#### Problem code: PT07A

Hey, ACRush and Jelly are playing a game ! Let take a look at its rule:

You are given a tree. Two players take turns cutting edges on a tree. Some nodes is on the "ground". When a player cuts an edge, all the edges that are no longer connected to the ground disappear. The player who can not take a move loses.

ACRush plays first. Both of them are very good players. If you know state of the tree they are playing with, can you guess who will win?

[IMAGE] Node 4 is on the ground.

#### Input

Input consists of multiple test-cases. The first line contains one integer  $t$  - number of cases ( $0 < t \leq 20$ ). For each case, the input format is following. The first line contains one integer  $N$  ( $1 \leq N \leq 100000$ ). The next line  $N$  integers  $s[i]$  (1 or 0). If  $s[i]$  is 1, the  $i$ -th node is on the ground. If  $s[i]$  is 0, the  $i$ -th node is not on the ground. Each line of the following  $N - 1$  lines contains two integers  $u, v$ . They denote there is an edge between node  $u$  and node  $v$  ( $1 \leq u, v \leq N$ ).

There is no blank line after each case.

#### Output

For each case, output who will win the game. If ACRush wins, output *1*; otherwise, output *0* (Jelly wins).

There is no blank line after each case.

#### Example

**Input :**

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

**Output :**

```
1
```

---

Added by: Thanh-Vy Hua  
Date: 2007-04-07  
Time limit: 0.5s-1s  
Source limit:50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1478. The Easiest Problem

#### Problem code: PT07B

You are given an unweighted, undirected tree  $T$ . We say  $T$  is special iff it has this property:

"All nodes of degree greater than or equal to 3 are surrounded by at most two nodes of degree two or greater."

Finding maximal size subtree of this tree so that it's a special tree.

#### Input

The first line of the input file contains one integer  $N$  --- number of nodes in the tree ( $0 < N \leq 10^6$ ). Next  $N-1$  lines contain  $N-1$  edges of that tree --- Each line contains a pair  $(u, v)$  means there is an edge between node  $u$  and node  $v$  ( $1 \leq u, v \leq N$ ).

#### Output

At the first line, output number of nodes in the optimal subtree you found. Next lines, print all edges belong to that subtree, each line contains a pair  $u v$  means an edge between node  $u$  and node  $v$ .

#### Example

**Input :**

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

**Output :**

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

---

Added by: Thanh-Vy Hua  
Date: 2007-04-07  
Time limit: 0.100s-10s  
Source limit: 50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1479. The GbAaY Kingdom

#### Problem code: PT07C

Jiajia is the king of the GbAaY Kingdom. He always squeezes his 20 ministers as coolies. There are  $n$  cities and  $m$  two-way roads connecting cities in the kingdom. Because of the increasing of the oil fee, he want to simplify the road system in the GbAaY Kingdom to save the traffic cost. Thus, some of roads will be removed. But he requests the ministers guarantee that there is always a path between any two cities. GbAaY Minister Loner suggests Jiajia for the convenience of the traffic management, the farthest distance between cities should be minimal. Unhesitatingly, Jiajia agrees this resolution. As the GbAaY Kingdom's minister (cooly), you must work hard for Jiajia to make the simplification plan.

#### Input

The first line contains two integers  $n, m$  ( $1 \leq n \leq 200, n - 1 \leq m \leq 20000$ ). Each line of the following  $m$  lines contains three integers  $u, v, w$  ( $u \neq v, 0 \leq w \leq 10^5$ ). They denote there is a road with length  $w$  between city  $u$  and city  $v$ .

#### Output

The first line contains one integer which is the farthest distance between cities after the simplification. Each line of the follow  $n - 1$  contains two integers  $u, v$  ( $u < v$ ). They denote there is an road between city  $u$  and city  $v$  in the simplification plan. If there are many optimal solutions, any of them will be accepted.

#### Example

**Input :**

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

**Output :**

```
2
1 2
1 3
```

---

Added by: Thanh-Vy Hua  
Date: 2007-04-07  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1480. Let us count 1 2 3

#### Problem code: PT07D

Given two integer  $n, p$ . 4 kinds of query is needed to solve:

1. Counting the number of labeled unrooted trees with  $n$  nodes
  2. Counting the number of labeled rooted trees with  $n$  nodes
  3. Counting the number of unlabeled rooted trees with  $n$  nodes
  4. Counting the number of unlabeled unrooted trees with  $n$  nodes
- Calculate the answer modulo  $p$ .

#### Input

Each line contains three integers  $k, n, p$ .  $k$  denotes which kind of query this case is.

For Kind 1 or Kind 2 query,  $1 \leq n \leq 10^9$ .

For Kind 3 or Kind 4 query,  $1 \leq n \leq 10^3$  and  $n \leq p$ .

For all queries,  $2 \leq p \leq 10^4$  and  $p$  is a prime.

#### Output

For each query, output a line which contains only one integer.

#### Example

**Input :**

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

**Output :**

```
1
2
1
1
```

---

Added by: Thanh-Vy Hua  
Date: 2007-04-07  
Time limit: 0.300s-4s  
Source limit: 50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1482. A short vacation in Disneyland

#### Problem code: PT07F

After a lot of exams at school, Amber and his friends Ahyangyi, Dragon have a short vacation in Hong Kong Disneyland. Many interesting places they want to visit there: resort, castle,... . In each place and between them, there are special bidirectional rails, so that the visitors can drive a small special car, go around and have a sightseeing tour. This rail system is quite optimal it has tree shape ! Each time, you start a new route (or you can call it "path") with a car, you must purchase a new ticket.

Amber and his friends surely want to visit all places, and each place exactly once, so bored to visit one place many times. But the trouble is they don't carry much money. So Amber thinks about a good way to purchase as small number of tickets as possible (i.e. minimal number of routes). We don't care how they can switch cars during their trip.

Now you're given maps of the Disneyland, please help them to find an optimal solution.

Take a look at the figure below:

[IMAGE]

There are many optimal solutions here and Amber must purchase at least 3 tickets, for 3 disjoint routes. Two possible solutions are:

**Solution 1:**

1-st route: they visit 1 2 3

2-nd route: they visit 4

3-rd route: they visit 5 6 7

**Solution 2:**

1-st route: they visit 1 2 4 6 5

2-nd route: they visit 3

3-rd route: they visit 7

#### Input

There may be many maps in one input file. The first line of file is number of maps  $T$  ( $0 < T \leq 10$ ). The following line is blank. Then, there are the descriptions of  $T$  maps.

For each map, the first line contains one integer  $N$  --- number of places in the Disneyland ( $0 < N \leq 10000$ ). We number places from 1 to  $N$ . Next  $N-1$  lines contain  $N-1$  rails between places --- Each line contains a pair  $(u, v)$  means there is a rail between place  $u$  and place  $v$  ( $1 \leq u, v \leq N$ ).

There is a blank line after each description.

#### Output

For each map, the first line, write minimal number of routes  $K$ . Next  $K$  lines, show out the routes in your solution, each has form  $u[1] u[2]...u[m]$ , means the route starts at place  $u[1]$  then visits place  $u[2]$ ,..., ends at place  $u[m]$ . So between 2 consecutive places in each route must have a rail. If there are many solutions, any of them will be accepted.

There is no blank line after each case.

## Example

**Input :**

1

7

1 2

2 3

2 4

4 6

5 6

6 7

**Output :**

3

1 2 3

4

5 6 7

---

Added by: Thanh-Vy Hua

Date: 2007-04-07

Time limit: 0.100s-0.5s

Source limit:50000B

Languages: All

Resource: Co-author Amber



## SPOJ Problem Set (classical)

### 1483. Colorful Lights Party

#### Problem code: PT07G

ACRush and his friends want to open a party to celebrate the good result of THU in ICPC 2007. They will use all halls in THU for their party. There are 2 kinds of hall: the small and the large one. In each hall, there is an electronic light system, which forms a tree topology to reduce redundant wires.

- In a small hall, the light system is a general tree with  $n$  lights. The lights are numbered from 1 to  $n$
- In a large hall, the light system is obtained from  $k$  chains of lights, each chain has length  $t$ . The first lights of these  $k$  chains are connected with a big light at the central stage of the hall. The big light has id 1, the first light of each chain has id from 2 to  $k+1$ , then we continue with the second light of each chain, so on...

Take a look at the figure below:  
[IMAGE]

ACRush hopes in every hall, each light has an unique color and so do the wires!

For easier to remember and to hang up lights against the walls, he sets a rule:

- For each hall, we number the color from 0 to  $n-1$ , so each light will get a color id in set  $\{0, 1, \dots, n-1\}$ .
- Color id of the wire connects  $i$ -th light and  $j$ -th light uniquely identified by the positive difference between color ids of  $i$ -th light and  $j$ -th light.

At first view, the rule seems easy, so everyone agrees with him. But it's really tough if the room is quite large, too hard to set colors for lights. After few seconds, ACRush says "*So in this hall, the 1-st light should have color 3, the 2-nd one should have color 0,...*". Well, how can he do it very fast?

How about you ? Let write a program to help ACRush's friends setting colors for lights in all  $T$  halls.

### Input

The first line of file is  $T$  -- number of halls in THU ( $0 < T \leq 10$ ). The following line is blank. Then, there are the descriptions of  $T$  halls.

For each hall, the first line contains one integer *kind*. *kind* denotes which kind of the current hall: 1 is a small hall, 2 is a large one. On next line, there are two cases:

- For Kind 1, first line is  $n$  ( $1 \leq n \leq 27$ ) -- number of lights. Next  $n - 1$  lines describe wires in this hall. Each line is pair  $(u, v)$  -- there is a wire between light  $u$  and  $v$  ( $1 \leq u, v \leq n$ ).
- For Kind 2, only one line contains two numbers  $k$  and  $t$  ( $1 \leq k, t \leq 1000$ ).

There is a blank line after each description.

## Output

For each hall, show us  $n$  numbers on one line,  $i$ -th number is the color id of  $i$ -th light. If there are many solutions any of them will be accepted. Otherwise, if there is no solution, all color id should be  $-1$ . The color ids on one line are separated by exactly one blank, and you'd better not print any redundant blanks. There is no blank line after each case.

## Example

**Input :**

2

1

3

1 2

2 3

2

2 1

**Output :**

0 2 1

0 4 2 1 3

---

Added by: Thanh-Vy Hua

Date: 2007-04-07

Time limit: 0.100s-2s

Source limit:50000B

Languages: All

Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1484. Search in XML

#### Problem code: PT07H

The XML (eXtensible Markup Language) is gaining popularity as a new standard for data representation and exchange on the internet. XML provides a text-based means to describe and apply a tree-based structure to information. The XML document consists of nested elements, some of which usually have attributes and content. But for simplifying this problem, we needn't consider the attributes and content, i.e. only tags allowed. An element typically consists of two tags, a start tag and an end tag. The start tag consists of a name surrounded by angle brackets, like "<tag>"; the end tag consists of the same name surrounded by angle brackets, but with a slash preceding the name, like "</tag>". The element's content is empty or other sub-element (child) that appears between the start tag and the end tag. Specially, no XML element that has the same tag in its direct sub-elements (children), i.e. All sibling elements have different tag names. The following is an valid example for XML documents.

```
<THU> <Team> <ACRush></ACRush> <Jelly></Jelly> <Cooly></Cooly> </Team> <ZiaZia> <Team> <Ahyangyi></Ahyangyi> <Dragon></Dragon> <Cooly><Ahuah></Ahuah></Cooly> </Team> </ZiaZia></THU>
```

For identifying the elements in a document, we number the elements in according to the order that the start tags of the elements appear in the document. For instances, "THU" is numbered 1. The first "Team" is numbered 2. "ACRush" is numbered 3. "Ahyangyi" is numbered 8.

The problem of querying XML documents has been given much attention by researchers. Now we are given a querying pattern of XML documents and a text of XML documents. The following is an valid example for pattern.

```
<Team><Cooly></Cooly></Team>
```

And we are requested to find all occurrences of the pattern in the text of XML documents. Here, the pattern occurs at a particular text position if placing the pattern with root element at that text position leads to a situation in which each pattern element overlaps some text element with the same label. Because the sibling elements have different labels, there is only one way to put the pattern into the text.

#### Input

There are two parts in the input file. The first part is a valid XML documents with exactly one root element. The second part is a valid XML documents as querying pattern with exactly one root element. Please ignore all whitespaces (unvisiable characters) in the input file, i.e. only consider the uppercase and lowercase letter and "/", "<", ">". Assume XML documents is always strictly a rooted tree. The input file is less than 100kb.

#### Output

Output all the occurrences of pattern in a text of XML documents. The first line consists of an integer  $n$  that denotes the number of the occurrences. Then the next  $n$  line, each line consists of an id number of an element that occurs the query pattern. Please print them in increasing order.

## Example

```
Input:
<TBD> <Team> <ACRush></ACRush> <Zilly></Zilly> <Cooly></Cooly> </Team> <ZiaZia>
<Team><Cooly></Cooly></Team>

Output:
2
7
```

---

Added by: Thanh-Vy Hua  
Date: 2007-04-07  
Time limit: 0.100s-3s  
Source limit:50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (classical)

### 1487. Query on a tree III

#### Problem code: PT07J

You are given a node-labeled rooted tree with  $n$  nodes.

Define the query  $(x, k)$ : Find the node whose label is  $k$ -th largest in the subtree of the node  $x$ . Assume no two nodes have the same labels.

#### Input

The first line contains one integer  $n$  ( $1 \leq n \leq 10^5$ ). The next line contains  $n$  integers  $l_i$  ( $0 \leq l_i \leq 10^9$ ) which denotes the label of the  $i$ -th node.

Each line of the following  $n - 1$  lines contains two integers  $u, v$ . They denote there is an edge between node  $u$  and node  $v$ . Node 1 is the root of the tree.

The next line contains one integer  $m$  ( $1 \leq m \leq 10^4$ ) which denotes the number of the queries. Each line of the next  $m$  contains two integers  $x, k$ . ( $k \leq$  the total node number in the subtree of  $x$ )

#### Output

For each query  $(x, k)$ , output the index of the node whose label is the  $k$ -th largest in the subtree of the node  $x$ .

#### Example

**Input :**

```
5
1 3 5 2 7
1 2
2 3
1 4
3 5
4
2 3
4 1
3 2
3 2
```

**Output :**

```
5
4
5
5
```

---

Added by: Thanh-Vy Hua  
Date: 2007-04-07  
Time limit: 1s-1.100s  
Source limit:50000B  
Languages: All  
Resource: Co-author Amber

## SPOJ Problem Set (main)

### 1488. Balloons of JiaJia

#### Problem code: PT07K

In WinD's birthday, JiaJia opens a small contest for all guests: just typing all characters from 'a' to 'z', who fastest is the winner. The award is a very big bunch of balloons. Of course, JiaJia hopes his girlfriend - WinD can win, since he only carries two bunches with him and the award for this contest looks prettier. Unfortunately, life is not always as he expected, the winner is Amber. So JiaJia can only give WinD his second bunch of balloons. After the party ended, WinD said "I prefer that bunch of balloons to this one!! If you can't give me something the same as it, I don't want to see you anymore!". Well, JiaJia really has a brainstorm.

If we consider balloons as nodes, the colorful strings connect them as edges, and color of each balloon is label of each node then we have each bunch of balloons is a rooted, labeled, ordered tree.

We call  $T$  a labeled tree if each node is assigned a symbol from a fixed finite alphabet. And  $T$  is an ordered tree if a left-to-right order among siblings in  $T$  is given.

JiaJia can do these 3 operators to change the shape of a bunch of balloons ( $T$ ):

- **Relabel** (recolor a balloon) Change the label of a node  $v$  in  $T$ .
- **Delete** (remove a balloon) Delete a non-root node  $v$  in  $T$  with parent  $p$ , making the children of  $v$  become the children of  $p$ . The children are inserted in the place of  $v$  as a subsequence in the left-to-right order of the children of  $p$ .
- **Insert** (add a balloon) The complement of **Delete**. Insert a node  $v$  with any label as a child of node  $p$  in  $T$ , making  $v$  be the parent of a consecutive subsequence of the children of  $p$ .

[IMAGE] [IMAGE]

Please help the poor guy JiaJia, use as few number of operators to make WinD's bunch of balloons exactly the same as Amber's bunch of balloons. His girlfriend can't wait any longer. Note that, he can only make changes with WinD's bunch.

#### Input

The input file contains two bunches of balloons (or trees). The first is of WinD, the second is of Amber.

The first line of the input file contains one integer  $N$  - number of balloons in the bunch  $T1$  ( $1 \leq N \leq 500$ ). Balloons are numbered from 1 to  $N$ .

In next  $N$  lines, the  $i$ -th line contains the ordered children list of the  $i$ -th balloon. The first integer  $l[i]$  of the  $i$ -th line is the color id of the  $i$ -th balloon ( $0 \leq l[i] \leq 10^4$ ). The second integer  $c[i]$  of the  $i$ -th line  $c[i]$  is the number of the children of the  $i$ -th balloon. Then  $c[i]$  integers followed, which means the ordered children list of the  $i$ -th balloon.

The remaining part of the input file is the description of the second bunch of balloons  $T2$ . The format is the same as  $T1$ .

## Output

Output minimum number of operators JiaJia needs to do.

## Example

**Input :**

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

**Output :**

```
2
```

## Explanation

We cut the string connected between 1st balloon and 3rd balloons, then change the color of 2nd balloon to 3.

---

Added by: Thanh-Vy Hua  
Date: 2007-04-07  
Time limit: 0.100s-2.5s  
Source limit: 50000B  
Languages: All  
Resource: Co-author Amber



## SPOJ Problem Set (classical)

### 1505. Whac-a-Mole

#### Problem code: MOLE

Map While visiting a traveling fun fair you suddenly have an urge to break the high score in the Whac-a-Mole game. The goal of the Whac-a-Mole game is to... well... whack moles. With a hammer. To make the job easier you have first consulted the fortune teller and now you know the exact appearance patterns of the moles. The moles appear out of holes occupying the  $n^2$  integer points  $(x, y)$  satisfying  $0 \leq x, y < n$  in a two-dimensional coordinate system. At each time step, some moles will appear and then disappear again before the next time step. After the moles appear but before they disappear, you are able to move your hammer in a straight line to any position  $(x_2, y_2)$  that is at distance at most  $d$  from your current position  $(x_1, y_1)$ . For simplicity, we assume that you can only move your hammer to a point having integer coordinates. A mole is whacked if the center of the hole it appears out of is located on the line between  $(x_1, y_1)$  and  $(x_2, y_2)$  (including the two endpoints). Every mole whacked earns you a point. When the game starts, before the first time step, you are able to place your hammer anywhere you see fit.

#### Input

The input consists of several test cases. Each test case starts with a line containing three integers  $n$ ,  $d$  and  $m$ , where  $n$  and  $d$  are as described above, and  $m$  is the total number of moles that will appear ( $1 \leq n \leq 20$ ,  $1 \leq d \leq 5$ , and  $1 \leq m \leq 1000$ ). Then follow  $m$  lines, each containing three integers  $x$ ,  $y$  and  $t$  giving the position and time of the appearance of a mole ( $0 \leq x, y < n$  and  $1 \leq t \leq 10$ ). No two moles will appear at the same place at the same time. The input is ended with a test case where  $n = d = m = 0$ . This case should not be processed.

#### Output

For each test case output a single line containing a single integer, the maximum possible score achievable.

#### Example

**Input :**

```
4 2 6
0 0 1
3 1 3
0 1 2
0 2 2
1 0 2
2 0 2
5 4 3
0 0 1
1 2 1
2 4 1
0 0 0
```

**Output :**

4  
2

---

Added by: Abhilash I  
Date: 2007-04-19  
Time limit: 5s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 1526. Ranklist Sorting

#### Problem code: RSORTING

You are given the scores of several players in a competition. Your task is to create a ranklist of the players, sorted in decreasing order by score.

Unfortunately, the data structure used for the list of players supports only one operation, which moves a player from position  $i$  to position  $j$  without changing the relative order of other players. If  $i > j$ , the positions of players at positions between  $j$  and  $i - 1$  increase by 1, otherwise if  $i < j$  the positions of players at positions between  $i + 1$  and  $j$  decrease by 1.

This operation takes  $i$  steps to locate the player to be moved, and  $j$  steps to locate the position where he or she is moved to, so the overall cost of moving a player from position  $i$  to position  $j$  is  $i + j$ . Here, positions are numbered starting with 1.

Determine a sequence of moves to create the ranklist such that the sum of the costs of the moves is minimized.

#### Input

The input consists of **exactly 10** test cases. The first line of each test case contains  $n$  ( $2 \leq n \leq 1000$ ), the number of players. Each of the following  $n$  lines contains one non-negative integer  $s_i$  ( $0 \leq s_i \leq 1000000$ ), the scores of the players in the current order. You may assume that all scores are distinct.

#### Output

For each test case, print in one line the number of moves used to create the ranklist. The following lines should specify the moves in the order in which they are applied. Each move should be described by a line containing two integers  $i$  and  $j$ , which means that the player at position  $i$  is moved to position  $j$ . The numbers  $i$  and  $j$  must be separated by a single space.

#### Example

*here only one test case*

**Input :**

```
5
20
30
5
15
10
```

**Output :**

```
2
2 1
3 5
```

---

Added by: Adrian Kuegel  
Date: 2007-05-04  
Time limit: 4s  
Source limit: 50000B  
Languages: All  
Resource: own problem, used in BOI 2007

## SPOJ Problem Set (classical)

### 1536. Help Blue Mary Please! (Act III)

#### Problem code: BLUEEQ3

#### Background

This morning Blue Mary wrote some equations on a piece of paper and left it on her desk. After solving some problems in SPOJ, she found that her classmate H.L. replaced all characters on the paper with some other ones. H.L. told her he replaced the same characters with the same ones, and different characters with different ones because of his goodness. Now Mary needs your help to get the original equations back. (See problem BLUEEQ)

#### Input

Ten test cases (given one after another, you have to process all!) For each test case, the first line is a single integer  $n$  ( $n \leq 21$ ). Next 3 lines contain 3 strings, each of them has a length of  $n$  and contains only first  $n$  capital latin characters. The sum of the numbers the first two strings indicates equals to the number the third string indicates. The numbers can have leading zeros and each of their bases is  $n$ .

#### Output

For each test case you should output one line contains  $n$  numbers separated by spaces, which is a permutation of integer numbers 0 to  $n-1$ . Number  $x$  is on the  $k$ -th position iff  $x$  is replaced by the  $k$ -th capital latin character. There is one and only one solution for each test case.

#### Example

**Input :**

```
5
ABCED
BDACE
EBBAA
[and 9 test cases more]
```

**Output :**

```
1 0 3 4 2
[and 9 test cases more]
```

---

Added by: Blue Mary  
Date: 2007-05-08  
Time limit: 17s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: description by Blue Mary

## SPOJ Problem Set (classical)

### 1538. Making Jumps

#### Problem code: MKJUMPS

A knight is a piece used in the game of chess. The chessboard itself is square array of cells. Each time a knight moves, its resulting position is two rows and one column, or two columns and one row away from its starting position. Thus a knight starting on row  $r$ , column  $c$  - which we'll denote as  $(r,c)$  - can move to any of the squares  $(r-2,c-1)$ ,  $(r-2,c+1)$ ,  $(r-1,c-2)$ ,  $(r-1,c+2)$ ,  $(r+1,c-2)$ ,  $(r+1,c+2)$ ,  $(r+2,c-1)$ , or  $(r+2,c+1)$ . Of course, the knight may not move to any square that is not on the board.

Suppose the chessboard is not square, but instead has rows with variable numbers of columns, and with each row offset zero or more columns to the right of the row above it. The figure to the left illustrates one possible configuration. How many of the squares in such a modified chessboard can a knight, starting in the upper left square (marked with an asterisk), not reach in any number of moves without resting in any square more than once?

[IMAGE]

If necessary, the knight is permitted to pass over regions that are outside the borders of the modified chessboard, but as usual, it can only move to squares that are within the borders of the board.

#### Input

There will be multiple cases to consider. The input for each case begins with an integer  $n$ , between 1 and 10, that specifies the number of rows in the modified chessboard. Following  $n$  there will be  $n$  pairs of integers, with the  $i$ th pair corresponding to the  $i$ th row of the chessboard. The first integer of each pair indicates the number of squares skipped at the beginning of the row. The second integer indicates the number of squares in the row (which will always be at least 1). The last case will be followed by the integer 0.

For example, input for the case illustrated by the chessboard shown above would be:

```
7 0 3 0 3 0 4 0 4 1 3 1 7 4 4
```

The maximum dimensions of the board will be 10 rows and 10 columns. That is, any modified chessboard specified by the input will fit completely on a 10 row, 10 column board.

#### Output

For each input case, display the case number (1, 2, ...), and the number of squares that the knight can not reach. Display the results in the format shown in the examples below.

## Example

**Input :**

```
7 0 3 0 3 0 4 0 4 1 3 1 7 4 4
3 0 3 0 3 0 3
2 0 1 2 1
0
```

**Output :**

```
Case 1, 4 squares can not be reached.
Case 2, 1 square can not be reached.
Case 3, 0 squares can not be reached.
```

---

Added by: Camilo Andrés Varela León

Date: 2007-05-11

Time limit: 5s

Source limit:50000B

Languages: All

Resource: North Central North America Regional Programming Contest - 2003

## SPOJ Problem Set (classical)

### 1552. Mobiles

#### Problem code: MOBILE2

You have been asked to buy a gift for your baby brother, Ike. However, you have noticed that Ike has a very particular taste in gifts. He only likes gifts that are configured in his particular style.

You have found a shop that sells mobiles. A mobile is a multi-layered decoration that is typically hung from the roof. Each mobile consists of a series of horizontal rods connected by vertical wires. Each rod has a wire hanging from both ends, which holds either another horizontal rod or a toy.

A sample mobile is shown below:

[IMAGE]

To satisfy your brother, you need to find a mobile that can be reconfigured so that:

- (i) any two toys are either at the same level (that is, joined to the roof by the same number of rods), or differ by only one level;
- (ii) for any two toys that differ by one level, the toy to the left is further down than the toy to the right.

Mobiles can be reconfigured by performing swaps. A swap involves taking some rod, unhooking whatever is hanging beneath the left and right ends, and reattaching them at opposite ends (that is, the right and left ends respectively). This process does not modify the ordering of any rods or toys further down.

Since you are training for the Informatics Olympiad, you decide to write a program to test whether a given mobile can be reconfigured into a gift that Ike will like!

As an example, consider the mobile illustrated earlier. Ike will not like this mobile. Although it satisfies condition (i), it breaks condition (ii) -- the toy at the leftmost end is at a higher level than the toys to its right.

However, the mobile can be reconfigured into a mobile that Ike will like. The following swaps are required:

1. First, the left and right ends of rod 1 are swapped. This exchanges the positions of rods 2 and 3, resulting in the following configuration:

[IMAGE]

2. Second, and finally, the left and right ends of rod 2 are swapped. This moves rod 4 to the left end of rod 2, and the toy to the right end of rod 2.

[IMAGE]



It can be seen that this final mobile satisfies Ike's requirements. All toys are at most one level apart, and the toys at a lower level are further to the left than the toys at a higher level.

Your task is, given a description of a mobile, to determine the smallest number of swaps required to reconfigure it so that Ike will like it (if this is possible). You may assume that the toys can never get in each other's way.

## Input

Multiple test cases, the number of them will be given at the very first line.

For each test case:

The first line of input will contain the single integer  $n$  ( $1 \leq n \leq 100\,000$ ) representing the number of rods in the mobile. The rods are numbered  $1, 2, \dots, n$ .

The following  $n$  lines will describe the connections for each rod. Specifically, the  $i$ th of these lines will describe rod  $i$ . Each of these lines will contain two integers  $l\ r$  separated by a single space, indicating what is hung beneath the left and right ends of the rod respectively. If a toy is hung beneath this rod, the corresponding integer  $l$  or  $r$  will be  $-1$ . Otherwise the integer  $l$  or  $r$  will be the number of a rod that is hung beneath this rod.

If there are any rods hanging beneath rod  $i$ , these rods will have numbers strictly greater than  $i$ . Rod  $1$  is the single rod at the top of the mobile.

## Output

Output should consist of a single line containing a single integer, giving the smallest number of swaps required to reconfigure the mobile according to Ike's constraints. If this is not possible, you should output the integer  $-1$ .

## Example

**Input :**

```
1
6
2 3
-1 4
5 6
-1 -1
-1 -1
-1 -1
```

**Output :**

```
2
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary  
Date: 2007-05-14  
Time limit: 17s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Asia-Pacific Informatics Olympiad(APIO) 2007

## SPOJ Problem Set (classical)

### 1553. Backup Files

#### Problem code: BACKUP

You run an IT company that backs up computer data for large offices. Backing up data is not fun, and so you design your system so that the different offices can back up each others' data while you sit at home and play computer games instead.

The offices are all situated along a single street. You decide to pair up the offices, and for each pair of offices you run a network cable between the two buildings so that they can back up each others' data.

However, network cables are expensive. Your local telecommunications company will only give you  $k$  network cables, which means you can only arrange backups for  $k$  pairs of offices ( $2k$  offices in total). No office may belong to more than one pair (that is, these  $2k$  offices must all be different). Furthermore, the telecommunications company charges by the kilometre. This means that you need to choose these  $k$  pairs of offices so that you use as little cable as possible. In other words, you need to choose the pairs so that, when the distances between the two offices in each pair are added together, the total distance is as small as possible.

As an example, suppose you had five clients with offices on a street as illustrated below. These offices are situated 1 km, 3 km, 4 km, 6km and 12km from the beginning of the street. The telecommunications company will only provide you with  $k = 2$  cables.

[IMAGE]

The best pairing in this example is created by linking the first and second offices together, and linking the third and fourth offices together. This uses  $k = 2$  cables as required, where the first cable has length  $3\text{km} - 1\text{km} = 2\text{ km}$ , and the second cable has length  $6\text{km} - 4\text{km} = 2\text{ km}$ . This pairing requires a total of  $4\text{km}$  of network cables, which is the smallest total possible.

#### Input

Multiple test cases, the number of them will be given at the very first line.

For each test case:

The first line of input will contain the integers  $n$  and  $k$ , representing the number of offices on the street ( $2 \leq n \leq 100\,000$ ) and the number of available network cables ( $1 \leq k \leq n/2$ ).

The following  $n$  lines will each contain a single integer ( $0 \leq s \leq 1\,000\,000\,000$ ), representing the distance of each office from the beginning of the street. These integers will appear in sorted order from smallest to largest. No two offices will share the same location.

## Output

Output should consist of a single positive integer, giving the smallest total length of network cable required to join  $2k$  distinct offices into  $k$  pairs.

## Example

**Input :**

```
1
5 2
1
3
4
6
12
```

**Output :**

```
4
```

**Explanation**

The sample input above represents the example scenario described earlier.

**Warning: large input/output data,be careful with certain languages**

Blue Mary's Note: test data has been modified on Dec. 5, 2007. All the solutions have been rejudged.

---

Added by: Blue Mary

Date: 2007-05-14

Time limit: 17s

Source limit:50000B

Languages: All except: C99 strict

Resource: Asia-Pacific Informatics Olympiad(APIO) 2007

## SPOJ Problem Set (classical)

### 1554. Zoo

#### Problem code: ZOO

The pride of the Asia-Pacific region is the newly constructed Great Circular Zoo. Situated on a small Pacific island, it consists of a large circle of different enclosures, each containing its own exotic animal as illustrated below.

[IMAGE]

You are in charge of public relations for the zoo, which means it is your job to keep people as happy as possible. A busload of schoolchildren has just arrived, and you are eager to please them. However, this is no easy task|there are animals that some children love, and there are animals that some children fear. For example, little Alex loves monkeys and koalas because they are cute, but fears lions because of their sharp teeth. On the other hand, Polly loves lions because of their beautiful manes, but fears koalas because they are extremely smelly.

You have the option of removing some animals from their enclosures, so that children are not afraid. However, you are worried that if you remove too many animals then this will leave the children with nothing to look at. Your task is to decide which animals to remove so that as many children can be made happy as possible.

Each child is standing outside the circle, where they can see five consecutive enclosures. You have obtained a list of which animals each child fears, and which animals each child loves. A child will be made happy if either at least one animal they fear is removed from their field of vision, or at least one animal they love is not removed from their field of vision.

For example, consider the list of children and animals illustrated below:

[IMAGE]

Child	Enclosures Visible	Fears	Loves	
Alex	2, 3, 4, 5, 6	Enclosure 4	Enclosures 2, 6	
Polly	3, 4, 5, 6, 7	Enclosure 6	Enclosure 4	
Chaitanya	6, 7, 8, 9, 10	Enclosure 9	Enclosures 6, 8	
Hwan	8, 9, 10, 11, 12	Enclosure 9	Enclosure 12	
Ka-Shu	12, 13, 14, 1, 2	Enclosures 12, 13, 2	-	

Suppose you remove the animals from enclosures 4 and 12. This will make Alex and Ka-Shu happy, because at least one animal that they fear has gone. This will also keep Chaitanya happy, since both enclosures 6 and 8 still contain animals that he loves. However, both Polly and Hwan will be unhappy, since they cannot see any animals that they love but they can still see all the animals that they fear. This arrangement therefore gives a total of three happy children.

Now suppose you put these animals back into their enclosures, and remove the animals from enclosures 4 and 6 instead. Alex and Polly will be happy because the animals that they fear in enclosures 4 and 6 have gone. Chaitanya will be happy because, even though animal 6 has gone, he

can still see the animal in enclosure 8 which he loves. Likewise, Hwan will be happy because she can now see the animal in enclosure 12, which she loves. The only person unhappy will be Ka-Shu.

Finally, suppose you put the animals back once more and then remove only the animal from enclosure 13. Ka-Shu will now be happy since one animal that he fears has been removed, and Alex, Polly, Chaitanya and Hwan will all be happy since they can all see at least one animal that they love. Thus this arrangement gives five happy children, the largest number possible.

## Input

Multiple test cases, the number of them will be given at the very first line.

For each test case:

The first line will be of the form  $N\ C$ , where  $N$  is the number of animal enclosures ( $10 \leq N \leq 10\,000$ ) and  $C$  is the number of children ( $1 \leq C \leq 50\,000$ ). The enclosures are numbered 1, 2, ...,  $N$  clockwise around the circle.

Following this will be  $C$  additional lines of input, where each line describes a single child. Each of these lines will be of the form:

$E\ F\ L\ X_1\ X_2\ \dots\ X_F\ Y_1\ Y_2\ \dots\ Y_L;$

where:

- $E$  is the first enclosure that the child can see ( $1 \leq E \leq N$ ). In other words, the child can see enclosures  $E, E + 1, E + 2, E + 3$  and  $E + 4$ . Note that numbers larger than  $N$  wrap back around the circle, so if  $N = 14$  and  $E = 13$  then the child can see enclosures 13, 14, 1, 2 and 3.
- $F$  is the number of animals that the child fears, and  $L$  is the number of animals that the child loves.
- Enclosures  $X_1, \dots, X_F$  contain the animals that the child fears ( $1 \leq X_1, \dots, X_F \leq N$ ).
- Enclosures  $Y_1, \dots, Y_L$  contain the animals that the child loves ( $1 \leq Y_1, \dots, Y_L \leq N$ ).
- No two of the integers  $X_1, \dots, X_F, Y_1, \dots, Y_L$  are equal, and all of these integers describe enclosures that the child can see.

Children will be listed in sorted order according to the first enclosure  $E$  (so the child with lowest  $E$  will appear first and the child with largest  $E$  will appear last). Note that more than one child may have the same first enclosure  $E$ .

## Output

Output must consist of a single integer, giving the largest number of children that can be made happy.

## Example

**Sample Input:**

```
2
14 5
2 1 2 4 2 6
3 1 1 6 4
6 1 2 9 6 8
8 1 1 9 12
12 3 0 12 13 2
12 7
```

```
1 1 1 1 5
5 1 1 5 7
5 0 3 5 7 9
7 1 1 7 9
9 1 1 9 11
9 3 0 9 11 1
11 1 1 11 1
```

**Sample Output:**

```
5
6
```

**Explanation:**

The first sample case is the example discussed earlier, in which all  $C = 5$  children can be made happy. The second sample case is an example in which it is impossible to make all  $C = 7$  children

happy.

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2007-05-14

Time limit: 17s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Asia-Pacific Informatics Olympiad (APIO) 2007

## SPOJ Problem Set (classical)

### 1557. Can you answer these queries II

#### Problem code: GSS2

Being a completist and a simplist, kid Yang Zhe cannot solve but get Wrong Answer from most of the OI problems. And he refuse to write two program of same kind at all. So he always failes in contests.

When having a contest, Yang Zhe looks at the score of every problems first. For the problems of the same score, Yang Zhe will do only one of them. If he's lucky enough, he can get all the scores wanted.

Amber is going to hold a contest in SPOJ. She has made a list of  $N$  candidate problems, which fit Yang Zhe very well. So Yang Zhe can solve any problem he want. Amber lined up the problems, began to select. She will select a subsequence of the list as the final problems. Being A girl of great compassion, she'd like to select such a subsequence (can be empty) that Yang Zhe will get the maximal score over all the possible subsequences.

Amber found the subsequence easily after a few minutes. To make things harder, Amber decided that, Yang Zhe can take this contest only if Yang Zhe can answer her  $Q$  questions. The question is: if the final problems are limited to be a subsequence of  $list[X..Y]$  ( $1 \leq X \leq Y \leq N$ ), what's the maximal possible score Yang Zhe can get?

As we know, Yang Zhe is a bit idiot (so why did he solve the problem with a negative score?), he got Wrong Answer again... Tell him the correct answer!

#### Input

- Line 1: integer  $N$  ( $1 \leq N \leq 100000$ );
- Line 2:  $N$  integers denoting the score of each problem, each of them is a integer in range  $[-100000, 100000]$ ;
- Line 3: integer  $Q$  ( $1 \leq Q \leq 100000$ );
- Line  $3+i$  ( $1 \leq i \leq Q$ ): two integers  $X$  and  $Y$  denoting the  $i$ th question.

#### Output

- Line  $i$ : a single integer, the answer to the  $i$ th question.

#### Example

Input :

```
9
4 -2 -2 3 -1 -4 2 2 -6
3
1 2
1 5
4 9
```



**Output :**

4  
5  
3

**Warning: large input/output data,be careful with certain languages**

---

Added by: Blue Mary

Date: 2007-05-16

Time limit: 1s-5s

Source limit:50000B

Languages: All except: C99 strict

Resource: Description, standard program and test data by Yang Zhe

## SPOJ Problem Set (classical)

### 1644. Trees

#### Problem code: TREEOI14

Byteasar has a cottage. Lately, he has bought  $n$  trees and had them planted all in one row. Byteasar does not, however, like the order which the trees have been planted in. It particularly annoys him that tall and short ones have been mixed up, and the composition does not meet his aesthetic criteria.

Byteasar has invented a *disorder coefficient* so as to allow the gardener to comprehend his intentions: the lower the value of the coefficient the prettier the row of trees. It is defined in the following way:  $|h_1 - h_2| + |h_2 - h_3| + \dots + |h_{n-1} - h_n|$ , where  $h_1, h_2, \dots, h_n$  are the heights of consecutive trees in a row.

Replanting is a very toilsome and cumbersome task, therefore Byteasar has ordered the gardener to replant two trees at the most (i.e. interchange their positions). The task of the gardener is to choose the pair to replant in a way that makes the disorder coefficient the smallest.

The gardener is not sure if he has chosen the correct pair of trees and he fears he may lose his job if he is mistaken. Help him: for each tree calculate the minimal disorder coefficient that may be attained by switching places with any other tree.

#### Task

Write a program which:

- reads the height of the consecutive trees in a row from the standard input,
- for each tree calculates the minimal disorder coefficient that may be attained should it switch places with some other tree (or should there be no change at all),
- writes the outcome to the standard output.

#### Input

The first line of the standard input contains one integer  $n$  ( $2 \leq n \leq 50000$ ). The other contains  $n$  integers  $h_i$  ( $1 \leq h_i \leq 100000000$ ) separated by single spaces, denoting the height of the consecutive trees in the row.

#### Output

The output should consist of precisely  $n$  lines. The  $i$ -th line should contain a single integer - the smallest disorder coefficient attainable when considering replanting of the  $i$ -th tree.

#### Example

Input :

5

7 4 5 2 5

Output :

7  
7  
8  
7  
7

**\* Added some unofficial tests**

---

Added by: Thanh-Vy Hua  
Date: 2007-06-09  
Time limit: 1s-6s  
Source limit:50000B  
Languages: All  
Resource: Polish Olympiad 14

## SPOJ Problem Set (classical)

### 1672. The Great Indian Wedding

#### Problem code: GIWED

A wedding is to be organized in a rectangular park of dimensions  $M$  by  $N$ . Some parts of the park are covered by  $K$  rectangular carpets. These carpets, produced by ItSucks Corporation are revolutionary self cleaning carpets - they suck any liquid they come in contact with! The organizer wants to water the park to keep the grass fresh. If there were no carpets, the organizer could have used a single pipe to water the whole park but unfortunately, the water doesn't seep through the carpets. The organizer has at his disposal  $L$  pipes. The pipes would be placed at fixed locations chosen by the organizer and can't be moved. Water spreads from a pipe in all directions unless obstructed by the park boundary or a carpet. What is the maximum area that can be watered using these  $L$  pipes?

#### Input

The first line of the input contains a single integer  $T$ , the number of test cases ( $1 \leq T \leq 30$ ). Each test case starts with a single line containing the values  $M, N, K$  and  $L$  ( $1 \leq M \leq 10000$ ,  $1 \leq N \leq 10000$ ,  $0 \leq K \leq 50$ ,  $1 \leq L \leq 10$ ). It is followed by  $K$  lines, each line containing 4 integers separated by single spaces,  $x_1, y_1, x_2, y_2$  where  $(x_1, y_1)$  and  $(x_2, y_2)$  are the zero based coordinates of lower left and upper right vertex of the carpet. Assume that  $x_1 < x_2$  and  $y_1 < y_2$ . The carpets may cover each other. Water would not be able to seep through even if two carpets touch in a corner.

#### Output

For each test case, print the maximum area that can be watered on a single line

#### Example

**Input :**

```
2
10 10 0 1
10 10 1 1
3 3 4 4
```

**Output :**

```
100
99
```

---

Added by: Rahul Garg

Date: 2007-07-04

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: C-maphore, Tryst 2007

## SPOJ Problem Set (classical)

### 1673. Ambitious Manager

#### Problem code: AMBM

The Bogus Corporation distributes salary to its employees in a weird manner. The salary is distributed every  $K$  days, and instead of same salary for each day, the salary for the  $i^{\text{th}}$  day is  $a_i$ . An ambitious young manager, fresh from Institute of Mismanagement, observes that people usually prefer to take leave towards the end of this period of  $K$  days, when the workload is higher. Instead of revising each of the  $a_i$ 's, the manager comes up with a quick fix solution - he redefines the new salary on the  $i^{\text{th}}$  day as  $b_i = a_i + 2a_{i-1} + 2^2a_{i-2} + 2^3a_{i-3} + \dots + 2^{i-1}a_1$ . Baba, one of the employees, is in a dire financial crisis, and must accumulate at least  $N$  rupees at the end of the forthcoming period. Being a lazy worker that he is, he is interested in finding out if attending particular days would guarantee him exactly  $N$  rupees at the end of the period. Can you help Baba?

#### Input

First line contains a single integer  $T$ , the number of test cases ( $1 \leq T \leq 100$ ). Each test case is described on two lines. First line contains two integers,  $N$  and  $K$  ( $1 \leq N \leq 2^{63} - 1$ ,  $1 \leq K \leq 50$ ), the second line contains a space separated list of  $K$  integers, the  $a_i$ 's ( $1 \leq a_i \leq 1000$ ).

#### Output

For each test case, output on a single line 1-based indices of the days (separated by a single space) he should attend to ensure a salary of exactly  $N$  rupees at the end of the period. The indices should be printed in the sorted order. In case of multiple answers, output any one of them. If there is no answer, print -1.

#### Example

**Input :**

```
2
9 3
1 1 2
10 2
2 3
```

**Output :**

```
1 3
-1
```

---

Added by: Rahul Garg

Date: 2007-07-04

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: C-maphore, Tryst 2007

## SPOJ Problem Set (classical)

### 1675. Fusion Cube

#### Problem code: FUSION

The Bogus Corporation claims to have solved the energy crisis by devising a method to perform controlled fusion reaction! The set up consists of a cube of side length  $N$  meters, which contain  $K$  point sources of electrons. Each of the sources can be configured to emanate an electron along any of the six possible directions corresponding to  $+X$  axis,  $-X$  axis,  $+Y$  axis,  $-Y$  axis,  $+Z$  axis,  $-Z$  axis. The cube is filled with a medium in which the electrons travel with a velocity of  $1\text{m/s}$ . At time  $t=0$ , all the sources are switched on simultaneously, emanating a single electron along the configured direction. An electron travels in a straight line until it strikes the boundary of the cube or collides with another electron. A collision between two electrons can occur in two possible ways - a head-on collision, and a side-on collision. In a head-on collision, both the electrons rebound in opposite directions with the same speed. A side-on collision occurs when the colliding electrons are travelling in mutually perpendicular directions. After a side-on collision, the colliding electrons are deflected by  $90$  degrees, rebounding in mutually perpendicular directions with the same speed, the plane of motion remaining the same. Note that throughout the experiment, the direction of motion of an electron remains oriented along one of the coordinate axes. If more than two electrons collide simultaneously, resolve the collision pairwise, where any two of the colliding electrons can be paired. To maximize the chances of initiating the fusion reaction, we would like to maximize the time before an electron hits a boundary wall of the cube. Given the location of the  $K$  sources, determine the orientation of the sources such that this time is maximized. Output this maximum value.

#### Input

First line contains a single integer  $T$ , the number of test cases ( $1 \leq T \leq 50$ ), followed by the description of the test cases. The first line of each test case contains two integers,  $K$  and  $N$  respectively ( $1 \leq K \leq 100$ ,  $1 \leq N \leq 1000$ ). It is followed by  $K$  lines, where each line contains space separated three integers representing the  $X$ ,  $Y$  and  $Z$  coordinates of the particular source. The coordinates of the diagonally opposite corners of the cube are  $(0,0,0)$  and  $(N,N,N)$ . All the sources will lie strictly inside the cube.

#### Output

For each test case, output the maximum value of the time before the first electron hits the boundary of the cube on a single line.

#### Example

Input :

```
2
1 10
5 5 5
2 10
1 1 1
```

1 1 2  
**Output :**  
5  
9

---

Added by: Rahul Garg  
Date: 2007-07-04  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: C-maphore, Tryst 2007

## SPOJ Problem Set (classical)

### 1677. Halloween treats

#### Problem code: HALLOW

Every year there is the same problem at Halloween: Each neighbor is only willing to give a certain total number of sweets on that day, no matter how many children call on him, so it may happen that a child will get nothing if it is too late. To avoid conflicts, the children have decided they will put all sweets together and then divide them evenly among themselves. From last year's experience of Halloween they know how many sweets they get from each neighbour. Since they care more about justice than about the number of sweets they get, they want to select a subset of the neighbours to visit, so that in sharing every child receives the same number of sweets. They will not be satisfied if they have any sweets left which cannot be divided.

Your job is to help the children and present a solution.

#### Input

The input contains several test cases.

The first line of each test case contains two integers **c** and **n** ( $1 \leq c \leq n \leq 100000$ ), the number of children and the number of neighbours, respectively. The next line contains **n** space separated integers **a<sub>1</sub>** , ... , **a<sub>n</sub>** ( $1 \leq a_i \leq 100000$  ), where **a<sub>i</sub>** represents the number of sweets the children get if they visit neighbour **i**.

The last test case is followed by two zeros.

#### Output

For each test case output one line with the indices of the neighbours the children should select (here, index **i** corresponds to neighbour **i** who gives a total number of **a<sub>i</sub>** sweets). If there is no solution where each child gets at least one sweet, print "no sweets" instead. Note that if there are several solutions where each child gets at least one sweet, you may print any of them.

#### Example

**Input :**

```
4 5
1 2 3 7 5
3 6
7 11 2 5 13 17
0 0
```

**Output :**

```
3 5
2 3 4
```

---



Added by: Simon Gog  
Date: 2007-07-05  
Time limit: 15s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2007/2008

## SPOJ Problem Set (classical)

### 1681. Cylinder

#### Problem code: CYLINDER

Using a sheet of paper and scissors, you can cut out two faces to form a cylinder in the following way:

1. Cut the paper horizontally (parallel to the shorter side) to get two rectangular parts.
2. From the first part, cut out a circle of maximum radius. The circle will form the bottom of the cylinder.
3. Roll the second part up in such a way that it has a perimeter of equal length with the circle's circumference, and attach one end of the roll to the circle. Note that the roll may have some overlapping parts in order to get the required length of the perimeter.

Given the dimensions of the sheet of paper, can you calculate the biggest possible volume of a cylinder which can be constructed using the procedure described above?

#### Input Specification

The input consists of several test cases. Each test case consists of two numbers **w** and **h** ( $1 \leq w \leq h \leq 100$ ), which indicate the width and height of the sheet of paper.

The last test case is followed by a line containing two zeros.

#### Output Specification

For each test case, print one line with the biggest possible volume of the cylinder. Round this number to 3 places after the decimal point.

#### Sample Input

```
10 10
10 50
10 30
0 0
```

#### Sample Output

```
54.247
785.398
412.095
```

---

*In the first case, the optimal cylinder has a radius of about 1.591549, in the second case, the optimal cylinder has a radius of 5, and in the third case, the optimal cylinder has a radius of about 3.621795.*

---

Added by: Adrian Kuegel

Date: 2007-07-06

Time limit: 4s

Source limit: 50000B

Languages: All

Resource: own problem, used in University of Ulm Local Contest 2007

## SPOJ Problem Set (classical)

### 1683. Expressions

#### Problem code: EXPRESS

Arithmetic expressions are usually written with the operators in between the two operands (which is called infix notation). For example,  $(x+y)*(z-w)$  is an arithmetic expression in infix notation. However, it is easier to write a program to evaluate an expression if the expression is written in postfix notation (also known as reverse polish notation). In postfix notation, an operator is written behind its two operands, which may be expressions themselves. For example,  $x\ y\ +\ z\ w\ -\ *$  is a postfix notation of the arithmetic expression given above. Note that in this case parentheses are not required.

To evaluate an expression written in postfix notation, an algorithm operating on a stack can be used. A stack is a data structure which supports two operations:

1. **push**: a number is inserted at the top of the stack.
2. **pop**: the number from the top of the stack is taken out.

During the evaluation, we process the expression from left to right. If we encounter a number, we push it onto the stack. If we encounter an operator, we pop the first two numbers from the stack, apply the operator on them, and push the result back onto the stack. More specifically, the following pseudocode shows how to handle the case when we encounter an operator O:

```
a := pop();  
b := pop();  
push(b O a);
```

The result of the expression will be left as the only number on the stack.

Now imagine that we use a queue instead of the stack. A queue also has a push and pop operation, but their meaning is different:

1. **push**: a number is inserted at the end of the queue.
2. **pop**: the number from the front of the queue is taken out of the queue.

Can you rewrite the given expression such that the result of the algorithm using the queue is the same as the result of the original expression evaluated using the algorithm with the stack?

#### Input Specification

The first line of the input contains a number **T** ( $T \leq 200$ ). The following **T** lines each contain one expression in postfix notation. Arithmetic operators are represented by uppercase letters, numbers are represented by lowercase letters. You may assume that the length of each expression is less than 10000 characters.

## Output Specification

For each given expression, print the expression with the equivalent result when using the algorithm with the queue instead of the stack. To make the solution unique, you are not allowed to assume that the operators are associative or commutative.

## Sample Input

```
2
xyPzwIM
abcABdefgCDEF
```

## Sample Output

```
wzyxIPM
gfCecbDdAaEBF
```

---

Added by: Adrian Kuegel

Date: 2007-07-06

Time limit: 4s

Source limit: 50000B

Languages: All

Resource: own problem, used in University of Ulm Local Contest 2007

## SPOJ Problem Set (classical)

### 1684. Frequent values

#### Problem code: FREQUENT

You are given a sequence of  $n$  integers  $a_1, a_2, \dots, a_n$  in non-decreasing order. In addition to that, you are given several queries consisting of indices  $i$  and  $j$  ( $1 \leq i \leq j \leq n$ ). For each query, determine the most frequent value among the integers  $a_i, \dots, a_j$ .

#### Input Specification

The input consists of several test cases. Each test case starts with a line containing two integers  $n$  and  $q$  ( $1 \leq n, q \leq 100000$ ). The next line contains  $n$  integers  $a_1, \dots, a_n$  ( $-100000 \leq a_i \leq 100000$ , for each  $i$  ( $1 \leq i \leq n$ )) separated by spaces. You can assume that for each  $i$  ( $1 \leq i < n$ ):  $a_i \leq a_{i+1}$ . The following  $q$  lines contain one query each, consisting of two integers  $i$  and  $j$  ( $1 \leq i \leq j \leq n$ ), which indicate the boundary indices for the query.

The last test case is followed by a line containing a single 0.

#### Output Specification

For each query, print one line with one integer: The number of occurrences of the most frequent value within the given range.

#### Sample Input

```
10 3
-1 -1 1 1 1 1 3 10 10 10
2 3
1 10
5 10
0
```

#### Sample Output

```
1
4
3
```

---

*A naive algorithm may not run in time!*

---

Added by: Adrian Kuegel

Date: 2007-07-06

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: University of Ulm Local Contest 2007

## SPOJ Problem Set (classical)

### 1685. Grocery store

#### Problem code: GROCERY

A cashier in a grocery store seems to have difficulty in distinguishing the multiplication symbol and the addition symbol. To make things easier for him, you want to buy goods in such a way that the product of their prices is the same as the sum of their prices.

Of course, if you buy only one item, this is always true. With two items and three items, it still seems quite a boring task to you, so now you are interested in finding possible prices of four items such that the sum of the four prices is equal to the product of the four prices. You should consider the prices are in Euro with two digits after the decimal point. Obviously, each product costs at least one cent.

#### Input Specification

This problem has no input.

#### Output Specification

Print all solutions which have a sum of the four items of at most **20.00 Euro**. For each solution, print one line with the prices of the four items in non-decreasing order, with one space character between them. You may print the solutions in any order, but make sure to print each solution only once.

#### Sample Output

```
0.50 1.00 2.50 16.00
1.25 1.60 1.75 1.84
1.25 1.40 1.86 2.00
...
```

---

Added by: Adrian Kuegel

Date: 2007-07-06

Time limit: 1.600s

Source limit: 600B

Languages: All

Resource: University of Ulm Local Contest 2007

# SPOJ Problem Set (classical)

## 1687. Logic II

### Problem code: LOGIC2

Some day in 2003 in Byteland began calm and quietly as any other day. Some people went to work, some to school, some to store to buy food. Drivers were traditionally stucked in traffic jams, drinking coffee and reading morning newspaper. Suddenly the regularity of this day was disturbed by huge explosion. "They blew up the embassy of Bajtocja!!!" somebody cried. Everybody began to run away in panic.

Police works pretty good in Byteland and first radiocars appeared near the embassy only few seconds after the explosion. All the people near the embassy were detained. Only one of the people is the organizer of the explosion, the others could be just occasional witnesses. It is known, among these  $M(1 \leq M \leq 11)$  people,  $N(1 \leq N \leq M)$  people always lie because they want to make the work of police more difficult, the others always tell the truth.

All these people say  $P(1 \leq P \leq 30)$  sentences in total. All the useful sentences are in one of the 4 forms below, all the other sentences are useless and you can ignore them.

- I am guilty.
- I am not guilty.
- *Somebody* is guilty.
- *Somebody* is not guilty.
- Today is *Someday*.

Among these sentences, *Somebody* is a name of one of these  $M$  people, and *Someday* is Monday, Tuesday, Wednesday, Thursday, Friday, Saturday or Sunday.

Your task is to help the police to find out the only one organizer of the explosion.

### Input

Multiple test cases. For each test case:

The first line contains three integers  $M$ ,  $N$  and  $P$ .  $M$  lines follow, each contains a name of one of the people. All names contain only capital Latin letters and no whitespaces.  $P$  lines come next, each contains no more than 250 characters, the speaker and his/her speech. See the example.

You can assume that there's no whitespace at the start and the end of a line, and there are no two consecutive spaces in the input.

Input terminate by EOF.



## Output

The name of the organizer if you can determine, or *Cannot Determine* if you find more than one, or *Impossible* if you find no one.

## Example

### Input :

3 1 5

MIKE

CHARLES

KATE

MIKE: I am guilty.

MIKE: Today is Sunday.

CHARLES: MIKE is guilty.

KATE: I am guilty.

KATE: How are you??

### Output :

MIKE

---

Added by: Blue Mary

Date: 2007-07-13

Time limit: 13s

Source limit:50000B

Languages: All except: C99 strict

Resource: Description by Blue Mary

## SPOJ Problem Set (classical)

### 1688. A Very Easy Problem!

**Problem code: EASYPROB**

#### Input

There's no input.

#### Output

Output some form of these numbers: 137, 1315, 73, 136, 255, 1384, 16385, one per line in the listed order.

#### Example

The first two lines of the CORRECT output file are:

```
137=2 (2 (2) +2+2 (0) ) +2 (2+2 (0) ) +2 (0)
1315=2 (2 (2+2 (0) ) +2) +2 (2 (2+2 (0) ) ) +2 (2 (2) +2 (0) ) +2+2 (0)
```

The correct output file should contain 7 lines.

---

Added by: Blue Mary  
Date: 2007-07-13  
Time limit: 1s  
Source limit: 500B  
Languages: TEXT  
Resource: You can imagine it.

## SPOJ Problem Set (classical)

### 1689. Hard Problem

#### Problem code: HARDP

[This space is intentionally left blank.]

#### Input

Multiple test cases. Each contains a single integer  $N$  ( $1 \leq N \leq 50$ ). Input terminates by EOF.

#### Output

For each test case, output one line contains the answer. See the example.

#### Example

Input :

8  
9  
10

Output :

8=90\*(0+0+0+0+45-3+20-42+60+10)  
9=20\*(0-3+10-14+15+2+0+0+0+0+10)  
10=66\*(0+0+0+0+0+33+5-33+66-66+55+6)

---

Added by: Blue Mary

Date: 2007-07-14

Time limit: 11s

Source limit:50000B

Languages: All except: C99 strict

Resource: Based on a problem from an ACM/ICPC Regional Contest

## SPOJ Problem Set (classical)

### 1695. Grandpa's Rubik Cube

#### Problem code: GRC

Documento sin título

A very well-known toy/pastime, called Rubik's cube, consists of a cube as shown in Figure 1a, where letters stand for colors (e.g. B for blue, R for red,...). The goal of the game is to rotate the faces of the cube in such a way that at the end each face has a different color, as shown in Figure 1b. Notice that,

[IMAGE]

when a face is rotated, the configuration of colors in all the adjacent faces changes. Figure 2 illustrates a rotation of one of the faces. Given a scrambled configuration, reaching the final position can be quite challenging, as you may know.

[IMAGE]

But your grandpa has many years of experience, and claims that, given any configuration of the Rubik cube, he can come up with a sequence of rotations leading to a winning configuration. In order to show all faces of the cube we shall represent the cube as in Figure 3a. The six colors are Yellow, Red, Blue, Green, White and Magenta (represented by their first letters).

You will be given an initial configuration and a list of rotations. A rotation will be represented by an integer number, indicating the face to be rotated and the direction of the rotation (a positive value means clockwise rotation, negative value means counter-clockwise rotation). Faces of the cube are numbered as shown in Figure 3b. You must write a program that checks whether the list of rotations will lead to a winning configuration.

[IMAGE]

#### Input

The input contains several test cases. The first line of the input is an integer which indicates the number of tests. Each test description consists of ten lines of input. The first nine lines of a test will describe an initial configuration, in the format shown in Figure 3a. The next line will contain a list of rotations, ending with the value 0.

#### Output

For each test case your program should print one line. If your grandpa is correct, print "Yes, grandpa!", otherwise print "No, you are wrong!". (See example.)

[IMAGE]

---

Added by: Andrés Leonardo Rojas Duarte

Date: 2007-07-24

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM International Collegiate Programming Contest 2002 - South America

## SPOJ Problem Set (classical)

### 1696. Will Indiana Jones Get There

#### Problem code: WIJGT

Documento sin título

Indiana Jones is in a deserted city, annihilated during a war. Roofs of all houses have been destroyed and only portions of walls are still standing. The ground is so full of mines that the only safe way to move around the city is walking over the remaining walls. The mission of our hero is to save a person who is trapped in the city. In order to move between two walls which are not connected Indiana Jones thought of taking with him a wooden board which he could place between the two walls and then cross from one to the other.

[IMAGE]

Initial positions of Indiana Jones and the trapped person are both on some section of the walls. Besides, walls are either in the direction South-North or West-East. You will be given a map of the city remains. Your mission is to determine the minimum length of the wooden board Indiana Jones needs to carry in order to get to the trapped person.

#### Input

Your program should process several test cases. Each test case starts with an integer  $N$  indicating the number of wall sections remaining in the city ( $2 \leq N \leq 1000$ ). Each of the next  $N$  lines describes a wall section. The first wall section to appear is the section where Indiana Jones stands at the beginning. The second section to appear is the section where the trapped person stands. Each wall section description consists of three integers  $X$ ,  $Y$  and  $L$  ( $-10000 \leq X, Y, L \leq 10000$ ), where  $X$  and  $Y$  define either the southernmost point of a wall section (for South-North sections) or the westernmost point (for West-East wall sections). The value of  $L$  determines the length and direction of the wall: if  $L > 0$ , the section is West-East, with length  $L$ ; if  $L < 0$ , the section is North-South, with length  $|L|$ . The end of input is indicated by  $N = 0$ .

#### Output

For each test case in the input your program should produce one line of output, containing a real value representing the length of the wooden board Indiana Jones must carry. The length must be printed as a real number with two-digit precision, and the last decimal digit must be rounded. The input will not contain test cases where differences in rounding are significant.

#### Sample input

```
14
1 1 5
6 8 2
7 2 -2
5 3 3
2 5 2
2 3 2
2 3 -2
```

4 3 -2  
0 7 1  
1 8 2  
3 6 -2  
4 7 2  
6 6 1  
6 6 -2  
3  
-10 0 20  
-5 1 10  
50 50 100  
0

**Output for the sample input**

1.41  
1.00

---

Added by: Andrés Leonardo Rojas Duarte

Date: 2007-07-25

Time limit: 10s

Source limit:50000B

Languages: All

Resource: ACM International Collegiate Programming Contest 2002 - South America

## SPOJ Problem Set (classical)

### 1697. Ohgas' Fortune

#### Problem code: OFORTUNE

The Ohgas are a prestigious family based on Hachioji. The head of the family, Mr. Nemochi Ohga, a famous wealthy man, wishes to increase his fortune by depositing his money to an operation company. You are asked to help Mr. Ohga maximize his profit by operating the given money during a specified period.

From a given list of possible operations, you choose an operation to deposit the given fund to. You commit on the single operation throughout the period and deposit all the fund to it. Each operation specifies an annual interest rate, whether the interest is simple or compound, and an annual operation charge. An annual operation charge is a constant not depending on the balance of the fund. The amount of interest is calculated at the end of every year, by multiplying the balance of the fund under operation by the annual interest rate, and then rounding off its fractional part. For compound interest, it is added to the balance of the fund under operation, and thus becomes a subject of interest for the following years. For simple interest, on the other hand, it is saved somewhere else and does not enter the balance of the fund under operation (i.e. it is not a subject of interest in the following years). An operation charge is then subtracted from the balance of the fund under operation. You may assume here that you can always pay the operation charge (i.e. the balance of the fund under operation is never less than the operation charge). The amount of money you obtain after the specified years of operation is called "the final amount of fund." For simple interest, it is the sum of the balance of the fund under operation at the end of the final year, plus the amount of interest accumulated throughout the period. For compound interest, it is simply the balance of the fund under operation at the end of the final year. Operation companies use C, C++, Java, etc., to perform their calculations, so they pay a special attention to their interest rates. That is, in these companies, an interest rate is always an integral multiple of 0.0001220703125 and between 0.0001220703125 and 0.125 (inclusive). 0.0001220703125 is a decimal representation of 1/8192. Thus, interest rates' being its multiples means that they can be represented with no errors under the double-precision binary representation of floating-point numbers. For example, if you operate 1000000 JPY for five years with an annual, compound interest rate of 0.03125 (3.125 %) and an annual operation charge of 3000 JPY, the balance changes as follows.

The balance of the fund under operation(at the beginning of year)	Interest	The balance of the fund under operation (at the end of year)
A	$B = A \times 0.03125$ (and rounding off fractions)	$A + B - 3000$
1000000	31250	1028250
1028250	32132	1057382
1057382	33043	1087425
1087425	33982	1118407
1118407	34950	1150357



After the five years of operation, the final amount of fund is 1150357 JPY.  
If the interest is simple with all other parameters being equal, it looks like:

The balance of the fund under operation (at the beginning of year)	Interest	The balance of the fund under operation (at the end of year)	Cumulative interest
A	$B = A \times 0.03125$ (and rounding off fractions)	A - 3000	
1000000	31250	997000	31250
997000	31156	994000	62406
994000	31062	991000	93468
991000	30968	988000	124436
988000	30875	985000	155311

In this case the final amount of fund is the total of the fund under operation, 985000 JPY, and the cumulative interests, 155311 JPY, which is 1140311 JPY.

## Input

The input consists of datasets. The entire input looks like:

```

the number of datasets (=m)
1st dataset
2nd dataset
...
m-th dataset

```

The number of datasets, m, is no more than 100. Each dataset is formatted as follows.

```

the initial amount of the fund for operation
the number of years of operation
the number of available operations (=n)
operation 1
operation 2
...
operation n

```

The initial amount of the fund for operation, the number of years of operation, and the number of available operations are all positive integers. The first is no more than 100000000, the second no more than 10, and the third no more than 100.

Each “operation” is formatted as follows.

```

simple-or-compound annual-interest-rate annual-operation-charge
where simple-or-compound is a single character of either '0' or '1', with '0' indicating simple interest
and '1' compound. annual-interest-rate is represented by a decimal fraction and is an integral multiple

```

of 1/8192. annual-operation-charge is an integer not exceeding 100000.

## Output

For each dataset, print a line having a decimal integer indicating the final amount of fund for the best operation. The best operation is the one that yields the maximum final amount among the available operations. Each line should not have any character other than this number.

You may assume the final balance never exceeds 1000000000. You may also assume that at least one operation has the final amount of the fund no less than the initial amount of the fund.

## Example

### Input :

```
4
1000000
5
2
0 0.03125 3000
1 0.03125 3000
6620000
7
2
0 0.0732421875 42307
1 0.0740966796875 40942
39677000
4
4
0 0.0709228515625 30754
1 0.00634765625 26165
0 0.03662109375 79468
0 0.0679931640625 10932
10585000
6
4
1 0.0054931640625 59759
1 0.12353515625 56464
0 0.0496826171875 98193
0 0.0887451171875 78966
```

### Output :

```
1150357
10559683
50796918
20829397
```

---

Added by: Camilo Andrés Varela León

Date: 2007-07-26

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Japan Domestic, 2005

## SPOJ Problem Set (classical)

### 1698. Polygonal Line Search

#### Problem code: PLSEARCH

Multiple polygonal lines are given on the xy-plane. Given a list of polygonal lines and a template, you must find out polygonal lines which have the same shape as the template.

A polygonal line consists of several line segments parallel to x-axis or y-axis. It is defined by a list of xy-coordinates of vertices from the start-point to the end-point in order, and always turns 90 degrees at each vertex. A single polygonal line does not pass the same point twice. Two polygonal lines have the same shape when they fully overlap each other only with rotation and translation within xy-plane (i.e. without magnification or a flip). The vertices given in reverse order from the start-point to the end-point is the same as that given in order.

Figure 1 shows examples of polygonal lines. In this figure, polygonal lines A and B have the same shape.

Write a program that answers polygonal lines which have the same shape as the template.

[IMAGE]

Figure 1: Polygonal lines

#### Input

The input consists of multiple datasets. The end of the input is indicated by a line which contains a zero.

A dataset is given as follows.

```
n
Polygonal line0
Polygonal line1
Polygonal line2
...
Polygonal linen
```

n is the number of polygonal lines for the object of search on xy-plane. n is an integer, and  $1 \leq n \leq 50$ . Polygonal line0 indicates the template.

A polygonal line is given as follows.

```
m
x1 y1
x2 y2
...
xm ym
```

m is the number of the vertices of a polygonal line ( $3 \leq m \leq 10$ ).  $x_i$  and  $y_i$ , separated by a space, are the x- and y-coordinates of a vertex, respectively ( $-10000 < x_i < 10000$ ,  $-10000 < y_i < 10000$ ).

## Output

For each dataset in the input, your program should report numbers assigned to the polygonal lines that have the same shape as the template, in ascending order. Each number must be written in a separate line without any other characters such as leading or trailing spaces.

Five continuous "+"s must be placed in a line at the end of each dataset.

## Example

**Input :**

```
5
5
0 0
2 0
2 1
4 1
4 0
5
0 0
0 2
-1 2
-1 4
0 4
5
0 0
0 1
-2 1
-2 2
0 2
5
0 0
0 -1
2 -1
2 0
4 0
5
0 0
2 0
2 -1
4 -1
4 0
5
0 0
2 0
2 1
4 1
4 0
4
4
-60 -75
-60 -78
-42 -78
-42 -6
4
10 3
```

```

10 7
-4 7
-4 40
4
-74 66
-74 63
-92 63
-92 135
4
-12 22
-12 25
-30 25
-30 -47
4
12 -22
12 -25
30 -25
30 47
3
5
-8 5
-8 2
0 2
0 4
8 4
5
-3 -1
0 -1
0 7
-2 7
-2 16
5
-1 6
-1 3
7 3
7 5
16 5
5
0 1
0 -2
8 -2
8 0
17 0
0

```

**Output :**

```

1
3
5
+++++
3
4
+++++
+++++

```

---

Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: Japan Domestic, 2005

# SPOJ Problem Set (classical)

## 1699. Numeral System

### Problem code: NSYSTEM

Prof. Hachioji has devised a new numeral system of integral numbers with four lowercase letters "m", "c", "x", "i" and with eight digits "2", "3", "4", "5", "6", "7", "8", "9". He doesn't use digit "0" nor digit "1" in this system.

The letters "m", "c", "x" and "i" correspond to 1000, 100, 10 and 1, respectively, and the digits "2", ..., "9" correspond to 2, ..., 9, respectively. This system has nothing to do with the Roman numeral system.

For example, character strings

"5m2c3x4i", "m2c4i" and "5m2c3x"

correspond to the integral numbers 5234 ( $=5*1000+2*100+3*10+4*1$ ), 1204 ( $=1000+2*100+4*1$ ), and 5230 ( $=5*1000+2*100+3*10$ ), respectively. The parts of strings in the above example, "5m", "2c", "3x" and "4i" represent 5000 ( $=5*1000$ ), 200 ( $=2*100$ ), 30 ( $=3*10$ ) and 4 ( $=4*1$ ), respectively.

Each of the letters "m", "c", "x" and "i" may be prefixed by one of the digits "2", "3", ..., "9". In that case, the prefix digit and the letter are regarded as a pair. A pair that consists of a prefix digit and a letter corresponds to an integer that is equal to the original value of the letter multiplied by the value of the prefix digit.

For each letter "m", "c", "x" and "i", the number of its occurrence in a string is at most one. When it has a prefix digit, it should appear together with the prefix digit. The letters "m", "c", "x" and "i" must appear in this order, from left to right. Moreover, when a digit exists in a string, it should appear as the prefix digit of the following letter. Each letter may be omitted in a string, but the whole string must not be empty. A string made in this manner is called an MCXI-string.

An MCXI-string corresponds to a positive integer that is the sum of the values of the letters and those of the pairs contained in it as mentioned above. The positive integer corresponding to an MCXI-string is called its MCXI-value. Moreover, given an integer from 1 to 9999, there is a unique MCXI-string whose MCXI-value is equal to the given integer. For example, the MCXI-value of an MCXI-string "m2c4i" is 1204 that is equal to  $1000 + 2*100 + 4*1$ . There are no MCXI-strings but "m2c4i" that correspond to 1204. Note that strings "1m2c4i", "mcc4i", "m2c0x4i", and "2cm4i" are not valid MCXI-strings. The reasons are use of "1", multiple occurrences of "c", use of "0", and the wrong order of "c" and "m", respectively.

Your job is to write a program for Prof. Hachioji that reads two MCXI-strings, computes the sum of their MCXI-values, and prints the MCXI-string corresponding to the result.

## Input

The input is as follows. The first line contains a positive integer  $n$  ( $\leq 500$ ) that indicates the number of the following lines. The  $k+1$  th line is the specification of the  $k$  th computation ( $k=1, \dots, n$ ).

```
n
specification1
specification2
...
specificationn
```

Each specification is described in a line:

MCXI-string1 MCXI-string2

The two MCXI-strings are separated by a space.

You may assume that the sum of the two MCXI-values of the two MCXI-strings in each specification is less than or equal to 9999.

## Output

For each specification, your program should print an MCXI-string in a line. Its MCXI-value should be the sum of the two MCXI-values of the MCXI-strings in the specification. No other characters should appear in the output.

## Example

### Input :

```
10
xi x9i
i 9i
c2x2i 4c8x8i
m2ci 4m7c9x8i
9c9x9i i
i 9m9c9x8i
m i
i m
m9i i
9m8c7xi c2x8i
```

### Output :

```
3x
x
6cx
5m9c9x9i
m
9m9c9x9i
mi
mi
mx
9m9c9x9i
```

---



Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Japan Domestic, 2005

## SPOJ Problem Set (classical)

### 1700. Traveling by Stagecoach

#### Problem code: TRSTAGE

Once upon a time, there was a traveler.

He plans to travel using stagecoaches (horse wagons). His starting point and destination are fixed, but he cannot determine his route. Your job in this problem is to write a program which determines the route for him.

There are several cities in the country, and a road network connecting them. If there is a road between two cities, one can travel by a stagecoach from one of them to the other. A coach ticket is needed for a coach ride. The number of horses is specified in each of the tickets. Of course, with more horses, the coach runs faster.

At the starting point, the traveler has a number of coach tickets. By considering these tickets and the information on the road network, you should find the best possible route that takes him to the destination in the shortest time. The usage of coach tickets should be taken into account.

The following conditions are assumed.

- A coach ride takes the traveler from one city to another directly connected by a road. In other words, on each arrival to a city, he must change the coach.
- Only one ticket can be used for a coach ride between two cities directly connected by a road.
- Each ticket can be used only once.
- The time needed for a coach ride is the distance between two cities divided by the number of horses.
- The time needed for the coach change should be ignored.

#### Input

The input consists of multiple datasets, each in the following format. The last dataset is followed by a line containing five zeros (separated by a space).

```
n m p a b
t1 t2 ... tn
x1 y1 z1
x2 y2 z2
...
xp yp zp
```

Every input item in a dataset is a non-negative integer. If a line contains two or more input items, they are separated by a space.

$n$  is the number of coach tickets. You can assume that the number of tickets is between 1 and 8.  $m$  is the number of cities in the network. You can assume that the number of cities is between 2 and 30.  $p$  is the number of roads between cities, which may be zero.

$a$  is the city index of the starting city.  $b$  is the city index of the destination city.  $a$  is not equal to  $b$ . You can assume that all city indices in a dataset (including the above two) are between 1 and  $m$ .

The second line of a dataset gives the details of coach tickets.  $t_i$  is the number of horses specified in the  $i$ -th coach ticket ( $1 \leq i \leq n$ ). You can assume that the number of horses is between 1 and 10.

The following  $p$  lines give the details of roads between cities. The  $i$ -th road connects two cities with city indices  $x_i$  and  $y_i$ , and has a distance  $z_i$  ( $1 \leq i \leq p$ ). You can assume that the distance is between 1

and 100.

No two roads connect the same pair of cities. A road never connects a city with itself. Each road can be traveled in both directions.

## Output

For each dataset in the input, one line should be output as specified below. An output line should not contain extra characters such as spaces.

If the traveler can reach the destination, the time needed for the best route (a route with the shortest time) should be printed. The answer should not have an error greater than 0.001. You may output any number of digits after the decimal point, provided that the above accuracy condition is satisfied.

If the traveler cannot reach the destination, the string "Impossible" should be printed. One cannot reach the destination either when there are no routes leading to the destination, or when the number of tickets is not sufficient. Note that the first letter of "Impossible" is in uppercase, while the other letters are in lowercase.

## Example

### Input :

```
3 4 3 1 4
3 1 2
1 2 10
2 3 30
3 4 20
2 4 4 2 1
3 1
2 3 3
1 3 3
4 1 2
4 2 5
2 4 3 4 1
5 5
1 2 10
2 3 10
3 4 10
1 2 0 1 2
1
8 5 10 1 5
2 7 1 8 4 5 6 3
1 2 5
2 3 4
3 4 7
4 5 3
1 3 25
2 4 23
3 5 22
1 4 45
2 5 51
1 5 99
0 0 0 0 0
```

### Output :

```
30.000
3.667
Impossible
Impossible
2.856
```

Since the number of digits after the decimal point is not specified, the above result is not the only solution. For example, the following result is also acceptable.

30.0  
3.66667  
Impossible  
Impossible  
2.85595

---

Added by: Camilo Andrés Varela León

Date: 2007-07-26

Time limit: 3s

Source limit:50000B

Languages: All

Resource: Japan Domestic, 2005

## SPOJ Problem Set (classical)

### 1701. Earth Observation with a Mobile Robot Team

#### Problem code: EOWAMRT

A new type of mobile robot has been developed for environmental earth observation. It moves around on the ground, acquiring and recording various sorts of observational data using high precision sensors. Robots of this type have short range wireless communication devices and can exchange observational data with ones nearby. They also have large capacity memory units, on which they record data observed by themselves and those received from others.

Figure 1 illustrates the current positions of three robots A, B, and C and the geographic coverage of their wireless devices. Each circle represents the wireless coverage of a robot, with its center representing the position of the robot. In this figure, two robots A and B are in the positions where A can transmit data to B, and vice versa. In contrast, C cannot communicate with A or B, since it is too remote from them. Still, however, once B moves towards C as in Figure 2, B and C can start communicating with each other. In this manner, B can relay observational data from A to C. Figure 3 shows another example, in which data propagate among several robots instantaneously.

[IMAGE]

Figure 1: The initial configuration of three robots

[IMAGE]

Figure 2: Mobile relaying

[IMAGE]

Figure 3: Instantaneous relaying among multiple robots

As you may notice from these examples, if a team of robots move properly, observational data quickly spread over a large number of them. Your mission is to write a program that simulates how information spreads among robots. Suppose that, regardless of data size, the time necessary for communication is negligible.

#### Input

The input consists of multiple datasets, each in the following format.

*N T R*

*nickname and travel route of the first robot*

*nickname and travel route of the second robot*

*...*

*nickname and travel route of the N-th robot*

The first line contains three integers  $N$ ,  $T$ , and  $R$  that are the number of robots, the length of the simulation period, and the maximum distance wireless signals can reach, respectively, and satisfy that  $1 \leq N \leq 100$ ,  $1 \leq T \leq 1000$ , and  $1 \leq R \leq 10$ .

The *nickname and travel route* of each robot are given in the following format.

```
nickname
t0 x0 y0
t1 vx1 vy1
t2 vx2 vy2
...
tk vxk vyk
```

*Nickname* is a character string of length between one and eight that only contains lowercase letters. No two robots in a dataset may have the same nickname. Each of the lines following nickname contains three integers, satisfying the following conditions.

$$0 = t_0 < t_1 < \dots < t_k = T$$
$$-10 \leq vx_1, vy_1, \dots, vx_k, vy_k \leq 10$$

A robot moves around on a two dimensional plane.  $(x_0, y_0)$  is the location of the robot at time 0. From time  $t_{i-1}$  to  $t_i$  ( $0 < i \leq k$ ), the velocities in the x and y directions are  $vx_i$  and  $vy_i$ , respectively. Therefore, the travel route of a robot is piecewise linear. Note that it may self-overlap or self-intersect.

You may assume that each dataset satisfies the following conditions.

- The distance between any two robots at time 0 is not exactly R.
- The x- and y-coordinates of each robot are always between -500 and 500, inclusive.
- Once any robot approaches within  $R + 10^{-6}$  of any other, the distance between them will become smaller than  $R - 10^{-6}$  while maintaining the velocities.
- Once any robot moves away up to  $R - 10^{-6}$  of any other, the distance between them will become larger than  $R + 10^{-6}$  while maintaining the velocities.
- If any pair of robots mutually enter the wireless area of the opposite ones at time t and any pair, which may share one or two members with the aforementioned pair, mutually leave the wireless area of the opposite ones at time t', the difference between t and t' is no smaller than  $10^{-6}$  time unit, that is,  $|t - t'| \geq 10^{-6}$ .

A dataset may include two or more robots that share the same location at the same time. However, you should still consider that they can move with the designated velocities.

The end of the input is indicated by a line containing three zeros.

## Output

For each dataset in the input, your program should print the nickname of each robot that have got until time T the observational data originally acquired by the first robot at time 0. Each nickname should be written in a separate line in dictionary order without any superfluous characters such as leading or trailing spaces.

## Example

```
Input :
3 5 10
red
0 0 0
5 0 0
```

```
green
0 5 5
5 6 1
blue
0 40 5
5 0 0
3 10 5
atom
0 47 32
5 -10 -7
10 1 0
pluto
0 0 0
7 0 0
10 3 3
gesicht
0 25 7
5 -7 -2
10 -1 10
4 100 7
impulse
0 -500 0
100 10 1
freedom
0 -491 0
100 9 2
destiny
0 -472 0
100 7 4
strike
0 -482 0
100 8 3
0 0 0
```

**Output:**

```
blue
green
red
atom
gesicht
pluto
freedom
impulse
strike
```

---

Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: Japan Domestic, 2005

## SPOJ Problem Set (classical)

### 1702. Cleaning Robot

#### Problem code: CLEANRBT

Here, we want to solve path planning for a mobile robot cleaning a rectangular room floor with furniture.

Consider the room floor paved with square tiles whose size fits the cleaning robot ( $1 \times 1$ ). There are 'clean tiles' and 'dirty tiles', and the robot can change a 'dirty tile' to a 'clean tile' by visiting the tile. Also there may be some obstacles (furniture) whose size fits a tile in the room. If there is an obstacle on a tile, the robot cannot visit it. The robot moves to an adjacent tile with one move. The tile onto which the robot moves must be one of four tiles (i.e., east, west, north or south) adjacent to the tile where the robot is present. The robot may visit a tile twice or more.

Your task is to write a program which computes the minimum number of moves for the robot to change all 'dirty tiles' to 'clean tiles', if ever possible.

#### Input

The input consists of multiple maps, each representing the size and arrangement of the room. A map is given in the following format.

```
w h
c11 c12 c13 ... c1w
c21 c22 c23 ... c2w
...
ch1 ch2 ch3 ... chw
```

The integers  $w$  and  $h$  are the lengths of the two sides of the floor of the room in terms of widths of floor tiles.  $w$  and  $h$  are less than or equal to 20. The character  $cyx$  represents what is initially on the tile with coordinates  $(x, y)$  as follows.

```
'.' : a clean tile
'*' : a dirty tile
'x' : a piece of furniture (obstacle)
'o' : the robot (initial position)
```

In the map the number of 'dirty tiles' does not exceed 10. There is only one 'robot'.

The end of the input is indicated by a line containing two zeros.

#### Output

For each map, your program should output a line containing the minimum number of moves. If the map includes 'dirty tiles' which the robot cannot reach, your program should output -1.



## Example

### Input :

```
7 5
.....
.O...*.
.....
.*...*.
.....
15 13
.....X.....
...O...X...*..
.....X.....
.....X.....
.....X.....
.....
xxxxx.....xxxxx
.....
.....X.....
.....X.....
.....X.....
..*...X...*..
.....X.....
10 10
.....
..O.....
.....
.....
.....
.....xxxxx
.....X.....
.....X.*..
.....X.....
.....X.....
0 0
```

### Output :

```
8
49
-1
```

---

Added by: Camilo Andrés Varela León

Date: 2007-07-26

Time limit: 5s

Source limit:50000B

Languages: All

Resource: Japan Domestic, 2005

## SPOJ Problem Set (classical)

### 1703. ACM (ACronymMaker)

#### Problem code: ACMAKER

The sadists who design problems for ACM programming contests often like to include the abbreviation "ACM" somewhere in their problem descriptions. Thus, in years past, the World Finals has had problems involving "Apartment Construction Management," the "Atheneum of Culture and Movies," the "Association of Cover Manufacturers," "ACM Airlines," the "Association for Computational Marinelife," and even an insect named "Amelia Cheese Mite." However, the number of word combinations beginning with A, C, and M that make sense is finite and the problem writers are starting to run out of ideas (it's hard to think of problems about "Antidisestablishmentarianistic Chthonian Metalinguistics"). Fortunately, modern culture allows more flexibility in designing abbreviations -- consider, for example:

```
GDB -- Gnu Debugger
LINUX -- either "LINus's UniX" or "LINUs's miniX" or "Linux Is Not UniX"
SNOBOL -- StriNg Oriented symBolic Language
SPITBOL -- SPeedy ImplemenTation of snoBOL
```

The rules used in these examples seem to be:

- Insignificant words (such as "of", "a", "the", etc.) are ignored.
- The letters of the abbreviation must appear, in the correct order, as an ordered sublist of the letters in the significant words of the phrase to be abbreviated.
- At least one letter of the abbreviation must come from every significant word (multiple occurrences of a letter are, of course, treated as distinct).

Of course these rules are often broken in real life. For instance, RADAR is an abbreviation for "Radio Detecting And Ranging". Under our rules (assuming that "and" is an insignificant word), this would not be a valid abbreviation (however, RADR or RADRAN or DODGING would be valid). You have been asked to take a list of insignificant words and a list of abbreviations and phrases and to determine in how many ways each abbreviation can be formed from the corresponding phrase according to the rules above.

#### Input

The input file consists of multiple scenarios. Each scenario begins with an integer  $100 \geq n \geq 1$  followed by  $n$  insignificant words, all in lower case, one per line with no extra white space. (A line containing 0 indicates end of input.) Following this are one or more test cases for this scenario, one per line, followed by a line containing the phrase "LAST CASE". Each line containing a test case begins with an abbreviation (uppercase letters only) followed by a phrase (lowercase letters and spaces only). The abbreviation has length at least 1 and the phrase contains at least one significant word. No input line (including abbreviation, phrase, and spaces) will contain more than 150 characters. Within these limits, however, abbreviations and phrase words may be any length.

## Output

For each test case, output the abbreviation followed by either

*is not a valid abbreviation*

*or*

*can be formed in  $i$  ways*

where  $i$  is the number of different ways in which the letters of the abbreviation may be assigned to the letters in the phrase according to the rules above. The value of  $i$  will not exceed the range of a 32-bit signed integer.

## Example

### Input :

```
2
and
of
ACM academy of computer makers
RADAR radio detection and ranging
LAST CASE
2
a
an
APPLY an apple a day
LAST CASE
0
```

### Output :

```
ACM can be formed in 2 ways
RADAR is not a valid abbreviation
APPLY can be formed in 1 ways
```

---

Added by: Camilo Andrés Varela León

Date: 2007-07-26

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: East Central North America 2005

## SPOJ Problem Set (classical)

### 1704. Countdown

#### Problem code: CDOWN

Ann Sister owns a genealogical database service, which maintains family tree history for her clients. When clients login to the system, they are presented with a variety of services: searching, printing, querying, etc. One recent question that came up which the system was not quite prepared for was the following: "Which member of my family had the most grandchildren?" The client who posed this question eventually had to answer it by manually searching the family tree database herself. Ann decided to have software written in case this question (or ones similar to it asking for great-grandchildren, or great-great-grandchildren, etc.) is asked in the future.

#### Input

Input will consist of multiple test cases. The first line of the input will contain a single integer indicating the number of test cases. Each test case starts with a single line containing two positive integers  $n$  and  $d$ , where  $n$  indicates the number of lines to follow containing information about the family tree, and  $d$  indicates the specific question being asked about the tree: if  $d = 1$ , then we are interested in persons with the most children (1 generation away); if  $d = 2$ , then we are interested in persons with the most grandchildren (2 generations away), and so on. The next  $n$  lines are of the form

*name m dname<sub>1</sub> dname<sub>2</sub> ... dname<sub>m</sub>*

where *name* is one of the family members' names,  $m$  is the number of his/her children, and *dname<sub>1</sub>* through *dname<sub>m</sub>* are the names of the children. These lines will be given in no particular order. You may assume that all  $n$  lines describe one single, connected tree. There will be no more than 1000 people in any one tree, and all names will be at most 10 characters long.

#### Output

For each test case, output the three names with the largest number of specified descendants in order of number of descendants. If there are ties, output the names within the tie in alphabetical order. Print fewer than three names if there are fewer than three people who match the problem criteria (you should not print anyone's name who has 0 of the specified descendants), and print more than three if there is a tie near the bottom of the list. Print each name one per line, followed by a single space and then the number of specified descendants. The output for each test case should start with the line

Tree  $i$ :

where  $i$  is the test case number (starting at 1). Separate the output for each problem with a blank line.

## Example

### Input :

```
3
8 2
Barney 2 Fred Ginger
Ingrid 1 Nolan
Cindy 1 Hal
Jeff 2 Oliva Peter
Don 2 Ingrid Jeff
Fred 1 Kathy
Andrea 4 Barney Cindy Don Eloise
Hal 2 Lionel Mary
6 1
Phillip 5 Jim Phil Jane Joe Paul
Jim 1 Jimmy
Phil 1 Philly
Jane 1 Janey
Joe 1 Joey
Paul 1 Pauly
6 2
Phillip 5 Jim Phil Jane Joe Paul
Jim 1 Jimmy
Phil 1 Philly
Jane 1 Janey
Joe 1 Joey
Paul 1 Pauly
```

### Output :

```
Tree 1:
Andrea 5
Don 3
Cindy 2
Tree 2:
Phillip 5
Jane 1
Jim 1
Joe 1
Paul 1
Phil 1
Tree 3:
Phillip 5
```

---

Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: East Central North America 2005

## SPOJ Problem Set (classical)

### 1705. The Game of Efil

#### Problem code: GAMEFIL

Almost anyone who has ever taken a class in computer science is familiar with the "Game of Life," John Conway's cellular automata with extremely simple rules of birth, survival, and death that can give rise to astonishing complexity.

The game is played on a rectangular field of cells, each of which has eight neighbors (adjacent cells). A cell is either occupied or not. The rules for deriving a generation from the previous one are:

- If an occupied cell has 0, 1, 4, 5, 6, 7, or 8 occupied neighbors, the organism dies (0, 1: of loneliness; 4 thru 8: of overcrowding).
- If an occupied cell has two or three occupied neighbors, the organism survives to the next generation.
- If an unoccupied cell has three occupied neighbors, it becomes occupied (a birth occurs).

One of the major problems researchers have looked at over the years is the existence of so-called "Garden of Eden" configurations in the Game of Life -- configurations that could not have arisen as the result of the application of the rules to some previous configuration. We're going to extend this question, which we'll call the "Game of Efil": Given a starting configuration, how many possible parent configurations could it have? To make matters easier, we assume a finite grid in which edge and corner cells "wrap around" (i.e., a toroidal surface). For instance, the 2 by 3 configuration:

[IMAGE]

has exactly three possible parent configurations; they are:

[IMAGE] [IMAGE] [IMAGE]

You should note that when counting neighbors of a cell, another cell may be counted as a neighbor more than once, if it touches the given cell on more than one side due to the wrap around. This is the case for the configurations above.

#### Input

There will be multiple test cases. Each case will start with a line containing a pair of positive integers  $m$  and  $n$ , indicating the number of rows and columns of the configuration, respectively. The next line will contain a nonnegative integer  $k$  indicating the number of "live" cells in the configuration. The following  $k$  lines each contain the row and column number of one live cell, where row and column numbering both start at zero. The final test case is followed by a line where  $m = n = 0$  -- this line should not be processed. You may assume that the product of  $m$  and  $n$  is no more than 16.

## Output

For each test case you should print one line of output containing the case number and the number of possible ancestors. Imitate the sample output below. Note that if there are 0 ancestors, you should print out

**Garden of Eden.**

## Example

### Input :

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

### Output :

```
Case 1: 3 possible ancestors.
Case 2: 1 possible ancestors.
Case 3: Garden of Eden.
```

---

Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 60s-65s  
Source limit:50000B  
Languages: All  
Resource: East Central North America 2005

## SPOJ Problem Set (classical)

### 1706. Queens, Knights and Pawns

#### Problem code: QKP

You all are familiar with the famous 8-queens problem which asks you to place 8 queens on a chess board so no two attack each other. In this problem, you will be given locations of queens and knights and pawns and asked to find how many of the unoccupied squares on the board are not under attack from either a queen or a knight (or both). We'll call such squares "safe" squares. Here, pawns will only serve as blockers and have no capturing ability. The board below has 6 safe squares. (The shaded squares are safe.)

[IMAGE]

Recall that a knight moves to any unoccupied square that is on the opposite corner of a 2x3 rectangle from its current position; a queen moves to any square that is visible in any of the eight horizontal, vertical, and diagonal directions from the current position. Note that the movement of a queen can be blocked by another piece, while a knight's movement can not.

#### Input

There will be multiple test cases. Each test case will consist of 4 lines. The first line will contain two integers  $n$  and  $m$ , indicating the dimensions of the board, giving rows and columns, respectively. Neither integer will exceed 1000. The next three lines will each be of the form

$k\ r_1\ c_1\ r_2\ c_2\ \dots\ r_k\ c_k$

indicating the location of the queens, knights and pawns, respectively. The numbering of the rows and columns will start at one. There will be no more than 100 of any one piece. Values of  $n = m = 0$  indicate end of input.

#### Output

Each test case should generate one line of the form

*Board  $b$  has  $s$  safe squares.*

where  $b$  is the number of the board (starting at one) and you supply the correct value for  $s$ .

#### Example

```
4 4
2 1 4 2 4
1 1 2
1 2 3
2 3
1 1 2
1 1 1
0
1000 1000
```



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

**Output:**

```
Board 1 has 6 safe squares.
Board 2 has 0 safe squares.
Board 3 has 996998 safe squares.
```

---

Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: East Central North America 2005

## SPOJ Problem Set (classical)

### 1707. Reliable Nets

#### Problem code: RELINETS

You're in charge of designing a campus network between buildings and are very worried about its reliability and its cost. So, you've decided to build some redundancy into your network while keeping it as inexpensive as possible. Specifically, you want to build the cheapest network so that if any one line is broken, all buildings can still communicate. We'll call this a *minimal reliable net*.

#### Input

There will be multiple test cases for this problem. Each test case will start with a pair of integers  $n$  ( $\leq 15$ ) and  $m$  ( $\leq 20$ ) on a line indicating the number of buildings (numbered 1 through  $n$ ) and the number of potential inter-building connections, respectively. (Values of  $n = m = 0$  indicate the end of the problem.) The following  $m$  lines are of the form  $b_1 \ b_2 \ c$  (all positive integers) indicating that it costs  $c$  to connect building  $b_1$  and  $b_2$ . All connections are bidirectional.

#### Output

For each test case you should print one line giving the cost of a minimal reliable net. If there is a minimal reliable net, the output line should be of the form:

*The minimal cost for test case  $p$  is  $c$ .*

where  $p$  is the number of the test case (starting at 1) and  $c$  is the cost. If there is no reliable net possible, output a line of the form:

There is no reliable net possible for test case  $p$ .

#### Example

##### Input :

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

##### Output :

```
The minimal cost for test case 1 is 6.
There is no reliable net possible for test case 2.
```

---

Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: East Central North America 2005

## SPOJ Problem Set (classical)

### 1708. Square Count

#### Problem code: SQCOUNT

Little Bobby Roberts, age 8, has been dragged to yet another museum by his parents. While they while away the hours studying Etruscan pottery and Warhol soup cans, Bobby must depend on himself for entertainment. Having a mathematical bent, he recently started counting all the square tiles on the floors of the museum. He soon realized that the tiles could be grouped into larger squares that needed to be added to the count. The problem became a bit more complicated when he started counting squares contained in multiple rooms, since some squares overlapped both rooms. For example, the two rooms shown below contain a total of 86 squares: 45  $1 \times 1$  squares, 28  $2 \times 2$  squares and 13  $3 \times 3$  squares. (Note the opening between the two rooms is only 3 squares wide.)

[IMAGE]

While this helped kill several days' worth of museum visits, it soon became rather tedious, so Bobby is now looking for a program to automate the counting process for him.

#### Input

Input will consist of multiple test cases. The first line of each case will be a positive integer  $n \leq 1000$  which will indicate the number of rooms in the museum. After this will be  $n$  lines, each containing a description of one room. Each room will be rectangular in shape and will be described by a line of the form

$x_1 \ y_1 \ x_2 \ y_2$

where  $(x_1, y_1)$  and  $(x_2, y_2)$  are opposing corner coordinates (integers) of the room. No two rooms will overlap, though they may share a side. If the shared side is of length  $m > 2$ , then a door of length  $m-2$  exists between the two rooms, centered along the shared length. No square of any size will overlap more than two rooms. All  $x$  and  $y$  values will be  $\leq 1,000,000$ . An input line of  $n = 0$  terminates input and should not be processed.

#### Output

For each test case, output the total number of squares on a single line in the format shown below. All answers will fit within a 32-bit integer and cases are enumerated starting at 1.

#### Example

Input :

```
2
0 0 9 3
10 6 4 3
3
11 20 15 24
11 17 15 20
15 16 20 24
```

0

**Output :**

Case 1: 86

Case 2: 152

---

Added by: Camilo Andrés Varela León

Date: 2007-07-26

Time limit: 1s

Source limit:50000B

Languages: All

Resource: East Central North America 2005

## SPOJ Problem Set (classical)

### 1709. Swamp Things

#### Problem code: SWTHIN

Hugh F. Oh, in his never-ending quest to prove the existence of extraterrestrials, has gotten hold of a number of nighttime photographs taken by a research group that is examining glowing swamp gas. Hugh wants to see if any of the photos show, not swamp gas, but Little Grey Men in glowing suits. The photographs consist of bright dots appearing against a black background. Unfortunately, at the time the photos were taken, trains were travelling through the area (there is a train trestle over the swamp), and occasional lights from the train windows also appear in the photographs. Hugh, being a fastidious researcher, wants to eliminate these spots from the images. He can't tell from the photos exactly where the tracks are, or from what direction the photos were taken, but he knows that the tracks in that area are perfectly straight, so he's decided on the following approach: he will find the line with the maximum number of spots lying on it and, if there are four or more spots on the line, he will eliminate those points from his calculations, assuming that those are windows on the train. If two or more lines have the maximum number of points, Hugh will just randomly select one such set and delete it from the photo (he's not all that fastidious - after all, he believes in Little Grey Men). If there are fewer than four points lying along a common line, Hugh will assume that there is no train in the photograph and won't delete any points. Please write a program for him to process a set of photographs.

#### Input

There will be a series of test cases. Each test case is one photograph described by a line containing a positive integer  $n$  ( $\leq 1000$ ) the number of distinct spots in the photograph, followed by  $n$  lines containing the integer coordinates of the spots, one  $(x, y)$  pair per line. All coordinates are between 0 and 10000. The last photo description is followed by a line containing a zero, marking the end of the input. This line should not be processed.

#### Output

For each test case, output the photo number followed by the number of points eliminated from the photograph. Imitate the sample output below.

#### Example

Input :

```
6
0 1
0 2
1 2
2 2
4 5
5 6
4
3 5
4 4
6 5
```

7 4  
0

**Output :**

Photo 1: 4 points eliminated  
Photo 2: 0 points eliminated

---

Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 25s  
Source limit:50000B  
Languages: All  
Resource: East Central North America 2005

## SPOJ Problem Set (classical)

### 1710. Two Ends

#### Problem code: TWENDS

In the two-player game "Two Ends", an even number of cards is laid out in a row. On each card, face up, is written a positive integer. Players take turns removing a card from either end of the row and placing the card in their pile. The player whose cards add up to the highest number wins the game. Now one strategy is to simply pick the card at the end that is the largest -- we'll call this the greedy strategy. However, this is not always optimal, as the following example shows: (The first player would win if she would first pick the 3 instead of the 4.)

3 2 10 4

You are to determine exactly how bad the greedy strategy is for different games when the second player uses it but the first player is free to use any strategy she wishes.

#### Input

There will be multiple test cases. Each test case will be contained on one line. Each line will start with an even integer  $n$  followed by  $n$  positive integers. A value of  $n = 0$  indicates end of input. You may assume that  $n$  is no more than 1000. Furthermore, you may assume that the sum of the numbers in the list does not exceed 1,000,000.

#### Output

For each test case you should print one line of output of the form:

*In game  $m$ , the greedy strategy might lose by as many as  $p$  points.*

where  $m$  is the number of the game (starting at game 1) and  $p$  is the maximum possible difference between the first player's score and second player's score when the second player uses the greedy strategy. When employing the greedy strategy, always take the larger end. If there is a tie, remove the left end.

#### Example

##### Input :

```
4 3 2 10 4
8 1 2 3 4 5 6 7 8
8 2 2 1 5 3 8 7 3
0
```

##### Output :

```
In game 1, the greedy strategy might lose by as many as 7 points.
In game 2, the greedy strategy might lose by as many as 4 points.
In game 3, the greedy strategy might lose by as many as 5 points.
```

---



Added by: Camilo Andrés Varela León  
Date: 2007-07-26  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: East Central North America 2005

## SPOJ Problem Set (classical)

### 1712. Permalex

#### Problem code: PRMLX

Given a string of characters, we can permute the individual characters to make new strings. If we can impose an ordering on the characters (say alphabetic sequence), then the strings themselves can be ordered and any given permutation can be given a unique number designating its position in that ordering. For example the string 'acab' gives rise to the following 12 distinct permutations:

aabc	1	acab	5	bcaa	9
aacb	2	acba	6	caab	10
abac	3	baac	7	caba	11
abca	4	baca	8	cbaa	12

Thus the string 'acab' can be characterised in this sequence as 5.

Write a program that will read in a string and determine its position in the ordered sequence of permutations of its constituent characters. Note that numbers of permutations can get very large; however we guarantee that no string will be given whose position is more than  $2^{31} = 2.147.483.647$

### Input and Output

Input will consist of a series of lines, each line containing one string. Each string will consist of up to 30 lower case letters, not necessarily distinct. Test cases are separated by empty lines. The file will be terminated by a line consisting of a single #.

Output will consist of a series of lines, one for each line of the input. Each line will consist of the position of the string in its sequence, right justified in a field of width 10.

### Sample Input

```
bacaa
abc
cba
```

```
bacaa
abc
cba
#
```

## Sample Output

15

1

6

15

1

6

---

Added by: Andrés Leonardo Rojas Duarte

Date: 2007-07-27

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM ICPC 1992 Northwestern European Regionals

## SPOJ Problem Set (classical)

### 1713. Funny scales

#### Problem code: SCALE

Kinh\_Can has a set of precious weights  $P_1, P_2, \dots, P_N$  in which the mass of the  $i^{\text{th}}$  weight is  $P_i = 3^{i-1}$ , and a balance with 2 scales. On a nice day, Kinh\_Can decided to show off his set of precious weights to his friends, and said that he can put them in equilibrium with any weight as long as its mass is not more than the mass of the sum of his weights. At first, his friends didn't believe, but after many trials they realized that Kinh\_Can was right. In addition, while putting a thing whose mass is  $X$  on a scale, Kinh\_Can could put right away the weights added on the 2 scales to keep their balance without any trial. With a random weight  $X$  ( $X$  is a natural number,  $X \neq 0$ ). Your task is to put weights on scales in order to keep the 2 scales' balance like Kinh\_Can. The first scale initially weights  $X$ , and the second one weights 0.

#### Input

Input has exactly one line consisting 2 numbers, the first is  $N$  and the second is  $X$ .

#### Output

- If there is no solution, you should write -1
- If there is at least one solution for the problem, you should write exactly 2 lines:
  - The first line contains some numbers describing the indices of the weights in the first disc
  - The second line contains some numbers description the indices of the weights in the second disc
  - **Note:** One of 2 lines can be blank

#### Constraints

- $1 \leq N \leq 20$
- $1 \leq X \leq 2000000000$

#### Example

**Input 1:**

10 2

**Output 1:**

1  
2

**Input 2:**

10 5

**Output 2:**

1 2  
3

---

Added by: Nguye^~n Ha Du+o+ng  
Date: 2007-07-29  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: Classical

## SPOJ Problem Set (classical)

# 1722. Life, the Universe, and Everything II

### Problem code: RP

This problem tests your mathematic knowledge and your programming ability very much. Your task is to calculate the number of different Minimum Spanning Trees (MSTs) of a special undirected unweighted graph. The graph has  $n$  nodes numbered from 1 to  $n$ , and there is an edge between node  $i$  ( $1 \leq i \leq n$ ) and node  $j$  ( $1 \leq j \leq n$ ) if and only if  $0 < |i - j| \leq k$ .

### Input

Multiple test cases, the number of them ( $\leq 8$ ) is given in the very first line.

Each test case contains one line with two space-separated numbers  $k$  ( $1 \leq k \leq 5$ ) and  $n$  ( $1 \leq n \leq 10^{15}$ ).

### Output

For each test case you should output one line, the number of different MSTs of the corresponding graph modulo 65521.

### Example

**Input :**

1  
3 5

**Output :**

75

---

Added by: Blue Mary

Date: 2007-08-04

Time limit: 1s-4s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2007, Day 2; Translated by Blue Mary

## SPOJ Problem Set (classical)

### 1723. Bee Maja

#### Problem code: BMJ

Documento sin título

Maja is a bee. She lives in a bee hive with thousands of other bees. This bee hive consists of many hexagonal honey combs where the honey is stored in.

But bee Maja has a problem. Willi told her where she can meet him, but because Willi is a male drone and Maja is a female worker they have different coordinate systems.

#### Maja's Coordinate System

Maja who often flies directly to a special honey comb has laid an advanced two dimensional grid over the whole hive.

Maja

#### Willi's Coordinate System

Willi who is more lazy and often walks around just numbered the cells clockwise starting from 1 in the middle of the hive.

Willi

Help Maja to convert Willi's system to hers. Write a program which for a given honey comb number gives the coordinates in Maja's system.

#### Input

The input contains one or more integers which represent Willi's numbers. Each number stands on its own in a separate line, directly followed by a newline. The honey comb numbers are all less than 100 000.

#### Output

You should output the corresponding Maja coordinates to Willi's numbers, each coordinate pair on a separate line.

#### Sample Input

1  
2  
3  
4  
5

#### Sample Output

0 0  
0 1  
-1 1  
-1 0  
0 -1

---

Added by: Andrés Leonardo Rojas Duarte  
Date: 2007-08-04  
Time limit: 20s  
Source limit: 50000B  
Languages: All  
Resource: Ulm Local 1999



## SPOJ Problem Set (classical)

### 1725. The Importance

#### Problem code: IMPORT1

Given an undirected weighted graph  $\{V, E\}$ . Your task to calculate the importance of each node.

The importance of a node  $v$  ( $I(v)$ ) can be defined as follow:

[IMAGE]

$C_{s,t}$  is the number of different shortest paths from  $s$  to  $t$ ,  $C_{s,t}(v)$  is the number of different shortest paths from  $s$  to  $t$  through  $v$ .

#### Input

Multiple test cases, the number of them is given in the very first line.

For each test case:

The first line contains two space-separated integers  $n$  ( $n \leq 100$ ) and  $m$  ( $m \leq 4500$ ), the number of nodes in the graph and the number of edges in the graph. The nodes are numbered from 1 to  $n$ .  $m$  lines follow, each contains 3 integers  $a, b, c$ ,  $1 \leq a, b \leq n$ ,  $1 \leq c \leq 1000$ ,  $a \neq b$ , which denotes that there is an undirected edge between node  $a$  and node  $b$  weighted  $c$ . You may assume that there is at most one edge between any pair of nodes, and the number of shortest paths between any pair of nodes is at least 1 and at most  $10^{10}$ .

#### Output

For each test case:

Your Output should contains  $n$  lines, each contains one single real number, with 3 decimal places after radix point. The number in the  $i$ th line denotes the importance of the  $i$ th node.

#### Example

**Input :**

```
1
4 4
1 2 1
2 3 1
3 4 1
4 1 1
```

**Output :**

```
1.000
1.000
1.000
1.000
```

---

Added by: Blue Mary  
Date: 2007-08-05  
Time limit: 1s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Chinese National Olympiad in Informatics 2007,Day 1; Translated by Blue Mary

## SPOJ Problem Set (classical)

### 1726. Exchange

#### Problem code: EXCHANGE

There are 3 kinds of money in a planet far away from the earth: Mone, Luck, and Rpin. There's a money exchange company in this planet. You must go to this company if you want to do some money exchange, and, more autocratically, this company regulate the exchange rate of each pair of these 3 kinds of money.

The money exchange will be done in the following two ways:

(A)

You give the company a real number  $x$  in the range  $(0,100]$ , the company will exchange  $x\%$  of your Mone and  $x\%$  of your Luck to equal Rpin according to the exchange rate of that day.

(B)

You give the company a real number  $x$ , the company will exchange your  $x$  Rpin to some Mone and Luck, whose value is equal to  $x$  Rpin according to the exchange rate of that day, and, the value of Mone is  $Rate$  times of the value of Luck.

You can do many exchange operations in the same day.

Now, as the excellent spy in this planet, you know the exchange rate between Mone and Rpin of each of the next  $n$  days( $a_i$  Mone per Rpin), and the exchange rate between Luck and Rpin of each of the next  $n$  days( $b_i$  Luck per Rpin), and, each Rate of the next  $n$  days( $Rate_i$ ). you have  $S$  Rpin in the start, and you want to get most Rpin in the  $n$ th day later.

#### Input

Multiple test cases, the number of them(  $\leq 5$  ) is given in the very first line.

For each test case:

The first line contains a integer number  $n(1 \leq n \leq 100000)$  and a real number  $S$ .  $n$  lines follow, each contains 3 real numbers:  $a_i$  (between 0 and 10),  $b_i$  (between 0 and 10),  $Rate_i$  (between 0 and 100).

#### Output

For each test case, output one line contains a real number with 3 digits after decimal point, which denotes to the answer. You can assume it is less than 1000000000.

## Example

**Input :**

```
1
3 100
1 1 1
1 2 2
2 2 3
```

**Output :**

```
225.000
```

**Warning: large input/output data, be careful with certain languages; the time limit is somewhat strict for this problem**

---

Added by: Blue Mary

Date: 2007-08-05

Time limit: 2s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2007,Day 1; Translated by Blue Mary

## SPOJ Problem Set (classical)

### 1728. Common Permutation

#### Problem code: CPRMT

Given two strings of lowercase letters, *a* and *b*, print the longest string *x* of lowercase letters such that there is a permutation of *x* that is a subsequence of *a* and there is a permutation of *x* that is a subsequence of *b*.

#### Input

Input file contains several lines of input. Consecutive two lines make a set of input. That means in the input file line **1** and **2** is a set of input, line **3** and **4** is a set of input and so on. The first line of a pair contains *a* and the second contains *b*. Each string is on a separate line and consists of at most **1000** lowercase letters.

#### Output

For each set of input, output a line containing *x*. If several *x* satisfy the criteria above, choose the first one in alphabetical order.

#### Example

**Sample input:**

```
pretty
women
walking
down
the
street
```

**Sample output:**

```
e
nw
et
```

---

Added by: Andrés Leonardo Rojas Duarte  
Date: 2007-08-05  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: University of Alberta Local Contest 1999

## SPOJ Problem Set (classical)

### 1730. Counting Triangles II

#### Problem code: TCOUNT2

We define the LEVEL of a triangle as in the following illustrative image:

[IMAGE]

And we continue defining the LEVEL of a hexagon. It's called level N hexagon if it's joined by 6 triangles, each one is a level N triangle.

[IMAGE]

**Task:** All you have to do is to count all triangles in the "level N" hexagon.

#### Input

The first line of the input contains an integer T - the number of test cases and T lines follow. Each line contains an integer N which is the level of the hexagon in that test case.

#### Output

For each test case, you should write a separate line: the number of triangles in the "level N" hexagon. (All answers will fit within the range of a 64-bit positive integer)

#### Example

**Input :**

1  
1

**Output :**

6

**Be careful with certain languages**

---

Added by: Nguyen Ha Duong

Date: 2007-08-06

Time limit: 1s

Source limit: 300B

Languages: C C99 strict C++ PAS gpc PAS fpc ASM D

Resource: Trần Huy Hoàng

## SPOJ Problem Set (classical)

### 1731. Counting Triangles III

#### Problem code: TCOUNT3

Have you felt bored when counting triangles?

Like TRICOUNT and TCOUNT2, we define the LEVEL of a triangle as in the following illustrative image:

[IMAGE]

And now we will continue defining the LEVEL of a hexagram. It's called level N hexagram if it's joined by 12 triangles, each one is a level N triangle.

[IMAGE]

**Task:** All you have to do is to count all triangles in the level N hexagram.

#### Input

The first line of the input contains an integer T - the number of test cases and T lines follow. Each line contains an integer N which is the level of the hexagram in that test case.

#### Output

For each test case, you should write a separate line: the number of triangles in the level N hexagram. (All answers will fit within the range of a 64-bit positive integer)

#### Example

**Input :**

1  
1

**Output :**

20

**The author allows only few languages**

---

Added by: Nguye~n Ha Du+o+ng

Date: 2007-08-07

Time limit: 1s

Source limit: 128B

Languages: C C99 strict C++ PAS gpc PAS fpc ASM D PERL PYTH RUBY

Resource: Trn Huy Hu+ng

## SPOJ Problem Set (classical)

### 1739. Yet Another Equation

#### Problem code: EQU2

Consider the equation

$$x^2 - ny^2 = 1$$

where  $n$  is some integer.

Find the smallest strictly positive integer solutions  $(x, y)$  for a given  $n$ .

#### Input

The number of test cases  $t$  (around 30), followed by a list of  $t$  values of  $n$  ( $2 \leq n \leq 1000$ ). You can assume that the equation can be solved for all values of  $n$  in the input set.

#### Output

For every test case, the values of  $x$  and  $y$  separated by a space character, on separate lines.

#### Example

**Input :**

3  
2  
6  
61

**Output :**

3 2  
5 2  
1766319049 226153980

---

Added by: Mauro Persano

Date: 2007-08-18

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: Brahmagupta, circa 628 AD



## SPOJ Problem Set (classical)

### 1744. Evaluate the polynomial

#### Problem code: POLEVAL

Your task consists of evaluate a polynomial of degree  $n$  ( $0 \leq n \leq 999$ ) represented by its  $n+1$  coefficients of the form:

$$p_n(x) = c_n x^n + c_{n-1} x^{n-1} + \dots + c_2 x^2 + c_1 x + c_0$$

in each one of the  $k$  ( $1 \leq k \leq 100$ ) points  $x_1, x_2, \dots, x_k$ . The coefficients of the polynomial and the values where they will be evaluated are integers in the interval  $[-100, 100]$  that guarantees that the polynomial's evaluation is at the most  $2^{63} - 1$ .

#### Input

There will be multiple test cases, each one with 4 lines that are described below  
 $n$ : degree of polynomial.

$c_n \ c_{n-1} \dots \ c_2 \ c_1 \ c_0$ : coefficients of the polynomial separated by a single space.

$k$ : number of points to evaluate the polynomial.

$x_1 \ x_2 \dots \ x_{k-1} \ x_k$ : points to evaluate the polynomial separated by a single space.

The final test case is a single line where  $n = -1$  and this case should not be processed.

#### Output

For each test case you should print  $k + 1$  lines of output, the very first line containing the case number and the following  $k$  lines with the result of the polynomial's evaluation in each one of the  $k$  given points. See the sample.

#### Example

**Input :**

21 -2 -150 1 -1 2 -232 1 -2 -140 -1 2 -2-1  
Case 1:-1-22-17Case 2:-1015-9

**Output :**

---

Added by: Ivan Alfonso Olamendy

Date: 2007-08-25

Time limit: 2.5s

Source limit:50000B

Languages: All except: C99 strict

Resource: My own resource

## SPOJ Problem Set (classical)

### 1772. Find The Determinant II

#### Problem code: DETER2

In this problem you have to calculate the determinant of an  $N \times N$  matrix whose entries are given by  $m[i][j] = \gcd(i,j)^k$ ,  $1 \leq i,j \leq N$ .

Here  $\gcd(i,j)$  denotes the greatest common divisor of  $i$  and  $j$ .

As the determinant  $D$  can grow very large, you have to print  $D \% 1000003$ .

#### Input

First line of input consists of a single integer containing the number of test cases  $T$  (equal to around 20), each of the following  $T$  lines contain two integers  $N$  and  $k$  where  $N$  is the size of the matrix and  $k$  is the exponent.

$1 \leq N \leq 1000000$

$1 \leq k \leq 10^9$

#### Output

One line corresponding to each test case containing the determinant modulo 1000003 for the corresponding test case.

#### Example

**Input :**

```
3
4 2
2 4
4 3
```

**Output :**

```
288
15
10192
```

**Note:** You may want to solve DETER first, in case you havent already solved it.

---

Added by: Ajay Somani

Date: 2007-09-07

Time limit: 1s

Source limit: 2048B

Languages: All

Resource: "The Art of Computer Programming"

## SPOJ Problem Set (classical)

### 1774. All Discs Considered

#### Problem code: ALL

Operating systems are large software artefacts composed of many packages, usually distributed on several media, e.g., discs. You probably remember the time when your favourite operating system was delivered on 21 floppy discs, or, a few years later, on 6 CDs. Nowadays, it will be shipped on several DVDs, each containing tens of thousands of packages.

The installation of certain packages may require that other packages have been installed previously. Therefore, if the packages are distributed on the media in an unsuitable way, the installation of the complete system requires you to perform many media changes, provided that there is only one reading device available, e.g., one DVD-ROM drive. Since you have to start the installation somehow, there will of course be one or more packages that can be installed independently of all other packages.

Given a distribution of packages on media and a list of dependences between packages, you have to calculate the minimal number of media changes required to install all packages. For your convenience, you may assume that the operating system comes on exactly 2 DVDs.

#### Input

The input contains several test cases. Every test case starts with three integers  $N_1$ ,  $N_2$ ,  $D$ . You may assume that  $1 \leq N_1, N_2 \leq 50000$  and  $0 \leq D \leq 100000$ . The first DVD contains  $N_1$  packages, identified by the numbers  $1, 2, \dots, N_1$ . The second DVD contains  $N_2$  packages, identified by the numbers  $N_1+1, N_1+2, \dots, N_1+N_2$ . Then follow  $D$  dependence specifications, each consisting of two integers  $x_i, y_i$ . You may assume that  $1 \leq x_i, y_i \leq N_1+N_2$  for  $1 \leq i \leq D$ . The dependence specification means that the installation of package  $x_i$  requires the previous installation of package  $y_i$ . You may assume that there are no circular dependences. The last test case is followed by three zeros.

#### Output

For each test case output on a line the minimal number of DVD changes required to install all packages. By convention, the DVD drive is empty before the installation and the initial insertion of a disc counts as one change. Likewise, the final removal of a disc counts as one change, leaving the DVD drive empty after the installation.

#### Example

**Input :**  
3 2 1  
1 2  
2 2 2  
1 3  
4 2  
2 1 1  
1 3

0 0 0

**Output :**

3

4

3

---

Added by: Wanderley Guimaraes

Date: 2007-09-14

Time limit: 5s

Source limit:50000B

Languages: All

Resource: University of Ulm Local Contest 2004

## SPOJ Problem Set (classical)

### 1775. Boolean Logic

#### Problem code: BOOLE

Propositions are logical formulas consisting of proposition symbols and connecting operators. They are recursively defined by the following rules:

1. All proposition symbols (in this problem, lower-case alphabetic characters, e.g.,  $a$  and  $z$ ) are propositions.
2. If  $P$  is a proposition,  $(\neg P)$  is a proposition, and  $P$  is a direct subformula of it.
3. If  $P$  and  $Q$  are propositions,  $(P \& Q)$ ,  $(P \mid Q)$ ,  $(P \rightarrow Q)$ , and  $(P \leftrightarrow Q)$  are propositions, and  $P$  and  $Q$  are direct subformulas of them.
4. Nothing else is a proposition.

The operations  $\neg$ ,  $\&$ ,  $\mid$ ,  $\rightarrow$ , and  $\leftrightarrow$  denote logical negation, conjunction, disjunction, implication, and equivalence, respectively. A proposition  $P$  is a subformula of a proposition  $R$  if  $P=R$  or  $P$  is a direct subformula of a proposition  $Q$  and  $Q$  is a subformula of  $R$ .

Let  $P$  be a proposition and assign boolean values (i.e., 0 or 1) to all proposition symbols that occur in  $P$ . This induces a boolean value to all subformulas of  $P$  according to the standard semantics of the logical operators:

negation	conjunction	disjunction	implication	equivalence
$\neg 0 = 1$	$0 \& 0 = 0$	$0 \mid 0 = 0$	$0 \rightarrow 0 = 1$	$0 \leftrightarrow 0 = 1$
$\neg 1 = 0$	$0 \& 1 = 0$	$0 \mid 1 = 1$	$0 \rightarrow 1 = 1$	$0 \leftrightarrow 1 = 0$
	$1 \& 0 = 0$	$1 \mid 0 = 1$	$1 \rightarrow 0 = 0$	$1 \leftrightarrow 0 = 0$
	$1 \& 1 = 1$	$1 \mid 1 = 1$	$1 \rightarrow 1 = 1$	$1 \leftrightarrow 1 = 1$

This way, a value for  $P$  can be calculated. This value depends on the choice of the assignment of boolean values to the proposition symbols. If  $P$  contains  $n$  different proposition symbols, there are  $2^n$  different assignments. To evaluate all possible assignments we may use truth tables.

A truth table contains one line per assignment (i.e.,  $2^n$  lines in total). Every line contains the values of all subformulas under the chosen assignment. The value of a subformula is aligned with the proposition symbol, if the subformula is a proposition symbol, and with the center of the operator otherwise.

#### Input Specification

The input contains several test cases, each on a separate line. Every test case denotes a proposition and may contain arbitrary amounts of spaces in between. The input file terminates immediately after the newline symbol following the last test case.

## Output Specification

For each test case generate a truth table for the denoted proposition. Start the truth table by repeating the input line. Evaluate the proposition (and its subformulas) for all assignments to its variables, and output one line for each assignment. The line must have the same length as the corresponding input line and must consist only of spaces and the characters 0 and 1. Output an empty line after each test case.

Let  $s_1, \dots, s_n$  be the proposition symbols in the denoted proposition sorted in alphabetic order. Then, all assignments of 0 to  $s_1$  must precede the assignments of 1 to  $s_1$ . Within each of these blocks of assignments, all assignments of 0 to  $s_2$  must precede the assignments of 1 to  $s_2$ , and so on.

## Sample Input

```
((b --> a) <-> ((! a) --> (! b)))  
((y & a) - -> (c | c))
```

## Sample Output

```
((b --> a) <-> ((! a) --> (! b)))  
0 1 0 1 1 0 1 1 0  
1 0 0 1 1 0 0 0 1  
0 1 1 1 0 1 1 1 0  
1 1 1 1 0 1 1 0 1  
  
((y & a) - -> (c | c))  
0 0 0 1 0 00  
1 0 0 1 0 00  
0 0 0 1 1 11  
1 0 0 1 1 11  
0 0 1 1 0 00  
1 1 1 0 0 00  
0 0 1 1 1 11  
1 1 1 1 1 11
```

---

Added by: Wanderley Guimaraes

Date: 2007-09-14

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: University of Ulm Local Contest 2004

## SPOJ Problem Set (classical)

### 1776. DNA Laboratory

#### Problem code: DNALAB

Having started to build his own DNA lab just recently, the evil doctor Frankenstein is not quite up to date yet. He wants to extract his DNA, enhance it somewhat and clone himself. He has already figured out how to extract DNA from some of his blood cells, but unfortunately reading off the DNA sequence means breaking the DNA into a number of short pieces and analyzing those first. Frankenstein has not quite understood how to put the pieces together to recover the original sequence.

His pragmatic approach to the problem is to sneak into university and to kidnap a number of smart looking students. Not surprisingly, you are one of them, so you would better come up with a solution pretty fast.

You are given a list of strings over the alphabet A (for adenine), C (cytosine), G (guanine), and T (thymine), and your task is to find the shortest string (which is typically not listed) that contains all given strings as substrings. If there are several such strings of shortest length, find the smallest in alphabetical/lexicographical order.

#### Input

The first line contains the number of scenarios. For each scenario, the first line contains the number  $n$  of strings with  $1 \leq n \leq 15$ . Then these strings with  $1 \leq \text{length} \leq 100$  follow, one on each line, and they consist of the letters 'A', 'C', 'G', and 'T' only.

#### Output

The output for every scenario begins with a line containing "Scenario #i:", where  $i$  is the number of the scenario starting at 1. Then print a single line containing the shortest (and smallest) string as described above. Terminate the output for the scenario with a blank line.

#### Sample Input

```
1
2
TGCACA
CAT
```

#### Sample Output

```
Scenario #1:
TGCACAT
```

---

Added by: Andrés Leonardo Rojas Duarte  
Date: 2007-09-15  
Time limit: 12s  
Source limit: 50000B  
Languages: All  
Resource: TUD Programming Contest 2004



## SPOJ Problem Set (classical)

### 1784. IOICamp Sequence

#### Problem code: ICAMPSEQ

Let's say we have 4 N-elements sequences of real numbers:  $A[]$ ,  $B[]$ ,  $C[]$ ,  $D[]$ .

Function  $F(i, j)$  is defined:  $F(i, j) = |A_i - A_j| + |B_i - B_j| + |C_i - C_j| + |D_i - D_j|$  ( $1 \leq i, j \leq N$ ).

Your task is very easy: you have to find the maximum of  $F(i, j)$ .

#### Input

The first line:  $N$  ( $N \leq 100000$ ).

Following are  $N$  lines: the  $i$ -th line contains four real numbers  $A_i$ ,  $B_i$ ,  $C_i$ ,  $D_i$ . ( $-10^9 \leq A_i, B_i, C_i, D_i \leq 10^9$ )

#### Output

Only one line is the maximum of  $F(i, j)$ .

(The result takes exactly 3 decimal places)

#### Example

**Input :**

2

1.0 1.0 2.0 0.5

1.0 1.0 0.5 2.0

**Output :**

3.000

---

Added by: Nghia Nguyen Hoang

Date: 2007-09-18

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: IOICamp and Ms. Thanh Vy Hua Le

## SPOJ Problem Set (classical)

### 1785. Code

#### Problem code: CODE

KEY Inc., the leading company in security hardware, has developed a new kind of safe. To unlock it, you don't need a key but you are required to enter the correct  $n$ -digit code on a keypad (as if this were something new!). There are several models available, from toy safes for children (with a 2-digit code) to the military version (with a 6-digit code).

The safe will open as soon as the last digit of the correct code is entered. There is no "enter" key. When you enter more than  $n$  digits, only the last  $n$  digits are significant. For example (in the 4-digit version), if the correct code is 4567, and you plan to enter the digit sequence 1234567890, the door will open as soon as you press the 7 key.

The software to create this effect is rather simple. In the  $n$ -digit version the safe is always in one of  $10^{n-1}$  internal states. The current state of the safe simply represents the last  $n-1$  digits that have been entered. One of these states (in the example above, state 456) is marked as the `unlocked` state. If the safe is in the unlocked state and then the right key (in the example above, 7) is pressed, the door opens. Otherwise the safe shifts to the corresponding new state. For example, if the safe is in state 456 and then you press 8, the safe goes into state 568.

A trivial strategy to open the safe is to enter all possible codes one after the other. In the worst case, however, this will require  $n * 10^n$  keystrokes. By choosing a good digit sequence it is possible to open the safe in at most  $10^n + n - 1$  keystrokes. All you have to do is to find a digit sequence that contains all  $n$ -digit sequences exactly once. KEY Inc. claims that for the military version ( $n=6$ ) the fastest computers available today would need billions of years to find such a sequence - but apparently they don't know what some programmers are capable of...

#### Input Specification

The input contains several test cases. Every test case is specified by an integer  $n$ . You may assume that  $1 \leq n \leq 6$ . The last test case is followed by a zero.

#### Output Specification

For each test case specified by  $n$  output a line containing a sequence of  $10^n + n - 1$  digits that contains each  $n$ -digit sequence exactly once.

#### Sample Input

```
1
2
0
```

## Sample Output

```
0123456789
00102030405060708091121314151617181922324252627282933435363738394454647484955657585966768697787988990
```

---

Added by: Wanderley Guimaraes

Date: 2007-09-19

Time limit: 2s

Source limit:50000B

Languages: All

Resource: University of Ulm Local Contest 2004

## SPOJ Problem Set (classical)

### 1786. In Danger

#### Problem code: DANGER

Flavius Josephus and 40 fellow rebels were trapped by the Romans. His companions preferred suicide to surrender, so they decided to form a circle and to kill every third person and to proceed around the circle until no one was left. Josephus was not excited by the idea of killing himself, so he calculated the position to be the last man standing (and then he did not commit suicide since nobody could watch).

We will consider a variant of this "game" where every second person leaves. And of course there will be more than 41 persons, for we now have computers. You have to calculate the safe position. Be careful because we might apply your program to calculate the winner of this contest!

#### Input Specification

The input contains several test cases. Each specifies a number  $n$ , denoting the number of persons participating in the game. To make things more difficult, it always has the format " $x y e z$ " with the following semantics: when  $n$  is written down in decimal notation, its first digit is  $x$ , its second digit is  $y$ , and then follow  $z$  zeros. Whereas  $0 \leq x, y \leq 9$ , the number of zeros is  $0 \leq z \leq 6$ . You may assume that  $n > 0$ . The last test case is followed by the string `00e0`.

#### Output Specification

For each test case generate a line containing the position of the person who survives. Assume that the participants have serial numbers from 1 to  $n$  and that the counting starts with person 1, i.e., the first person leaving is the one with number 2. For example, if there are 5 persons in the circle, counting proceeds as 2, 4, 1, 5 and person 3 is staying alive.

#### Sample Input

```
05e0
01e1
42e0
66e6
00e0
```

#### Sample Output

```
3
5
21
64891137
```

---

Added by: Wanderley Guimaraes  
Date: 2007-09-19  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2004

## SPOJ Problem Set (classical)

### 1787. Run Length Encoding

#### Problem code: ENCONDIN

Your task is to write a program that performs a simple form of run-length encoding, as described by the rules below.

Any sequence of between 2 to 9 identical characters is encoded by two characters. The first character is the length of the sequence, represented by one of the characters 2 through 9. The second character is the value of the repeated character. A sequence of more than 9 identical characters is dealt with by first encoding 9 characters, then the remaining ones.

Any sequence of characters that does not contain consecutive repetitions of any characters is represented by a 1 character followed by the sequence of characters, terminated with another 1. If a 1 appears as part of the sequence, it is escaped with a 1, thus two 1 characters are output.

#### Input Specification

The input consists of letters (both upper- and lower-case), digits, spaces, and punctuation. Every line is terminated with a newline character and no other characters appear in the input.

#### Output Specification

Each line in the input is encoded separately as described above. The newline at the end of each line is not encoded, but is passed directly to the output.

#### Sample Input

```
AAAAABCCCC  
12344
```

#### Sample Output

```
6A1B14C  
11123124
```

---

Added by: Wanderley Guimaraes  
Date: 2007-09-19  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2004

## SPOJ Problem Set (classical)

### 1788. Fractan

#### Problem code: FRACTAN

To play the "fraction game" corresponding to a given list  $f_1, f_2, \dots, f_k$  of fractions and starting integer  $N$ , you repeatedly multiply the integer you have at any stage (initially  $N$ ) by the earliest  $f_i$  in the list for which the answer is integral. Whenever there is no such  $f_i$ , the game stops.

Formally, we define a sequence by  $S_0 = N$ , and  $S_{j+1} = f_i S_j$ , if for  $1 \leq i \leq k$ , the number  $f_i S_j$  is an integer but the numbers  $f_1 S_j, \dots, f_{i-1} S_j$  are not.

For example, if we have the list of eight fractions  $f_1 = 170/39$ ,  $f_2 = 19/13$ ,  $f_3 = 13/17$ ,  $f_4 = 69/95$ ,  $f_5 = 19/23$ ,  $f_6 = 1/19$ ,  $f_7 = 13/7$ ,  $f_8 = 1/3$ , and start with  $N = 21$ , we produce the (finite) sequence  $(21, 39, 170, 130, 190, 138, 114, 6, 2)$ . In general, the sequence may be infinite.

Given a fraction list and a starting integer calculate a part of the defined sequence. Actually, we are interested only in the powers of 2 that appear in the sequence.

#### Input Specification

The input contains several test cases. Every test case starts with three integers  $m, N, k$ . You may assume that  $1 \leq m \leq 40$ ,  $1 \leq N \leq 1000$ , and  $1 \leq k \leq 100$ . Then follow  $k$  fractions  $f_1, \dots, f_k$ . For each fraction, first its numerator is given, followed by its denominator. You may assume that both are positive integers less than 1000 and their greatest common divisor is 1. The last test case is followed by a zero.

#### Output Specification

For each test case output on a line  $m$  numbers  $e_1, \dots, e_m$ , separated by one space character, such that  $2^{e_1}, \dots, 2^{e_k}$  are the first  $m$  numbers in the defined sequence that are powers of 2. You may assume that there are at least  $m$  powers of 2 among the first 7654321 elements of the sequence.

#### Sample Input

```
1 21 8 170 39 19 13 13 17 69 95 19 23 1 19 13 7 1 3
20 2 14 17 91 78 85 19 51 23 38 29 33 77 29 95 23 77 19 1 17 11 13 13 11 15 2 1 7 55 1
0
```

#### Sample Output

```
1
1 2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67
```

---

Added by: Wanderley Guimaraes  
Date: 2007-09-19  
Time limit: 2s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2004



## SPOJ Problem Set (classical)

### 1789. Huffman's Greed

#### Problem code: GREEDULM

In the following we define the basic terminology of trees. A **tree** is defined inductively: It has a **root** which is either an **external node** (a leaf), or an **internal node** having a sequence of trees as its children. An internal node is also called the **parent** of the roots of its child trees. The **level** of a node in a tree is defined inductively: The root has level 0, and the level of a node is 1 more than the level of its parent node.

Every internal node of a **binary tree** has precisely two children, its left sub-tree and its right sub-tree. Every internal node of a **labelled binary tree** is additionally marked with a string, its label. A **binary search tree** is a labelled binary tree where every internal node  $t$  satisfies the following condition: All labels of nodes in the left sub-tree of  $t$  are less than the label of  $t$  which is, in turn, less than all labels of nodes in the right sub-tree of  $t$ . For this condition, we assume lexicographic, i.e., alphabetic order on the strings.

An **inorder traversal** of a tree is defined recursively: A leaf is just visited, and for an internal node first its left sub-tree is traversed inorder, then the node itself is visited, finally its right sub-tree is traversed inorder. It follows that an inorder traversal of a binary search tree yields the labels in lexicographic order. Note that binary search trees whose shapes differ may nevertheless yield the same sequence of strings while being traversed inorder.

When a given string  $s$  is looked for in a binary search tree, we compare  $s$  to the label  $l$  of the root. We are done if  $s=l$ , otherwise if  $s<l$  we continue to search in the left sub-tree, and if  $s>l$  in the right sub-tree. If a leaf is reached, we know that  $s$  is not in the tree.

The number of comparisons performed in such a search procedure depends on  $s$  and the actual shape of the search tree. Therefore, there is an interest in constructing binary search trees that store a given sequence of strings but provide as efficient access as possible. Of course, we don't know in advance which strings will be looked up in the tree, so we need to make some assumptions.

Let  $n$  be the number of strings that are to be stored in the binary search tree. Let  $K_1, \dots, K_n$  be these strings in lexicographic order. Let  $p_1, \dots, p_n$  and  $q_0, \dots, q_n$  be  $2n+1$  non-negative real numbers such that  $\sum_{i=1..n} p_i + \sum_{i=0..n} q_i = 1$ . The interpretation of these numbers is:

- $p_i$  = probability that the search argument  $s$  is  $K_i$ .
- $q_i$  = probability that  $s$  lies (lexicographically) strictly between  $K_i$  and  $K_{i+1}$ .

By convention,  $q_0$  is the probability that  $s$  is less than  $K_1$ , and  $q_n$  is the probability that  $s$  is greater than  $K_n$ . We want to find a binary search tree containing nodes with labels  $K_1, \dots, K_n$  that minimises the expected number of comparisons in the search, namely

$$\text{cost} = \sum_{i=1..n} p_i * (1 + \text{level of internal node } K_i) + \sum_{i=0..n} q_i * (\text{level of leaf between } K_i \text{ and } K_{i+1}).$$

The leaf between  $K_i$  and  $K_{i+1}$  is that leaf reached in the search for a string  $s$  that lies (lexicographically) strictly between  $K_i$  and  $K_{i+1}$ . Adhere to the convention stated above for the border cases.

The following figure illustrates the first test case of the sample input. It shows the two possible binary search trees, the probabilities and the associated costs.

[IMAGE]

## Input Specification

The input contains several test cases. Every test case starts with an integer  $n$ . You may assume that  $1 \leq n \leq 200$ . Then follow  $2n+1$  non-negative integers denoting frequencies. Let  $s$  be the sum of all frequencies. You may assume that  $1 \leq s \leq 1000000$ . The probabilities  $p_1, \dots, p_n$  and  $q_0, \dots, q_n$  are calculated in this order by dividing the frequencies by  $s$ . The last test case is followed by a zero.

## Output Specification

For each test case devise a binary search tree whose cost is minimal for the specified probabilities. Output the integer  $\text{cost} * s$  for such a tree.

## Sample Input

```
2
20 15 15 25 25
35
142 35 58 5 20 5 10 9 15 23 129 4 52 5 38 18 9 7 2 4 266 93 5 18 18 27 5 10 11 180 4 32 21 3 21
0 55 27 36 85 31 58 3 334 0 98 27 113 89 180 0 62 12 0 37 0 3 64 70 0 277 0 0 0 170 0 18 76 27 3 29
0
```

## Sample Output

```
160
13637
```

---

Added by: Wanderley Guimaraes

Date: 2007-09-19

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: University of Ulm Local Contest 2004

## SPOJ Problem Set (classical)

### 1790. Binary Search Heap Construction

#### Problem code: HEAPULM

Read the statement of problem G for the definitions concerning trees. In the following we define the basic terminology of heaps. A **heap** is a tree whose internal nodes have each assigned a **priority** (a number) such that the priority of each internal node is less than the priority of its parent. As a consequence, the root has the greatest priority in the tree, which is one of the reasons why heaps can be used for the implementation of priority queues and for sorting.

A binary tree in which each internal node has both a label and a priority, and which is both a binary search tree with respect to the labels and a heap with respect to the priorities, is called a **treap**. Your task is, given a set of label-priority-pairs, with unique labels and unique priorities, to construct a treap containing this data.

#### Input Specification

The input contains several test cases. Every test case starts with an integer  $n$ . You may assume that  $1 \leq n \leq 50000$ . Then follow  $n$  pairs of strings and numbers  $l_1/p_1, \dots, l_n/p_n$  denoting the label and priority of each node. The strings are non-empty and composed of lower-case letters, and the numbers are non-negative integers. The last test case is followed by a zero.

#### Output Specification

For each test case output on a single line a treap that contains the specified nodes. A treap is printed as `(<left sub-treap><label>/<priority><right sub-treap>)`. The sub-treaps are printed recursively, and omitted if leafs.

#### Sample Input

```
7 a/7 b/6 c/5 d/4 e/3 f/2 g/1
7 a/1 b/2 c/3 d/4 e/5 f/6 g/7
7 a/3 b/6 c/4 d/7 e/2 f/5 g/1
0
```

#### Sample Output

```
(a/7(b/6(c/5(d/4(e/3(f/2(g/1)))))))
((((((a/1)b/2)c/3)d/4)e/5)f/6)g/7)
((a/3)b/6(c/4))d/7((e/2)f/5(g/1))
```

---

Added by: Wanderley Guimaraes  
Date: 2007-09-19  
Time limit: 4s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2004

## SPOJ Problem Set (classical)

### 1793. Text Generater II

#### Problem code: GEN2

HL, HJ and FGD set problem for ZMY everyday. The title of each problem bores them very much. The title is a string which consists only lower case letters. It's length is  $L$ , and, of course, the title must contain their names(hl, hj, fgd) as consecutive substrings. More apparently,  $N$  evil consecutive substrings should not appear in the title. Any string satisfying the two conditions above is OK.

The task ZMY is to do today is: if they give ZMY 8 problems every week, and the title of each problem should not be repeated, how many (complete) weeks can they set problems?

#### Input

Multiple test cases. Input terminates by EOF.

For each test case:

The first line contains two space-separated integers  $L(0 \leq L \leq 10^9)$  and  $N(0 \leq N \leq 20)$ .  $N$  lines follow, each contains a string (contains only lowercase letters), which is evil. You can assume the total length of the  $N$  evil strings is no more than 20.

#### Output

For each test case output one line contains the answer modulo 1000.

#### Example

**Input :**

```
10 1
zmy
```

**Output :**

```
245
```

---

Added by: Blue Mary

Date: 2007-09-20

Time limit: 7s

Source limit: 50000B

Languages: All except: C99 strict

Resource: description by Blue Mary; standard program and test data by g201513

## SPOJ Problem Set (classical)

### 1794. Greedy Hydra II

#### Problem code: DRAGON2

The problem description is the same as the problem DRAGON.

#### Input

The first line contains 3 integers  $N(1 \leq N \leq 3000)$ ,  $M(2 \leq M \leq N)$ ,  $K(1 \leq K \leq N)$ , separated by single spaces. The  $N$  fruits are numbered  $1..N$ , and the biggest fruit is always numbered 1.  $N-1$  lines follow, each contains 3 integers  $i, j, k$  separated by spaces denoted that there is a branch between fruit  $i(1 \leq i \leq N)$  and fruit  $j(1 \leq j \leq N)$  and the weight of illness of this branch is  $k(0 \leq k \leq 100000)$ .

#### Output

Output one line contains a single integer denoted the minimum weight of illness of the hydra. If we can't divide the fruit into  $M$  groups, output "-1"(without quotes).

#### Example

**Input :**

```
8 2 4
1 2 20
1 3 4
1 4 13
2 5 10
2 6 12
3 7 15
3 8 5
```

**Output :**

```
4
```

Blue Mary's Note: some new test cases were added on Dec.7, 2007.

---

Added by: Blue Mary

Date: 2007-09-20

Time limit: 0.5s-1s

Source limit: 50000B

Languages: All except: C99 strict

Resource: description by Blue Mary; standard program and test data by lcosvse

## SPOJ Problem Set (classical)

### 1797. Cardsharper

#### Problem code: CARD

Zenek is a well known (at least in Byteotia) card-sharper. He spent most of his best years practicing one card shuffle with his deck of  $n$  cards, which for simplicity we will call  $1, 2, \dots, n$ . Unfortunately, it turns out that knowing this one card shuffle  $a$  is not enough to earn a good living. To become rich and famous Zenek needs to know  $k$  shuffles  $c_1, \dots, c_k$ . As he doesn't have enough time to learn all of them, he decided to learn only one shuffle  $b$  so that using both  $a$  and  $b$  he will be able to perform as many of  $c_i$  as it is possible.

Each shuffle is described by  $n$  numbers  $t_1, t_2, \dots, t_n$ . Such description means that after performing shuffle, card that was originally at position  $i$  will be at position  $t_i$ .

#### Task

Find shuffle  $b$  maximizing number of shuffles that can be performed.

#### Input

First line contains  $n$  ( $2 \leq n \leq 52$ ). Second line contains  $n$  numbers  $a_1, a_2, \dots, a_n$  describing shuffle that Zenek already knows. Third line contains  $k$  ( $2 \leq k \leq 6$ ).  $i$ -th of the next  $k$  lines contains description of  $c_i$ .

#### Output

First line contains description of the shuffle  $b$  that Zenek should learn.  $i$ -th of the next  $k$  lines contains:

- $-1$  when it is not possible to perform  $c_i$  using only  $a$  and  $b$
- $m, r_1, r_2, \dots, r_m$  ( $0 \leq m \leq 500000$ ,  $0 \leq r_i \leq 10^6$ ) meaning that applying  $a$   $r_1$  times, then  $b$   $r_2$  times, then  $a$   $r_3$  times and so on is the same as applying shuffle  $c_i$  once.

#### Examples

##### Input

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

##### Output

```
2 1 3 4 5
3 4 1 1
0
9 1 1 3 1 4 1 1 1 1
```

### Input

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

### Output

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

---

Added by: Pawel Gawrychowski  
Date: 2007-09-20  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Fajne Zawody Informatyczne



## SPOJ Problem Set (classical)

### 1798. Assistance Required

#### Problem code: ASSIST

After the 1997/1998 Southwestern European Regional Contest (which was held in Ulm) a large contest party took place. The organization team invented a special mode of choosing those participants that were to assist with washing the dirty dishes. The contestants would line up in a queue, one behind the other. Each contestant got a number starting with 2 for the first one, 3 for the second one, 4 for the third one, and so on, consecutively.

The first contestant in the queue was asked for his number (which was 2). He was freed from the washing up and could party on, but every second contestant behind him had to go to the kitchen (those with numbers 4, 6, 8, etc). Then the next contestant in the remaining queue had to tell his number. He answered 3 and was freed from assisting, but every third contestant behind him was to help (those with numbers 9, 15, 21, etc). The next in the remaining queue had number 5 and was free, but every fifth contestant behind him was selected (those with numbers 19, 35, 49, etc). The next had number 7 and was free, but every seventh behind him had to assist, and so on.

Let us call the number of a contestant who does not need to assist with washing up a lucky number. Continuing the selection scheme, the lucky numbers are the ordered sequence 2, 3, 5, 7, 11, 13, 17, etc. Find out the lucky numbers to be prepared for the next contest party.

#### Input Specification

The input contains several test cases. Each test case consists of an integer  $n$ . You may assume that  $1 \leq n \leq 3000$ . A zero follows the input for the last test case.

#### Output Specification

For each test case specified by  $n$  output on a single line the  $n$ -th lucky number.

#### Sample Input

```
1
2
10
20
0
```

#### Sample Output

```
2
3
29
83
```

---

Added by: Wanderley Guimaraes  
Date: 2007-09-21  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2003

## SPOJ Problem Set (classical)

### 1799. The Bottom of a Graph

#### Problem code: BOTTOM

We will use the following (standard) definitions from graph theory. Let  $V$  be a nonempty and finite set, its elements being called vertices (or nodes). Let  $E$  be a subset of the Cartesian product  $V \times V$ , its elements being called edges. Then  $G = (V, E)$  is called a directed graph.

Let  $n$  be a positive integer, and let  $p = (e_1, \dots, e_n)$  be a sequence of length  $n$  of edges  $e_i \in E$  such that  $e_i = (v_i, v_{i+1})$  for a sequence of vertices  $(v_1, \dots, v_{n+1})$ . Then  $p$  is called a path from vertex  $v_1$  to vertex  $v_{n+1}$  in  $G$  and we say that  $v_{n+1}$  is reachable from  $v_1$ , writing  $(v_1 \rightarrow v_{n+1})$ .

Here are some new definitions. A node  $v$  in a graph  $G = (V, E)$  is called a sink, if for every node  $w$  in  $G$  that is reachable from  $v$ ,  $v$  is also reachable from  $w$ . The bottom of a graph is the subset of all nodes that are sinks, i.e.,  $\text{bottom}(G) = \{v \in V \mid \forall w \in V: (v \rightarrow w) \Rightarrow (w \rightarrow v)\}$ . You have to calculate the bottom of certain graphs.

#### Input Specification

The input contains several test cases, each of which corresponds to a directed graph  $G$ . Each test case starts with an integer number  $v$ , denoting the number of vertices of  $G = (V, E)$ , where the vertices will be identified by the integer numbers in the set  $V = \{1, \dots, v\}$ . You may assume that  $1 \leq v \leq 5000$ . That is followed by a non-negative integer  $e$  and, thereafter,  $e$  pairs of vertex identifiers  $v_1, w_1, \dots, v_e, w_e$  with the meaning that  $(v_i, w_i) \in E$ . There are no edges other than specified by these pairs. The last test case is followed by a zero.

#### Output Specification

For each test case output the bottom of the specified graph on a single line. To this end, print the numbers of all nodes that are sinks in sorted order separated by a single space character. If the bottom is empty, print an empty line.

#### Sample Input

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

#### Sample Output

```
1 3
2
```

---

Added by: Wanderley Guimaraes  
Date: 2007-09-21  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2003

## SPOJ Problem Set (classical)

### 1800. Fixed Partition Contest Management

#### Problem code: CONTEST

A technique used in early programming contest strategies involved partitioning the available intellectual capacity of a team into a number of members with each member having a fixed amount of intelligence, different members potentially having different amounts. The sum of the brightness of all members equals the total intellectual capacity of the team.

Given a set of problems, it was the task of the team to assign the problems to different team members, so that they could be solved concurrently. This was made difficult due to the fact that the solution time of a problem might depend on the amount of intelligence available to it. Every problem has a minimum intelligence requirement, but if assigned to a brighter member its solution time might increase or decrease.

In this task, you have to determine optimal assignments of problems to team members. Your program is given the intellectual capacities of the team members available for the solution of problems, and for each problem a description of how its solution time depends on the amount of intelligence available to it. Your program has to find the solution schedule of the problems that minimizes the average solution time for the problems. A solution schedule is an assignment of problems to team members and times, such that no two problems use the same member at the same time, and no problem is assigned to a team member with less brightness than its minimum requirement. The solution time of the problem is the difference between the time when the problem was submitted to be solved (which is the start of the contest at time zero for all problems in this task), and the time that the problem is solved.

#### Input Specification

The input data will contain multiple test cases. Each test case begins with a line containing a pair of integers  $m$  and  $n$ . The number  $m$  specifies the number of team members ( $1 \leq m \leq 3$ ), and  $n$  specifies the number of problems to be solved ( $1 \leq n \leq 10$ ).

The next line contains  $m$  positive integers giving the intelligence amounts of the  $m$  team members. Following this are  $n$  lines, describing the time-brightness tradeoffs for each of the  $n$  problems. Each line starts with a positive integer  $k$  ( $k \leq 10$ ), followed by  $k$  pairs of positive integers  $s_1, t_1, s_2, t_2, \dots, s_k, t_k$  that satisfy  $s_i < s_{i+1}$  for  $1 \leq i < k$ . The minimum intelligence requirement of the problem is  $s_1$ , i.e. it cannot be solved by a member with less intellectual capacity than this number. If the problem is solved by a team member with brightness  $s$ , where  $s_i \leq s < s_{i+1}$  for some  $i$ , then its solution time will be  $t_i$ . Finally, if the problem is solved by a team member with intellectual capacity  $s_k$  or more, then its execution time will be  $t_k$ .

A pair of zeroes will follow the input for the last test case.

You may assume that each problem will be solved in exactly the time specified for the given brightness, regardless of the number of other problems being solved by other team members at the same time. No problem will have an intelligence requirement larger than that of the brightest team member.

## Output Specification

For each test case, first display the case number (starting with 1 and increasing sequentially). Then print the minimum average solution time for the set of problems with two digits to the right of the decimal point. Follow this by the description of a solution schedule that achieves this average solution time. Display one line for each problem, in the order they were given in the input, that identifies the problem number, the member used to solve it (numbered in the order given in the input), the time when the member started to solve the problem, and the time when the problem was solved. Follow the format shown in the sample output, and print a blank line after each test case.

## Sample Input

```
2 4
40 60
1 35 4
1 20 3
1 40 10
1 60 7
3 5
10 20 30
2 10 50 12 30
2 10 100 20 25
1 25 19
1 19 41
2 10 18 30 42
0 0
```

## Sample Output

```
Case 1
Average solution time = 7.75
Problem 1 is solved by member 2 from 0 to 4
Problem 2 is solved by member 1 from 0 to 3
Problem 3 is solved by member 1 from 3 to 13
Problem 4 is solved by member 2 from 4 to 11

Case 2
Average solution time = 35.40
Problem 1 is solved by member 3 from 19 to 49
Problem 2 is solved by member 2 from 0 to 25
Problem 3 is solved by member 3 from 0 to 19
Problem 4 is solved by member 2 from 25 to 66
Problem 5 is solved by member 1 from 0 to 18
```

---

Added by: Wanderley Guimaraes

Date: 2007-09-21

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: University of Ulm Local Contest 2003

## SPOJ Problem Set (classical)

### 1801. Drink, on Ice

#### Problem code: DRINK

A good drink is always served on ice. That said, the amount of ice is what makes the difference. If it is too much, the drink will be well cooled, however, this is a bit of fraud as there could be less ice (and more Vodka for example). On the other hand, if there is too little ice the drink is warm which is unacceptable. You are to help the bartender, of course neither with mixing nor drinking, but with calculating the expected outcome of such mixtures.

To make things easier, we assume that pure water is mixed with ice in a closed system, i.e., there is no problem with the outside temperature or the warming of the bottle, etc. Therefore, after a some time has passed, the system may be regarded as balanced (there is no further change in temperature and no more melting or freezing). Your job is to calculate the final temperature of this balanced system and the amount of ice and water in this equilibrium state.

As you know from physics, it takes 4.19 Joule to heat one gram of water one Kelvin, whereas it takes 2.09 Joule if it is ice. We define the capacities  $c_w = 4.19 \text{ J/(g}\cdot\text{K)}$  and  $c_i = 2.09 \text{ J/(g}\cdot\text{K)}$ . Melting one gram of ice takes 335 Joule, where the temperature remains constant at zero. We define the constant  $e_m = 335 \text{ J/g}$ . The total thermal energy of the ice and the water before the experiment is equal to the thermal energy of the final mixture.

The figure below shows the energy of one gram of ice, ice-water-mixture, or water, where the temperature is measured relative to -30 degrees Celsius. The jump at 0 degrees represents the melting of ice to water. The amount of energy gained is proportional to the amount of ice already melted.

#### Input Specification

The input contains several test cases. Each test case consists of four real numbers  $m_w$ ,  $m_i$ ,  $t_w$ ,  $t_i$ . The mass of water  $m_w$  and the mass of ice  $m_i$  are both non-negative, given in grams, and  $m_w + m_i > 0$ . The water temperature  $t_w$  and the ice temperature  $t_i$  follow, both given in degrees Celsius, and you may assume that  $-30 < t_i \leq 0 \leq t_w < 100$ . The last test case is followed by four zeroes.

#### Output Specification

For each test case output the amount of ice and water in grams and the final temperature of the mixture in degrees Celsius. All numbers must be rounded to one digit. Adhere to the sample output for the exact format to use.

## Sample Input

[IMAGE]

```
100 20 50 -10
100 22 0 0
100 35 25 -10.5
10 90 25 -28
0 0 0 0
```

## Sample Output

```
0.0 g of ice and 120.0 g of water at 27.5 C
22.0 g of ice and 100.0 g of water at 0.0 C
6.0 g of ice and 129.0 g of water at 0.0 C
100.0 g of ice and 0.0 g of water at -4.2 C
```

---

Added by: Wanderley Guimaraes

Date: 2007-09-21

Time limit: 1s

Source limit:50000B

Languages: All

Resource: University of Ulm Local Contest 2003



## SPOJ Problem Set (classical)

### 1802. Edge

#### Problem code: EDGE

For products that are wrapped in small packings it is necessary that the sheet of paper containing the directions for use is folded until its size becomes small enough. We assume that a sheet of paper is rectangular and only folded along lines parallel to its initially shorter edge. The act of folding along such a line, however, can be performed in two directions: either the surface on the top of the sheet is brought together, or the surface on its bottom. In both cases the two parts of the rectangle that are separated by the folding line are laid together neatly and we ignore any differences in thickness of the resulting folded sheet.

After several such folding steps have been performed we may unfold the sheet again and take a look at its longer edge holding the sheet so that it appears as a one-dimensional curve, actually a concatenation of line segments. If we move along this curve in a fixed direction we can classify every place where the sheet was folded as either `type A` meaning a clockwise turn or `type V` meaning a counter-clockwise turn. Given such a sequence of classifications, produce a drawing of the longer edge of the sheet assuming 90 degree turns at equidistant places.

#### Input Specification

The input contains several test cases, each on a separate line. Each line contains a nonempty string of characters `A` and `V` describing the longer edge of the sheet. You may assume that the length of the string is less than 200. The input file terminates immediately after the last test case.

#### Output Specification

For each test case generate a PostScript drawing of the edge with commands placed on separate lines. Start every drawing at the coordinates (300,420) with the command `"300 420 moveto"`. The first turn occurs at (310,420) using the command `"310 420 lineto"`. Continue with clockwise or counter-clockwise turns according to the input string, using a sequence of `"x y lineto"` commands with the appropriate coordinates. The turning points are separated at a distance of 10 units. Do not forget the end point of the edge and finish each test case by the commands `stroke` and `showpage`.

You may display such drawings with the `gv` PostScript interpreter, optionally after a conversion using the `ps2ps` utility.

## Sample Input

V  
AVV

## Sample Output

```
300 420 moveto
310 420 lineto
310 430 lineto
stroke
showpage
300 420 moveto
310 420 lineto
310 410 lineto
320 410 lineto
320 420 lineto
stroke
showpage
```

[IMAGE]

---

Added by: Wanderley Guimaraes

Date: 2007-09-21

Time limit: 1s

Source limit:50000B

Languages: All

Resource: University of Ulm Local Contest 2003

## SPOJ Problem Set (classical)

### 1803. Fold

#### Problem code: FOLD

Read the statement of problem E: Edge to understand how to fold a sheet of paper and how to interpret the input. We define a "stripe" to be a maximally large part of the sheet that has no folding line going through. Since the turns occur at equidistant places, all stripes are congruent.

In this problem you are given the description of the result of performing several folding steps as in problem E: Edge, i.e., in the unfolded state. Additionally, you know that the length of the sheet in its folded state is exactly the length of 1 stripe (again, we ignore thickness).

Find the minimum number of folding steps necessary to generate the described sheet from an initially flat sheet of paper. Note that performing a folding step may create more than one turn in the result because parts of the sheet already overlay due to previous folding steps. When a step is carried out, however, all overlaying parts of the sheet are affected, i.e., it is not allowed to fold, say, only the top three layers.

Finally, note that every result can be obtained by iterating through the turns in a fixed direction and performing a folding step at each turn, thereby accumulating a 1 stripe long stack of all stripes. If  $n$  is the number of turns in the input description, this procedure in fact requires  $n$  folding steps, which is not necessarily minimal as can be observed in the sample output.

#### Input Specification

The input contains several test cases, each on a separate line. Each line contains a nonempty string of characters A and V describing the longer edge of the sheet. You may assume that the length of the string is less than 200. The input file terminates immediately after the last test case.

#### Output Specification

For each test case print on a line the minimum number of folding steps required to produce the described sheet of paper.

#### Sample Input

```
V
AVV
AAVAAVVVAAV
```

#### Sample Output

```
1
2
4
```

---

Added by: Wanderley Guimaraes  
Date: 2007-09-21  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: University of Ulm Local Contest 2003

## SPOJ Problem Set (classical)

### 1804. Genetic Code

#### Problem code: GENETIC

The connections between mathematics and biology are complicated. Most of the time they do not run along nice-looking links that merrily join at first glance, but they are abstract and not always easily established.

Lake Vostok - about 14000 square kilometers large, up to 650 meters deep, and covered by 3743 meters of ice - was recently discovered on the Antarctic continent. The lake remained under conditions of high pressure and no sunlight for several millions of years. It is believed that ordinary life has evolved to a more efficient form using a genetic code composed of only three bases (the current state of ignorance proclaims the four bases adenine, cytosine, guanine, and thymine). Until reasonable names are found, the three bases will be abbreviated as N, O, and P.

Moreover, the genome is single-stranded and directed, i.e., we may see it as a sequence over the alphabet  $\{N, O, P\}$ . Unless risking instability, it is necessary that the genome is a Thue-sequence, due to the Norwegian mathematician A. Thue (1863-1922). Define a subsegment of a sequence to be a connected subsequence, and call two subsegments adjacent if one follows immediately after the other in the sequence. A Thue-sequence is a sequence where no adjacent subsegments are equal. For example, NOPNO is and NOPNPNO is not a Thue-sequence, so that the first may be a genome whereas the second may not.

To be able to simulate experiments with the new genomes, you are asked to generate genomes of certain lengths.

#### Input Specification

The input contains several test cases. Each test case consists of an integer  $n$ . You may assume that  $1 \leq n \leq 5000$ . The last test case is followed by a zero.

#### Output Specification

For each test case specified by  $n$  output on a single line any genome of length  $n$ . If no genome of length  $n$  exists, output a blank line instead.

#### Sample Input

```
1
2
10
20
0
```

## Sample Output

N  
NO  
NONPNOPNPO  
NONPNOPNPONOPNONPNOP

---

Added by: Wanderley Guimaraes

Date: 2007-09-21

Time limit: 1s

Source limit:50000B

Languages: All

Resource: University of Ulm Local Contest 2003

## SPOJ Problem Set (classical)

### 1805. Largest Rectangle in a Histogram

#### Problem code: HISTOGRAM

A histogram is a polygon composed of a sequence of rectangles aligned at a common base line. The rectangles have equal widths but may have different heights. For example, the figure on the left shows the histogram that consists of rectangles with the heights 2, 1, 4, 5, 1, 3, 3, measured in units where 1 is the width of the rectangles:

[IMAGE]

Usually, histograms are used to represent discrete distributions, e.g., the frequencies of characters in texts. Note that the order of the rectangles, i.e., their heights, is important. Calculate the area of the largest rectangle in a histogram that is aligned at the common base line, too. The figure on the right shows the largest aligned rectangle for the depicted histogram.

#### Input Specification

The input contains several test cases. Each test case describes a histogram and starts with an integer  $n$ , denoting the number of rectangles it is composed of. You may assume that  $1 \leq n \leq 100000$ . Then follow  $n$  integers  $h_1, \dots, h_n$ , where  $0 \leq h_i \leq 1000000000$ . These numbers denote the heights of the rectangles of the histogram in left-to-right order. The width of each rectangle is 1. A zero follows the input for the last test case.

#### Output Specification

For each test case output on a single line the area of the largest rectangle in the specified histogram. Remember that this rectangle must be aligned at the common base line.

#### Sample Input

```
7 2 1 4 5 1 3 3
4 1000 1000 1000 1000
0
```

#### Sample Output

```
8
4000
```

---

Added by: Wanderley Guimaraes  
Date: 2007-09-21  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2003

## SPOJ Problem Set (classical)

### 1810. Nuclear Plants

#### Problem code: ORZ

The Great Plain of Algorithmia plays an extremely important role in the agriculture of the Bandulu Kingdom: this is the only place where barley (*Hordeum vulgare*), an essential ingredient of beer, can be produced. Unfortunately, it is not possible to grow barley on the full area of the plain, as several nuclear plants have recently been built, and you cannot grow barley near a nuclear plant (since you do not want to produce giant-size, aggressive, man-eating barley-mutants). Your task is to write a program that determines the size of the area that can be used for growing barley.

The Great Plain of Algorithmia is an  $n * m \text{ km}^2$  rectangle, the coordinates of the four corners being (0, 0), (0, m), (n, 0) and (n, m). There are two types of nuclear plants: small and large. You are not allowed to grow barley within 0.58km of a small nuclear plant or within 1.31km of a large nuclear plant.

#### Input

The input contains several blocks of test cases. Each block begins with a line containing four integers:  $1 \leq n, m \leq 10000$  describe the size of the plain,  $k_s \leq 100$  is the number of small nuclear plants, and  $k_l \leq 100$  is the number of large nuclear plants. The next  $k_s$  lines describe the coordinates of the small nuclear plants, each line contains two integers  $0 \leq x \leq n$  and  $0 \leq y \leq m$ . The next  $k_l$  lines describe the large nuclear plants in a similar fashion.

The input is terminated by a block with  $n = m = k_s = k_l = 0$ .

#### Output

For each test case, you have to output a single line containing the area that can be used for growing barley. This number should be a real value with two digits of precision. To avoid rounding problems, we accept solutions with a maximum of 0.01(positive or negative) error.

#### Example

**Input :**

```
10 10 2 2
2 2
4 4
5 6
1 8
10 10 1 0
5 5
0 0 0 0
```

**Output :**

```
87.46
98.94
```

**Time limit has been changed from 2 seconds to 5 seconds.**



---

Added by: Blue Mary  
Date: 2007-09-23  
Time limit: 5s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: ACM Central European Programming Contest, Budapest 2005

## SPOJ Problem Set (classical)

### 1825. Free tour II

#### Problem code: FTOUR2

After the success of 2nd anniversary (take a look at problem **FTOUR** for more details), this 3rd year, Travel Agent SPOJ goes on with another discount tour.

The tour will be held on *ICPC* island, a miraculous one on the Pacific Ocean. We list **N** places (indexed from 1 to **N**) where the visitors can have a trip. Each road connecting them has an *interest value*, and this value can be *negative* (if there is nothing interesting to view there). Simply, these **N** places along with the roads connecting them form a *tree structure*. We will choose *two places* as the departure and destination of the tour.

Since September is the festival season of local inhabitants, some places are extremely crowded (we call them *crowded places*). Therefore, the organizer of the excursion hopes the tour will visit *at most K crowded places* (too tiring to visit many of them) and of course, the *total number of interesting value* should be maximum.

Briefly, you are given a map of **N** places, an integer **K**, and **M** id numbers of *crowded place*. Please help us to find the optimal tour. Note that we can visit each place only *once* (or our customers easily feel bored), also the departure and destination places *don't need to be different*.

#### Input

There is exactly one case. First one line, containing 3 integers **N K M**, with  $1 \leq N \leq 200000$ ,  $0 \leq K \leq M$ ,  $0 \leq M \leq N$ .

Next **M** lines, each line includes an id number of a *crowded place*.

The last (**N** - 1) lines describe (**N** - 1) two-way roads connected **N** places, form **a b i**, with **a, b** is the id of 2 places, and **i** is its *interest value* ( $-10000 \leq i \leq 10000$ ).

#### Output

Only one number, the maximum total interest value we can obtain.

#### Example

**Input :**

```
8 2 3
3
5
7
1 3 1
2 3 10
3 4 -2
4 5 -1
5 7 6
5 6 5
```

4 8 3

**Output :**

12

## Explanation

We choose 2 and 6 as the departure and destination place, so the tour will be 2 -> 3 -> 4 -> 5 -> 6, total interest value =  $10 + (-2) + (-1) + 5 = 12$

**\* Added some unofficial cases**

---

Added by: Thanh-Vy Hua

Date: 2007-09-28

Time limit: 1s-5s

Source limit: 50000B

Languages: All

Resource: Adapted from Preslav Le's problem, first used in Bulgarian OI 07

## SPOJ Problem Set (classical)

### 1833. Sudoku

#### Problem code: SUDOKU2

Oh no! Bill just realized that the sudoku puzzle he had spent the last ten minutes trying to solve essentially was last week's puzzle, only rotated counterclockwise. How cheap! Couldn't the magazine afford to make a new one every week? Of course, he had no way of knowing about this before he started to solve it, as the holes to fill with digits were other than last week. Nevertheless, realizing that this week's puzzle was a simple derivative of last week's certainly took the fun out of solving the rest of it.

[IMAGE]

The sudoku board consists of  $9 \times 9$  cells. These can be grouped into  $3 \times 3$  *regions* of  $3 \times 3$  cells each. Some of the cells are filled with a digit 1 through 9 while the rest of them are left empty. The aim of the game is to fill each empty cell with a digit 1...9 so that every row, every column and every region contains each of the numbers 1...9 exactly once. A proper sudoku puzzle always has exactly one solution.

Help Bill avoid unpleasant surprises by creating a program that checks whether an unsolved sudoku puzzle is in fact derived from an earlier puzzle by simple operations.

The allowed operations are:

- Rotating the entire puzzle clockwise or counterclockwise.
- Swapping two columns within a  $3 \times 9$  column segment.
- Swapping two rows within a  $9 \times 3$  row segment.
- Swapping entire row or column segments.
- Applying a permutation  $f$  of the digits 1...9 to every cell (i.e. replace  $x$  by  $f(x)$  in every cell).

An operation is considered being performed on the sudoku solution (rather than on the unsolved puzzle) and always guarantees that if the board before the transformation was a solution to a sudoku puzzle, it still is afterwards.

#### Input

The input starts with the number of test cases  $0 \leq N \leq 50$  on a single line.

Then for every test case follow nine lines describing last week's puzzle solution, from top to bottom. Each line corresponds to a row in the puzzle and consists of nine digits (1...9), describing the contents of the cell from left to right.

Last week's solution is followed by nine lines describing this week's unsolved puzzle. Here, also, every line corresponds to a puzzle row and every digit (0...9) describes the contents of a cell. 0 indicates that the cell is empty. The rows are presented ordered from top to bottom, and within each row, the cells are ordered from left to right.

After every test case except the last one follows a blank line. Every unsolved puzzle is guaranteed to be uniquely solvable and last week's solution is always a proper sudoku solution. /p>

## Output

For every test case, output Yes if the sudoku puzzle can be derived from the given solved puzzle using the allowed operations, or No if this is not possible.

## Example

### Input :

```
2
963174258
178325649
254689731
821437596
496852317
735961824
589713462
317246985
642598173
060104050
200000001
008305600
800407006
006000300
700901004
500000002
040508070
007206900
```

```
534678912
672195348
198342567
859761423
426853791
713924856
961537284
287419635
345286179
010900605
025060070
870000902
702050043
000204000
490010508
107000056
040080210
208001090
```

### Output :

```
Yes
No
```

---

Added by: Robin Nittka  
Date: 2007-10-02  
Time limit: 10s  
Source limit: 50000B  
Languages: All  
Resource: ACM ICPC NWERC 2006

## SPOJ Problem Set (classical)

### 1835. The SetStack Computer

#### Problem code: SETSTACK

[IMAGE]

Background from Wikipedia: “Set theory is a branch of mathematics created principally by the German mathematician Georg Cantor at the end of the 19th century. Initially controversial, set theory has come to play the role of a foundational theory in modern mathematics, in the sense of a theory invoked to justify assumptions made in mathematics concerning the existence of mathematical objects (such as numbers or functions) and their properties. Formal versions of set theory also have a foundational role to play as specifying a theoretical ideal of mathematical rigor in proofs.”

Given this importance of sets, being the basis of mathematics, a set of eccentric theorist set off to construct a supercomputer operating on sets instead of numbers. The initial SetStack Alpha is under construction, and they need you to simulate it in order to verify the operation of the prototype.

The computer operates on a single stack of sets, which is initially empty. After each operation, the cardinality of the topmost set on the stack is output. The cardinality of a set  $S$  is denoted  $|S|$  and is the number of elements in  $S$ . The instruction set of the SetStack Alpha is `PUSH`, `DUP`, `UNION`, `INTERSECT`, and `ADD` }.

- `PUSH` will push the empty set  $\{\}$  on the stack.
- `DUP` will duplicate the topmost set (pop the stack, and then push that set on the stack twice).
- `UNION` will pop the stack twice and then push the union of the two sets on the stack.
- `INTERSECT` will pop the stack twice and then push the intersection of the two sets on the stack.
- `ADD` will pop the stack twice, add the first set to the second one, and then push the resulting set on the stack.

For illustration purposes, assume that the topmost element of the stack is

$A = \{\{\}, \{\{\}\}\}$ ,

and that the next one is

$B = \{\{\}, \{\{\{\}\}\}\}$ .

For these sets, we have  $|A| = 2$  and  $|B| = 2$ . Then:

- `UNION` would result in the set  $\{\{\}, \{\{\}\}, \{\{\{\}\}\}\}$ . The output is 3.
- `INTERSECT` would result in the set  $\{\{\}\}$ . The output is 1.
- `ADD` would result in the set  $\{\{\}, \{\{\{\}\}\}, \{\{\}, \{\{\}\}\}\}$ . The output is 3.

## Input

An integer  $0 \leq T \leq 5$  on the first line gives the cardinality of the set of test cases. The first line of each test case contains the number of operations  $0 \leq N \leq 2000$ . Then follow  $N$  lines each containing one of the five commands. It is guaranteed that the SetStack computer can execute all the commands in the sequence without ever popping an empty stack.

## Output

For each operation specified in the input, there will be one line of output consisting of a single integer. This integer is the cardinality of the topmost element of the stack after the corresponding command has executed. After each test case there will be a line with `***` (three asterisks).

## Example

### Input :

```
2
9
PUSH
DUP
ADD
PUSH
ADD
DUP
ADD
DUP
UNION
5
PUSH
PUSH
ADD
PUSH
INTERSECT
```

### Output :

```
0
0
1
0
1
1
2
2
2
***
0
0
1
0
0
***
```

---



Added by: Robin Nittka  
Date: 2007-10-02  
Time limit: 12s  
Source limit: 50000B  
Languages: All  
Resource: ACM ICPC NWERC 2006

## SPOJ Problem Set (classical)

### 1837. Pie

#### Problem code: PIE

[IMAGE]

My birthday is coming up and traditionally I'm serving pie. Not just one pie, no, I have a number  $N$  of them, of various tastes and of various sizes.  $F$  of my friends are coming to my party and each of them gets a piece of pie. This should be one piece of one pie, not several small pieces since that looks messy. This piece can be one whole pie though.

My friends are very annoying and if one of them gets a bigger piece than the others, they start complaining. Therefore all of them should get equally sized (but not necessarily equally shaped) pieces, even if this leads to some pie getting spoiled (which is better than spoiling the party). Of course, I want a piece of pie for myself too, and that piece should also be of the same size.

What is the largest possible piece size all of us can get? All the pies are cylindrical in shape and they all have the same height 1, but the radii of the pies can be different.

#### Input

One line with a positive integer: the number of test cases. Then for each test case:

- One line with two integers  $N$  and  $F$  with  $1 \leq N, F \leq 10000$ : the number of pies and the number of friends.
- One line with  $N$  integers  $r_i$  with  $1 \leq r_i \leq 10000$ : the radii of the pies.

#### Output

For each test case, output one line with the largest possible volume  $V$  such that me and my friends can all get a pie piece of size  $V$ . The answer should be given as a floating point number with an absolute error of at most  $10^{-3}$ .

#### Example

**Input :**

```
3
3 3
4 3 3
1 24
5
10 5
1 4 2 3 4 5 6 5 4 2
```

**Output :**

```
25.1327
3.1416
50.2655
```

---

Added by: Robin Nittka  
Date: 2007-10-02  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: ACM ICPC NWERC 2006

## SPOJ Problem Set (classical)

### 1838. Ticket to Ride

#### Problem code: TICKET

[IMAGE]

Ticket to Ride is a board game for up to 5 players. The goal of the game is to set up train lines (and to thwart the opponents' attempts at setting up their train lines). At the beginning of play, each player is assigned four train lines. A player may choose to discard as many of these four assignments as she likes. Each assignment has a score, corresponding to its difficulty (so, typically, a train line between e.g. Stockholm and Tokyo would be worth more than a train line between e.g. Stockholm and Utrecht). At the end of the game, each player gets points for the assignments that they have successfully completed, and penalty points for the assignments that they have failed to complete.

An assignment consists of a pair of cities that are to be connected by a series of shorter railway routes. A route can be claimed (for a certain cost associated with the route), but things are complicated by the fact that there is only a limited number of routes, and once a player claims a route, none of the other players can claim it. A player has successfully set up a train line between two cities if there is a path between the two cities using only routes that have been claimed by this player. For simplicity, we will ignore all additional aspects of the game (including the actual process of claiming routes and additional ways to score points).

For instance, if your assignment is to connect Stockholm and Amsterdam in the Figure above, you would probably want to claim the routes between Stockholm and Copenhagen, and between Copenhagen and Amsterdam. But if another player manages to claim the route between Copenhagen and Stockholm before you, your train line would have to use some other routes, e.g. by going to Copenhagen via Oslo.

In this problem, we will consider the rather bold strategy of trying to complete all four assignments (typically, this will be quite hard). As a preliminary assessment of the difficulty of achieving this, we would like to calculate the minimum cost of setting up all four lines assuming that none of the other players interfere with our plans. Your job is to write a program to determine this minimum cost.

#### Input

The input consists of several (at most 20) games to be analyzed. Each game starts with two integers  $1 \leq n \leq 30$ ,  $0 \leq m \leq 1000$ , giving the number of cities and railway routes in the map, respectively. Then follow  $n$  lines, giving the names of the  $n$  cities. City names are at most 20 characters long and consist solely of lower case letters ('a'-'z').

After this follow  $m$  lines, each containing the names of two different cities and an integer  $1 \leq c \leq 10000$ , indicating that there is a railway route with cost  $c$  between the two cities. Note that there may be several railway routes between the same pair of cities. You may assume that it is always possible to set up a train line from any city to any other city.

Finally, there will be four lines, each containing the names of two cities, giving the four train line assignments.

The input is terminated by a case where  $n = m = 0$ . This case should not be processed.

## Output

For each game, output a single line containing a single integer, the minimum possible cost to set up all four train lines.

## Example

### Input :

```
10 15
stockholm
amsterdam
london
berlin
copenhagen
oslo
helsinki
dublin
reykjavik
brussels
oslo stockholm 415
stockholm helsinki 396
oslo london 1153
oslo copenhagen 485
stockholm copenhagen 522
copenhagen berlin 354
copenhagen amsterdam 622
helsinki berlin 1107
london amsterdam 356
berlin amsterdam 575
london dublin 463
reykjavik dublin 1498
reykjavik oslo 1748
london brussels 318
brussels amsterdam 173
stockholm amsterdam
oslo london
reykjavik dublin
brussels helsinki
2 1
first
second
first second 10
first first
first first
second first
first first
0 0
```

### Output :

```
3907
10
```

---

Added by: Robin Nittka  
Date: 2007-10-02  
Time limit: 20s  
Source limit: 50000B  
Languages: All  
Resource: ACM ICPC NWERC 2006

## SPOJ Problem Set (classical)

### 1839. The Bookcase

#### Problem code: BOOKCASE

[IMAGE]

No wonder the old bookcase caved under the massive piles of books Tom had stacked on it. He had better build a new one, this time large enough to hold all of his books. Tom finds it practical to have the books close at hand when he works at his desk. Therefore, he is imagining a compact solution with the bookcase standing on the back of the desk. Obviously, this would put some restrictions on the size of the bookcase, it should preferably be as small as possible. In addition, Tom would like the bookcase to have exactly three shelves for aesthetical reasons.

Wondering how small his bookcase could be, he models the problem as follows. He measures the height  $h_i$  and thickness  $t_i$  of each book  $i$  and he seeks a partition of the books in three non-empty sets  $S_1, S_2, S_3$  such that

[IMAGE]

is minimized, i.e. the area of the bookcase as seen when standing in front of it (the depth needed is obviously the largest width of all his books, regardless of the partition). Note that this formula does not give the exact area of the bookcase, since the actual shelves cause a small additional height, and the sides cause a small additional width. For simplicity, we will ignore this small discrepancy.

Thinking a moment on the problem, Tom realizes he will need a computer program to do the job.

#### Input

The input begins with a positive number on a line of its own telling the number of test cases (at most 20). For each test case there is one line containing a single positive integer  $N$ ,  $3 \leq N \leq 70$  giving the number of books. Then  $N$  lines follow each containing two positive integers  $h_i, t_i$ , satisfying  $150 \leq h_i \leq 300$  and  $5 \leq t_i \leq 30$ , the height and thickness of book  $i$  respectively, in millimeters.

#### Output

For each test case, output one line containing the minimum area (height times width) of a three-shelf bookcase capable of holding all the books, expressed in square millimeters.

#### Example

Input :  
2  
4  
220 29  
195 20  
200 9  
180 30  
6

256 20  
255 30  
254 15  
253 20  
252 15  
251 9

**Output :**

18000  
29796

---

Added by: Robin Nittka

Date: 2007-10-02

Time limit: 40s

Source limit:50000B

Languages: All

Resource: ACM ICPC NWERC 2006



## SPOJ Problem Set (classical)

### 1840. Printer Queue

#### Problem code: PQUEUE

[IMAGE]

The only printer in the computer science students' union is experiencing an extremely heavy workload. Sometimes there are a hundred jobs in the printer queue and you may have to wait for hours to get a single page of output.

Because some jobs are more important than others, the Hacker General has invented and implemented a simple priority system for the print job queue. Now, each job is assigned a priority between 1 and 9 (with 9 being the highest priority, and 1 being the lowest), and the printer operates as follows.

- The first job  $J$  in queue is taken from the queue.
- If there is some job in the queue with a higher priority than job  $J$ , then move  $J$  to the end of the queue without printing it.
- Otherwise, print job  $J$  (and do not put it back in the queue).

In this way, all those important muffin recipes that the Hacker General is printing get printed very quickly. Of course, those annoying term papers that others are printing may have to wait for quite some time to get printed, but that's life.

Your problem with the new policy is that it has become quite tricky to determine when your print job will actually be completed. You decide to write a program to figure this out. The program will be given the current queue (as a list of priorities) as well as the position of your job in the queue, and must then calculate how long it will take until your job is printed, assuming that no additional jobs will be added to the queue. To simplify matters, we assume that printing a job always takes exactly one minute, and that adding and removing jobs from the queue is instantaneous.

#### Input

One line with a positive integer: the number of test cases (at most 100). Then for each test case:

- One line with two integers  $n$  and  $m$ , where  $n$  is the number of jobs in the queue ( $1 \leq n \leq 100$ ) and  $m$  is the position of your job ( $0 \leq m \leq n-1$ ). The first position in the queue is number 0, the second is number 1, and so on.
- One line with  $n$  integers in the range 1 to 9, giving the priorities of the jobs in the queue. The first integer gives the priority of the first job, the second integer the priority of the second job, and so on.

#### Output

For each test case, print one line with a single integer; the number of minutes until your job is completely printed, assuming that no additional print jobs will arrive.

## Example

**Input :**

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

**Output :**

```
1
2
5
```

---

Added by: Robin Nittka

Date: 2007-10-02

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: ACM ICPC NWERC 2006

## SPOJ Problem Set (classical)

### 1841. Prime Path

#### Problem code: PPATH

[IMAGE]

The ministers of the cabinet were quite upset by the message from the Chief of Security stating that they would all have to change the four-digit room numbers on their offices.

-- It is a matter of security to change such things every now and then, to keep the enemy in the dark.

-- But look, I have chosen my number 1033 for good reasons. I am the Prime minister, you know!

-- I know, so therefore your new number 8179 is also a prime. You will just have to paste four new digits over the four old ones on your office door.

-- No, it's not that simple. Suppose that I change the first digit to an 8, then the number will read 8033 which is not a prime!

-- I see, being the prime minister you cannot stand having a non-prime number on your door even for a few seconds.

-- Correct! So I must invent a scheme for going from 1033 to 8179 by a path of prime numbers where only one digit is changed from one prime to the next prime.

Now, the minister of finance, who had been eavesdropping, intervened.

-- No unnecessary expenditure, please! I happen to know that the price of a digit is one pound.

-- Hmm, in that case I need a computer program to minimize the cost. You don't know some very cheap software gurus, do you?

-- In fact, I do. You see, there is this programming contest going on...

Help the prime minister to find the cheapest prime path between any two given four-digit primes! The first digit must be nonzero, of course. Here is a solution in the case above.

```
1033
1733
3733
3739
3779
8779
8179
```

The cost of this solution is 6 pounds. Note that the digit 1 which got pasted over in step 2 can not be reused in the last step - a new 1 must be purchased.

#### Input

One line with a positive number: the number of test cases (at most 100). Then for each test case, one line with two numbers separated by a blank. Both numbers are four-digit primes (without leading zeros).

## Output

One line for each case, either with a number stating the minimal cost or containing the word Impossible.

## Example

**Input :**

```
3
1033 8179
1373 8017
1033 1033
```

**Output :**

```
6
7
0
```

---

Added by: Robin Nittka

Date: 2007-10-02

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: ACM ICPC NWERC 2006

## SPOJ Problem Set (classical)

### 1842. Lineland Airport

#### Problem code: LINELAND

Lineland is a strange country. As the name suggests, it's shape (as seen from above) is just a straight line, rather than some two-dimensional shape. The landscape along this line is very mountainous, something which occasionally leads to some problems. One such problem now occurs: in this modern era the king wants to build an airport to stimulate the country's economy. Unfortunately, it's impossible for airplanes to land on steep airstrips, so a horizontal piece of land is needed. To accommodate for the larger airplanes, this strip needs to have length at least  $L$ .

Over the years, the inhabitants of Lineland have become very proficient in flattening pieces of land. Given a piece a land, they can remove rock quickly. They don't want to add rock for that may lead to an unstable landing strip. To minimize the amount of effort, however, they want to remove the least amount of rock necessary to reach their goal: a flat piece of land of length  $L$ . What is this minimum amount? Because of the low-dimensional nature of Lineland, the amount of rock that needs to be removed is measured as the total area of land above the place where the landing strip is placed, rather than the volume (so in the Figure below, the amount of land removed is given by the lightly shaded area).

[IMAGE]

#### Input

One line with a positive number: the number of test cases (at most 25). Then for each test case:

- One line with an integer  $N$ ,  $2 \leq N \leq 500$ , the number of points, and an integer  $L$ ,  $1 \leq L \leq 10000$ , the necessary length to flatten.
- $N$  lines with two integers  $x_i$  and  $y_i$  with  $0 \leq x_i, y_i \leq 10000$  describing the landscape of Lineland. The  $x_i$  are in (strictly) ascending order. At position  $x_i$  the height of the landscape is  $y_i$ . Between two  $x_i$  the landscape has constant slope. (So the landscape is piecewise linear). The difference between  $x_N$  and  $x_1$  is greater than or equal to  $L$ .

#### Output

For each test case, output one line with the minimum amount of rock which must be removed in order to build the airport. The answer should be given as a floating point number with an absolute error of at most  $10^{-3}$ .

#### Example

Input :

```
4
3 5
0 2
4 2
14 0
```

4 3  
0 2  
2 0  
4 0  
5 3  
3 10  
10 2  
30 2  
35 7  
2 777  
222 333  
4444 5555

**Output :**

0.9000  
0.3750  
0.0000  
373362.4867

---

Added by: Robin Nittka

Date: 2007-10-02

Time limit: 20s

Source limit:50000B

Languages: All

Resource: ACM ICPC NWERC 2006

## SPOJ Problem Set (classical)

### 1843. Leonardo Notebook

#### Problem code: LEONARDO

[IMAGE]

-- I just bought Leonardo's secret notebook!

Rare object collector Stan Ucker was really agitated but his friend, special investigator Sarah Keptic was unimpressed.

-- How do you know it is genuine?

-- Oh, it must be, at that price. And it is written in the da Vinci code.

Sarah browsed a few of the pages. It was obvious to her that the code was a substitution cipher, where each letter of the alphabet had been substituted by another letter.

-- Leonardo would have written the plain-text and left it to his assistant to encrypt, she said. And he must have supplied the substitution alphabet to be used. If we are lucky, we can find it on the back cover!

She turned up the last page and, lo and behold, there was a single line of all 26 letters of the alphabet:

QWERTYUIOPASDFGHJKLZXCVBNM

-- This may be Leonardo's instructions meaning that each A in the plain-text was to be replaced by Q, each B with W, etcetera. Let us see...

To their disappointment, they soon saw that this could not be the substitution that was used in the book. Suddenly, Stan brightened.

-- Maybe Leonardo really wrote the substitution alphabet on the last page, and by mistake his assistant coded that line as he had coded the rest of the book. So the line we have here is the result of applying some permutation TWICE to the ordinary alphabet!

Sarah took out her laptop computer and coded fiercely for a few minutes. Then she turned to Stan with a sympathetic expression.

-- No, that couldn't be it. I am afraid that you have been duped again, my friend. In all probability, the book is a fake.

Write a program that takes a permutation of the English alphabet as input and decides if it may be the result of performing some permutation twice.

#### Input

The input begins with a positive number on a line of its own telling the number of test cases (at most 500). Then for each test case there is one line containing a permutation of the 26 capital letters of the English alphabet.

#### Output

For each test case, output one line containing `Yes` if the given permutation can result from applying some permutation twice on the original alphabet string `ABC...XYZ`, otherwise output `No`.

## Example

**Input :**

2  
QWERTYUIOPASDFGHJKLZXCVBNM  
ABCDEFGHIJKLMNOPQRSTUVWXYZ

**Output :**

No  
Yes

---

Added by: Robin Nittka  
Date: 2007-10-02  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: ACM ICPC NWERC 2006



## SPOJ Problem Set (classical)

### 1845. Mice and Maze

#### Problem code: MICEMAZE

A set of laboratory mice is being trained to escape a maze. The maze is made up of cells, and each cell is connected to some other cells. However, there are obstacles in the passage between cells and therefore there is a time penalty to overcome the passage. Also, some passages allow mice to go one-way, but not the other way round.

Suppose that all mice are now trained and, when placed in an arbitrary cell in the maze, take a path that leads them to the exit cell in minimum time.

We are going to conduct the following experiment: a mouse is placed in each cell of the maze and a count-down timer is started. When the timer stops we count the number of mice out of the maze.

#### Problem

Write a program that, given a description of the maze and the time limit, predicts the number of mice that will exit the maze. Assume that there are no bottlenecks in the maze, i.e. that all cells have room for an arbitrary number of mice.

#### Input

The maze cells are numbered  $1, 2, \dots, N$ , where  $N$  is the total number of cells. You can assume that  $N \leq 100$ .

The first three input lines contain  $N$ , the number of cells in the maze,  $E$ , the number of the exit cell, and the starting value  $T$  for the count-down timer (in some arbitrary time unit).

The fourth line contains the number  $M$  of connections in the maze, and is followed by  $M$  lines, each specifying a connection with three integer numbers: two cell numbers  $a$  and  $b$  (in the range  $1, \dots, N$ ) and the number of time units it takes to travel from  $a$  to  $b$ .

Notice that each connection is one-way, i.e., the mice can't travel from  $b$  to  $a$  unless there is another line specifying that passage. Notice also that the time required to travel in each direction might be different.

#### Output

The output consists of a single line with the number of mice that reached the exit cell  $E$  in at most  $T$  time units.

## Example

**Input :**

```
4
2
1
8
1 2 1
1 3 1
2 1 1
2 4 1
3 1 1
3 4 1
4 2 1
4 3 1
```

**Output :**

```
3
```

---

Added by: Robin Nittka

Date: 2007-10-04

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ACM ICPC -- SWERC 2001

## SPOJ Problem Set (classical)

### 1846. Project File Dependencies

#### Problem code: PFDEP

Project managers, such as the UNIX utility `make`, are used to maintain large software projects made up from many components. Users write a *project file* specifying which components (called *tasks*) depend on others and the project manager can automatically update the components in the correct order.

#### Problem

Write a program that reads a project file and outputs the order in which the tasks should be performed.

#### Input

For simplicity we represent each task by an integer number from  $1, 2, \dots, N$  (where  $N$  is the total number of tasks). The first line of input specifies the number  $N$  of tasks and the number  $M$  of rules, such that  $N \leq 100$ ;  $M \leq 100$ .

The rest of the input consists of  $M$  rules, one in each line, specifying dependencies using the following syntax:

$T_0$        $k$        $T_1$        $T_2$       ...       $T_k$

This rule means that task number  $T_0$  depends on  $k$  tasks  $T_1, T_2, \dots, T_k$  (we say that task  $T_0$  is the *target* and  $T_1 \dots T_k$  are *dependents*).

Note that tasks numbers are separated by single spaces and that rules end with a newline. Rules can appear in any order, but each task can appear as target only once.

Your program can assume that there are no circular dependencies in the rules, i.e. no task depends directly or indirectly on itself.

#### Output

The output should be a single line with the permutation of the tasks  $1 \dots N$  to be performed, ordered by dependencies (i.e. no task should appear before others that it depends on).

To avoid ambiguity in the output, tasks that do not depend on each other should be ordered by their number (lower numbers first).

#### Example

**Input :**

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

5 1 1

**Output :**

1 5 3 2 4

---

Added by: Robin Nittka

Date: 2007-10-04

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ACM ICPC -- SWERC 2001

## SPOJ Problem Set (classical)

### 1847. No Change

#### Problem code: NOCHANGE

Though it might be hard to imagine, the inhabitants of a small country Additivian do not know of such thing as change, which probably has to do with them not knowing subtraction either. When they buy something, they always need to have the exact amount of addollars, their currency. The only other option, but not a really attractive one, is over-paying.

Professor Adem, one of the Additivian mathematicians came up with an algorithm for keeping a balanced portfolio. The idea is the following. Suppose you have more coins of value  $v_1$  than coins of value  $v_2$ . In this case you should try to spend at least as many coins of value  $v_1$  as those of value  $v_2$  on any buy you make. Of course spending too many  $v_1$  coins is not a good idea either, but to make the algorithm simpler professor Adem decided to ignore the problem. The algorithm became an instant hit and professor Adem is now designing a kind of “electronic portfolio” with built-in Adem’s algorithm. All he needs now is a software for these machines, that will decide whether a given amount of addollars can be paid using a given set of coins according to the rules of Adem’s algorithm. Needless to say, you are his chosen programmer for the task.

#### Problem

Write a program that reads the description of a set of coins and an amount of addollars to be paid, and determines whether you can pay that amount according to Professor Adem’s rules.

#### Input

The input starts with the amount of addollars to be paid  $x$ , where  $1 \leq x \leq 100\,000$ . The number of different coin values  $k$  follows, where  $1 \leq k \leq 5$ . The values of the coins  $v_1, \dots, v_k$  follow, where  $1 \leq v_i \leq 10\,000$ .

Notice that the order among coin values is significant: you need to spend at least as many coins of value  $v_1$  as coins of value  $v_2$ , at least as many coins of value  $v_2$  as those of value  $v_3$ , and so on. You may assume that you have a sufficiently large number of coins of each value.

#### Output

Your program should output for each test case either a single word “YES”, if the given amount can be paid according to the rules, or a single word “NO” otherwise.

#### Example

**Input :**  
13 3 9 2 1  
**Output :**  
NO

---

Added by: Robin Nittka  
Date: 2007-10-04  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: ACM ICPC -- SWERC 2001

## SPOJ Problem Set (classical)

### 1865. Making Waves

#### Problem code: MKWAVES

Suppose we know a signal is generated by the function  $x \sin(f_1 t) \sin(f_2 t)$ .  $f_1$  and  $f_2$  are two unique frequencies, each having an integral value in the range 400 to 600 Hz (Hz = cycles per second), and  $t$  represents time. In this problem, you will be given  $N$  samples of this function at equally-spaced time intervals corresponding to  $t = 1/N$ ,  $t = 2/N$ , and so forth. From these samples, you are to determine  $f_1$  and  $f_2$ .

For example, suppose  $f_1 = 400$  Hz,  $f_2 = 500$  Hz, and  $N = 100$ . The first sample, at time  $t = 1/100$  sec, is equal to  $\sin(400 \cdot 0.01) \sin(500 \cdot 0.01) \sin(4) \sin(5) \cdot 0.156912$ . Similarly, the second sample, at time  $t = 2/100$  sec, is equal to  $\sin(400 \cdot 0.02) \sin(500 \cdot 0.02) \sin(8) \sin(10) \cdot 0.312821$ .

#### Input

There will be multiple cases to consider. Each case begins with an integer  $N$ , no larger than 1000, that specifies the number of signal samples. The next  $N$  data items are real numbers representing the signal samples at time  $1/N$  sec,  $2/N$  sec, and so forth. A single integer 0 follows the last case.

The number of samples for each case is guaranteed to be sufficient to allow the correct result to be obtained.

#### Output

For each input case, display a single line that is formatted like this:

Case 1,  $f_1 = 400$ ,  $f_2 = 500$

#### Example

**Input :**

```
100
0.156912 0.312821 0.466731 0.617657 0.764638 0.906737 1.04305 1.17271
1.29489 1.40883 1.51381 1.60917 1.69432 1.76873 1.83195 1.8836 1.92338
1.95106 1.96649 1.96962 1.96045 1.93908 1.9057 1.86055 1.80396 1.73634
1.65816 1.56997 1.47237 1.36603 1.25166 1.13003 1.00196 0.868307 0.729943
0.587785 0.442764 0.295823 0.147918 1.68756e-010 -0.146981 -0.292088
-0.434403 -0.573031 -0.707107 -0.835801 -0.958325 -1.07394 -1.18195
-1.28171 -1.37266 -1.45428 -1.52611 -1.58779 -1.63898 -1.67947 -1.70907
-1.7277 -1.73535 -1.73205 -1.71795 -1.69323 -1.65816 -1.61308 -1.55838
-1.49452 -1.42201 -1.34141 -1.25334 -1.15846 -1.05745 -0.951057 -0.840028
-0.725146 -0.607206 -0.487017 -0.365392 -0.243145 -0.121082 -2.75143e-010
0.119322 0.236125 0.34968 0.459289 0.564288 0.664055 0.758014 0.845635
0.926438 1 1.06595 1.12398 1.17384 1.21533 1.24833 1.27276 1.28862
1.29596 1.29489 1.28558
```

0

**Output :**

Case 1, f1 = 400, f2 = 500

---

Added by: Camilo Andrés Varela León

Date: 2007-10-07

Time limit: 1s

Source limit:50000B

Languages: All

Resource: North Central North America Regional Programming Contest - 2003



## SPOJ Problem Set (classical)

### 1866. Making Pals

#### Problem code: MKPALS

A *palindrome* is a sequence that is the same when read forward or backward. For example, "pop" is a palindrome, as are "Poor Dan is in a droop" (ignoring spaces and case), and "12321".

In this problem, you are to find the "cheapest" way to transform a sequence of decimal digits into a palindrome. There are only two types of modifications you may make to the sequence, but each of these may be repeated as many times as necessary. You may delete a digit from either end of the sequence, or you may add a digit to either end of the sequence. Each of these operations incurs a "cost" of 1. For each input sequence, determine the smallest cost of transforming the sequence into a palindrome, and the length of the resulting palindrome. If two palindromes can be produced with the same cost, the length of the longer palindrome (the one with more digits) is to be reported.

For example, suppose the initial sequence was "911". This can be transformed into a palindrome by deleting the leading "9" (yielding "11") or by adding an additional "9" to the right end of the sequence (yielding "9119"). Since both of these transformations have a cost of 1, and the second transformation yields a longer palindrome, it is this one which would be reported as your result.

Note that the particular palindrome produced by the cheapest sequence of transformations is not necessarily unique, but since you are not required to report the resulting palindrome, any of these will suffice.

#### Input

There will be multiple cases to consider. Each case has a single line of input that contains one or more decimal digits followed by the end of line. The maximum number of digits in a sequence will be 6. The last case is followed by an empty line (that is, only an end of line).

#### Output

For each input case, display the case number (1, 2, ...), the input sequence, the cost of the cheapest transformation, and the length of the resulting palindrome. Your output should follow the format shown in the examples below.

#### Example

**Input :**

```
911
9118
11234
<-- This line is blank
```

**Output :**

```
Case 1, sequence = 911, cost = 1, length = 4
Case 2, sequence = 9118, cost = 2, length = 4
Case 3, sequence = 11234, cost = 3, length = 8
```

---

Added by: Camilo Andrés Varela León

Date: 2007-10-07

Time limit: 1s

Source limit:50000B

Languages: All

Resource: North Central North America Regional Programming Contest - 2003

## SPOJ Problem Set (classical)

### 1869. Making Mountains Out Of Molehills

#### Problem code: MKMOOM

A macro processor is a symbol processing program. It takes a stream of characters as its input, and produces a stream of characters as its output. A "macro" is similar to ordinary function in that it has a definition, and when invoked, that definition is applied to the argument(s) to yield the result. In this problem, you will develop a simple macro processor.

A "macro call" consists of a name and a list of arguments, separated by commas. The name is preceded by '[' (a left bracket) and the last argument is followed by ']' (a right bracket). For example, "[doit,to,it]" calls the macro named "doit" with two arguments, "to" and "it". "[random]" calls the macro named "random" with no arguments.

Before a macro can be called, it must be defined by associating its name with a symbol string. This definition string may contain the special constructions "\$1" through "\$9" to reference the first through the ninth macro parameters. "\$0" references the macro's name itself. When the macro is called, these constructions are literally replaced by the values of the parameters. For example, suppose the definition string for the macro named "321" was "\$3-\$2-\$1". The macro call "[321,This,is,fun]" would yield the output "fun-is-This". A macro call can appear anywhere. For example, the macro call "[321,[321,A,B,C],D,E]" would yield the output "E-D-C-B-A".

Input enclosed in '<' and '>' prevents the evaluation of the text enclosed, allowing special characters like '[', ']', ',', and '\$' to be used in other than their usual contexts. Thus the macro call "[321,<\$>,<[>,<,>]" would yield ",-[-\$".

Macros are defined using the predefined macro named "def", which has two arguments. The first argument is the name of the macro being defined, and the second argument is the defining symbol string for the macro. The "321" macro definition is "[def,321,<\$3-\$2-\$1>]". Note that the definition is enclosed in '<' and '>' to prevent "\$1", "\$2", and "\$3" from being interpreted as parameter references to def. The def macro produces no output. Naturally, the def macro isn't defined using def, but is treated specially by the implementation.

#### Processing

The input stream is processed character by character and copied to the output until a macro call is encountered, or the input is exhausted (which terminates processing). A macro call is evaluated as described below, with the result (if any) copied to the output.

1. The macro name and the parameters are evaluated in sequence from left to right. This may require evaluating additional macro calls, which must be processed recursively.
2. When the argument list is complete (that is, when the closing ']' is encountered) the definition of the macro being called is scanned in the same manner as the original input stream except that occurrences of "\$0", "\$1", and so forth are replaced literally by the corresponding arguments. The result of the macro call is the symbol stream produced by this scan.
3. When the macro call is completed, the macro name and the arguments are discarded, and processing resumes at the point where it was interrupted by the macro call.

## Limits and Caveats

Macro names and arguments will contain no more than 32 characters each. The defining string for a macro will contain no more than 100 characters. Macros will never be defined more than once (that is, the same macro name will not be used more than once as the first argument to "def"). Macro calls will always provide the correct number of arguments. Character case is significant in comparisons. All input characters, including end of line characters, are to be processed through the macro processor. No output line will contain more than 80 characters, including the end of line character. The input is guaranteed to be correct.

## Input

There will be multiple cases to consider. The input for each case begins with a line containing a single integer between 1 and 10, that specifies the number of lines of text immediately following that will be used as input to the macro processor. None of these lines will contain more than 80 characters, so the input to the macro processor will contain at most 810 characters. The last case will be followed by a line containing the integer 0.

## Output

For each input case, display the case number (1, 2, ...), a line containing 79 hyphens, the output from the macro processor, another line containing 79 hyphens, and a blank line.

In the sample input shown below, assume that the last visible character on each line is immediately followed by the end of line character. Blank lines in the expected output are shown here as **\*\*BLANK\*\*** for clarity, but these should actually be totally blank in your output.

## Example

### Input :

```
1
This is just copied (including end of line).
1
[def, 321, <$3-$2-$1>] [321, This, is, fun]
1
[def, 321, <$3-$2-$1>] [321, [321, A, B, C], D, E]
1
[def, 321, <$3-$2-$1>] [321, This, is, fun] [321, [321, A, B, C], D, E]
3
[def, 321, <$3-$2-$1>]
[321, This, is, fun]
[321, [321, A, B, C], D, E]
3
[def, A, <$1 [B] $2>]
[def, B, *B*]
[A, 1, 2]
2
[def, #, <[-] $1 [-] $2 [-] $3 [-]>] [def, -, <$0>] [def, DEF, def] [[DEF], X, THIS IS X]
[X] [# , DEF, #, X]
0
```

### Output :

Case 1

-----  
This is just copied (including end of line).

-----  
\*\*BLANK\*\*

Case 2

-----  
fun-is-This

-----  
\*\*BLANK\*\*

Case 3

-----  
E-D-C-B-A

-----  
\*\*BLANK\*\*

Case 4

-----  
fun-is-ThisE-D-C-B-A

-----  
\*\*BLANK\*\*

Case 5

-----  
\*\*BLANK\*\*

fun-is-This

E-D-C-B-A

-----  
\*\*BLANK\*\*

Case 6

-----  
\*\*BLANK\*\*

\*\*BLANK\*\*

1\*B\*2

-----  
\*\*BLANK\*\*

Case 7

-----  
\*\*BLANK\*\*

THIS IS X-DEF-#-X-

-----  
\*\*BLANK\*\*

---

Added by: Camilo Andrés Varela León

Date: 2007-10-07

Time limit: 1s

Source limit:50000B

Languages: All

Resource: North Central North America Regional Programming Contest - 2003

## SPOJ Problem Set (classical)

### 1870. Making Labels

#### Problem code: MKLABELS

Trees comes in many varieties other than the popular binary tree. In general, a tree is a connected acyclic graph. That is, it consists of some number of vertices  $N$  (which we'll assume is at least one in this problem), and  $N - 1$  edges, each of which connects a pair of vertices.

A "labeled tree" is a tree in which each vertex has been given a "label." For simplicity, let us assume these labels are the integers 1 through  $N$ . In how many different ways may a tree with  $N$  vertices be labeled? By "different" we mean that no rearrangement of two trees with the same number of vertices with different labeling will be identical. (Note that although we commonly associate data with each vertex, and identify one vertex as the root of the tree, that's not significant in this problem.)

Let's consider some examples. The figure below shows all possible arrangements of trees with  $N = 1, 2, 3, 4$ , or  $5$  vertices. The number shown below each tree is the number of different ways in which the vertices in each tree can be labeled.

[IMAGE]

Clearly a tree with only one vertex can be labeled in only one way - by assigning the label "1" to the single vertex. A tree with two vertices can also be labeled in only one way. For example, although the two trees shown on the left below appear to be different, the first can be easily transformed into the second. (Imagine the edges are strings, so the vertices can be easily repositioned without losing their connectivity.)

[IMAGE]

There are, however, three possible ways to label the vertices in a 3-vertex tree, as shown on the right above. No matter how you rearrange the labeled vertices in any of the three trees, you cannot produce any of the other labeled trees.

In a similar manner, the various arrangements of four vertices in a tree yield a total of 16 possible labelings - 12 for the four vertices "in a row," and 4 for the other configuration. There are three possible arrangements of the vertices in a tree with  $N = 5$ , with a total of 125 possible

#### Input

There will be multiple cases to consider. The input for each case is an integer  $N$  specifying the number of vertices in a tree, which will always be between 1 and 10. The last case will be followed by a zero.

#### Output

For each input case, display the case number (1, 2, ...), the input value of  $N$ , and the number of different ways in which a tree with  $N$  vertices may be labeled. Use the format shown in the examples below.

## Example

### Input :

```
2
3
4
5
0
```

### Output :

```
Case 1, N = 2, # of different labelings = 1
Case 2, N = 3, # of different labelings = 3
Case 3, N = 4, # of different labelings = 16
Case 4, N = 5, # of different labelings = 125
```

---

Added by: Camilo Andrés Varela León

Date: 2007-10-07

Time limit: 1s

Source limit:50000B

Languages: All

Resource: North Central North America Regional Programming Contest - 2003

## **SPOJ Problem Set (classical)**

### **1871. Making A Budget**

#### **Problem code: MKBUDGET**

A company uses temporary employees ("temps") to handle its varying workloads. By doing so, it avoids having to pay for benefits normally provided to its permanent employees. However, the company must pay an employment agency a fixed fee for each temp they hire, as well as paying the temp a fixed amount of severance pay when they are terminated - in addition, of course, to the monthly salary each temp receives. The company has a good understanding of when it needs temporary workers, and how many such workers it will require each month. Depending on the fee paid to the employment agency, the temporary worker's salary, and the severance pay, it may make sense to retain an unneeded worker for one or more months if it's known that they will be needed again in the future.

Let's consider an example. Suppose we know that in March the company will need 10 temps, in April they'll need 9, and in May they'll need 11. Suppose a temp earns \$500 per month, that the employment agency receives \$400 for each temp hired, and \$600 is paid as severance to each temp that is terminated. If the company employs just the minimum number of temps required, then their payments will be as follows (we ignore the cost of terminating all employees at the end of the last month):

[IMAGE]

The total cost to the company is \$20,400. But suppose they did not terminate the unneeded temp at the end of March, but just let that person remain employed. They would then save \$400 in employment agency fees (since they'd need to hire just one additional temp for May), \$600 in severance pay, and only have to pay the temp worker \$500, for an overall savings of \$500.

In this problem you are given, as input, the number of months for which the company is to plan its temp worker budget, the cost of hiring and firing a temp worker, the temp worker's monthly salary, and the required minimum number of workers needed each month. You are to determine the minimum cost to the company to have at least the required minimum number of workers on hand each month. Assume there are no temporary workers on hand before the first month, and that the cost of terminating the workers at the end of the last month is not to be included in the cost. You may assume that the planning interval will be no longer than 24 months, and the hiring cost, severance pay, and monthly salary for each temp worker is greater than zero.

#### **Input**

There will be multiple cases to consider. The input for each case begins with an integer N, the number of months for which planning is required (never larger than 24). This is followed by three integers giving the cost of hiring a worker, the worker's monthly salary, and the severance pay for a terminated worker. Finally there will appear N integers giving the required minimum number of workers needed in each month. The last case will be followed by a zero.



## Output

For each input case, display the case number (1, 2, ...) and the minimum cost to the company. Use the format shown in the examples below.

## Example

### Input :

```
3 400 500 600 10 9 11
8 400 600 600 11 9 10 14 9 9 13 15
0
```

### Output :

```
Case 1, cost = $19900
Case 2, cost = $66600
```

---

Added by: Camilo Andrés Varela León

Date: 2007-10-07

Time limit: 1s

Source limit: 500000B

Languages: All

Resource: North Central North America Regional Programming Contest - 2003

## SPOJ Problem Set (classical)

### 1873. Accumulate Cargo

#### Problem code: ACARGO

A cargo shipment containing  $N$  ( $1 \leq N \leq 10^5$ ) boxes, has just arrived and it requires some regrouping. All the cargo is currently placed on a long circular conveyor belt of length  $L$  metres ( $1 \leq L \leq 10^9$ ), which you can control and perform the following operations.

- Rotate the wheel clock wise or anti-clockwise (free of cost).
- Hold the cargo at some point and not let it move, while the belt is rolling. This causes the cargo behind it to come closer to this cargo by one step. Any consecutive sequence of cargo is grouped together and called as a luggage. The aim of the program is to group all cargo as a single luggage. Now the cost of this holding operation for one second is equal to the weight of the *luggage* that is held fixed. Also please note that you can hold the luggage only at ends of the luggage and never at inbetween points.

Each unit of cargo weighs exactly one Kg. The conveyor belt rotates at a speed of one meters per second.

This cost function directly reflects the human effort required to group the cargo. Workers would be happy if you can write a program that prints the minimal required effort to group the cargo, assuming an intelligent sequence of operations.

#### Input Format:

The input file consists of multiple testcases.

The first line of each testcase contains two integers,  $N$  and  $L$ .

The following  $N$  lines contain one integer each specifying the position of the  $i^{\text{th}}$  cargo on the belt. The positions will be between 0 &  $L-1$ .

Input terminates with a line containing  $N=0$  and  $L=0$  which must not be processed.

#### Output Format:

For each testcase print one integer in a single line, which is the minimal required cost for grouping all the cargo into a single luggage.

#### Sample Input:

```
3 5
0
1
3
2 3
0
1
5 20
2
7
12
9
13
0 0
```

#### Sample Output:

1  
0  
10

NOTE: Please use 64-bit integers.

---

Added by: Prasanna

Date: 2007-10-08

Time limit: 1s-10s

Source limit:50000B

Languages: All

Resource: NITT ACM ICPC Local Contest 2007 [Idea from a Topcoder problem]

## SPOJ Problem Set (main)

### 1874. Burrows Wheeler Precompression

#### Problem code: BWHEELER

The **Burrows-Wheeler transform** (BWT, also called **block-sorting compression**), is an algorithm used in data compression techniques such as bzip2. It was invented by Michael Burrows and David Wheeler.

When a character string is transformed by the BWT, none of its characters change value. The transformation permutes the order of the characters. If the original string had several substrings that occurred often, then the transformed string will have several places where a single character is repeated multiple times in a row. This is useful for compression, since it tends to be easy to compress a string that has runs of repeated characters by techniques such as move-to-front transform and run-length encoding.

For example, the string:

```
SIX.MIXED.PIXIES.SIFT.SIXTY.PIXIE.DUST.BOXES
```

could be transformed into this string, which is easier to compress because it has many repeated characters:

```
TEXYDST.E.IXIXXXSSMPPS.B..E.S.EUSFXDIIIOIIIT
```

Now the Burrows-Wheeler algorithm works as follows:

- Given an input string **S**, eg: "abcba".
- Find all rotations of **S**.

eg: "abcba", "bcbaa", "cbaab", "baabc", "aabcb"

- Now sort the strings hence produced.

eg: "aabcb", "abcba", "baabc", "bcbaa", "cbaab"

- Arrange the strings in a  $\text{len}(S) \times \text{len}(S)$  grid.

```
aabcb
abcba
baabc
bcbaa
cbaab
```

- Output the row number (1-based indexing) containing the original input string. Also output the strings formed by characters in the last column.  
eg: 2 bacab

Now given the output of Burrows-Wheeler, can you recover the original string?

**Input Format:**

The input file consists of multiple testcases.

The first line of each testcase contains one integer, **R**, indicating the row number containing the original input string in the sorted matrix.

The second line of each testcase contains one string, **Col**, which is the last column of the grid. ( $1 \leq \text{len}(\text{Col}) \leq 1000$ )

**Col** contains only lowercase characters.  $1 \leq \mathbf{R} \leq \text{len}(\text{Col})$ .

Input terminates with a line containing  $R=0$  which must not be processed.

**Output Format:**

Print the original input string to the burrow wheeler's algorithm.

**Testdata:**

30 testcases

**Sample Input:**

```
2
bacab
3
rwl b
11
baaabaaaabbbaba
0
```

**Sample Output:**

```
abcb a
rbwl
baaabbbbbaaaaaab
```

---

Added by: Prasanna

Date: 2007-10-08

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: NITT ACM ICPC Local Contest 2007 [Wikipedia/General]

## SPOJ Problem Set (classical)

### 1875. Cool Numbers

#### Problem code: COOLNUMS

Cool numbers are those, whose digits can be partitioned into two sets such that the sum of the digits in either sets are equal.

Example: 23450 is cool because  $3+4+0 = 2+5$ ; So is 91125;

The numbers 567, 34523 are not cool, since there is no such digit partition.

Write a program that prints the number of cool numbers in the inclusive range [A,B].

#### Input Format:

The input file consists of multiple testcases.

Each case contains one line containing two 32-bit unsigned integers A and B. ( $1 \leq A \leq B \leq 4 \cdot 10^9$ ).

Input terminates with a line containing two zeros and must not be processed.

#### Output Format:

For each testcase print a single line containing one integer saying the number of cool numbers between A and B, inclusive.

#### Sample Input:

```
1 11
12 20
1 20
3 100
6354 234363
123456789 234567891
0 0
```

#### Sample Output:

```
1
0
1
9
82340
54801678
```

#### Test Data:

About 50 testcases.

---

Added by: Prasanna

Date: 2007-10-08

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: NITT ACM ICPC Local Contest 2007 [Topcoder problem with Constraints raised]

## SPOJ Problem Set (classical)

### 1876. Dragon Curves

#### Problem code: DRAGONCU

Define  $r(s)$  to be the complement of the reverse of the binary string  $s$ . i.e. Reverse  $s$  and then convert all 1's to 0's and all 0's to 1's.

Further define a sequence of binary string as follow:  $s_0 = 1$  and  $s_n = s_{n-1} 1r(s_{n-1})$ . i.e.

$$s_0 = 1$$

$$s_1 = 110$$

$$s_2 = 1101100$$

$$s_3 = 110110011100100$$

...

We then program a robot to move at a steady speed of 1 unit per second and make a right-angle turn according to the characters of  $s_{10}$  after every unit of movement. At the  $k$ th turn, the robot turns to left if the  $k$ th character of  $s_{10}$  is a 1, and to right otherwise. The figure below shows the whole path of the robot.

[IMAGE]

The robot is placed at the origin (the small circle) and face east originally. It ends up at the coordinates (-32,32) (the small spot) after 2048 seconds. The path of the robot is known as a dragon curve, a pretty well-known pattern of fractal.

If the robot is now programmed with input string  $s_{30}$  (with identical initial conditions as above), it will keep moving and then stop after  $2^{31}$  seconds. We want to know the location of the robot at any given time.

#### Input Format:

Input consists of multiple problem instances. Each instance consists of a single non-negative integer  $n$ , where  $n \leq 10^9$ . The input data is terminated by a "-1". There will be less than 5000 test cases.

#### Output Format:

For each input integer  $n$ , print out the location of the robot right after  $n$  second since the robot starts its journey with input string  $s_{30}$ . The location should be printed with the format "(x,y)" in a single line.

#### Sample Input:

```
1
2
3
2048
1000000000
-1
```

#### Sample Output:

```
(1,0)
(1,1)
(0,1)
(-32,32)
(9648,-31504)
```

---

Added by: Prasanna  
Date: 2007-10-08  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: NITT ACM ICPC Local Contest 2007 [Tsinghua]



## SPOJ Problem Set (classical)

### 1877. Enrich my purse

#### Problem code: EPURSE

Jack plays this ball game for the first time in his club. Jack has a ball, which bounces with a width of **W**. Coins are arranged on a straight line at regular intervals. If the ball strikes the *i*-th coin, Jack gains **money[i]** (which could possibly be negative). Jack can take atmost **B** turns, to throw the ball. At each turn, jack can either throw the ball from left to right, or right to left, and choose which ball to start the knock out. If he chooses to knock out from ball *i* to the right, he will knock out *i*, *i*+**W**, *i*+2**W**, ...; Similarly if he chooses to knock out from right to left, starting from ball *i* he will knock out, *i*, *i*-**W**, *i*-2**W**, ...; Please note that once a ball is knocked out, it is removed and it's place contains a void. i.e., you cant gain **money[i]** for the same *i* twice.

Jack wants to maximise his money gained, by carefully choosing his turns. If there is more than one way to gain the same money, jack wishes to minimise the number of times he throws.

#### Input Format

The input file consists of multiple testcases.

The first line of each testcase contains three integers, **W B N** ( $1 \leq N \leq 100$ ;  $W, B > 0$ )

The second line of each testcase contains *N* integers, denoting **money[i]**. ( $|\text{money}[i]| \leq 10^6$ )

Input terminates with a line containing three zeros which must not be processed.

#### Output Format

For each testcase print one line denoting the maximal money gained and the number of turns taken. Please see the sample output and stick to the output format.

*"Case#id: Jack wins \$X out of Y throws."*

**NOTE:** You must spell the same way the sample output says. Extra spaces and case insensitivity can cause wrong answer responses.

#### Testdata:

100 testcases, Timelimit: 10s

#### Sample Input:

```
2 3 10
-1 3 2 5 1 -2 0 5 1 -3
2 3 14
-1 3 2 5 -5 -5 1 -2 0 5 -5 -5 1 -3
3 3 5
-1 -2 -3 -4 -5
1 2 6
-1 -1 10 10 -1 -1
0 0 0
```

#### Sample Output:

```
Case#1: Jack wins $15 out of 2 throws.
Case#2: Jack wins $10 out of 3 throws.
Case#3: Jack wins $0 out of 0 throws.
Case#4: Jack wins $18 out of 1 throws.
```

**Output Explanation:**

We present one of the optimal solutions. We number balls from 1 to N.

TestCase#1: [Jack takes only two throws, though he can take three]

Throw#1: From ball#3 towards right,  $2 + 1 + 0 + 1 = 4$

Throw#2: From ball#8 towards left,  $5 + -2 + 5 + 3 = 11$

TestCase#2:

Throw #1: From ball#3 towards left,  $2 + -1 = 1$

Throw #2: From ball#4 towards left,  $5 + 3 = 8$

Throw #3: From ball#13 towards right,  $1 = 1$

TestCase#3:

All numbers are negative. Jack takes no throws.

---

Added by: Prasanna

Date: 2007-10-08

Time limit: 10s

Source limit: 50000B

Languages: All

Resource: NITT ACM ICPC Local Contest 2007 [Self]

## SPOJ Problem Set (classical)

### 1878. Farmers Cattle

#### Problem code: FCATTLE

Farmer John owns a single cow and he loves it a lot. The cow has a disease and is going to die. To survive, the cow needs medicine of a particular type each day. Let us say the cow needs **medicine**[i] to survive the  $i^{\text{th}}$  day. (medicine[i] will be terminated by -1, which is an unavailable medicine, and the cow has to invariably die that day).

To help the cow, John has decided to buy pastures of some medical value. Farmer sees a two-dimensional grid of pastures, each cell having exactly one medical herb. Now he needs to buy a sub-rectangular region of the grid, whose area cannot exceed **A** ( $A > 1$ ). With this region the farmer intends to feed his cow, as long as possible.

#### Input Format:

The input file consists of multiple testcases.

The first line of each testcase contains three integers, **R**, **C** and **A**.

The second line consists of sequence of integers describing **medicine**[i]. This list will be terminated by -1.

The next **R** lines contain **C** integers each, specifying the medicinal type of the herb in that cell. ( $1 \leq R, C \leq 200$ ). All herbs are specified by non negative integers.

Input terminates with a line containing three zeros and must not be processed.

#### Output Format:

For each testcase print a single line containing 5 integers:

*days r1 c1 r2 c2*

( $1 \leq r1 \leq r2 \leq R$ ,  $1 \leq c1 \leq c2 \leq C$ )

- *days* is the number of days the cow survives. We wish to maximise this.
- If there are more than one solutions print the one with minimal *r1*.
- If there are more than one solutions still, print the one with minimal *c1*.
- If there are more than one solutions still, print the one with minimal *r2*.
- If there are more than one solutions still, print the one with minimal *c2*.

#### Sample Input:

```
3 4 6
12 30 12 100 22 -1
30 12 5 3
12 30 100 5
22 3 22 100
3 4 6
2 30 12 100 22 -1
30 12 5 3
12 30 100 5
22 3 22 100
3 4 6
12 30 12 100 22 -1
```

```
30 12 5 3
12 30 100 5
22 12 22 100
0 0 0
```

**Sample Output:**

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

---

Added by: Prasanna

Date: 2007-10-08

Time limit: 5s-120s

Source limit:50000B

Languages: All

Resource: NITT ACM ICPC Local Contest 2007 [Self]

## SPOJ Problem Set (classical)

### 1879. Game Time

#### Problem code: GAMETIME

Jack has got a new game of Super Mario recently. There are  $n$  castles in the game, and Princess Peach has been kidnapped by the King Koopa and enjailed in castle  $n - 1$  (0-based). The King Koopa has Son Koopas, and the Son Koopas has Grandson Koopas, and the Grandson Koopas has Great-Grandson Koopas... The whole Koopa family is taking possession of these  $n$  castles, and there is exactly one Koopa in each castle and the King Koopa is in castle  $n - 1$ . Super Mario's task is to conquer these castles and save Princess Peach.

Each time, Super Mario can freely choose an unconquered castle and go in to fight with the Koopa. Super Mario has time  $T[i]$  to conquer castle  $i$  and beat the Koopa in it. If Super Mario fails to conquer the castle or fails to do that within the time limit, the game is over. Otherwise, the defeated Koopa will go to seek the Father Koopa for help. If any Koopa has two or more Son Koopas beaten by Super Mario, he will get angry. Super Mario has to go to the castle of the angry Koopa and beat him immediately; otherwise the Princess Peach will be killed. If castle  $n - 1$  is conquered and King Koopa is defeated, the game will also end, but with triumph and Princess Peach saved.

Jack loves this game a lot, but he has to prepare for the upcoming ACM/ICPC. So he guarantees to himself that he only plays the game once a month. However, Jack really loves playing game and hates programming, he wants to maximize the time he can spend on the game without breaking his promise.

#### Input Format:

The input consists of multiple test cases.

Each test case starts with a number  $N$  ( $0 < N \leq 100,000$ ) in a single line, the number of castles and Koopas. There are two lines following and each contains  $N$  numbers.

The first line is  $N$  numbers,  $T[i]$  ( $0 < T[i] \leq 100$ ) for Super Mario to conquer castle  $i$ .

The second line is  $N$  numbers of  $P[i]$  ( $-1 \leq P_i < N$ ), the castle (0-based) in which the Parent of each Koopa resides.

-1 means that there is no parent for him, and the last number will always be -1, since King Koopa has no Parent Koopa. The input ends with 0(zero), which should not be processed.

#### Output Format:

Output the maximal time Jack can play in a single line for each test case.

#### Sample Input:

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

#### Sample Output:

12  
10  
8

---

Added by: Prasanna  
Date: 2007-10-08  
Time limit: 10s  
Source limit:50000B  
Languages: All  
Resource: NITT Local Contest 07 [ZJU inc constrts]

## SPOJ Problem Set (classical)

### 1880. Hanoi Calls

#### Problem code: HANOICAL

Theory:

- Towers of hanoi is an arrangement consisting of three pegs and  $N$  discs of radius 1 to  $N$ .
- Each peg can hold zero or more discs, but at any point of time, the radius of the discs must be in decreasing order from bottom to top.
- A move consists of moving the topmost disc from one peg to another. After the move, the decending order property of pegs must hold.

Traditional problem is: If all discs are stacked up on peg#1, how many moves will it take to move all the discs to peg#2?

Recursive solution: Noting that for disc  $N$  to move, from peg  $\#a$  to peg  $\#b$ , all discs of size 1 to  $N-1$  must be in peg  $\#c$ . Hence there is exactly one minimal way to move the discs. After disc  $N$  has moved, all pegs from  $\#c$  must be moved back to  $\#a$ . If  $\text{moves}(N)$  denote the number of moves required to transfer  $N$  discs between two pegs (both sorted configuration), then  $\text{moves}(N) = \text{moves}(N-1) + 1 + \text{moves}(N-1)$ ; Solving the recurrence yields  $\text{moves}(N) = 2^N - 1$ ; The idea i am trying to share is that, there is exactly one such move sequence.

Now the problem is that given any initial configuration of the discs, and any final configuration, Can you tell me the minimal number of moves required to change it from initial to final configuration?

#### Input Format:

The input file consists of multiple testcases.

The first line of each testcase contains one integer,  $N$  ( $1 \leq N \leq 30$ )

The second line of each testcase contains  $N$  integers, each one of which will be between 1 and 3. The  $i$ -th integer tells you the peg number at which disc of radius  $i$  is present in the initial configuration.

The third line contains a similar specification for the final configuration.

Input terminates with a line containing a single zero, which must not be processed.

#### Output Format:

For each testcase print one line containing a single integer, which is the minimal number of moves to make the transfer.

#### Testdata:

100 testcases

#### Sample Input:

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

#### Sample Output:

15  
6  
14

**Output Explanation:**

TestCase#1:

This is the moves(4) =  $2^4 - 1$ ;

TestCase#2:

```
[peg1, peg2, peg3] =  
#0 [ {1}, {}, {3,2} ]  
#1 [ {1}, {2}, {3} ]  
#2 [ {}, {2,1}, {3} ]  
#3 [ {3}, {2,1}, {} ]  
#4 [ {3}, {2}, {1} ]  
#5 [ {3,2}, {}, {1} ]  
#6 [ {3,2}, {1}, {} ]
```

---

Added by: Prasanna

Date: 2007-10-08

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: NITT ACM ICPC Local Contest 2007 [Self/Traditional]



## SPOJ Problem Set (classical)

### 1881. Instruction Decoder

#### Problem code: ICODER

Mathews uses a brand new 16-bit instruction processor. (Yeah i am being sarcastic!). It has one register (say R) and it supports two instructions:

- ADD X; Impact:  $R = (R + X) \bmod 65536$
- MUL X; Impact:  $R = (R * X) \bmod 65536$
- [For both instructions  $0 \leq X \leq 65535$ ]

Mathews sees a segment of code, but doesnot know what value the register had before the code was being executed. How many possible values can the register have after the segment completed execution?

#### Input Format:

The input file consists of multiple testcases.

The first line of each testcase contains one integer, N. ( $1 \leq N \leq 100,000$ ).

The following N lines contain one instructions each.

Input terminates with a line containing N=0, which must not be processed.

#### Output Format:

For each testcase print one integer in a single line, denoting the number of different values the register can take after code execution.

#### Sample Input:

```
1
ADD 3
1
MUL 0
5
MUL 3
ADD 4
MUL 5
ADD 3
MUL 2
8
ADD 32
MUL 5312
ADD 7
MUL 7
ADD 32
MUL 5312
ADD 7
MUL 7
0
```

#### Sample Output:

```
65536
1
32768
16
```

---

Added by: Prasanna  
Date: 2007-10-08  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: NITT ACM ICPC Local Contest 2007 [Self]

## SPOJ Problem Set (classical)

### 1960. Rectangles

#### Problem code: RECTANGL

You are given a set  $S$  of  $N$  points in the plane and must count the number of distinct axis-parallel rectangles whose four vertices all lie in  $S$  (that is, count those rectangles which have two sides parallel to the  $x$ -axis, and the other two sides parallel to the  $y$ -axis).

#### Input

The first line of the input is  $N$  ( $1 \leq N \leq 250000$ ), the number of points in  $S$ .  $N$  lines then follow, where the  $i$ -th line is of the form " $x_i y_i$ ", giving the coordinates of a point  $(x_i, y_i)$  in  $S$ . All given points are distinct, and all coordinates fit into a 32-bit signed integer.

#### Output

Your output should consist of a single number, the number of distinct axis-parallel rectangles whose four vertices all lie in  $S$ , followed by a newline.

#### Example

**Input :**

```
6
-1 0
-1 1
0 0
0 1
1 0
1 1
```

**Output :**

```
3
```

---

Added by: Jelani Nelson (Minilek)  
Date: 2007-10-25  
Time limit: 1s-30s  
Source limit: 50000B  
Languages: All  
Resource: MIT Individual Contest 2007

## SPOJ Problem Set (classical)

### 1961. Roman Roads

#### Problem code: ROMANRDS

Some 2000 years ago the Roman Empire covered a large part of Europe including the entire coast of the Mediterranean. The transportation network of that empire consisted of roads and sea routes (the two are considered equivalent and simply called roads for this problem). Each road connected exactly two cities and the road network was such that every city can be reached from Rome. However, building this network required resources (cobblestone and buoys) proportional to the total length of the network. In order to cut down on building costs and maintainance and spend the rest of the money on wine, the empire built the cheapest possible network.

Additionally, each road had a single signpost that listed all of the other roads it connected to (at any of its two cities). There were  $N$  roads in the empire labeled  $1, 2, \dots, N$ . It is believed that a traveller once travelled all roads and for each road wrote down the numbers on its signpost, thus making a map.

2000 years later a young archaeologist found something that looks suspiciously like that map. Your job is to write a program that determines if this can really be a map of the Roman empire and for each road output the two cities it connected. Note that roads in a valid map are always between two distinct cities.

(Disclaimer: The description of the transportation network is for this problem only and may not necessarily be what the Roman Empire actually did. Do not cite this in your history papers: I made it up.)

#### Input

The first line of input contains  $N$ ,  $1 \leq N \leq 500$ . Each of the next  $N$  lines contains a space-separated list of integers. The  $i$ -th of these lines describes the "roads" that connect to "road"  $i$ . The first number on the line specifies the number of those "roads",  $d_i$ , and the following  $d_i$  numbers specify their labels.

Note that although at this point we don't know if the map is valid, the input is consistent, i.e. if a road  $x$  is on the signpost of  $y$ , then  $y$  will be on the signpost of  $x$ . (Otherwise the archaeologist would know this is not a Roman map right away).

#### Output

If the input *cannot* describe a valid map according to the description, output "NO" on the first (and only) line of output.

Otherwise, output "YES" and on each of the next  $N$  lines, write two integers separated by space, the numbers of the two cities that the road connected. City labeling is up to you with the only restriction that all city labels must be integers between  $1$  and  $M$ , where  $M$  is the total number of cities. Of course, a city can only have one label.

Note that since we don't know the actual locations of the cities or whether the roads were straight, we have no idea what the total cost of the network might have been. The archaeologist is willing to accept any map for which she can't determine if there is a cheaper network without knowing the actual costs. It is assumed that each road had some positive cost.

## Example

**Input :**

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

**Output :**

```
YES
1 3
4 1
1 2
```

---

Added by: Jelani Nelson (Minilek)

Date: 2007-10-25

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: MIT Individual Contest 2007

## SPOJ Problem Set (classical)

### 1962. Circles

#### Problem code: CIRCLES

Little Gary plays the following video game. Circles pop up on the screen and disappear from it. When the screen flashes, Gary can draw a straight line on the screen and win as many points as there are circles intersected by the line. As a born-to-be-winner, Gary wants to maximize his score. Please, help him, and write a program that will determine the maximum number of points he can win each time the screen flashes.

#### Input

The first line of the input contains  $M$  ( $1 \leq M \leq 1000$ ), the number of events during the game. The next  $M$  lines contain descriptions of the events, one per line. They can be in one of the following three formats:

1  $x$   $y$   $r$

, representing a circle of radius  $r$  popping up with the position of its center at  $(x, y)$  in the plane

2  $i$

, representing a circle  $i$  disappearing, where circle  $i$  is the  $i$ th circle that popped up since the beginning of the game; and

3

, representing the screen flashing.

$x$ ,  $y$ , and  $r$  are real numbers with at most two decimals,  $-10^6 < x, y, r < 10^6$ ,  $r > 0$ .

Notes:

- A line intersects a circle if it has at least two common points with it.
- At any time, no two Circles on the screen have a common point.
- At any time, there is no line that "touches" more than two circles (a line touches a circle if they have exactly one common point).
- At any time, there are no more than 100 circles on the screen.
- Each  $i$  determines a circle that is on the screen at the moment of removal.
- No circle is removed twice.

#### Output

Each time the screen flashes, write an integer to a separate line, which is the maximum number of circles Gary can intersect.

#### Example

Input :

```
9
1 3.00 0.00 1.00
1 -2.00 0.00 1.00
3
1 2.00 3.00 1.50
3
```

```
1 2.00 -4.00 1.00
3
2 3
3
```

**Output :**

```
2
2
3
2
```

---

Added by: Jelani Nelson (Minilek)

Date: 2007-10-25

Time limit: 30s

Source limit:50000B

Languages: All

## SPOJ Problem Set (main)

### 1963. Image Projections

#### Problem code: IMGPROJ

Given an image  $I$  with  $N$  columns and  $M$  rows, a diagonal projection is the vector  $(d_1, d_2, \dots, d_{M+N-1})$  where  $d_i = \sum_{x+y=i} I(x,y)$ . Here  $I(x,y)$ ,  $1 \leq x \leq N$ ,  $1 \leq y \leq M$ , is the image intensity (a non-negative integer less than 256) at column  $x$  and row  $y$ .

You are given a set of images and you are asked to find the diagonal projection for each of them.

#### Input

The first line of input contains a positive number, the number of images that follow. For each image there is a line with  $N$  and  $M$ . The following  $M$  lines describe one row each starting from row 1. A row is described in run-length encoding by pairs of numbers separated by spaces. The first number in each pair is the length of the run and the second number is the image intensity. Obviously, for each row, the run lengths add up to  $N$ . As in the example input, there is a blank line between each two consecutive images and before the first one.

The number of test cases is at most 10. The width of each image is less than  $10^9$  and the height is less than  $10^3$ . Additionally, the total size of the input does not exceed 4 MB.

#### Output

For each image you should output one line, the diagonal projection for the image in run length encoding. The number of output lines should be the same as the number of images in the input. All the numbers on a line should be separated by exactly one space.

When encoding the output in run-length encoding, the runs should be as long as possible, i.e. no two consecutive runs should have the same intensity value.

#### Example

**Input :**

2

3 3  
1 1 1 2 1 3  
1 1 1 2 1 3  
1 3 1 2 1 1

3 2  
3 1  
3 1

**Output :**

1 1 1 3 1 8 1 5 1 1  
1 1 2 2 1 1

---



Added by: Jelani Nelson (Minilek)  
Date: 2007-10-25  
Time limit: 30s  
Source limit: 50000B  
Languages: All  
Resource: MIT Individual Contest 2007

## SPOJ Problem Set (main)

### 1964. Tree cut

#### Problem code: MMCUT

You are given a tree (a connected, acyclic graph) along with a set of **commodities**, i.e. pairs of vertices,  $(s_1, t_1), \dots, (s_m, t_m)$  ( $s_i \neq t_i$ ). A **multicut** is a set of edges that when removed disconnects  $s_i$  from  $t_i$  for all  $i$ . There is a unique path  $P_{u,v}$  between every pair of vertices  $u, v$  in a tree, and the **max-cost** of a multicut  $S$  is  $\max_i |S \cap P_{s_i, t_i}|$ . You will be given a rooted tree of height  $I$  and a set of commodities and must return the minimum possible max-cost over all multicuts.

#### Input

The first line of the input is " $N M$ " ( $I \leq N$ ,  $M \leq 100000$ ), where  $N$  is the number of vertices in the tree and  $M$  is the number of commodities. All vertices are numbered  $0, \dots, N-1$ , and the root has label  $N-1$ .  $M$  lines then follow, where the  $i$ th line is " $s_i t_i$ ", representing a commodity  $(s_i, t_i)$  where  $s_i \neq t_i$ . Commodities are distinct: neither  $(s_i, t_i) = (s_j, t_j)$  nor  $(s_i, t_i) = (t_j, s_j)$  will hold when  $i \neq j$ .

#### Output

Your output should consist of a single number, the minimum possible max-cost of a multicut, followed by a newline.

#### Example

**Input :**

```
10 2
0 5
4 8
```

**Output :**

```
1
```

---

Added by: Jelani Nelson (Minilek)

Date: 2007-10-25

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: MIT Individual Contest 2007

## SPOJ Problem Set (main)

### 1965. Set Cover

#### Problem code: SETCOV

In the set cover problem there is a collection  $C = \{S_1, \dots, S_m\}$  of subsets of the universe  $[n] = \{0, \dots, n-1\}$ , and one must find a minimum-sized subcollection of  $C$  that still covers  $[n]$  (it may be the case that  $S_i$  and  $S_j$  contain the exact same elements for some  $i \neq j$ ). A **path of length  $r$**  is a graph on  $r+1$  vertices  $v_0, \dots, v_r$  where  $v_i$  has an undirected edge to  $v_{i+1}$  for  $i = 0, \dots, r-1$  (these are the only edges). A set cover instance  $I$  is said to be **path-realizable** if there exists a mapping from  $I$  to a path of length  $m$  where the  $S_i$  are mapped to edges in the path and each  $i$  in  $[n]$  is mapped to a pair of (not-necessarily distinct) vertices  $s_i, t_i$  on the path such that the edges lying between  $s_i$  and  $t_i$  correspond exactly to the sets of  $C$  that contain  $i$ . Two sets  $S_i, S_j$  must be mapped to different edges on the path if  $i \neq j$ . You will be given a set cover instance that is guaranteed to be path-realizable and should output the size of a minimum-sized subcollection of  $C$  still covering  $[n]$ .

#### Input

The first line of the input is " $N M$ " ( $1 \leq N, M \leq 300$ ), where  $N$  is the size of the universe and  $M$  is the number of sets  $S_i$  in the collection of subsets of  $\{0, \dots, N-1\}$ . What follows are  $M$  groups of lines. The  $i$ th group starts with one line containing  $|S_i|$ , the size of the  $i$ th subset. If  $|S_i| = 0$ , the current group of lines ends. Otherwise the next line is a space-separated list of the elements contained in  $S_i$ .

#### Output

If  $[n]$  cannot be covered by a subcollection of  $C$  then you should output  $-1$ , followed by a newline. Otherwise, your output should consist of two lines. The first line is the size of a minimum-sized set cover. The second line is a space-separated list of the 0-based indices of the sets in an optimal set cover.

#### Example

**Input :**

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

**Output :**

```
2
1 2
```

---

Added by: Jelani Nelson (Minilek)  
Date: 2007-10-25  
Time limit: 30s  
Source limit: 50000B  
Languages: All  
Resource: MIT Individual Contest 2007

## SPOJ Problem Set (main)

### 1966. Ski Valley

#### Problem code: SKIVALL

The Society of Sport of New Hampshire has decided to build a new attraction in White Mountains. For the first time, the world will see a ski-valley, a ski path that goes downhill then uphill. They believe that skiers can gain enough speed from going down in the first part in order to climb up the second part. To maximize the joy of visitors, they want to find the longest such path.

To simplify calculations, they approximate the mountain terrain with a matrix of square fields and obtain the height of each field from the New Hampshire Geographical Institute. A ski-valley is a sequence of neighboring fields, such that height of fields only decreases along the sequence until some point, and then it only increases until its end. No field appears more than once in a ski-valley. Two fields are neighbors if they share a common edge. The length of a ski-valley is the number of fields in its sequence.

More technically, the terrain is an  $M \times N$  matrix of fields, where  $(i, j)$  denotes a field in the  $i$ th row and  $j$ th column, and  $h(i, j)$  denotes its height. A ski-valley is a sequence  $(x_1, y_1), (x_2, y_2), \dots, (x_l, y_l)$ , such that:

1. for any  $i$  ( $1 \leq i \leq l-1$ ), either  $x_i = x_{i+1}$  and  $|y_i - y_{i+1}| = 1$ , or  $y_i = y_{i+1}$  and  $|x_i - x_{i+1}| = 1$  (neighbors rule)
2. if  $i \neq j$  ( $1 \leq i, j \leq l$ ), then either  $x_i \neq x_j$  or  $y_i \neq y_j$  (no repeating rule), and
3. There exists a  $k$  ( $1 \leq k \leq l$ ), such that  $h(x_1, y_1) > h(x_2, y_2) > \dots > h(x_{k-1}, y_{k-1}) > h(x_k, y_k) < h(x_{k+1}, y_{k+1}) < \dots < h(x_l, y_l)$  (down-up rule).

The length of such ski-valley is  $l$ .

They hire you, a reputable programmer, to write a program that will find a ski-valley of maximum length. If there are multiple ski-valleys with the same (maximum) length, you can choose any of them.

Note: Yes, they were not cautious and also allowed a ski-valley to be only downhill or only uphill, but your job is only to adhere to the specification they gave you!

#### Input

The first line of the input contains  $M$  and  $N$  ( $1 \leq M, N \leq 60$ ), respectively, separated by a space character. Each of the next  $M$  lines contains  $N$  numbers, such that the  $j$ th number in the  $i$ th line represents  $h(i, j)$  ( $-10^6 \leq h(i, j) \leq 10^6$ ). No two fields in the terrain are of the same height. Numbers on a line are separated by a space character.

## Output

In the first line of the output, write a single number  $l_{max}$ , which is the maximum length of a ski-valley. In the next  $l_{max}$  lines write a description of any ski-valley of that length. In each of the lines, write two integers separated by a space character, such that numbers  $x_i$  and  $y_i$  in the  $i$ th line represent  $(x_i, y_i)$ , the  $i$ th field in the ski-valley.

## Example

**Input :**

```
3 4
2 6 7 16
1 4 3 20
9 8 17 12
```

**Output :**

```
9
3 1
3 2
2 2
2 1
1 1
1 2
1 3
1 4
2 4
```

---

Added by: Jelani Nelson (Minilek)

Date: 2007-10-25

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: MIT Individual Contest 2007

## SPOJ Problem Set (classical)

### 2006. Load Balancing

#### Problem code: BALIFE

SuperComputer Inc. have built a super-fast computer server consisting of  $N$  hyper-scalar lightning-fast processors Beta 007. These processors are numbered from 1 to  $N$  and are used to process independent jobs. Every new incoming job is assigned to an arbitrary processor. Sometimes, a processor may be assigned too many jobs while other processors have a relatively light load (or even wait idly). In that case, the whole system undergoes rebalancing.

Rebalancing proceeds in rounds. In each round, every processor can transfer at most one job to each of its neighbors on the bus. Neighbors of the processor  $i$  are the processors  $i-1$  and  $i+1$  (processors 1 and  $N$  have only one neighbor each, 2 and  $N-1$  respectively). The goal of rebalancing is to achieve that all processors have the same number of jobs.

Given the number of jobs initially assigned to each processor, you are asked to determine the minimal number of rounds needed to achieve the state when every processor has the same number of jobs, or to determine that such rebalancing is not possible.

#### Input file specification

The input file consists of several blocks. Each block begins with a line containing a single number  $N$  ( $1 \leq N \leq 9000$ ) - the number of processors.  $N$  numbers follow, separated by spaces and/or end of line characters. The  $i$ -th number denotes the number of jobs assigned to the  $i$ -th processor before rebalancing. There is a blank line after each block. The last block is followed by a single number -1 on a separate line (which should not be processed).

#### Output file specification

For each block in the input file, output the minimal number of rounds needed to rebalance loads for all the processors. If it is not possible to rebalance jobs so that each processor has the same number of jobs, output -1.

#### Example

**Input file:**

```
3
0 99 3

2
49 50

8
16 17 15 0 20 1 1 2

10
0 0 100 0 0 0 0 0 0 0

-1
```

**Output file:**

34  
-1  
23  
70

---

Added by: Blue Mary  
Date: 2007-11-03  
Time limit: 1s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: IPSC 2002



## SPOJ Problem Set (classical)

### 2008. Dab of Backpack

#### Problem code: BACKPACK

One day Blue Mary goes to a nearby supermarket to buy some goods. She has a backpack, whose capacity is  $V_{Max}$ . She finds that there are many goods in the market, each has a volume  $V_i$  (it will always be a multiple of 10 and less than 10000) and an importance  $C_i$  ( $1 \leq C_i \leq 5$ ). Since she has almost unlimited money, the only problem she is to solve is how to choose goods such that the total volume won't exceed the capacity of the backpack and the sum of the product of the volume and the importance of each good is maximum. To be an excellent mathematician, she comes up with the answer quickly, and now she wants you to do a harder task. There are two kinds of goods: main goods and attachments. If you want to buy an attachment you must buy its main good before.

#### Input

Multiple test cases, the number of them is given in the very first line.

For each test case:

The first line contains two space-separated integers  $V_{Max}$  ( $1 \leq V_{Max} \leq 32000$ ) and the number of the goods  $N$  ( $1 \leq N \leq 60$ ).  $N$  lines follow, each contains three space-separated integers  $V_i$ ,  $C_i$  and a integer  $u$ . If  $u$  is not 0, this good is an attachment of good  $u$  (as the order in the input file).

To make the problem not too difficult, Blue Mary tells you that:

(A) An attachment won't have any attachments which belong to it.

(B) A main good will always have less than 3 attachments.

#### Output

For each test case:

The first and the only line contains a single integer denoted the answer.

#### Example

**Input :**

```
1
1000 5
800 2 0
400 5 1
300 5 1
400 3 0
500 2 0
```

**Output :**

```
2200
```

---

Added by: Blue Mary  
Date: 2007-11-03  
Time limit: 3s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: Based on a Problem from Chinese National Olympiad in Informatics in Province 2006

## SPOJ Problem Set (classical)

### 2019. The Rolling Ball

#### Problem code: ROLLBALL

Rolling Ball

#### Problem

A solid spherical ball of radius **R** rolls without slipping on the inside surface of a fixed cone, whose tip points downward. The half-angle at the vertex of the cone is **u**. Initial conditions have been set up so that the ball travels around the cone in a horizontal circle of radius **L > R**, with the points on the ball that touch the cone tracing out a circle on the ball. Determine the radius of the circle of these contact points, if you want the sphere to travel around the cone as fast as possible.

#### The Input

Each line of input has integers **L** ( $R < L \leq 1000000$ ) **R** ( $0 < R \leq 1000$ ) and **u** ( $0 < u < 90$ ) given in degrees.

#### The Output

For each line of input, output the radius of the circle of the contact points, round to integer.

#### Sample Input

```
220000 100 29
```

#### Sample Output

```
46
```

---

Problemsetter --- Wu, Xiaogang

---

Added by: Chen Xiaohong

Date: 2007-11-06

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 2021. Moving Pebbles

#### Problem code: PEBBMOV

A Game of Moving Pebbles

#### Problem

Two players play the following game. At the beginning of the game they start with  $n$  ( $1 \leq n \leq 100000$ ) piles of stones. At each step of the game, the player chooses a pile and remove at least one stone from this pile and move zero or more stones from this pile to any other pile that still has stones. A player loses if he has no more possible moves. Given the initial piles, determine who wins: the first player, or the second player, if both play perfectly.

#### The Input

Each line of input has integers  $0 < n \leq 100000$ , followed by  $n$  positive integers denoting the initial piles.

#### The Output

For each line of input, output "first player" if first player can force a win, or "second player", if the second player can force a win.

#### Sample Input

```
3 2 1 3
```

#### Sample Output

```
first player
```

---

Problemsetter --- Chen, Jiahong

---

Added by: Chen Xiaohong

Date: 2007-11-06

Time limit: 5s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (main)

### 2022. Truth Or Lie

**Problem code: TRUTHORL**

Truth Or Lie

#### Problem

Suppose you have **m** yes or no questions that you want to ask **n** people. You are allowed to ask each person exactly two different questions. He/she will answer exactly one of them correctly and one of them incorrectly, you don't know which is a correct answer and which is an incorrect one. Given their answers, determine the number of combinations of answers to the **m** questions that can still be correct (i.e., no contradictions).

#### The Input

First line is the number of inputs. For each set of input, start out with a line of **n** ≤ 10000 and **m** ≤ 200, followed by **n** lines. The i-th line has four integers **a b c d**. It means that the answer given by the i-th person for question a is b, and for question c is d. Moreover, the answer "1" means yes, and "0" means no.

#### The Output

For each line of input, output "No Inference" if the answers do not help you eliminate any wrong combination of answers or the number of combinations of possible answers is 0, otherwise output the size of the set of combinations of answers still possible.

#### Sample Input

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

#### Sample Output

```
No Inference
2
```

---

Problemsetter --- sy

---

Added by: Chen Xiaohong  
Date: 2007-11-06  
Time limit: 1s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

# 2023. One Instruction Computer Simulator

## Problem code: ONEINSTR

A computer with only one instruction! The instruction is:

```
SUBLEQ A B C
```

This means: subtract the value in  $M(A)$  from  $M(B)$  and store it in  $M(B)$ ; if the result is non-positive jump to the instruction in position  $C$ .  $M(i)$  represents the value stored in memory position  $i$ . The computer has a memory of 9999 integer positions, numbered from 0 to 9998.  $C > 9996$ , indicates the end of the program. Also, if  $A$  is negative, then the value of  $A$  is directly subtracted from  $M(B)$ .

Since there is only one instruction, it is unnecessary to represent its opcode explicitly in memory. Therefore, an instruction is stored in main memory using three consecutive memory positions, which correspond to the three instruction parameters. The memory is organized as follows:

Position	Content
0-8	input/output variables ( $M_0$ to $M_8$ )
9-9998	program memory (instructions+data)

The following pseudo-code shows the one instruction computer simulator:

```
simulate(integer M[0..9998])
  integer pc,A,B,C
  pc = 9
  while (pc<9997)
    A = M[pc]; B = M[pc+1]; C = M[pc+2]
    if (A>=0)
      M[B] = M[B] - M[A]
    else
      M[B] = M[B] - A
    if (M[B]>0)
      pc = pc + 3
    else
      pc = C
    end_if
  end_while
end_simulate
```

Each iteration of the above while instruction is called a simulation cycle. You are to translate postfix instructions into this machine language. There are at most 100 arithmetic terms and 99 operators. Numerical constants are non-negative and less than or equal to 10000.

## Input

The input has several test cases, one test case per line. Each test case corresponds to an arithmetic expression in postfix notation. An expression may contain constants (integer values), input variables ( $M_0$  to  $M_8$ ) and arithmetic operators (+, -, \*, /).

## Output

For each test case, a program must be printed using the following format: First line indicates  $m$ , the number of instructions of the program; and the following  $m$  lines contain the program, one instruction per line, where each instruction is represented by 3 integer values separated by one blank space. Your outputed program must finish within  $10^7$  simulation cycles for each test case.

## Example

**Input :**

```
100
M1 M2 -
```

**Output :**

```
4
0 0 12
-100 0 0
19 19 10000

4
0 0 12
1 2 15
2 0 18
21 21 10000
```

---

Added by: Chen Xiaohong

Date: 2007-11-06

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Changed and Enhanced from Columbian National Contest



## SPOJ Problem Set (classical)

### 2031. Please help You-Know-Who

**Problem code: YKH**

#### Background

Poor You-Know-Who was out of business for quite some time, being neither dead, nor alive. He would like to get rich so that he can run for the post of Minister of Magic. From there he could unfold at least some of his evil plots even if he lost most of his magical powers. You are fed up with all this Harry Potter business and decide to help You-Know-Who make some dough. You-Know-Who inherited lots of magic powder that increases one's sense of smell for a short period of time if inhaled. He will sell it and you'll help him maximize the profit.

#### Problem

You-Know-Who has  $C$  clients. Client  $i$  will buy  $a[i] - b[i] * p$  powder if the unit price is  $p$ . That is, if You-Know-Who shows a certificate issued by the Minister saying that the asked price is the correct price. Getting one such certificate involves paying a bribe  $B$ . To maximize the profit he may buy several such certificates and use for each client the one that maximizes his profit. You must tell You-Know-Who what certificates he should get. With some luck, Harry Potter is out!

#### Input

The first line contains the number of testcases, which shall be less than 20. The testcases follow. (Possible empty lines between testcases should be ignored.)

The first line of each testcase input contains two non-negative integers: the bribe  $B$  and the number of clients  $C$ . The next  $C$  lines describe each client by two positive integers  $a[i]$  and  $b[i]$  (on line  $i$ ). You are guaranteed that all numbers in the input are at most 2000.

#### Output

For each testcase the output is a single number, the maximum profit of You-Know-Who, and it should be written on a line by itself. The answer should have either an absolute or a relative error less than  $1e-6$ .

#### Example

**Input :**

```
2
10 2
10 1
20 3
100 1
5 1
```

**Output :**

46.25

0

First testcase: If YKW would have only the first client then he should choose to get a certificate for the price 5. This way he will sell 5 grams of powder for a profit of  $5 \times 5 - 10 = 15$ . Analogously, for the second client the optimal price would be 3.(3), which would make the client buy 10 grams of magic powder. Choosing the optimal price for each client means that two bribes must be payed, which leads to a profit of  $5 \times 5 + 10 \times 3.(3) - 2 \times 10 = 38.(3)$ . Nevertheless, YKW can win more money by getting only one certificate for the price 3.75. This way the profit is  $6.25 \times 3.75 + 8.75 \times 3.75 - 10 = 46.25$ .

The second testcase shows that sometimes it's better to not sell magic powder to some clients.

---

Added by: Radu Grigore

Date: 2007-11-07

Time limit: 10s

Source limit: 10000B

Languages: All

Resource: CSIC 2007

## SPOJ Problem Set (classical)

### 2038. Rectangle Tiling

#### Problem code: TILING

We say that a 2-dimensional, rectangular word  $w$  of size  $n \times m$  (imagine it as a board with letter written in the squares) can be tiled with a rectangular pattern  $p$  if there are such occurrences of  $p$  in  $w$  (but not necessarily all of them) that no two of them overlap and each symbol (square) of  $w$  is covered by one of them. Given such word  $w$ , find a rectangular pattern  $p$  of smallest size (area) which the word  $w$  can be tiled with.

#### Input

The first line of input contains a number  $t$  ( $1 \leq t \leq 100$ ) that indicates the number of test cases to follow. Each test case begins with a line consisting of two positive integers  $n$  and  $m$  ( $1 \leq n, m \leq 1000$ ) indicating dimensions of the board.  $n$  lines follow, each of them containing  $m$  small letters of the English alphabet (a,b,...,z).

#### Output

For each test case output the smallest possible area of a pattern  $p$  that can be used to tile the given board.

#### Example

**Input :**

```
3
4 3
aaa
aaa
aaa
aaa
4 4
abab
cdcd
abab
cdcd
3 4
aaaa
aaaa
aaab
```

**Output :**

```
1
4
12
```

---

Added by: Pawel Gawrychowski  
Date: 2007-11-10  
Time limit: 1s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 2047. Stone Removing Game

#### Problem code: REMGAME

Consider the following game. The game is played on a 5 x 5 board. Initially every array cell has a piece in it. Two players remove pieces alternatively from the board. The player can remove any number of consecutive pieces in a row or column. For example, in the configuration depicted below where one indicates a piece, the player can either remove one piece (**A1**, **A2**, or **B1**), or remove two pieces (**A1** and **A2**, or **A1** and **B1**) simultaneously. The game ends when one player is forced to take the last piece, and the other player wins the game.

	1	2	3	4	5
A	1	1	0	0	0
B	1	0	0	0	0
C	0	0	0	0	0
D	0	0	0	0	0
E	0	0	0	0	0

Write a program that evaluates board configurations from this game. The program must output "winning" when there exists a winning move that no matter how the opponent responds, it will force the opponent to take the last piece. Otherwise, the program must output "losing".

#### Input

The first line contains **n**, the number of test cases. For each test case, a 5x5 grid of an initial game configuration is shown.

#### Output

For each case, output "winning" or "losing".

#### Example

**Input :**

```
1
1 0 0 0 0
1 1 0 0 0
1 1 1 0 0
1 1 1 1 0
1 1 1 1 1
```

**Output :**

```
winning
```

---

Added by: Chen Xiaohong

Date: 2007-11-13

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Adapted from Taiwan TPC 1999, Harder datasets.

## SPOJ Problem Set (classical)

### 2050. Strange Billboard

#### Problem code: CERC07B

The marketing and public-relations department of the Czech Technical University has designed a new reconfigurable mechanical Flip-Flop Bill-Board (FFBB). The billboard is a regular two-dimensional grid of  $R \times C$  square tiles made of plastic. Each plastic tile is white on one side and black on the other. The idea of the billboard is that you can create various pictures by flipping individual tiles over. Such billboards will hang above all entrances to the university and will be used to display simple pictures and advertise upcoming academic events. To change pictures, each billboard is equipped with a "reconfiguration device". The device is just an ordinary long wooden stick that is used to tap the tiles. If you tap a tile, it flips over to the other side, i.e., it changes from white to black or vice versa. Do you agree this idea is very clever?

Unfortunately, the billboard makers did not realize one thing. The tiles are very close to each other and their sides touch. Whenever a tile is tapped, it takes all neighboring tiles with it and all of them flip over together. Therefore, if you want to change the color of a tile, all neighboring tiles change their color too. Neighboring tiles are those that touch each other with the whole side. All inner tiles have 4 neighbors, which means 5 tiles are flipped over when tapped. Border tiles have less neighbors, of course.

example

For example, if you have the billboard configuration shown in the left picture above and tap the tile marked with the cross, you will get the picture on the right. As you can see, the billboard reconfiguration is not so easy under these conditions. Your task is to find the fastest way to "clear" the billboard, i.e., to flip all tiles to their white side.

#### Input

The input consists of several billboard descriptions. Each description begins with a line containing two integer numbers  $R$  and  $C$  ( $1 \leq R, C \leq 16$ ) specifying the billboard size. Then there are  $R$  lines, each containing  $C$  characters. The characters can be either an uppercase letter "X" (black) or a dot "." (white). There is one empty line after each map. The input is terminated by two zeros in place of the board size.

#### Output

For each billboard, print one line containing the sentence "You have to tap  $T$  tiles.", where  $T$  is the minimal possible number of taps needed to make all squares white. If the situation cannot be solved, output the string "Damaged billboard." instead.

## Example

### Input :

```
5 5
XX.XX
X.X.X
.XXX.
X.X.X
XX.XX
```

```
5 5
.XX.X
.....
..XXX
..X.X
..X..
```

```
1 5
...XX
```

```
5 5
...X.
...XX
.XX..
..X..
.....
```

```
8 9
..XXXXX..
.X.....X.
X..X.X..X
X.....X
X.X...X.X
X..XXX..X
.X.....X.
..XXXXX..
```

```
0 0
```

### Output :

```
You have to tap 5 tiles.
Damaged billboard.
You have to tap 1 tiles.
You have to tap 2 tiles.
You have to tap 25 tiles.
```

---

Added by: Rafal

Date: 2007-11-15

Time limit: 1s-20s

Source limit:50000B

Languages: All

Resource: Central European Programming Contest, Prague 2007



## SPOJ Problem Set (classical)

### 2051. Cell Phone

#### Problem code: CERC07C

Nowadays, everyone has a cellphone, or even two or three. You probably know where their name comes from. Do you. Cellphones can be moved (they are "mobile") and they use wireless connection to static stations called BTS (Base Transceiver Station). Each BTS covers an area around it and that area is called a cell.

The Czech Technical University runs an experimental private GSM network with a BTS right on top of the building you are in just now. Since the placement of base stations is very important for the network coverage, your task is to create a program that will find the optimal position for a BTS. The program will be given coordinates of "points of interest". The goal is to find a position that will cover the maximal number of these points. It is supposed that a BTS can cover all points that are no further than some given distance  $R$ . Therefore, the cell has a circular shape.

example

The picture above shows eight points of interest (little circles) and one of the possible optimal BTS positions (small triangle). For the given distance  $R$ , it is not possible to cover more than four points. Notice that the BTS does not need to be placed in an existing point of interest.

#### Input

The input consists of several scenarios. Each scenario begins with a line containing two integer numbers  $N$  and  $R$ .  $N$  is the number of points of interest,  $1 \leq N \leq 2\,000$ .  $R$  is the maximal distance the BTS is able to cover,  $0 \leq R < 10\,000$ . Then there are  $N$  lines, each containing two integer numbers  $X_i$ ,  $Y_i$  giving coordinates of the  $i$ -th point,  $|X_i|, |Y_i| < 10\,000$ . All points are distinct, i.e., no two of them will have the same coordinates.

The scenario is followed by one empty line and then the next scenario begins. The last one is followed by a line containing two zeros.

A point lying at the circle boundary (exactly in the distance  $R$ ) is considered covered. To avoid floating-point inaccuracies, the input points will be selected in such a way that for any possible subset of points  $S$  that can be covered by a circle with the radius  $R + 0.001$ , there will always exist a circle with the radius  $R$  that also covers them.

#### Output

For each scenario, print one line containing the sentence "It is possible to cover  $M$  points.", where  $M$  is the maximal number of points of interest that may be covered by a single BTS.

## Example

### Input :

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

2 100
0 100
0 -100

0 0
```

### Output :

```
It is possible to cover 4 points.
It is possible to cover 2 points.
```

*The first sample input scenario corresponds to the picture, providing that the X axis aims right and Y axis down.*

---

Added by: Rafal  
Date: 2007-11-16  
Time limit: 20s  
Source limit: 50000B  
Languages: All  
Resource: Central European Programming Contest, Prague 2007

## SPOJ Problem Set (classical)

### 2052. Hexagonal Parcels

#### Problem code: CERC07H

A civil engineer that has recently graduated from the Czech Technical University encountered an interesting problem and asked us for a help. The problem is more of economical than engineering nature. The engineer needs to connect several buildings with an infrastructure. Unfortunately, the investor is not the owner of all the land between these places. Therefore, some properties have to be bought first.

The land is divided into a regular "grid" of hexagonal parcels, each of them forms an independent unit and has the same value. Some of the parcels belong to the investor. These parcels form four connected areas, each containing one building to be connected with the others. Your task is to find the minimal number of parcels that must be acquired to connect the four given areas.

example

The whole land also has a hexagonal shape with six sides, each consisting of exactly  $H$  parcels. The above picture shows a land with  $H = 4$ , parcels with letters represent the four areas to be connected. In this case, it is necessary to buy four additional parcels. One of the possible solutions is marked by crosses.

#### Input

The input contains several scenarios. Each scenario begins with an integer number  $H$ , which specifies the size of the land,  $2 \leq H \leq 20$ . Then there are  $2H - 1$  lines representing individual "rows" of the land (always oriented as in the picture). The lines contain one non-space character for each parcel. It means the first line will contain  $H$  characters, the second line  $H + 1$ , and so on. The longest line will be the middle one, with  $2H - 1$  characters. Then the "length" descends and the last line contains  $H$  parcels, again.

The character representing a parcel will be either a dot (".") for the land that is not owned by the investor, or one of the uppercase letters "A", "B", "C", or "D". The areas of parcels occupied by the same letter will always be connected. It means that between any two parcels in the same area, there exists a path leading only through that area.

Beside the characters representing parcels, the lines may contain any number of spaces at any positions to improve "human readability" of the input. There is always at least one space between two letters (or the dots). After the land description, there will be one empty line and then the next scenario begins. The last scenario is followed by a line containing zero.

#### Output

For each scenario, output one line with the sentence "You have to buy  $P$  parcels.", where  $P$  is the minimal number of parcels that must be acquired to make all four areas connected together.

Areas are considered connected, if it is possible to find a path between them that leads only through parcels that have been bought.

## Example

**Input :**

```
4
  B . . C
. . . . C
. A . . C .
. A A . . .
. A . . . .
. . . D D
. . . .
```

0

**Output :**

You have to buy 4 parcels.

---

Added by: Rafal

Date: 2007-11-16

Time limit: 5s

Source limit:50000B

Languages: All

Resource: Central European Programming Contest, Prague 2007

## SPOJ Problem Set (classical)

### 2053. Key Task

#### Problem code: CERC07K

The Czech Technical University is rather old - you already know that it celebrates 300 years of its existence in 2007. Some of the university buildings are old as well. And the navigation in old buildings can sometimes be a little bit tricky, because of strange long corridors that fork and join at absolutely unexpected places.

The result is that some first-graders have often difficulties finding the right way to their classes. Therefore, the Student Union has developed a computer game to help the students to practice their orientation skills. The goal of the game is to find the way out of a labyrinth. Your task is to write a verification software that solves this game.

The labyrinth is a 2-dimensional grid of squares, each square is either free or filled with a wall. Some of the free squares may contain doors or keys. There are four different types of keys and doors: blue, yellow, red, and green. Each key can open only doors of the same color. You can move between adjacent free squares vertically or horizontally, diagonal movement is not allowed. You may not go across walls and you cannot leave the labyrinth area. If a square contains a door, you may go there only if you have stepped on a square with an appropriate key before.

#### Input

The input consists of several maps. Each map begins with a line containing two integer numbers R and C ( $1 \leq R, C \leq 100$ ) specifying the map size. Then there are R lines each containing C characters. Each character is one of the following:

Hash mark '#' Wall

Dot '.' Free square

Asterisk '\*' Your position

Uppercase letter 'B', 'Y', 'R', 'G' Blue, yellow, red or green door

Uppercase X 'X' Exit

Note that it is allowed to have \* more than one exit,

\* no exit at all,

\* more doors and/or keys of the same color, and

\* keys without corresponding doors and vice versa.

You may assume that the marker of your position ("\*") will appear exactly once in every map. There is one blank line after each map. The input is terminated by two zeros in place of the map size.

#### Output

For each map, print one line containing the sentence "Escape possible in S steps.", where S is the smallest possible number of step to reach any of the exits. If no exit can be reached, output the string "The poor student is trapped!" instead. One step is defined as a movement between two adjacent cells. Grabbing a key or unlocking a door does not count as a step.

## Example

### Input :

```
1 10
*.....X
```

```
1 3
*#X
```

```
3 20
#####
#XY.gBr.*.Rb.G.GG.y#
#####
```

```
0 0
```

### Output

```
Escape possible in 9 steps.
The poor student is trapped!
Escape possible in 45 steps.
```

---

Added by: Rafal

Date: 2007-11-16

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Central European Programming Contest, Prague 2007

## SPOJ Problem Set (classical)

### 2054. Gates of Logic

#### Problem code: CERC07L

The Department of Computer Science and Engineering runs courses dealing not only with algorithms but also with computer hardware. One such introductory course explains basic principles of integrated circuits ("chips"), binary logic, boolean algebra, etc. As you may know, the very basic units of logical circuits are called gates. A gate is an element performing one simple logical operation. It can be connected to other gates using lines.

Logical circuits may be drawn as pictures with the gates represented as squares with inputs on the left and outputs on the right. In each square, there is a symbol that determines the gate type: Number 1 denotes an OR gate (its outputs are 0 if and only if there is no input with the value of 1), & is an AND gate (outputs are 1 if and only if there is no 0 input), and = is a XOR gate (outputs are 1 if and only if there is an odd number inputs that have the value of 1).

Your task is to scan such a "picture" and compute values of all named circuit outputs. The lines may split and join again but you may assume that each "value consumer" (input port of a gate or a named output) will be connected to exactly one "value source" (output port of a gate or an input value). There will be no feedback loops, i.e., there exists no cycle that would lead through the same gate twice.

#### Input

The input contains several pictures. Each picture consists of at least one and at most 200 rows composed of the following characters:

- \* Space (" "). Empty space in the picture. Spaces are used to indent other characters to appropriate locations, because the exact position of characters is often important. Trailing spaces at the end of input rows may be present but may also be left out.
- \* Dash ("-"). Horizontal line. It connects characters on its left and right together, those characters will always exist and be able to "accept" the connection.
- \* Pipe ("|"). Vertical line, connects characters that are directly above and below. Like with the horizontal line, those characters will always accept the connection.
- \* Plus sign ("+" ). Line connection or a bend. Connects characters on all four sides. All characters that are able to accept the connection are considered connected (there will always be at least two). However, there may be sides that contain a non-empty character that is not connected. For example, if a dash is present on a position directly below the plus sign, they are not considered connected.
- \* Lowercase letter x ("x"). Crossing of two lines without a connection. All four neighboring characters will accept the connection. The character above is connected to the one below and the character to the left with the one on the right, but there is no mutual connection between these two pairs.

\* Equal sign ("="). Represents an input or output port. It always connects characters on its left and right, at least one of these characters is the port. If there is a port on the left, it may only be a value source. If there is a port on the right, it may only be a value consumer.

\* Lowercase letter o ("o"). Negation. There will always be a gate on the left and a port on the right of this character. It makes the particular gate output negated.

\* Hash mark ("#"). Gate, which has always a rectangular shape with two vertical and two horizontal sides. The left vertical side may be connected to input ports, the right side to output ports (possibly negated). No two gates will touch each other's side, which means that any two vertically or horizontally neighboring hash marks are always parts of the same gate.

The rectangle size will always be at least 3 characters in both directions, which means there is at least one character inside. All inner characters are empty (spaces), with exactly one exception. That single non-empty character denotes the gate type (note that it may have different meaning than outside the gate area) and will be a digit "one" ("1"), ampersand("&"), or an equal sign ("=").

\* Binary digit ("0" and "1"). Input value of the circuit. It is connected to the character on its right, which is always an equal sign.

\* Uppercase letter ("A" through "Z"). Named output of the circuit. It accepts connection from its left, which is always an equal sign. Each letter will appear at most once, which means the number of circuit outputs is between 0 and 26, inclusive. Each picture will be terminated by a row consisting solely of asterisk ("\*") characters (at least one). The last picture will be followed by two such rows. No row in the input will be longer than 200 characters.

## Output

For each picture, print the values of all named outputs, sorted alphabetically. Each output row should contain three characters: output name (one uppercase letter), equals sign, and a binary value (zero or one). Print one empty line after each test case.

## Example

**Input :**

```

0=+
  |
  | #####
 +=#      #
   # &    #o---+
1=-----#  #  |
   #      #  |
   #####  +---#### ###
               |   ##=#1#o==X
1=-----x---#  #  ###
               1---x---###
                   +-----=Y
*****
1=A
***
*
```

**Output :**



X=0  
Y=1

A=1

---

Added by: Rafal  
Date: 2007-11-16  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Central European Programming Contest, Prague 2007

## SPOJ Problem Set (classical)

### 2055. Weird Numbers

#### Problem code: CERC07N

Binary numbers form the principal basis of computer science. Most of you have heard of other systems, such as ternary, octal, or hexadecimal. You probably know how to use these systems and how to convert numbers between them. But did you know that the system base (radix) could also be negative. One assistant professor at the Czech Technical University has recently met negabinary numbers and other systems with a negative base. Will you help him to convert numbers to and from these systems.

A number  $N$  written in the system with a positive base  $R$  will always appear as a string of digits between 0 and  $R - 1$ , inclusive. A digit at the position  $P$  (positions are counted from right to left and starting with zero) represents a value of  $R^P$ . This means the value of the digit is multiplied by  $R^P$  and values of all positions are summed together. For example, if we use the octal system (radix  $R = 8$ ), a number written as 17024 has the following value:

$$1 \cdot 8^4 + 7 \cdot 8^3 + 0 \cdot 8^2 + 2 \cdot 8^1 + 4 \cdot 8^0 = 1.4096 + 7.512 + 2.8 + 4.1 = 7700$$

With a negative radix  $-R$ , the principle remains the same: each digit will have a value of  $(-R)^P$ . For example, a negaoctal (radix  $R = -8$ ) number 17024 counts as:

$$1 \cdot (-8)^4 + 7 \cdot (-8)^3 + 0 \cdot (-8)^2 + 2 \cdot (-8)^1 + 4 \cdot (-8)^0 = 1.4096 - 7.512 - 2.8 + 4.1 = 500$$

One big advantage of systems with a negative base is that we do not need a minus sign to express negative numbers. A couple of examples for the negabinary system ( $R = -2$ ):

decimal	negabinary	decimal	negabinary	decimal	negabinary
-10	1010	-3	1101	4	100
-9	1011	-2	10	5	101
-8	1000	-1	11	6	11010
-7	1001	0	0	7	11011
-6	1110	1	1	8	11000
-5	1111	2	110	9	11001
-4	1100	3	111	10	11110

You may notice that the negabinary representation of any integer number is unique, if no "leading zeros" are allowed. The only number that can start with the digit "0", is the zero itself.

#### Input

The input will contain several conversions, each of them specified on one line. A conversion from the decimal system to some negative-base system will start with a lowercase word "to" followed by a minus sign (with no space before it), the requested base (radix)  $R$ , one space, and a decimal number  $N$ .

A conversion to the decimal system will start with a lowercase word "from", followed by a minus sign, radix R, one space, and a number written in the system with a base of -R.

The input will be terminated by a line containing a lowercase word "end". All numbers will satisfy the following conditions:  $2 \leq R \leq 10$ ,  $-1\,000\,000 \leq N \leq 1\,000\,000$  (decimal).

## Output

For each conversion, print one number on a separate line. If the input used a decimal format, output the same number written in the system with a base -R. If the input contained such a number, output its decimal value.

Both input and output numbers must not contain any leading zeros. The minus sign "-" may only be present with negative numbers written in the decimal system. Any non-negative number or a number written in a negative-base system must not start with it.

## Example

### Input

```
to-2 10
from-2 1010
to-10 10
to-10 -10
from-10 10
end
```

### Output

```
11110
-10
190
10
-10
```

---

Added by: Rafal

Date: 2007-11-16

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Central European Programming Contest, Prague 2007

## SPOJ Problem Set (classical)

### 2056. Rectangular Polygon

#### Problem code: CERC07P

In this problem, we will help the Faculty of Civil Engineering. They need a software to analyze ground plans of buildings. Specifically, your task is to detect outlines of a building when all of its corners are given.

example

You may assume that each building is a rectangular polygon with each of its sides being parallel either with X or Y axis. Therefore, each of its vertex angles is exactly either 90 or 270 degrees.

#### Input

The input contains several buildings. The description of each building starts with a single positive integer  $N$ , the number of corners (polygon vertices),  $1 \leq N \leq 1000$ . Then there are  $N$  pairs of integer numbers  $X_i, Y_i$  giving coordinates of individual corners,  $|X_i|, |Y_i| \leq 10\,000$ .

You may assume that all corners are listed and no two of them have the same coordinates. The polygon does always exist, it is closed, its sides do not intersect or touch (except neighboring sides, of course), and it contains no "holes" inside. In other words, the outline is formed by one closed line. The order of corners in the input file may be arbitrary.

There is an empty line after each building, then the next one is described. After the last building, there is a single zero that signals the end of input.

#### Output

For each building, output one line containing  $N$  characters without any whitespace between them. The characters should be uppercase letters that specify directions of individual walls (sides) when the building outline is followed. "N" stands for North (the positive direction of the Y axis), "E" for East (the positive direction of the X axis), "W" for West, and "S" for South. The "walk" should start in the vertex that has been given first in the input and always proceed in the clockwise direction.

#### Example

##### Input

```
4
0 0
2 2
0 2
2 0

6
1 1
2 2
0 1
1 0
```

0 2  
2 0

0

**Output**

NESW  
WNESWN

*The second sample input corresponds to the picture.*

---

Added by: Rafal

Date: 2007-11-16

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Central European Programming Contest, Prague 2007

## SPOJ Problem Set (classical)

### 2058. Reaux! Sham! Beaux!

#### Problem code: CERC07R

Roshambo - this simple game is known all around the world. In German, it is called "Schnick, Schnack, Schnuck", in Japanese "Janken", in Spanish "Cachipún", in Polish "Papier, kamień, nożyce". The Czechs call it "Kámen, nůžky, papír".

Whatever is the name of the game, its principles remain the same. Two players simultaneously form their hand into one of three possible shapes (symbols): Rock (closed fist), Paper (open hand), or Scissors (two fingers extended). If both of them show the same symbol, it is a tie and no points are given. Otherwise, one of the symbols wins: Rock blunts Scissors, Scissors cut Paper, and Paper covers Rock.

Czech Technical University students also know the game very well and use it to resolve small disputes. Imagine, for example, two students living together in one room. Yesterday evening, there was a small celebration, and in the morning, no one wants to go to the lectures. They agreed that one person would be enough to take notices for both, but who will be the poor one. Roshambo is a very effective way to decide.

Did you know there are even the World Series of Roshambo. Our organizing team would like to host the World Championships in 2009. Your task is to help us in developing a Roshambo scoring system and write a program that evaluates one game between two players.

Since the participants will come from different countries, the system must accept input in various languages. The following table shows names of three Roshambo symbols. Note that in some languages, there may be two different words for the same symbol.

Language	Code	Rock	Scissors	Paper
Czech	cs	Kamen	Nuzky	Papir
English	en	Rock	Scissors	Paper
French	fr	Pierre	Ciseaux	Feuille
German	de	Stein	Schere	Papier
Hungarian	hu	Ko   Koe	Ollo   Olloo	Papir
Italian	it	Sasso   Roccia	Forbice	Carta   Rete
Japanese	jp	Guu	Choki	Paa
Polish	pl	Kamien	Nozyce	Papier
Spanish	es	Piedra	Tijera	Papel

#### Input

The input contains several games. Each game starts with two lines describing players. Each of these two lines contains two lowercase letters specifying the language used by the player (see the language code in the table above), one space, and a player name. The name will consist from at most twenty upper- or lower-case letters.

After the players description, there are at most 100 lines containing individual rounds. Each round is described by two words separated with one space. The words name the symbol shown by the first and second player, respectively. All symbols are named in the mother tongue of the concerned player. All allowed words are shown in the table above, the first letter will be always in uppercase, all other letters in lowercase.

The last round is followed by a line containing one single dash character ("-") and then the next game begins. The only exception is the last game in the input, which is terminated by a dot (".") instead of the dash.

## Output

For each game, print five lines of output. The first line should contain the string "Game #G:", where G is the number of the game, starting with one.

The second line will contain the first player name followed by a colon (":"), one space and the number of rounds won by that player. The number should be followed by one space and the word "points". Use the singular form "point" if (and only if) the number of points of the player equals one.

The third line has the same format and shows the second player's name and points.

The fourth line displays the outcome of the game. It must contain the word "WINNER" followed by a colon, space and the name of the player who gained more points. If both players have the same number of points, the fourth line will contain words "TIED GAME" instead.

The fifth line is left empty to visually separate individual games.

## Example

### Input

```
cs Pepik
en Johnny
Nuzky Scissors
Papir Rock
Papir Scissors
-
de Gertruda
cs Lenka
Stein Papir
Schere Kamen
.
```

### Output

```
Game #1:
Pepik: 1 point
Johnny: 1 point
TIED GAME

Game #2:
Gertruda: 0 points
Lenka: 2 points
WINNER: Lenka
```

---

Added by: Rafal  
Date: 2007-11-16  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Central European Programming Contest, Prague 2007



## SPOJ Problem Set (classical)

### 2059. Robotic Sort

#### Problem code: CERC07S

Somewhere deep in the Czech Technical University buildings, there are laboratories for examining mechanical and electrical properties of various materials. In one of yesterday's presentations, you have seen how was one of the laboratories changed into a new multimedia lab. But there are still others, serving to their original purposes.

In this task, you are to write software for a robot that handles samples in such a laboratory. Imagine there are material samples lined up on a running belt. The samples have different heights, which may cause troubles to the next processing unit. To eliminate such troubles, we need to sort the samples by their height into the ascending order.

Reordering is done by a mechanical robot arm, which is able to pick up any number of consecutive samples and turn them round, such that their mutual order is reversed. In other words, one robot operation can reverse the order of samples on positions between A and B.

A possible way to sort the samples is to find the position of the smallest one ( $P_1$ ) and reverse the order between positions 1 and  $P_1$ , which causes the smallest sample to become first. Then we find the second one on position  $P_2$  and reverse the order between 2 and  $P_2$ . Then the third sample is located etc.

example

The picture shows a simple example of 6 samples. The smallest one is on the 4th position, therefore, the robot arm reverses the first 4 samples. The second smallest sample is the last one, so the next robot operation will reverse the order of five samples on positions 2-6. The third step will be to reverse the samples 3-4, etc.

Your task is to find the correct sequence of reversal operations that will sort the samples using the above algorithm. If there are more samples with the same height, their mutual order must be preserved: the one that was given first in the initial order must be placed before the others in the final order too.

#### Input

The input consists of several scenarios. Each scenario is described by two lines. The first line contains one integer number  $N$ , the number of samples,  $1 \leq N \leq 100\,000$ . The second line lists exactly  $N$  space-separated positive integers, they specify the heights of individual samples and their initial order.

The last scenario is followed by a line containing zero.

#### Output

For each scenario, output one line with exactly  $N$  integers  $P_1, P_2, \dots, P_N$ , separated by a space. Each  $P_i$  must be an integer ( $1 \leq P_i \leq N$ ) giving the position of the  $i$ -th sample just before the  $i$ -th reversal operation.

Note that if a sample is already on its correct position  $P_i$ , you should output the number  $P_i$  anyway, indicating that the "interval between  $P_i$  and  $P_i$ " (a single sample) should be reversed.

## Example

### Input

```
6
3 4 5 1 6 2
4
3 3 2 1
0
```

### Output

```
4 6 4 5 6 6
4 2 4 4
```

---

Added by: Rafal

Date: 2007-11-16

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Central European Programming Contest, Prague 2007

## SPOJ Problem Set (classical)

### 2060. Tough Water Level

#### Problem code: CERC07W

Czech Technical University has the word "technical" in its name. Beside others, this means that lectures in physics are important here. Do you still remember some of the basic physical principles.

For example, imagine a simple glass of water. Or, we will rather call it a cup to avoid ambiguity of this word. So, imagine a simple cup (made of glass) that is partially filled with water. You might have noticed that the stability of such a cup depends on the amount of water inside. If you brush against a full cup, it is relatively easy to knock it down and spill its contents. If the cup is empty, there is fortunately nothing to be spilled, but other than that, the situation does not improve much - it is still easy to knock the cup down with only a little force. The best stability is usually achieved with a "half-full" cup.

In this problem, your task is to determine the water level that makes a cup as much stable as possible. For the purpose of this problem, we will make a simple assumption that the "stability" of a cup is higher, if its center of mass (sometimes also called the center of gravity) is lower (closer to the bottom).

The center of mass can be informally defined as follows: Imagine that glass and water consist of a very large number of very small particles. Then the center of mass is an average of the position of all these particles. The average is weighted by particle masses. Since the density of glass is approximately 2 500 kg.m<sup>-3</sup> and the density of water only 1 000 kg.m<sup>-3</sup>, we will suppose that the mass of a glass particle is 2.5 times higher than the mass of a water particle of the same size.

All cups considered in this problem will have an exact rotary shape. But their radius may vary with the height - some cups are wider at the top, others are wider at the bottom. Also, the thickness of the glass may not be constant.

example

The left figure shows a typical cup considered in this problem. It can be fully described by its height (H), thickness of the bottom (B), and two functions R and T . Both of these functions take a current height as their argument and they give the outer radius (R) and glass thickness (T ) in the appropriate height. Please note that the thickness is always measured strictly horizontally and may therefore not reflect the "real thickness" of the glass in its usual meaning.

#### Input

The input contains several cup descriptions. Each description consists of three lines. The first line contains two numbers: H (cup height) and B (bottom thickness),  $0 < B < H \leq 100$ . The second line contains an expression R(x) (radius), the third line an expression T (x) (glass thickness). All data are given in centimeters. The last description is followed by a line with two zeros.

The expressions will contain only digits ("0" through "9"), decimal points ((".")), four basic operators ("+", "-", "\*", and "/"), parentheses ("(" and ")"), and the lowercase letters "x" denoting the input variable (height measured from the cup bottom).

$\forall x, 0 \leq x \leq H$ , the radius will satisfy:  $0.1 < R(x) \leq 100$

$\forall x, B \leq x \leq H$ , the thickness will satisfy:  $0.1 \leq T(x) < R(x)$

Arithmetical operators have their usual meaning and priorities, i.e., multiplication and division have a higher priority than addition and subtraction.

## Output

For each cup, output the sentence "Pour L litres / W cm of water.", where L is the amount of water that must be poured into the cup to reach the maximal stability (in litres). W is the water level (in centimeters) measured from the bottom of the cup. Both numbers must be given with exactly three decimal digits.

## Example

### Input

```
9 1
3+x/6
17/8-x/8
10 1
(x+10)
10/(x+10)
0 0
```

### Output

```
Pour 0.030 litres / 3.365 cm of water.
Pour 0.878 litres / 2.193 cm of water.
```

---

Added by: Rafal

Date: 2007-11-16

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: Central European Programming Contest, Prague 2007

## SPOJ Problem Set (classical)

### 2070. Minimum Distance

#### Problem code: MINDIST

Given an weighted tree, you are to find two nodes A and B of the tree(A and B needn't to be different), such that the length of the path between A and B is less than or equals to a given integer S, and the maximum distance from each node of the tree to this path is minimum.

#### Input

The first line of the input contains a single integer T, the number of test cases. T blocks follow.

For each test case, the first line contains two space-separated integer N ( $1 \leq N \leq 100000$ ) and S ( $0 \leq S \leq 100000000$ ). N-1 lines follow, each contains three integers X ( $1 \leq X \leq N$ ), Y ( $1 \leq Y \leq N$ ) and Z ( $1 \leq Z \leq 1000$ ), denotes that there is an (undirected) edge weighted Z between node X and Y. The input is correct.

#### Output

T lines, each contains a single integer denoted the minimum distance.

#### Example

##### Input :

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

##### Output :

```
5
5
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary  
Date: 2007-11-19  
Time limit: 15s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: description by Blue Mary; standard program and test data by g201513

## SPOJ Problem Set (classical)

### 2123. Candy I

#### Problem code: CANDY

Jennifer is a teacher in the first year of a primary school. She has gone for a trip with her class today. She has taken a packet of candies for each child. Unfortunately, the sizes of the packets are not the same.

Jennifer is afraid that each child will want to have the biggest packet of candies and this will lead to quarrels or even fights among children. She wants to avoid this. Therefore, she has decided to open all the packets, count the candies in each packet and move some candies from bigger packets to smaller ones so that each packet will contain the same number of candies. The question is how many candies she has to move.

#### Input specification

The input file consists of several blocks of data. Each block starts with the number of candy packets  $N$  ( $1 \leq N \leq 10000$ ) followed by  $N$  integers (each less than 1000) in separate lines, giving the number of candies in each packet. After the last block of data there is the number -1.

#### Output specification

The output file should contain one line with the smallest number of moves for each block of data. One move consists of taking one candy from a packet and putting it into another one. If it is not possible to have the same number of candies in each packet, output the number -1.

#### Example

**Input file:**

```
5
1
1
1
1
6
2
3
4
-1
```

**Output file:**

```
4
-1
```

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: IPSC 1999



## SPOJ Problem Set (classical)

### 2125. Number Labyrinth

#### Problem code: LABYR2

Fred is a robotic mouse built by a group of students of artificial intelligence. Fred can move around in the labyrinth shown in the picture below. Whenever Fred comes to a place marked by a number, he has to choose one of the possible directions. Behavior of the mouse should look chaotic and complex enough so that it will impress students' supervisor.

```
+-----4
|       |
|  8--9  |
|  |  |  |
2--7--0  |
|  |  |  |
1  6-----+
```

Numbered places in the labyrinth are called nodes. Fred has one integer  $X$  stored in its memory and can perform some calculations. In each node (except node 1) he chooses a direction according to  $X$ , decreases  $X$  by 1 and goes to the chosen node. The direction is chosen according to this rules:

Node 2: Compute  $X \bmod 3$ .

    If the result is 0, go to 7  
        1, go to 1  
        2, go to 4.

Node 4: Let  $Y$  be  $X$  written backwards (in decimal system).

    If  $Y > X$  then go to 6 otherwise go to 2.

Node 6: Compute the number of digits of  $X$  (in decimal system).

    If the result is even then go to 4 otherwise go to 7.

Node 7: Compute  $(X \cdot X) \bmod 7$ .

    If the result is 0 go to 2  
        1 go to 6  
        2 go to 8  
        4 go to 0.

Node 8: Compute  $X \bmod 5$ .

    If the result is 2 or 3 then go to 7 otherwise go to 9.

Node 9: If you have come from 8 then go to 0.

    If you have come from 0 then go to 8.

Node 0: Let  $Y$  be the third least significant digit of  $X$  in decimal system

    (if  $X < 100$  then  $Y = 0$ ). If  $Y \leq 7$  then go to 7 otherwise go to 9.

At the beginning of each experiment, the experimenter puts the mouse in the node 0 and initializes value  $X$  by voice. After that, the mouse starts to move. The mouse displays current value of  $X$  on its digital display. The experiment finishes when the mouse enters the node 1, the result of the experiment is the number displayed. If the value of  $X$  decreases to zero, the experiment fails and its result is -1.

## Input file description

The input file contains several initial values of X (less than two-million) as they were told by the experimenter.

## Output file description

For each value of X in the input file write to a separate line of the output file the result of the corresponding experiment (see example output).

## Example

### Input file:

```
thirteen
fourteen
one-thousand
one-million-three-hundred-and-twenty-five-thousand-nine-hundred-and-seventy-nine
```

### Output file:

```
-1
9
789
1325784
```

**Blue Mary's Note:** new test cases were added on Jun.6, 2008.

**Another Note:** One of the test cases has something wrong & it has been fixed in Jul. 19, 2008. Thanks to Robert Gerbicz and Stephen Merriman's discussion in the forum.

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 1999

## SPOJ Problem Set (classical)

### 2127. Rain

#### Problem code: RAIN3

Doctor Jones is a famous archeologist. He did some research on the Tiribaki Islands recently. His most famous discovery was the Meteoronome - a machine with a yellow button used by the Tiribakian highest priest to predict the weather. The Meteoronome had been set up by the gods at the Beginning of Time. Tiribakians pressed the button every day. As a result, the Meteoronome produced a number - the expected rainfall in millimetres for the next day. More precisely, after  $i$  button hits (counted since the Beginning of Time) Meteoronome gives the expected rainfall for the day  $i$  since the Beginning of Time.

Unfortunately, the Meteoronome has not been used for several thousands of years and nobody knows how many steps should be performed to reach the current date. Researchers have spent a lot of effort to find out how the Meteoronome works. A mathematical model has been proposed: The Meteoronome is initialized by a pair of integers,  $s[0]$  and  $t[0]$ . For the  $i$ -th step, the Meteoronome computes the values

```
s[i] = (78901 + 31*s[i-1]) mod 699037
t[i] = (23456 + 64*t[i-1]) mod 2097151
```

The output of the  $i$ -th step is the number

```
a[i] = (s[i] mod 100 + 1) * (t[i] mod 100 + 1)
```

Doctor Jones's friend, Ms. Linda Watson, is now planning a holiday on Tiribaki Islands. She would like to stay there as long as possible but she hates the rain. She can stand no more than  $M$  millimetres of rainfall during her entire stay on Tiribaki.

Doctor Jones wants to help his friend and to compute the longest period which she can safely stay on Tiribaki. He simulated  $N$  steps of the Meteoronome. This way, he obtained a sequence of numbers  $a[1], a[2], \dots, a[N]$  which represent predictions for  $N$  subsequent days. Now he wants to find the largest  $K$  such that for each period of at most  $K$  subsequent days from day  $i$  to day  $j$  the sum of the predictions  $a[i] + a[i+1] + \dots + a[j]$  is less than or equal to  $M$ . Linda can be sure that if she stays on Tiribaki for at most  $K$  days, she can endure the rain (provided that  $N$  is large enough).

#### Input specification

The input file consists of several blocks of data. The first line of the input file contains the number of blocks. Each block contains four integers delimited by whitespace:  $s[0]$ ,  $t[0]$  - the initial values for the Meteoronome,  $N$  ( $1 \leq N \leq 1500000$ ) - the length of the sequence and  $M$  - the maximum sum of a subsequence. All the input data fits into 32-bit signed integer.

## Output specification

The output file contains one line for each block of input data. In this line there is a single integer  $K$  as specified above.

## Example

**Input file:**

```
1
123456 123456 10 10000
```

**Output file:**

```
2
```

Note, that the sequence produced by Meteoronome for this input file is 4664,1248,267,4900,837,4048,990,6935,1155,490. No subsequence of length 2 has sum greater than 10000 and there are subsequences of length 3 with greater sum.

---

Added by: Blue Mary

Date: 2007-12-01

Time limit: 2s

Source limit:50000B

Languages: All except: C99 strict

Resource: IPSC 1999

## SPOJ Problem Set (classical)

### 2129. Cake

#### Problem code: CAKE2

Some time ago a VERY huge cake was made in the village called Nalomena Trieska. Well, it was infinitely large and infinitely thin. For our needs it looked exactly like an infinite plane. It was not very tasty, so nobody wanted to eat it. Instead, local children started to play with it. Each of them drew one straight line on the plane. These lines divided the plane into many parts. For a few hours the children were happy, they jumped from one part into another and played other similar games. But then little Tommy suddenly asked: "How many parts does the cake have?" "1999." answered Martin. "No, 2000 !" replied Richard. "Well, I think it's only 1748." stated Michael. And they started to argue. Now their parents need your help, because the children spend all their time counting the parts of the cake.

#### Input file specification

The first line of the input file contains the number of straight lines  $N$  ( $N \leq 3000$ ). Each of the next  $N$  lines contains four integers  $x_1, y_1, x_2, y_2$  (the absolute value of each number is at most 10000). These integers are the coordinates of two different points in the plane  $[x_1, y_1]$  and  $[x_2, y_2]$ . These two points determine one straight line in the plane. You can assume that no two straight lines are the same.

#### Output file specification

The output file contains a single integer giving the number of parts into which given  $N$  lines divide the plane.

#### Example

**Input file:**

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

**Output file:**

```
9
```

**Added some unofficial test cases.**

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s-7s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2000

## SPOJ Problem Set (classical)

### 2130. Trolls

#### Problem code: TROLLS

In a secret forest, there are many trolls. They are intelligent and most of them even knows programming languages C or PASCAL. They have written many programs. With their super computers, their programs will run for a very short time and they can get the correct answer. Being an excellent programmer, you can even come up with the answer without computers!!!

#### Input

There's no real input file. The four programs can be downloaded [here](#).

#### Output

For **program1.txt** and **program2.txt** in the zip file:

Your output should contain a single integer denoting the number of "\*" the program will output.

For **program3.txt** and **program4.txt** in the zip file:

Your output should contain a single integer denoting the number the program will output.

You can merge the 4 output lines together to get the real output file and submit it.

#### Example

If **program1.txt** is

```
var i:integer;
begin
  for i:=2 to 8 do write('*');
end.

#include <stdio.h>
void main() {
  int i;
  for(i=2; i<=8; i++) printf("*");
}
```

The corresponding line should be:

7

If **program3.txt** is

```
var a, i: integer;

begin
  a := 0;
```

```
for i:= 1 to 9 do
  a := a * 10 + i;
writeln(a);
end.
```

```
#include <stdio.h>
```

```
void main() {
  int i, a;
  a = 0;
  for(i=1; i<=9; i++)
    a = a * 10 + i;
  printf("%d\n", a);
}
```

The corresponding line should be

123456789

## Note

The numbers fit into the type "int" in C program or "integer" in PASCAL program in the zip file can be arbitrarily large because the computers used by trolls are **super computers**.

---

Added by: Blue Mary

Date: 2007-12-01

Time limit: 1s

Source limit:50000B

Languages: TEXT

Resource: IPSC 2000 and IPSC 2001

## **SPOJ Problem Set (classical)**

### **2131. Get Back!**

#### **Problem code: GETBACK**

Somewhere deep in a desert lives a small, completely forgotten tribe N'Gubara. All the men, women and children of the tribe live with a few camels in the N'Gubara oasis (the N'Gubara people don't have great creativity when it comes to geography names). These poor people have only the N'Gubara well, a few acres of irrigated land and the N'Gubara cave. Yes, the cave.

You do not remember exactly how you have come to N'Gubara. Maybe your car broke when you travelled across the desert. Maybe you jumped out of an airplane. Maybe you were brought here by Martians. But this does not matter now. You know that you are here, pretty far from any civilization. And you desperately want to go home.

The only possibility how to get home is to walk across the desert to Desertville, the closest city. You have to use paths in the desert shown in your map. Each such path connects two restpoints. The N'Gubara oasis and Desertville are also considered to be restpoints. You can walk, but you need water. For each mile travelled, you have to drink one unit of water. You are able to carry at most  $C$  units of water at once. Thus, you can never walk more than  $C$  miles without replenishing your water supply. The shortest way to Desertville is probably much longer than  $C$  miles. It would thus seem that you will stay in N'Gubara forever, but there's a trick: at the end of each path, there is a restpoint with an empty water reservoir. You can transport water into a reservoir from N'Gubara or from other reservoirs where you stored some water previously. You can then use the stored water later on (the water doesn't evaporate). Of course, you can take only as much water from any reservoir as you brought into it. You may use as much water from the N'Gubara oasis as you need, but since water is very valuable in the desert, you promised that you will use only the minimal amount needed for your return to Desertville. In this task, we want you to compute the minimal amount of water you need.

#### **Input file specification**

Input contains several test cases, the number of them is given in the very first line.

The first line contains three integers  $N$ ,  $M$  and  $C$ , where  $N$  is the number of the restpoints,  $M$  is the number of the paths and  $C$  is your carrying capacity.  $M$  lines follow, each describing one path on the map. Each line contains three numbers  $x$ ,  $y$  and  $l$ , where  $x$  and  $y$  are the restpoints joined by a path and  $l$  is the length of that path in miles. The restpoints are numbered from 1 to  $N$ , where restpoint 1 is the N'Gubara oasis and restpoint  $N$  is Desertville.

You may assume all the numbers in the input file are non-negative integers less than 100.

#### **Output file specification**

For each test case:

Your output file should contain a single integer - the minimum amount of water needed for you to get from N'Gubara to Desertville. If there is no possibility how to get to Desertville with your current carrying capacity  $C$ , you should output the number -1.



## Example

### Input file:

```
1
9 10 25
1 2 3
2 3 12
3 4 4
3 5 9
4 9 13
5 9 5
2 6 10
6 7 10
7 8 10
8 9 10
```

### Output file:

```
65
```

Note: You can get to Desertville as follows: first you take 25 units of water from N’Gubara, go to restpoint 2, leave there 19 units in the reservoir and go back to N’Gubara. Then you repeat this trip, bringing additional 19 units to restpoint 2. Last, you take 15 units from N’Gubara to restpoint 2. Now you have  $19+19+12 = 50$  units of water here. You take a round trip to point 3 and back, leaving there 1 unit of water. Now you take all water left from point 2, go to point 3, take the one unit from point 3 (now you have  $25-12+1=14$  units) and go via restpoint 5 to Desertville.

---

Added by: [Trichromatic] XilinX

Date: 2007-12-01

Time limit: 1s

Source limit: 50000B

Languages: All except: C99 strict ERL TECS JS

Resource: IPSC 2000

## SPOJ Problem Set (classical)

### 2132. Puzzle

#### Problem code: PUZZLE2

Sam loves all kinds of puzzles. Recently he received a very special puzzle - a grid of  $N \times M$  squares, each square is occupied either by a red or by a blue pebble. The puzzle is controlled by several buttons.

Each row of the grid has its corresponding black button. When you press a black button, a complicated mechanism of the puzzle flips the colors of all pebbles in the row corresponding to that button (all red pebbles in this row become blue and vice versa).

Each column of the grid has its corresponding white button. When you press exactly two white buttons simultaneously, the puzzle mechanism exchanges the contents of the two columns corresponding to those buttons without changing the order of the pebbles in the columns.

Sam has found the puzzle very interesting. Unfortunately, he lent it to his daughter Ann yesterday. She was able to understand the idea of the puzzle very quickly and she gave him this teasing task. She drew two arrangements - initial and final and she changed the colors of the pebbles according to the initial arrangement. Sam's task is to decide whether there exists a sequence of puzzle operations which transforms the initial arrangement of the puzzle to the final arrangement.

#### Input file specification

The input file contains several blocks of input data. The first line of the input file contains  $K$  - the number of blocks. The first line of each block contains integers  $N$  ( $1 \leq N \leq 100$ ) and  $M$  ( $1 \leq M \leq 100$ ). Each of the next  $N$  lines contain  $M$  words (either RED or BLUE), describing the initial Ann's arrangement of the colors of the pebbles. One blank line follows. The next  $N$  lines contain  $M$  words corresponding to the final arrangement of the colors.

#### Output file specification

The output file contains  $K$  lines, the  $i$ -th line corresponds to the  $i$ -th block of the input data. Each line contains either YES or NO, the answer to the Ann's question.

#### Example

**Input file:**

```
2
3 4
BLUE RED BLUE RED
RED BLUE BLUE RED
BLUE BLUE BLUE BLUE

BLUE RED BLUE RED
RED RED BLUE BLUE
BLUE BLUE BLUE BLUE
2 2
BLUE BLUE
```

BLUE RED

RED RED

RED RED

**Output file**

YES

NO

Note: In the first block of the input data it suffices to use the black button for the second row and then to press the white buttons for the first and the third columns simultaneously.

---

Added by: Blue Mary

Date: 2007-12-01

Time limit: 2s

Source limit:50000B

Languages: All except: C99 strict

Resource: IPSC 2000

## SPOJ Problem Set (classical)

### 2136. Candy II

#### Problem code: CANDY2

Little Michael loves candies. Most of all, he likes chocolate, strawberry and banana flavored ones. No wonder that he has candy bags everywhere - there are at least four bags on his table, one or two in the pockets of his jeans, and one under his bed (just in case). Each bag contains some candies of all three flavors. Whenever he wants to eat a candy, he finds the nearest bag (which is usually is not very far because he has really A LOT of them) and eats the candy he wants.

Yesterday, he wanted a strawberry one, so he opened one of his bags and... It is almost impossible to describe how great his disappointment was when he found out that there were no strawberry candies left in that bag. To make the matters worse, there were also none in the second bag he found. He was sure that he had lots of strawberry candies left, but he didn't know in which bags they were. Therefore, he decided to reorganize his candies, and keep the candies of the three different flavors in three distinct bags. He brought all his bags into the center of his room and realized, that there are really an awful lot of them.

Michael has  $N$  bags full of candies. He knows the number of candies of each flavor in each bag. He wants to put all chocolate ones into one bag, all strawberry ones into another bag and all banana ones into yet another bag. He has to move the candies one-by-one, because he always has to look at it to determine its flavor. Moving one candy from one bag into another takes 1 second. Your task is to select the bag for each flavor, so that the total time required for Michael to move all the candies into their bags would be minimal.

#### Input file specification

The first line of the input file contains a single integer  $N$  - the number of bags ( $N \leq 5000$ ). Each of the following  $N$  lines consists of three numbers  $c_i$ ,  $s_i$ ,  $b_i$  - the numbers of chocolate, strawberry and banana candies in the  $i$ -th bag. The bags are numbered from 0 to  $N-1$  in the order in which they appear in the input.

#### Output file specification

Output file should contain three lines with the following text:

```
C[Bag for chocolate candies]
S[Bag for strawberry candies]
B[Bag for banana candies]
```

The numbers  $C$ ,  $S$ ,  $B$  have to be such that the total number of the required moves is minimal. If there are more solutions, you may choose any of them.

## Example

### Input file:

```
5
10 10 10
40 39 40
10 20 30
30 20 10
1 2 27
```

### Output file:

```
3
1
2
```

Note: In this case Michael has to move 200 candies. If the bags for the different flavors were chosen in any other way, he would have to move more than 200 candies.

**Note: the test data is very naive for this problem.**

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2001

## SPOJ Problem Set (classical)

### 2138. Pibonacci

#### Problem code: PIB

You might have heard of the Fibonacci numbers and of the number **pi**. If you let these two ideas merge, a new and esoteric concept comes into being: **the Pibonacci numbers**. These can be defined for real  $x \geq 0$  by:

$$\begin{aligned} P(x) &= 1 && \text{for } 0 \leq x < 4 \\ P(x) &= P(x-1) + P(x-\pi) && \text{for } 4 \leq x, \end{aligned}$$

where  $\pi = 3.1415926535\dots$ . In this problem, you are asked to compute  $P(x)$  for a given  $x$ .

#### Input file specification

The input file contains several non-negative integer numbers (less than 30000) each on a separate line. The last line contains -1 marking the end of the input file.

#### Output file specification

For each non-negative real number in the input file, output the corresponding Pibonacci number. If the Pibonacci number be more than 50 digits long, divide it on the consecutive lines, outputting 50 digits on each (the last line may contain less digits).

#### Example

##### Input file:

```
0
4
11
-1
```

##### Output file:

```
1
2
20
```

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 42s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2001; standard program and test data by Blue Mary

## SPOJ Problem Set (classical)

### 2139. Gossipers

#### Problem code: GOSSIPER

Doulnee Keltchow is a small town in the middle of nowhere; what makes it so famous is the number of gossipers who live there. Every morning, each gossiper finds out a new gossip, a gossip so unique that nobody else in the town knows it. The gossipers talk, gossip and exchange rumors all day long. What happens when two gossipers meet? Of course, they exchange all the gossips they have heard so far. Your task is to determine whether every gossiper will know all the gossips by the end of the day.

#### Input file specification

The input file consists of multiple test cases separated by blank lines. On the first line of every test case there are two positive integers  $N$  ( $1 \leq N \leq 2100$ ) and  $M$  ( $1 \leq M \leq 12000$ ), where  $N$  is the number of gossipers and  $M$  is the number of meetings. On the next  $N$  lines there are the names of the gossipers. The name of each gossiper is a single word consisting of lower- and uppercase letters. The following  $M$  lines describe the meetings in the order they happened. Each meeting is described by two distinct names of the gossipers separated by a single space. The values  $M=N=0$  indicate the end of the input file.

#### Output file specification

The output file should contain for each test case one line containing a single word "YES" if every gossiper knows all the gossips, or "NO", otherwise.

#### Example

**Input file:**

```
3 3
Alice
Bob
Cindy
Alice Bob
Bob Cindy
Cindy Alice
```

```
4 4
Kirk
Lucy
Mike
Nancy
Kirk Lucy
Lucy Mike
Mike Nancy
Nancy Lucy
```

```
0 0
```



**Output file:**

YES

NO

---

Added by: Blue Mary

Date: 2007-12-01

Time limit: 2s

Source limit:50000B

Languages: All except: C99 strict

Resource: IPSC 2001

## **SPOJ Problem Set (classical)**

### **2140. (un)Fair Play**

#### **Problem code: FAIRONOT**

It is not an easy job to be a coach of a football team. Especially if you do not coach great teams like Ajax, Inter, Dynamo (ok, fill in the name of your dream team), but only a mediocre one like FC Dead Horse, playing in the second league. The season is almost over, only a few matches are left to play. All of sudden the team manager comes to you and tells you bad news: the main sponsor of your club is not happy with your results and decided to stop sponsoring your team, which probably means the end of your club. The sponsor's decision is final and there is no way to change it unless... unless your team miraculously wins the league.

The manager left you in deep thought. If you increase the number of practices and offer players a generous bonus for each match, you may be able to win all the remaining matches. Is that enough? You also have to make sure that teams with many points lose against teams with few points so that in the end, your team will have more points than any other team. You know some of the referees and can bribe them to manipulate the result of each match. But first you need to figure out how to manipulate the results and whether it is possible at all.

#### **Problem Description**

There are  $N$  teams numbered 1 through  $N$ , your team has the number  $N$ . The current number of points of each team and the list of remaining matches are given. Your task is to find out whether it is possible to manipulate each remaining match so that the team  $N$  will finish with strictly more points than any other team. In every match, the winning team gets 2 points, the losing team gets 0. If the match ends with a draw, both teams get 1 point.

#### **Input file specification**

The input file consists of several blocks. Each block has the following form: The first line contains two numbers  $N$  ( $1 \leq N \leq 100$ ) and  $M$  ( $0 \leq M \leq 1000$ ). The next line contains  $N$  numbers separated by spaces giving the current number of points of teams 1, 2, ...,  $N$  respectively. The following  $M$  lines describe the remaining matches. Each line corresponds to one match and contains two numbers  $a$  and  $b$  ( $a \neq b$ ) identifying the teams that will play in the given match. The last block is followed by a "-1" (without quotes) on a separate line.

#### **Output file specification**

For each block in the input file, output YES if you can manipulate the remaining matches so that the team  $N$  would win the league, or NO otherwise.

## Example

### Input file:

```
5 8
2 1 0 0 1
1 2
3 4
2 3
4 5
3 1
2 4
1 4
3 5
5 4
4 4 1 0 3
1 3
2 3
3 4
4 5
-1
```

### Output file:

```
YES
NO
```

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 3s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2002

## SPOJ Problem Set (classical)

### 2141. Golden Garden

#### Problem code: GARDEN

Little Jelly is playing in the Golden Garden alone. She is such a pretty girl that the Evil Uncle wants to catch her. The Evil Uncle drives his flying saucer over the Golden Garden and tries to inhale Little Jelly.

It is known that the Golden Garden is a perfect rectangle and the Evil Uncle's flying saucer can inhale her if and only if she is in a circle with a certain radius around the flying saucer.

Your task is to avoid the Evil Uncle catching Little Jelly. First of all, you should find out the common area of the garden and the inhaling circle.

#### Input

There are multiple test cases in the input file. First line of each test case are three integers  $x$ ,  $y$  and  $r$ , for the coordinate of the center of the inhaling circle.

The second line contains four integers  $x_1$ ,  $y_1$ ,  $x_2$  and  $y_2$ . Which are the coordinate of the Golden Garden. The Golden Garden is such a perfect rectangle so that its sides are parallel to the axis.

All numbers in the input are integers and do not reach 1000 by their absolute values. Sides of the Golden Garden are non-zero.

#### Output

For each test case, output only one line with one real number which is the common area of the garden and the circle. Your answer must be accurate up to 0.000001.

#### Note

There are two input files for this problem. If you get Wrong Answer, click on the "wrong answer" to get more details. For each test file, my judge will give you the id of the test case for which your program gives a wrong response.

#### Example

**Input :**

```
0 0 5
3 3 7 7
```

**Output :**

```
0.547426365104
```

**Warning: enormous input/output data, be careful with certain languages**

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 7s-13s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Description, standard program & test data by g201513

## SPOJ Problem Set (classical)

### 2142. Arranging Flowers

#### Problem code: FLOWERS

Bratislava has a long tradition in organizing an international flower exhibition - Flora. Professor Andrew as a true flower lover visited the Flora exhibition also this year. He was pleased by the most beautiful flowers and other plants of the world - roses, orchids, magnolias, cactuses. All flowers were nicely arranged.

The flower arrangement that was the most appealing to him (at least mathematically) was composed of many kinds of flowers arranged in a rectangular grid, such that each row of the grid contained each kind of flowers exactly once and each column of the grid contained each kind of flowers at most once.

Professor Andrew is a good mathematician and soon he realized that the number of columns of the grid has to be the same as the number of different kinds of flowers in the arrangement. But soon he encountered a problem he was unable to solve: He would like to add more rows of flowers to the arrangement without violating the rules stated above. (Note that he may not modify the existing rows and therefore he may not use any new kinds of flowers in the new rows.) Help him add as many rows as possible!

#### Input file specification

The input data set describes several flower arrangements; on the first line their number is given. Each flower arrangement description begins with two positive integers  $N$  ( $1 \leq N \leq 220$ ) and  $M$ , representing the number of columns and rows of the grid. The different kinds of flowers are represented by numbers  $1, 2, \dots, N$ . The following  $M$  lines contain  $N$  integers each representing the kinds of flowers in one row of the arrangement.

#### Output file specification

For each flower arrangement, output  $K$  in the first line, then print  $K$  lines containing  $N$  numbers each, where  $K$  is the maximum number of lines that can be added to the arrangement, describing the added rows. The numbers in the output file may be separated by **exactly one** space. If there are multiple number of solutions, you must output the **lexicographically first** solution.

Print a blank line after each test case.

There is no special judge program for this problem.

#### Example

**Input :**

2

3 2  
3 2 1  
1 3 2

```
4 2
1 4 3 2
2 1 4 3
```

**Output :**

```
1
2 1 3

2
3 2 1 4
4 3 2 1
```

---

Added by: Xilinx

Date: 2007-12-01

Time limit: 35s

Source limit:50000B

Languages: All except: C99 strict ERL JS

Resource: IPSC 2003

## SPOJ Problem Set (classical)

### 2143. Dependency Problems

#### Problem code: DEPEND

We bought a brand new computer and now we would like to install an operating system. The only problem is that our chosen operating system consists of many packages and they cannot be installed in an arbitrary order. E.g. you cannot install the package tuxracer, which depends on the package libSDL, before you install libSDL. But libSDL can depend on another packages and so on. The packages may only be installed one at a time. You may install a package only if you already installed all packages it depends on. Your task is to determine how many packages can be installed on our computer.

#### Input file specification

The input file contains a single line for each available package. The line for each package P begins with the name of the package. The name of each package is a non-empty string of printable characters containing no spaces. Following the name of the package P is the dependency list of P. The dependency list is simply a list of names of packages that P depends on, separated by spaces. A whitespace followed by a single 0 (zero) is at the end of each line. You may assume that no package has the name '0'.

The dependency list of a package P may be empty; in that case, P does not depend on any packages and may be installed immediately. It is possible that a package Q occurs in the dependency list of a package P more than once; this merely means that P depends on Q, nothing more. Only the packages that have a dependency list in the input file are available and may be installed. It is possible that a package P depends on a package that is not available. Such a package cannot be installed.

The number of lines in the input file will be less than 9000.

#### Output file specification

The output consists of one number -- the maximum number of packages that may be installed on the computer.

#### Example

##### Input file

```
a b c b 0
b c 0
c 0
d e f 0
e f 0
f e 0
g h 0
```

##### Output file

```
3
```

#### Note



Package c can be installed immediately. Package b depends only on c, and hence can also be installed once we installed c. Finally, package a depends only on b and c and can now also be installed. It is easy to verify that no other packages can be installed.

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s-5s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: IPSC 2003

## SPOJ Problem Set (classical)

### 2144. K Edge-disjoint Branchings

#### Problem code: FOREST

Given a directed graph, may contains repeated edges. We assume that the graph contains and only contains K edge-disjoint branchings rooted by node 0.

A branching for a graph is a set of directed edges that from a certain root (root, in this problem, is node 0) we can find one path to every other node in the graph by only the edges in the branching.

K edge-disjoint branching is K branchings that share no common edges.

Your task which is easy and funny is to find out the K branchings.

#### Input

The first line of input contains a single integer T, ( $T \leq 20$ ), denoting the number of test cases.

For each test case:

The first line contains two integers N and K, ( $2 \leq N \leq 500, 2 \leq K \leq 6$ ), which is the number of the nodes in the graph and the number of edge-disjoint branchings.

Then next  $(N-1) \cdot K$  lines contains the information about the edges. There are 2 integers X and Y in every line, meaning there exist an edge from X to Y in the graph.

#### Output

You should output the branchings you have found.

For every test cases, print the number of test case at the start of output, then you should output K lines.

Each line is about a branching which contains N-1 integers that the ID of the edges in this branching.

The ID of edges starts with 0. Every edge will appear and only appear once in the output.

See samples for further details.

#### Example

**Input :**

```
22 20 10 13 20 10 22 11 2
```

**Output :**

```
Case 1:01Case 2:0 31 2
```

**Test data have been enhanced.**

---

Added by: [Trichromatic] XilinX

Date: 2007-12-01

Time limit: 20s

Source limit:50000B

Languages: All except: C99 strict ERL TECS JS

Resource: g201513

## SPOJ Problem Set (classical)

### 2147. Root of a Linear Equation

#### Problem code: ROOT

Given two nonnegative integers  $a$  and  $b$ , you are to generate the solution of the equation  $b \cdot x = a$ .

#### Input

The number of test cases is given in the very first line. For each test case there is a single line containing two integers  $a$  and  $b$  without any leading zeroes, separated by a single space.

*Tip:* For more than 95% of test cases, **int** in C/C++/Java or **longint** in Pascal is enough.

The input file is about 1.4 KB.

#### Output

For each test case, output a single line containing the root in decimal cyclic notations, or "Invalid Input!!!" (without quotes) if the solution is not unique or the solution doesn't exist. See the example for more details.

The output file is about 1.3MB.

#### Example

##### Input :

```
8
1 1
1 2
1 3
1 4
1 6
24 2
15 7
1 89
```

##### Output :

```
1.0
0.5
0.(3)
0.25
0.1(6)
12.0
2.(142857)
0.(01123595505617977528089887640449438202247191)
```

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 15s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: UVA 942; USACO 79; test data by Blue Mary

## SPOJ Problem Set (classical)

### 2148. Candy III

#### Problem code: CANDY3

A class went to a school trip. And, as usually, all  $N$  kids have got their backpacks stuffed with candy. But soon quarrels started all over the place, as some of the kids had more candies than others. Soon, the teacher realized that he has to step in: "Everybody, listen! Put all the candies you have on this table here!"

Soon, there was quite a large heap of candies on the teacher's table. "Now, I will divide the candies into  $N$  equal heaps and everyone will get one of them." announced the teacher.

"Wait, is this really possible?" wondered some of the smarter kids.

#### Problem specification

You are given the number of candies each child brought. Find out whether the teacher can divide the candies into  $N$  exactly equal heaps. (For the purpose of this task, all candies are of the same type.)

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case looks as follows: The first line contains  $N$  : the number of children. Each of the next  $N$  lines contains the number of candies one child brought.

#### Output specification

For each of the test cases output a single line with a single word "YES" if the candies can be distributed equally, or "NO" otherwise.

#### Example

**Input :**

```
2

5
5
2
7
3
8

6
7
11
2
7
```

3  
4

**Output :**

YES

NO

**Note: the input file will not exceed 1MB.**

---

Added by: Blue Mary

Date: 2007-12-01

Time limit: 1s-2s

Source limit:50000B

Languages: All except: C99 strict

Resource: IPSC 2006

## SPOJ Problem Set (classical)

### 2149. Biased Standings

#### Problem code: BAISED

Usually, results of competitions are based on the scores of participants. However, we are planning a change for the next year of IPSC. During the registration each team will be able to enter a single positive integer : their preferred place in the ranklist. We would take all these preferences into account, and at the end of the competition we will simply announce a ranklist that would please all of you.

But wait... How would that ranklist look like if it won't be possible to satisfy all the requests?

Suppose that we already have a ranklist. For each team, compute the distance between their preferred place and their place in the ranklist. The sum of these distances will be called the badness of this ranklist.

#### Problem specification

Given team names and their preferred placements find one ranklist with the minimal possible badness.

#### Input specification

The first line of the input file contains an integer **T** specifying the number of test cases. Each test case is preceded by a blank line.

Each test case looks as follows: The first line contains **N** : the number of teams participating in the competition. Each of the next **N** lines contains a team name (a string of letters and numbers) and its preferred place (an integer between 1 and **N**, inclusive). No two team names will be equal.

#### Output specification

For each of the test cases output a single line with a single integer : the badness of the best ranklist for the given teams.

#### Example

**Input :**

2

7

noobz 1  
llamas 2  
Winn3rz 2  
5thwheel 1  
NotoricCoders 5  
StrangeCase 7  
WhoKnows 7

3

ThreeHeadedMonkey 1

MoscowSUX13 1  
NeedForSuccess 1

**Output :**

5  
3

**Explanation:**

In the first test case, one possible ranklist with the minimal badness is:

1. noobz  
2. llamas  
3. Winn3rz  
4. 5thwheel  
5. NotoricCoders  
6. WhoKnows  
7. StrangeCase

In the second test case all ranklists are equally good.

**Note: the input file will not exceed 5MB.**

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s-3s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: IPSC 2006



## SPOJ Problem Set (classical)

### 2150. Counting Subsequences

#### Problem code: SUBSEQ

"47 is the quintessential random number," states the 47 society. And there might be a grain of truth in that.

For example, the first ten digits of the Euler's constant are:

2 7 1 8 2 8 1 8 2 8

And what's their sum? Of course, it is 47.

Try walking around with your eyes open. You may be sure that soon you will start discovering occurrences of the number 47 everywhere.

#### Problem specification

You are given a sequence **S** of integers we saw somewhere in the nature. Your task will be to compute how strongly does this sequence support the above claims.

We will call a **continuous** subsequence of **S** interesting if the sum of its terms is equal to 47.

E.g., consider the sequence **S** = (24, 17, 23, 24, 5, 47). Here we have two interesting continuous subsequences: the sequence (23, 24) and the sequence (47).

Given a sequence **S**, find the count of its interesting subsequences.

#### Input specification

The first line of the input file contains an integer **T** specifying the number of test cases. Each test case is preceded by a blank line.

The first line of each test case contains the length of a sequence **N**. The second line contains **N** space-separated integers : the elements of the sequence.

#### Output specification

For each test case output a single line containing a single integer : the count of interesting subsequences of the given sentence.

#### Example

Input :

2

13

2 7 1 8 2 8 1 8 2 8 4 5 9

7  
2 47 10047 47 1047 47 47

**Output :**

3  
4

**Note: the input file will not exceed 4MB.**

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 3s-5s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: IPSC 2006

## SPOJ Problem Set (classical)

### 2151. Digital Calculator

#### Problem code: CALCULAT

Dan likes playing with his pocket calculator during those long, boring math classes. Just now the teacher started to talk about the factorial function.

$N$  factorial, denoted by  $N!$ , is the product of all the integers between 1 and  $N$ , inclusive. For example  $6! = 6*5*4*3*2*1 = 720$ .

Dan took out his calculator out of his pocket to play around with this new function. Unfortunately his calculator quickly ran out of digits and only showed overflow errors. Soon, Dan realized that the factorial function grows very quickly. Still, he would like to know at least some of its digits.

#### Problem specification

Given three positive integers  $N(1 \leq N \leq 10^8)$ ,  $K(1 \leq K \leq 50)$ ,  $L(1 \leq L \leq 100)$ , compute the first  $K$  digits and the last  $L$  digits of  $N$  factorial.

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case consists of one line containing three positive integers  $N$ ,  $K$  and  $L$  separated by single spaces. Neither  $K$  nor  $L$  will exceed the number of digits in  $N!$ .

#### Output specification

For each test case output one line containing two strings  $A$  and  $B$  separated by a single space. Here,  $A$  is the string composed of the first  $K$  digits of  $N!$  and  $B$  is the string composed of the last  $L$  digits of  $N!$ .

#### Example

**Input :**

3

6 2 1

10 3 2

8 5 5

**Output :**

72 0

362 00

40320 40320

**Note : for all test cases whose  $N \geq 100$ , its  $K \leq 15$ .**

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s-10s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2006

## SPOJ Problem Set (classical)

### 2152. Hilbert Curve

#### Problem code: FRACTAL

The Hilbert Mole is a small and very rare mole. The first and only specimen was found by David Hilbert at his backyard. This mole lives in a huge burrow under the ground, and the border of this burrow forms a Hilbert curve of  $n$ -th order ( $H_n$ ).

[IMAGE]

Figure 1. Hilbert curves, order 1 to 4.

Hilbert curves can be defined as follows.  $H_1$  is a unit square with open top side (figure 1(a)),  $H_n$  consists of four copies of  $H_{n-1}$ : bottom left and bottom right are copied without changes, top left is rotated  $90^\circ$  counter-clockwise and top right is rotated  $90^\circ$  clockwise. These small copies are connected by three segments of unit length (figure 1(b),(c),(d)).

[IMAGE]

Figure 2. Burrow, filled with water.

Trying to exterminate the mole, Mr. Hilbert fills the burrow with water (figure 2). But air inside the burrow prevents water from filling it entirely. In this problem we suppose that air and water are incompressible and cannot leak through the borders of the burrow. Your task is to find the total area of the burrow, filled with water.

Note that water can flow over the obstacle only when its level is strictly higher. See examples on figure 3 for further clarification.

[IMAGE]

Figure 3. More examples of filled burrows.

#### Input

Multiple test cases. For each test case:

The first line of the input file contains two integer numbers:  $n$  and  $\alpha$  - order of Hilbert curve and slope angle of surface in degrees ( $1 \leq n \leq 12$ ,  $0 \leq \alpha < 90$ ).

Input terminates by EOF.

#### Output

For each test case:

The first line of the output file must contain a single real number - the total area of the burrow, filled with water. The relative error of the answer must not exceed  $10^{-6}$ .

## Example

**Input :**

```
5 30
3 45
4 10
3 0
```

**Output :**

```
190.803847577293
15.5
91.573591766702
26.0
```

---

Added by: [Trichromatic] XilinX

Date: 2007-12-01

Time limit: 3s

Source  
limit: 50000B

Languages: All except: C99 strict ERL TECS JS

Resource: ACM/ICPC Northeastern Europe Programming Contest(Northern Subregional) 2008,  
with description modified

## SPOJ Problem Set (classical)

### 2153. Internet is Faulty

#### Problem code: IMATCH

David has a problem. He wants to transfer a big file through the internet from his home computer to his computer at work. The size of his file is  $S$  kilobytes.

The internet consists of  $N$  computers, numbered from 1 to  $N$ . David's home computer has the number 1 and his computer at work has the number 2. Some pairs of computers are connected by different types of links (such as network cables or wi-fi). Some of these links (e.g., a satellite dish) may be unidirectional, thus for simplicity we will assume that all links are unidirectional.

The data are sent across the network in packets, each packet contains exactly one kilobyte of data. For each link David knows how faulty it is, i.e. the probability that a network packet gets from one computer to the other through the link. We assume that all transfers are independent from each other. That is, regardless of whether the previous packet was transferred successfully or not, the probability that the next one will pass through remains the same.

Since the network is faulty and the work computer might be many links away from the home computer, the transfer of David's file along even the best route between the two computers might take too long. Luckily, David has an account on some of the machines in the network. He may use these machines as temporary storage, and thus shorten the time of the transfer.

The file transfer will consist of several steps. In each step, David selects a series of links starting with a computer that already has the file and ending with a computer David has an account on. Prior to the transfer, the file is split into  $S$  packets. Then the packets are sent one after another along the chosen route. The probability that a packet successfully arrives at the destination computer is the product of probabilities that it passes all the links. If the packet is lost it is resent immediately. Each attempt to send a packet, successful or unsuccessful, takes exactly one millisecond, regardless of the number of links on the route. After the entire file is transferred, David may start another transfer from the new machine, and so on.

#### Problem specification

You are given the number of computers  $N$  and the file size  $S$ . For each pair of computers  $u, v$  we know the probability  $p(u, v)$  that a network packet passes successfully through the direct link from computer  $u$  to  $v$ . (The value zero means that there is no direct link from  $u$  to  $v$ .) Finally, you are given a list of servers where David has an account.

Find a way how to send David's file so that the expected transfer time is minimized, and output this expected time in milliseconds. You may assume that the expected transfer time is less than 1 000 000 000 (1 billion) milliseconds.

## Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case looks as follows: The first line contains a positive integer  $2 \leq N \leq 200$  giving the number of computers on the internet.

$N$  lines follow. The  $i$ -th of these lines contains  $N$  integers, each of them between 0 and 100, inclusive. These integers give the probabilities  $p(i, 1)$ ,  $p(i, 2)$ , ...,  $p(i, N)$  in percents.

The next line contains a non-negative integer  $M$  - the number of computers on which David has an account. The following line contains  $M$  integers - the numbers of these computers. This list will always contain the integers 1 and 2 (corresponding to David's home and work computer).

The last line contains an integer  $S$  - the size of David's file in kilobytes.

## Output specification

For each test case output a single line with a real number - the expected time of the transfer in milliseconds when using the best possible strategy.

Each number in the output file should have sufficiently many decimal places. We recommend printing all results rounded to seven decimal places. Your output will be considered correct if each number has an absolute or relative error less than  $10^{-6}$ .

## Example

**Input :**

```
2

4
0 0 40 66
0 0 0 30
40 47 0 66
0 30 66 0
4
1 2 3 4
47

5
0 1 20 0 0
0 0 0 0 0
0 0 0 50 90
0 20 0 0 0
0 0 0 90 0
3
1 2 5
10
```

**Output :**

```
207.897153
111.111111
```



## Hint

In the second case, we have four possible strategies.

The first one is to use the direct link from 1 to 2. This link is really really faulty, and the expected time for this solution is 1000 milliseconds. The second strategy is to transfer the file from computer 1 to computer 2 using the route 1-3-4-1. The probability that a packet passes this route is  $20\% * 50\% * 20\% = 2\%$ , and thus the expected transfer time is 500 milliseconds. The third strategy is to use the route 1-3-5-4-2. Here the probability of successfully transferring a packet is 3.24% and the expected transfer time is roughly 308.6 milliseconds.

The optimal solution is to use the computer 5 as temporary storage. We will first transfer the file along the route 1-3-5, and then along the route 5-4-2. For each of the transfers the probability is  $20\% * 90\% = 18\%$ , and thus the expected time of each of the transfers is 55.5555 milliseconds.

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s-11s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2007

## SPOJ Problem Set (classical)

### 2154. Kruskal

#### Problem code: KRUSKAL

A three-headed monkey was on his (theirs?) peaceful way from his dorm to the university. He decided to use the subway. But as soon as he descended into the station, he was stopped by a strange geek with a flashlight, saying strange words...

*"I am a servant of the Secret Group Order, wielder of the flame of Primes. Your limited knowledge of partial derivatives will not avail you, flame of Riemann! You shall not pass! You can't beat Kruskal in his game!"*

The three-headed monkey shook his head. The left one. But there was no way out. If he wanted to get to the university in time, he had to play.

(Many others in his situation would use the distract-and-run tactics to get past the evil Kruskal into the subway. However, this was not possible in this case : nobody will turn around upon hearing *"Hey! Look behind you! A three-headed monkey!"* when he already sees the monkey in front of him...)

So, what was the game about? It is a two-player game. At the beginning there are  $N$  (not necessarily equal) heaps of matches. On each turn, a player may only remove matches from one heap only, and he has to remove between 1 and  $K$  matches, inclusive. A player wins if after his move the size of some heap is a prime number. The three-headed monkey moves first.

#### Problem specification

You will be given several starting positions. For each of them, determine whether the three-headed monkey can win this game. You may assume that Kruskal (the monkey's opponent) plays optimally.

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases.

Each test case looks as follows: on the first line there are the two integers  $N$  ( $1 \leq N \leq 200$ ) and  $K$  ( $1 \leq K \leq 100$ ), separated by a single space.  $N$  lines follow, one for each heap of matches. The  $i$ -th of these lines contains a single integer  $a_i$  ( $3 \leq a_i < 2^{32}$ ) giving the number of matches on the  $i$ -th heap.

#### Output specification

For each test case output one line. If the monkey can win the game, output the string "YES", otherwise output the string "NO".

## Example

**Input :**

2

3 3

48

15

4

2 3

51

51

**Output :**

YES

NO

**Note: a somewhat hard test has been removed.**

---

Added by: Blue Mary

Date: 2007-12-01

Time limit: 3s-9s

Source limit:50000B

Languages: All except: C99 strict

Resource: IPSC 2006

## SPOJ Problem Set (classical)

### 2157. Anti-Blot System

#### Problem code: ABSYS

Jimmy is a hard-working pupil in his second year at primary school. Recently he decided to convert all his notes into an electronic version. Sadly, he found that his math notes were full of ink blots.

He scanned the notes and sent them through his own OCR package (yes, he coded it all by himself at the age of 8). The OCR package replaced all ink blots by the string "machula".

#### Problem specification

You are given Jimmy's notes, processed by the OCR. They contain simple math exercises, which were used to practice addition on positive integers. Your task is to recover the damaged part of the notes.

#### Input specification

The first line of the input file contains an integer **T** specifying the number of test cases. Each test case is preceded by a blank line.

Each test case consists of exactly one line. The line represents an equation of the form "number + number = number", where each number is a positive integer. One part of the equation will be replaced by the string "machula". The string always covers a contiguous non-empty sequence of digits, possibly even an entire number. You may assume that for each equation in the input there will be exactly one way to fill in the missing digits.

#### Output specification

For each test case, the output shall contain one line of the form "number + number = number". The line must represent the equation from that test case with all missing digits filled in.

#### Example

##### Input:

```
>
3

23 + 47 = machula

3247 + 5machula2 = 3749

machula13 + 75425 = 77038
<pre>
```

##### Output :>

```
23 + 47 = 70
3247 + 502 = 3749
1613 + 75425 = 77038
<pre>
```

Note: **int** in C++/C/Java or **longint** in Pascal is enough.

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2007

## SPOJ Problem Set (classical)

### 2159. Delicious Cake

#### Problem code: CAKE3

Lenka likes to bake cakes since her childhood, when she has learned to bake from her mom. She soon became a cake expert able to bake chocolate cakes, apple pies, muffins, cookies, cheese cakes, tortes and many other cakes.

Recently, she has started her studies of math at Comenius University in Bratislava. In the first year she is taking combinatorics class. Today she is studying for the final exam. Since the brain needs a lot of sugar to study math, she has baked, just for herself, her favorite, very delicious, strawberry cake.

The cake, still hot, is lying on an  $N \times M$  inch sheet pan. Hungrily waiting for the cake to cool off Lenka came up with an interesting combinatorial question: How many different possibilities to cut the cake are there so that every connected piece consists of some number of  $1 \times 1$  inch unit squares?

#### Problem specification

The cake can be viewed as a grid consisting of  $N \times M$  unit squares. We are allowed to cut the cake along the grid lines. As a result the cake splits into several connected pieces. (Two unit squares remain connected if they share a side which was not cut.) How many different ways are there to cut the cake? We consider two cuttings of the cake to be the same if the resulting connected pieces of both cuttings have the same shape and are at the same positions within the cake. In other words, we are only counting those cuttings where no cut leads between two unit squares that are in the same connected piece.

The following picture illustrates all the 12 different possible ways how to cut a  $2 \times 2$  inch cake: 12 possible ways of cutting a  $2 \times 2$  cake

Note that cutting, for example, as on following picture

Not a good way of cutting

is the same as not cutting at all.

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case consists of a single line with two positive integers  $N$  and  $M$  - dimensions of the cake.

#### Output specification

For each test case output a line with a single positive integer - the number of different possibilities how to cut the cake.

## Example

### Input:

>

2

1 2

2 2

<pre>

Output:>

2

12

<pre>

Note

For all the test cases,  $\min(\mathbf{N}, \mathbf{M}) \leq 5$ ,  $\max(\mathbf{N}, \mathbf{M}) \leq 130$ .

Blue Mary's Note: The data has been enhanced on Feb.28, 2008 to avoid precalculated tables. Sorry to some users.

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 8s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2007

## SPOJ Problem Set (classical)

### 2160. Here-There

#### Problem code: HERE

Do you know the game Here-There? I presume you don't. It's a virtual board game, so you should first learn how this virtual board looks like.

The process of making the board is remarkably simple. You start by taking a square with side of length  $3^N$ , divide it into nine smaller squares of equal size and remove the central one. Then, you repeat the same divide-and-remove-the-centre process with each of the eight smaller squares over and over ( $N$  times in total), until you are left with a grid that consists of many little squares with side length 1 - and of many holes. By the way, the number  $N$  is called the degree of the board.

The game itself consists of two steps. First, your opponent chooses two squares on the board, one of them will be "Here" and the other one "There". Your task is to estimate the least number of steps you have to take if you started Here and wanted to get to There. One step consists of moving to another square, which has a common side with the one you're standing on. Obviously, you cannot move over the removed parts of the board. If you guess the number of steps correctly, you get a point.

You would really like to become a master of this game, so you have written down the sizes of the boards and the positions of the Here and There squares from several games in the past. Now, you'd like to find the exact number of steps you need to take to get from Here to There on each of the boards. Each square is described by two numbers between 1 and  $3^N$ , the first of them denoting the column and the second one the row the square is in. The square in the upper left corner of the board has coordinates (1, 1), as you can see on the picture below.

[IMAGE]

You can see one of the shortest paths between squares (1, 1) and (4, 8) on the picture, consisting of 10 steps.

[IMAGE]

#### Problem specification

You are given several boards and pairs of squares on them and your task is to find the steps-distances between the squares in each pair.

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case consists of five integers  $D(1 \leq D \leq 39)$ ,  $H_c$ ,  $T_c$ ,  $H_r$ ,  $T_r$ , specifying the degree of the board  $D$ , the coordinates of Here ( $H_c$ ,  $H_r$ ) and the coordinates of There ( $T_c$ ,  $T_r$ ).



## Output specification

For each of the test cases, output a single line with one integer - the steps-distance between Here and There.

## Example

**Input :**

2

1 1 2 2 1

2 1 1 4 8

**Output :**

2

10

---

Added by: Blue Mary

Date: 2007-12-01

Time limit: 3s

Source limit: 50000B

Languages: All except: C99 strict

Resource: IPSC 2007

## SPOJ Problem Set (classical)

### 2161. Pixel Shuffle

#### Problem code: JPIX

[IMAGE]

Shuffling the pixels in a bitmap image sometimes yields random looking images. However, by repeating the shuffling enough times, one finally recovers the original images. This should be no surprise, since "shuffling" means applying a one-to-one mapping (or permutation) over the cells of the image, which come in finite number.

Your program should read a number  $n$ , and a series of elementary transformations that define a "shuffling" [IMAGE] of  $n * n$  images. Then, your program should compute the minimal number  $m$  ( $m > 0$ ), such that  $m$  applications of [IMAGE] always yield the original  $n * n$  image.

For instance if [IMAGE] is counter-clockwise  $90^\circ$  rotation then  $m = 4$ .

[IMAGE]

#### Input

Test cases are given one after another, and a single 0 denotes the end of the input. For each test case:

Input is made of two lines, the first line is number  $n$  ( $2 \leq n \leq 2^{10}$ ,  $n$  even). The number  $n$  is the size of images, one image is represented internally by a  $n * n$  pixel matrix  $(a^j_i)$ , where  $i$  is the row number and  $j$  is the column number. The pixel at the upper left corner is at row 0 and column 0.

The second line is a non-empty list of at most 32 words, separated by spaces. Valid words are the keywords **id**, **rot**, **sym**, **bhsym**, **bvsym**, **div** and **mix**, or a keyword followed by -. Each keyword **key** designates an elementary transform (as defined by Figure 1), and **key-** designates the inverse of transform **key**. For instance, **rot-** is the inverse of counter-clockwise  $90^\circ$  rotation, that is clockwise  $90^\circ$  rotation. Finally, the list  $k_1, k_2, \dots, k_p$  designates the compound transform [IMAGE] =  $k_1 \circ k_2 \circ \dots \circ k_p$ . For instance, "bvsym rot-" is the transform that first performs clockwise  $90^\circ$  rotation and then vertical symmetry on the lower half of the image.


[IMAGE]

Figure 1: Transformations of image  $(a^j_i)$  into image  $(b^j_i)$

[IMAGE]

#### Output

For each test case:

Your program should output a single line whose contents is the minimal number  $m$  ( $m > 0$ ) such that  is the identity. You may assume that, for all test input, you have  $m < 2^{31}$ .

## Example

**Input :**

```
256
rot- div rot div
256
bvsym div mix
0
```

**Output :**

```
8
63457
```

---

Added by: Blue Mary

Date: 2007-12-01

Time limit: 13s

Source limit:50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Budapest 2005

## SPOJ Problem Set (classical)

### 2162. Towers of Powers

#### Problem code: TOWER

One of the many problems in computer-generated graphics is realistically modeling the "orderly randomness" of things like mountain ranges and city skylines. A new student intern at a graphics company had an idea - use fluctuations in number representations to model height. In this problem you will compute several such number representations and show the "skylines" they produce.

Let  $n$  be any positive integer, and let  $b$  be an integer greater than or equal to 2. The *complete base -  $b$  expansion of  $n$*  is obtained as follows. First write the usual base -  $b$  expansion of  $n$ , which is just a sum of powers of  $b$ , each multiplied by a coefficient between 1 and  $b - 1$ , omitting terms with zero coefficients. For example, if  $n = 20000$  and  $b = 3$ , the base - 3 expansion of 20000 is given by

$$20000 = 3^9 + 3^5 + 2 \times 3^3 + 2 \times 3^2 + 2$$

To obtain the complete base -  $b$  expansion, we apply the same procedure to the exponents until all numbers are represented in base  $b$ . For  $n = 20000$  and  $b = 3$  we would have

$$20000 = 3^{3^2} + 3^{3+2} + 2 \times 3^3 + 2 \times 3^2 + 2$$

As another example, consider  $n = 16647$  and  $b = 2$ . The resulting expansion is

$$16647 = 2^{2^{2+1} + 2^2 + 2} + 2^{2^{2+1}} + 2^2 + 2 + 1$$

The rising and falling heights of the numbers form the number's "skyline".

For each pair of integers  $n$  and  $b$  in the input, display the complete base -  $b$  representation of  $n$ . Your display should use multiple output lines for different exponent heights. The display must begin with  $n =$ , followed by the expansion. Answers should use an asterisk as the multiplication symbol between coefficients and powers of  $b$ . Zero terms must not be printed, and unnecessary coefficients and exponents must not be shown (for example, display 1 instead of  $b^0$ ,  $b^2$  instead of  $1 \times b^2$  and  $b$  instead of  $b^1$ ). To assist in accurately viewing the skyline of the number, the display must show one character (either a digit, +, or \*) per column of the multi-line display; there must be no unnecessary spaces. The correct format is illustrated in the sample output shown below.

Answers must be displayed using no more than 80 columns. Expansions requiring more than 80 columns must be split between terms, into two or more sets of display lines to show the remaining portion of the expansion. The second and following parts of the answer must begin in the same column as the first part of the answer and should contain the same number of (possibly blank) lines. The split may only occur between terms of the number itself (the bottom line), not between terms in an exponent. See the sample output for an example. Note that each set of display lines starts with a blank line.

## Input

Input is a sequence of pairs of integers, **n** and **b**, followed by a pair of zeroes. Each value for **n** will be positive, and each value for **b** will be greater than or equal to 2. All values will fit into 64 bits unsigned integers (the maximum is therefore 18446744073709551615).

## Output

For each input pair print the complete base - **b** expansion of **n** as described above. Print a line containing

**n** in complete base **b**:

preceding each expansion. Separate the output for consecutive pairs by a line of exactly 80 hyphens. All coefficients, bases, and exponents are to be displayed as standard base 10 integers.

## Example

### Input :

```
20000 3
16647 2
1000 12
85026244 3
0 0
```

### Output :

20000 in complete base 3:

$$20000 = 3^2 + 3^{3+2} + 2 \cdot 3^3 + 2 \cdot 3^2 + 2$$

-----

16647 in complete base 2:

$$16647 = 2^{2+1} + 2^2 + 2^{2+1} + 2^2 + 2^2 + 2^2 + 2 + 1$$

-----

1000 in complete base 12:

$$1000 = 6 \cdot 12^2 + 11 \cdot 12 + 4$$

-----

85026244 in complete base 3:

$$85026244 = 3^2 + 2 \cdot 3^{3+1} + 2 \cdot 3^2 + 2 \cdot 3^{3+2} + 2 \cdot 3^{3+1} + 2 \cdot 3^2 + 3 + 1 + 3^2 + 2 \cdot 3^{2+2} + 2 \cdot 3^{2+1} + 3$$

-----

## Note

The number of test cases will be no more than 100. The judge of this problem compares your output and the expected output, an extra whitespace will cause Wrong Answer.

---

Added by: Blue Mary  
Date: 2007-12-01  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: ACM ICPC World Final 1998

## **SPOJ Problem Set (classical)**

### **2171. Ambiguous Codes**

#### **Problem code: AMCODES**

An extensive area of research in computer science is the field of communications. With computer networks being part of everyday life of many people, the development of ways for making networks faster, more reliable and secure is constantly needed. This practical need motivates an extensive research activity in the theory behind communications.

The very first thing needed to establish any kind of communication is a common code. A code is a way of changing the form of a piece of information into some other form, in general to make it possible to convey that piece of information from one place to another. Flag codes used by boats and the Morse code used in telegraphy are examples of codes for translating letters into different forms to enable communication over different media.

More formally, a code is a set of strings composed of symbols from one alphabet. Each string defined in the code is called a code word. A message is then composed concatenating a set of code words to convey the information needed. For example, in Morse code the alphabet is composed of the symbols hyphen and dot; letter "S" is represented by the code word "...", letter "O" is represented by the code word "---", and therefore the distress message "SOS" in Morse code is "...---...".

Codes for communication can have many desirable and undesirable properties such as ambiguity, entropy, redundancy, and many more. In this problem we will focus on ambiguity as a key property.

A code is ambiguous when there exists a message using that code that can be partitioned into different sequences of code words. In other words, in an ambiguous code a message may have more than one meaning. For example, consider the binary alphabet, composed of symbols {0,1}. For the code composed of the words {10, 01, 101} the message 10101 can be understood as 10-101 or 101-01 and therefore the code is ambiguous. On the other hand, for the code composed of the words {01, 10, 011} no ambiguous message exists and therefore the code is unambiguous.

As a part of the computer science community, you are required to develop a tester that checks if codes are ambiguous. In case a code is indeed ambiguous, you are also required to report the length (i.e. the number of symbols) of the shortest ambiguous message for that code.

#### **Input**

Each test case will consist on several lines. In all test cases the alphabet will be the set of hexadecimal digits (decimal digits plus the uppercase letters "A" to "F"). The first line of a test case will contain an integer N ( $1 \leq N \leq 100$ ), the number of code words in the code. Each of the next N lines describes a code word and contains a different and non-empty string of at most 50 hexadecimal digits.

Input is terminated by  $N = 0$ .

## Output

For each test case, output a single line with the length of the shortest ambiguous message for the provided code or -1 if the code is unambiguous.

## Example

**Input :**

```
3
10
01
101
3
AB
BA
ABB
0
```

**Output :**

```
5
-1
```

---

Added by: Camilo Andrés Varela León

Date: 2007-12-02

Time limit: 3s

Source limit:50000B

Languages: All

Resource: The 2007 ACM South American Programming Contest



## SPOJ Problem Set (classical)

### 2175. Emoticons

#### Problem code: EMOTICON

Emoticons are used in chat and e-mail conversations to try to express the emotions that printed words cannot. This may seem like a nice feature for many, but a lot of people find it really annoying and wants to get rid of emoticons.

George is one of those people. He hates emoticons so bad, that he is preparing a plan to remove all emoticons from all e-mails in the world. Since you share his visionary plans, you are preparing a special program to help him.

Your program will receive the list of emoticons to proscribe. Each emoticon will be a string of characters not including any whitespace. You will also receive several lines of text. What you need to do is change some characters of the text into spaces to ensure no emoticon is left on the text. For an emoticon to be considered to appear in the text it has to appear in a single line and be made of consecutive characters.

To help George's plan remain secret as long as possible, you need to do your job with the minimum possible amount of character changes.

#### Input

The input file contains several test cases. Each test case consists of several lines. The first line of each test case will contain two integers separated by a single space: N, the number of emoticons to proscribe, and M, the number of lines the text has. The next N lines contain one emoticon each, a non-empty string of at most 15 characters. Each of the last M lines of the test case contains a line of text of at most 80 characters. You can assume  $1 \leq N, M \leq 100$ .

Valid input characters for emoticons are uppercase and lowercase letters, digits and the symbols " ! ? , . ; \_ ' # \$ % & / = \* + ( ) { } [ ] " (quotes for clarity). Each line of the text may contain the same characters with the addition of the space character.

The input is terminated by  $N = M = 0$ .

#### Output

For each test case, output exactly one line containing a single integer that indicates the minimum number of changes you need to make to the entire text to ensure no emoticon on the list appears in it.

#### Example

**Input :**

```
4 6
:-)
:-(
(-:
)-:
```

```

Hello uncle John! :-) :-D
I am sad or happy? (-:-(?
I feel so happy, my head spins
(-:-) (-:-) (-:-) (-:-) :-) (-: :-)
but then sadness comes :- (
Loves you, Joanna :-)))))
3 1
:)
):
))
):))):))):(:(:(:(:(:(:):)
0 0

```

**Output:**

```

11
8

```

---

Added by: Camilo Andrés Varela León

Date: 2007-12-02

Time limit: 4s

Source limit: 50000B

Languages: All

Resource: The 2007 ACM South American Programming Contest

## SPOJ Problem Set (classical)

### 2185. Musical Optimization

#### Problem code: MUSIC

Bessie the cow used to write musical melody. A musical melody is represented as a sequence of  $N$  ( $1 \leq N \leq 100,000$ ) notes numbered  $1..N$ . Note  $i$  is represented by the integer  $A_i$  ( $-10,000 \leq A_i \leq 10,000$ ).

To Bessie's cow-like mind, a musical melody is called 'perfect' if and only if the sum of all the notes in any of its consecutive subsequences is strictly positive.

For a given musical melody, Bessie wants to make it perfect, but she wants to change the melody as little as possible.

Thus, to perfect the melody, she repeatedly chooses a consecutive subsequence of the melody,  $[x, y]$  ( $1 \leq x \leq y \leq N$ ), whose sum  $S$  is negative. Then she adds  $S$  to both  $A_{x-1}$  and  $A_{y+1}$ , while subtracting  $S$  from both  $A_x$  and  $A_y$ . (It is possible to subtract from the same note twice if  $x = y$ .)

Given a musical melody, compute the minimum number of steps to make the melody perfect.

#### Input

\* Line 1: The single integer  $N$ .

\* Lines  $2..N+1$ : Line  $i+1$  contains the single integer  $A_i$ .

#### Output

\* Line 1: A single integer that represents the minimum number of steps needed to make the given musical melody perfect. If there are no solutions, output -1 instead.

#### Example

Input :

5  
13  
-3  
-4  
-5  
62

Output :

2

#### Explanation

There is a musical melody with length of 5. The notes are (13, -3, -4, -5, 62).

First, we choose the range [2, 4]; its sum is  $(-3) + (-4) + (-5) = -12$ . After the first step, the melody becomes (1, 9, -4, 7, 50). Second, we choose the range [3, 3], whose sum is -4, and the melody after the second step becomes (1, 5, 4, 3, 50). The melody is perfect now.

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2007-12-03

Time limit: 1s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Lei HUANG [g201513], used in USACO

## SPOJ Problem Set (classical)

### 2202. Tan and His Interesting Game

#### Problem code: TAN1

#### Background

Tan always creates some interesting and strange games to kill time, and the Pick-Number Game on Tree is his favorite one. He got the idea from his another game (Pick-Number Game on sequence): there is an integer sequence, he picks a number from the head or the tail of the sequence each turn. When the sequence gets empty, he gets another sequence  $A$ , in which  $A[i]$  is the  $i$ -th integer he picks, then he calculates:

$S = A[0] * 5^0 + A[1] * 5^1 + \dots + A[n-1] * 5^{n-1}$ , while  $n$  is the length of the sequence. If  $S$  modulo 8 equals to 3, he wins, otherwise he loses (Tan is such a strange person that he likes games with strange rules).

Tan got tired of generating sequence randomly before playing a game, and he changed the rule to avoid it. This time he plays the game on trees. He generates a big tree. Every time he wants to play, he chooses two nodes  $(A, B)$  randomly and he finds the path connected  $A, B$  (including  $A, B$ ). In this way he gets a sequence and he can play games. He calls this game "Game( $A, B$ )". He can play many times on a big tree without generating a new one. If he can win in Game( $A, B$ ), he says that Game( $A, B$ ) is a good game, otherwise Game( $A, B$ ) is a bad game.

If a game is a bad game, he can never win, so he has to find a way to identify if a game is bad or good.

He played this game for a long time, and he thought he found a great law: if Game( $A, B$ ) is a good game and Game( $B, C$ ) is a good game, then Game( $A, C$ ) is a good game. And if Game( $A, B$ ) is a bad game and Game( $B, C$ ) is a bad game, then ( $A, C$ ) is a bad game. But soon he found it was wrong, but he wanted to know in how many cases it is right.

P.S: "Tan" in Chinese means funny and droll. And Mr. Tan in the story is a real person.

#### Task

The input data describes a tree with integer numbers on each of its nodes. You should count the number of triple  $(A, B, C)$  ( $A, B, C$  are distinct nodes) that  $(A, B), (B, C), (A, C)$  are all good games or all bad games ( $(A, B, C)$  and  $(B, C, A)$  are supposed to be counted once).

#### Input

The first line of the test data is the number of test case  $t$ , then  $t$  test case follow.

For each test case:

The first line contains a single integer  $M$ , the number of nodes in the tree ( $M \leq 100000$ ).

M lines follow, each contains two integers  $F_i$  and  $V_i$ .  $F_i$  is the father of node  $i$  ( $F_i=0$  if node  $i$  is the root).  $V_i$  is the number on the node  $i$ . ( $0 \leq V_i \leq 40000$ )

## Output

For each test case:

The first and only line contains a single integer  $S$ , which means there are  $S$  triples  $(A,B,C)$  that  $(A,B), (B,C), (A,C)$  are all good games or all bad games.

## Example

**Input :**

```
1
3
0 3
1 5
1 7
```

**Output :**

```
0
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2007-12-07

Time limit: 2s

Source limit: 50000B

Languages: All except: C99 strict

Resource: description and test data by LoLitter; standard program by rendezvous

## SPOJ Problem Set (classical)

### 2270. Balloons in a Box

#### Problem code: BALLOON

You must write a program that simulates placing spherical balloons into a rectangular box.

The simulation scenario is as follows. Imagine that you are given a rectangular box and a set of points. Each point represents a position where you might place a balloon. To place a balloon at a point, center it at the point and inflate the balloon until it touches a side of the box or a previously placed balloon. You may not use a point that is outside the box or inside a previously placed balloon. However, you may use the points in any order you like, and you need not use every point. Your objective is to place balloons in the box in an order that maximizes the total volume occupied by the balloons.

You are required to calculate the volume within the box that is not enclosed by the balloons.

#### Input

The input consists of several test cases. The first line of each test case contains a single integer  $n$  that indicates the number of points in the set ( $1 \leq n \leq 6$ ). The second line contains three integers that represent the  $(x, y, z)$  integer coordinates of a corner of the box, and the third line contains the  $(x, y, z)$  integer coordinates of the opposite corner of the box. The next  $n$  lines of the test case contain three integers each, representing the  $(x, y, z)$  coordinates of the points in the set. The box has non-zero length in each dimension and its sides are parallel to the coordinate axes.

The input is terminated by the number zero on a line by itself.

#### Output

For each test case print one line of output consisting of the test case number followed by the volume of the box not occupied by balloons. Round the volume to the nearest integer. Follow the format in the sample output given below.

Place a blank line after the output of each test case.

#### Example

**Input :**

```
2
0 0 0
10 10 10
3 3 3
7 7 7
0
```

**Output :**

```
Box 1: 774
```

---

Added by: Blue Mary  
Date: 2008-01-03  
Time limit: 1s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: ACM/ICPC World Final 2002 (unofficial testdata)



## SPOJ Problem Set (classical)

### 2271. Undecodable Codes

#### Problem code: UCODES

Phil Oracle has a unique ability that makes him indispensable at the National Spying Agency. His colleagues can bring him any new binary code and he can tell them immediately whether the code is uniquely decodable or not. A *code* is the assignment of a unique sequence of characters (a *codeword*) to each character in an *alphabet*. A binary code is one in which the codewords contain only zeroes and ones. For example, here are two possible binary codes for the alphabet {a,c,j,l,p,s,v}.

[IMAGE]

The *encoding* of a string of characters from an alphabet (the *cleartext*) is the concatenation of the codewords corresponding to the characters of the cleartext, in order, from left to right. A code is *uniquely decodable* if the encoding of every possible cleartext using that code is unique. In the example above, Code 1 is uniquely decodable, but Code 2 is not. For example, the encodings of the cleartexts "pascal" and "java" are both **001010101010**. Even shorter encodings that are not uniquely decodable are **01** and **10**.

While the agency is very proud of Phil, he unfortunately gives only "yes" or "no" answers. Some members of the agency would prefer more tangible proof, especially in the case of codes that are not uniquely decodable. For this problem you will deal only with codes that are *not* uniquely decodable. For each of these codes you must determine the single encoding having the minimum length (measured in bits) that is ambiguous because it can result from encoding each of two or more different cleartexts. In the case of a tie, choose the encoding which comes first lexicographically.

#### Input

One or more codes are to be tested. The input for each code begins with an integer  $m$ ,  $1 \leq m \leq 20$ , on a line by itself, where  $m$  is the number of binary codewords in the code. This is followed by  $m$  lines each containing one binary codeword string, with optional leading and trailing whitespace. No codeword will contain more than 20 bits.

The input is terminated by the number zero on a line by itself.

#### Output

For each code, display the sequential code number (starting with 1), the length of the shortest encoding that is not uniquely decodable, and the shortest encoding itself, with ties broken as previously described. The encoding must be displayed with 20 bits on each line except the last, which may contain fewer than 20 bits. Place a blank line after the output for each code. Use the format shown in the samples below.

## Example

### Input :

```
3
0
01
10
5
0110
00
111
001100
110
5
1
001
0001
0000000000000000000001
1000000000000000000000
0
```

### Output :

```
Code 1: 3 bits
010
```

```
Code 2: 9 bits
001100110
```

```
Code 3: 21 bits
10000000000000000000000
1
```

---

Added by: Blue Mary  
Date: 2008-01-03  
Time limit: 5s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: ACM/ICPC World Final 2002 (unofficial testdata)

## **SPOJ Problem Set (classical)**

### **2272. Crossing the Desert**

#### **Problem code: DESERT**

In this problem, you will compute how much food you need to purchase for a trip across the desert on foot.

At your starting location, you can purchase food at the general store and you can collect an unlimited amount of free water. The desert may contain oases at various locations. At each oasis, you can collect as much water as you like and you can store food for later use, but you cannot purchase any additional food. You can also store food for later use at the starting location. You will be given the coordinates of the starting location, all the oases, and your destination in a two-dimensional coordinate system where the unit distance is one mile.

For each mile that you walk, you must consume one unit of food and one unit of water. Assume that these supplies are consumed continuously, so if you walk for a partial mile you will consume partial units of food and water. You are not able to walk at all unless you have supplies of both food and water. You must consume the supplies while you are walking, not while you are resting at an oasis. Of course, there is a limit to the total amount of food and water that you can carry. This limit is expressed as a carrying capacity in total units. At no time can the sum of the food units and the water units that you are carrying exceed this capacity.

You must decide how much food you need to purchase at the starting location in order to make it to the destination. You need not have any food or water left when you arrive at the destination. Since the general store sells food only in whole units and has only one million food units available, the amount of food you should buy will be an integer greater than zero and less than or equal to one million.

#### **Input**

The first line of input in each trial data set contains  $n$  ( $2 \leq n \leq 20$ ), which is the total number of significant locations in the desert, followed by an integer that is your total carrying capacity in units of food and water. The next  $n$  lines contain pairs of integers that represent the coordinates of the  $n$  significant locations. The first significant location is the starting point, where your food supply must be purchased; the last significant location is the destination; and the intervening significant locations (if any) are oases. You need not visit any oasis unless you find it helpful in reaching your destination, and you need not visit the oases in any particular order.

The input is terminated by a pair of zeroes.

#### **Output**

For each trial, print the trial number followed by an integer that represents the number of units of food needed for your journey. Use the format shown in the example. If you cannot make it to the destination under the given conditions, print the trial number followed by the word "Impossible."

Place a blank line after the output of each test case.

## Example

### Input :

```
4 100
10 -20
-10 5
30 15
15 35
2 100
0 0
100 100
0 0
```

### Output :

```
Trial 1: 136 units of food
```

```
Trial 2: Impossible
```

---

Added by: Blue Mary

Date: 2008-01-03

Time limit: 1s

Source limit:50000B

Languages: All except: C99 strict

Resource: ACM/ICPC World Final 2002 (unofficial testdata)

## SPOJ Problem Set (classical)

### 2273. Ferries

#### Problem code: FERRY

Millions of years ago massive fields of ice carved deep grooves in the mountains of Norway. The sea filled these grooves with water. The Norwegian people call them fjords. This landscape of mountains and water is beautiful, but it makes traveling difficult. The usual scheme is: drive some kilometers, wait for a ferry, cross a fjord with the ferry, drive some more kilometers, and so on until the destination has been reached. To reach a destination as early as possible, most people have the following strategy: drive as fast as allowed (the maximum speed is 80 km/h) to the next ferry, and wait until it goes. Repeat until the destination has been reached.

Since driving fast requires more fuel than driving slow, this strategy is both expensive and harmful to the environment. The new generation of cruise control systems is designed to help. Given the route you want to go, these systems will gather information about the ferries involved, calculate the earliest possible time of arrival at the final destination, and calculate a driving scheme that avoids driving faster than needed. The systems will calculate your road speed so that you board the next ferry the moment it leaves.

Given a route (a sequence of road-pieces and crossings with ferries), you must write a program to calculate the minimal time it takes to complete this route. Moreover, your program must find a driving scheme such that the maximal driving speed at any point during the trip is as small as possible.

#### Input

The input file contains one or more test cases. Each test case describes a route. A route consists of several sections, each section being either a piece of road or a crossing. The first line in the description contains a single number  $s$  ( $s > 0$ ), which is the number of sections in the route. The next  $s$  lines contain the descriptions of the sections. Every line describing a section starts with two names: the place of departure and the place of arrival, followed by either the word 'road' or the word 'ferry' indicating what kind of section it is. If the section is a road, its length (a positive integer) is given in km. For example:

*Dryna Solholmen road 32*

Lines describing ferry sections have more information. Following the word "ferry", the duration of the ferry crossing, in minutes (a positive integer) is given. This is followed by the frequency  $f$  ( $f > 0$ ) of the ferry, that is, the number of times the ferry departs in a single hour. The next  $f$  integers give the departure times of the ferry, in ascending order. For example:

*Manhiller Fodnes ferry 20 2 15 35*

The ferry travels from Manhiller to Fodnes in 20 minutes, and it leaves twice an hour (on 0h15, 0h35, 1h15, 1h35,...). The beginning of the entire trip always starts at a full hour. The sections in a route are consecutive, that is, if a section goes from A to B then the next section starts at B. Every route in the input can be traveled in no more than 10 hours.

The input is terminated by the number zero on a line by itself.

## Output

Output for each test case is a single line containing three items. The first item is the test case number. The second is the total travel time for an optimal scheme in the form hh:mm:ss. The third item is the maximal road speed in an optimal scheme rounded to two digits to the right of the decimal point.

Place a blank line after the output of each test case.

## Example

### Input :

```
1
Bygd Bomvei road 7
2
Ferje Overfarten ferry 20 2 5 25
Overfarten Havneby ferry 30 3 10 30 50
5
Begynnelse Brygge road 30
Brygge Bestemmelse ferry 15 4 10 25 40 55
Bestemmelse Veiskillet road 20
Veiskillet Grusvei road 25
Grusvei Slutt ferry 50 1 10
0
```

### Output :

```
Test Case 1: 00:05:15 80.00

Test Case 2: 01:00:00 0.00

Test Case 3: 03:00:00 45.00
```

---

Added by: Blue Mary

Date: 2008-01-03

Time limit: 20s

Source limit:50000B

Languages: All except: C99 strict

Resource: ACM/ICPC World Final 2002 (unofficial testdata)

## SPOJ Problem Set (classical)

### 2274. Island Hopping

#### Problem code: ISLHOP

The company Pacific Island Net (PIN) has identified several small island groups in the Pacific that do not have a fast internet connection. PIN plans to tap this potential market by offering internet service to the island inhabitants. Each group of islands already has a deep-sea cable that connects the main island to the closest internet hub on the mainland (be it America, Australia or Asia). All that remains to be done is to connect the islands in a group to each other. You must write a program to help them determine a connection procedure.

[IMAGE]

For each island, you are given the position of its router and the number of island inhabitants. In the figure, the dark dots are the routers and the numbers are the numbers of inhabitants. PIN will build connections between pairs of routers such that every router has a path to the main island. PIN has decided to build the network such that the total amount of cable used is minimal. Under this restriction, there may be several optimal networks. However, it does not matter to PIN which of the optimal networks is built.

PIN is interested in the average time required for new customers to access the internet, based on the assumption that construction on all cable links in the network begins at the same time. Cable links can be constructed at a rate of one kilometer of cable per day. As a result, shorter cable links are completed before the longer links. An island will have internet access as soon as there is a path from the island to the main island along completed cable links. If  $m_i$  is the number of inhabitants of the  $i$ th island and  $t_i$  is the time when the island is connected to the internet, then the average connection time is:

[IMAGE]

#### Input

The input consists of several descriptions of groups of islands. The first line of each description contains a single positive integer  $n$ , the number of islands in the group ( $n \leq 50$ ). Each of the next  $n$  lines has three integers  $x_i$ ,  $y_i$ ,  $m_i$ , giving the position of the router ( $x_i$ ,  $y_i$ ) and number of inhabitants  $m_i$  ( $m_i > 0$ ) of the islands. Coordinates are measured in kilometers. The first island in this sequence is the main island.

The input is terminated by the number zero on a line by itself.

#### Output

For each group of islands in the input, output the sequence number of the group and the average number of days until the inhabitants are connected to the internet. The number of days should have two digits to the right of the decimal point. Use the output format in the sample given below.

Place a blank line after the output of each test case.

## Example

**Input :**

```
7
11 12 2500
14 17 1500
9 9 750
7 15 600
19 16 500
8 18 400
15 21 250
0
```

**Output :**

```
Island Group: 1 Average 3.20
```

---

Added by: Blue Mary

Date: 2008-01-03

Time limit: 1s

Source limit:50000B

Languages: All except: C99 strict

Resource: ACM/ICPC World Final 2002 (unofficial testdata)



```
(function() { var po = document.createElement('script'); po.type = 'text/javascript'; po.async = true;
po.src = 'https://apis.google.com/js/plusone.js'; var s =
document.getElementsByTagName('script')[0]; s.parentNode.insertBefore(po, s); })();
```

## SPOJ Problem Set (classical)

### 2276. Partitions

#### Problem code: RECTNG2

A partition of a rectangle is either a whole rectangle or a subdivision the rectangle into either a upper part and a lower part or a left part and a right part, and each part is a partition of the corresponding rectangle. Figure 1 shows several examples of partitions.

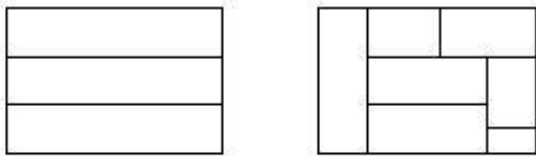


Figure 1

Figure 2 shows three equal sized rectangles, partitioned into sub-rectangles. Partition B is obtained from partition A by partitioning two of the sub-rectangles of A. Generally, if a partition B is obtained from A by partitioning one or more of its sub-rectangles, we say that B is finer than A, or that A is coarser than B. This relation is partial: partition C is neither coarser nor finer than A or B.

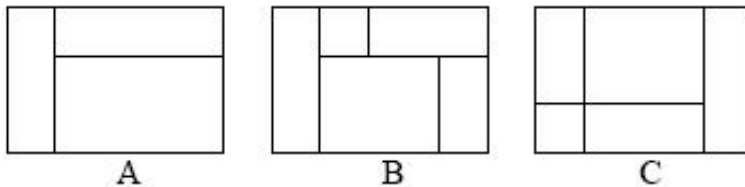


Figure 2

Given two partitions D and E of the same rectangle, infinitely many partitions exist that are finer than both D and E. In Figure 3 both F and G are finer than D and E. Among the partitions that are finer than both D and E, a unique one exists that is coarsest. This partition is called the infimum of D and E. In Figure 3, partition F is the infimum of D and E.

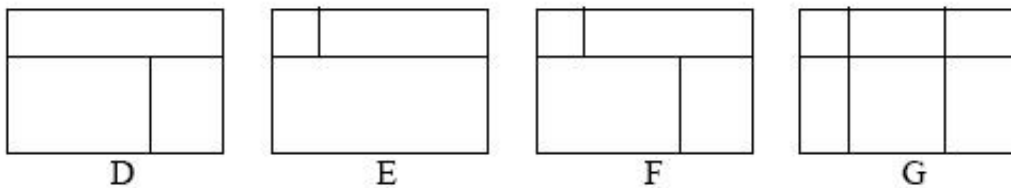


Figure 3

In Figure 4, both H and J are coarser than D and E. Here J is the finest partition that is coarser than D and E. Then J is the supremum of D and E.

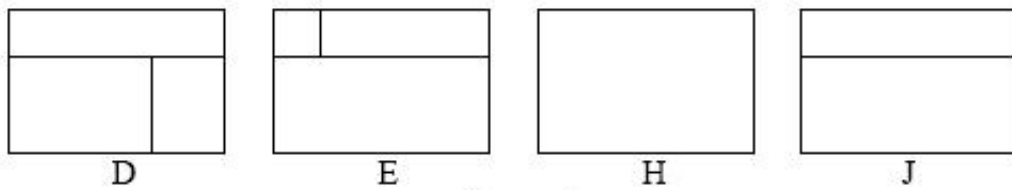


Figure 4

Write a program that, given two partitions of the same rectangle, finds the infimum and the supremum of these partitions.

## Input

The input file contains one or more test cases. The first line of each test case gives the width  $w$  and height  $h$  of the rectangle ( $0 < w, h \leq 20$ ). In the next  $h+1$  lines the two partitions are given, as in the sample. Each of these lines contains  $4*w+3$  characters. The first  $2*w+1$  of these belong to the first partition; the last  $2*w+1$  of these belong to the second partition. A space separates the two partitions. Horizontal lines are created using underscores '\_', vertical lines using '|'.

The input is terminated by a pair of zeroes.

## Output

For every case in the input file the output contains a single line containing the case number (in the format shown in the sample), followed by the infimum and the supremum of the two partitions, using the same format as the input.

Place a blank line after the output of each test case.

## Example

**Input :**

4 3

```

_ _ _ _ _ _ _ _ _
|_ _ _ _ | | _ _ _
|   |   | | _ _ _ _
|_ _ | _ _ | _ _ _ _

```

3 4

```

_ _ _ _ _ _ _ _ _
| | _ _ _ | | _ _ _
| |   |   | | _ _ _
|_ | _ _ | |   |   |
|_ _ | _ | _ _ _ _

```

0 0

**Output :**

Case 1:

```

_ _ _ _ _ _ _ _ _
|_ | _ _ _ | | _ _ _
|   |   | | _ _ _ _
|_ _ | _ _ | _ _ _ _

```

Case 2:

```
  _ _ _ _  
| | | | |  
|_|_|_|_|  
|_|_|_|_|  
|_|_|_|_|
```

**Please read the problem statement carefully. The judge compares your output and the expected output, any extra whitespace will cause Wrong Answer.**

---

Added by: [Trichromatic] XilinX

Date: 2008-01-03

Time limit: 1s

Source limit:50000B

Languages: All except: C99 strict ERL JS PERL 6

Resource: ACM/ICPC World Final 2002 (unofficial testdata)

## SPOJ Problem Set (classical)

### 2277. Silly Sort

#### Problem code: SSORT

Your younger brother has an assignment and needs some help. His teacher gave him a sequence of numbers to be sorted in ascending order. During the sorting process, the places of two numbers can be interchanged. Each interchange has a cost, which is the sum of the two numbers involved.

You must write a program that determines the minimal cost to sort the sequence of numbers.

#### Input

The input file contains several test cases. Each test case consists of two lines. The first line contains a single integer  $n$  ( $n > 1$ ), representing the number of items to be sorted. The second line contains  $n$  different integers (each positive and less than 1000), which are the numbers to be sorted.

The input is terminated by a zero on a line by itself.

#### Output

For each test case, the output is a single line containing the test case number and the minimal cost of sorting the numbers in the test case.

Place a blank line after the output of each test case.

#### Example

**Input :**

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

**Output :**

```
Case 1: 4

Case 2: 17

Case 3: 41

Case 4: 34
```

---

Added by: Blue Mary  
Date: 2008-01-03  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: ACM/ICPC World Final 2002 (unofficial testdata)

## SPOJ Problem Set (classical)

### 2317. Bracket Sequence

#### Problem code: LEXBRAC

Correct Bracket Sequence (CBS) is a sequence that can be obtained through following rules:

- 1) An empty string is the CBS.
- 2) If A is a CBS, then  $B = (A)$  is also a CBS.
- 3) If A is a CBS, then  $B = [A]$  is also a CBS.
- 4) If A and B are CBS, then  $C = AB$  is also a CBS.

Length of the CBS is the number of brackets in it, and this number is always even.

Assume that  $'(' < ')'$  <  $'[' < ']'$ .

CBS  $a_1a_2 \dots a_n$  is lexicographically smaller than the CBS  $b_1b_2 \dots b_n$  if and only if there exists an integer  $i$ ,  $i \leq n$ , so that  $a_j = b_j$ , for each  $j$ ,  $1 \leq j < i$  and  $a_i < b_i$ .

#### Illustration

Enumerate all CBS length 4 in lexicographical order:  $()()$ ,  $OO$ ,  $O[]$ ,  $([])$ ,  $[O]$ ,  $[][]$ ,  $[]O$ ,  $[][]$ .

#### Task

Your task is to find  $k$ -th CBS with length  $n$  in lexicographical order

#### Input

Contains 2 integers  $n$  ( $2 \dots 250$ ) and  $k$  ( $1 \dots 10^{120}$ )

#### Output

Print the  $k$ -th CBS with length  $n$  in lexicographical order

#### Example

**Input :**

4

3

**Output :**

$() []$

---

Added by: Chinh Nguyen

Date: 2008-01-10

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 2318. Overlapping Words

#### Problem code: WORDS

Consider the following game: you are given a word  $W$  that contains only lower-case letters ("a" to "z"). You are also given a set of words and you are allowed to do the following operation: choose a suffix of  $W$  and replace it with another word (you can do this only if that word contains the suffix as its prefix). For example, if the current word is "acmicpc" you can choose to replace the suffix "pc" with any word in the set you are given that starts with "pc", e.g. "pcaargh" thus forming the word "acmicpcaargh". You can then repeat this procedure as many times as you wish. You are free to choose any suffix of the current word as long as it matches a prefix of the word you are replacing it with. You can also choose not to do the operation at all. Each suffix you replace must have length at least 1 (you cannot replace the "null suffix" with a word).

You are also given an integer  $L$ ,  $1 \leq L \leq 5$ . Your task is to find how many different subwords of length exactly  $L$  can be produced using the following operation. A "subword" means a substring of length  $L$ .

#### Input

The first line of the input file contains two integers,  $N$  and  $L$  separated by space.  $N$ ,  $1 \leq N \leq 100$  is the number of words in the set (including the initial word). The next  $N$  lines describe one word each. No other symbols except small latin letters, and the end-of-line symbol are found on these lines. Each word has length at least  $L$  and at most 128. The word you start with is the first word in this set.

#### Output

The only line of the output should contain one integer: the number of different subwords of length  $L$  that can be produced using the operation described above.

#### Example

**Input :**

```
2 5
acmicpc
pcaaaaaaargh
```

**Output :**

```
11
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-01-10

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: MIT 1st Team Contest 2007

## SPOJ Problem Set (classical)

### 2319. Sequence

#### Problem code: BIGSEQ

You are given the sequence of all  $K$ -digit binary numbers:  $0, 1, \dots, 2^K - 1$ . You need to fully partition the sequence into  $M$  chunks. Each chunk must be a consecutive subsequence of the original sequence. Let  $S_i$  ( $1 \leq i \leq M$ ) be the total number of 1's in all numbers in the  $i$ th chunk when written in binary, and let  $S$  be the maximum of all  $S_i$ , i.e. the maximum number of 1's in any chunk. Your goal is to minimize  $S$ .

#### Input

In the first line of input, two numbers,  $K$  and  $M$  ( $1 \leq K \leq 100$ ,  $1 \leq M \leq 100$ ,  $M \leq 2^K$ ), are given, separated by a single space character.

#### Output

In one line of the output, write the minimum  $S$  that can be obtained by some split. Write it without leading zeros. The result is not guaranteed to fit in a 64-bit integer.

#### Example

**Input :**

3 4

**Output :**

4

---

Added by: Jelani Nelson (Minilek)

Date: 2008-01-10

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: MIT 1st Team Contest 2007



## SPOJ Problem Set (classical)

### 2320. Manhattan

#### Problem code: DISTANCE

The  $L_1$  distance of two  $d$ -dimensional points is the sum of absolute values of their coordinate differences (i.e.  $\sum_{i=1}^d |x_i - y_i|$  for two points  $x, y$ ). Given  $N$  points in the plane you must find the farthest pair of points under the  $L_1$  distance metric and output their distance.

#### Input

The first line of the input is " $N$   $d$ " ( $2 \leq N \leq 100000$ ,  $1 \leq d \leq 6$ ) signifying that there are  $N$  points in  $d$ -dimensional space.  $N$  lines then follow, where the  $i$ th line is a space-separated list of  $d$  numbers, the coordinates of the  $i$ th point. All given coordinates are integers that are at most 1000000 in absolute value, and all given points are distinct.

#### Output

Your output should consist of a single integer, the farthest distance between a pair of input points, followed by a newline.

#### Example

**Input :**

```
3 2
0 0
-5 0
1 1
```

**Output :**

```
7
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-01-10

Time limit: 1s-30s

Source limit: 50000B

Languages: All

Resource: MIT 1st Team Contest 2007

## SPOJ Problem Set (classical)

### 2321. Segments

#### Problem code: SEGMENTS

There are  $N$  horizontal line segments in the plane. The  $i$ th segment has some height  $h_i$  (which may be negative) and runs from  $x = a_i$  to  $x = b_i$  ( $a_i < b_i$ ). Segments do not contain their endpoints. You must draw a set of vertical lines (note *lines* and not *line segments*) so that every given horizontal segment is intersected at least once and at most  $R$  times by vertical lines in such a way that  $R$  is minimized.

#### Input

The first line of the input is  $N$  ( $1 \leq N \leq 400$ ), the number of horizontal line segments.  $N$  lines then follow, where the  $i$ th line is " $a_i \ b_i \ h_i$ ". Each of  $a_i, b_i, h_i$  are 32-bit signed integers. Horizontal segments may overlap.

#### Output

Your output should consist of a single integer, the smallest value of  $R$  that is achievable, followed by a newline.

#### Example

**Input :**

```
3
0 1 5
0 2 -2
1 2 7
```

**Output :**

```
2
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-01-10

Time limit: 10s

Source limit: 50000B

Languages: All

Resource: MIT 1st Team Contest 2007

## SPOJ Problem Set (main)

### 2322. Tree Game

#### Problem code: TREEGAME

A complete binary tree of depth  $h$  is given. You can assign the value 0 or 1 to each leaf. Its internal nodes compute their values based on the values of their children, which is 0 if both children have value 1, and 1 otherwise. You play a game with a computer. The computer can ask you for a value of any leaf, and you can tell him either 0 or 1. The computer wants to know the root value, and he will keep asking until he is absolutely sure what the root value is. Your goal is to make him ask as many questions as possible. It is known that you can make a computer ask for all leaves. For a given sequence of leaves determine a sequence of 0's and 1's as answers to those leaves such that at no point before asking the last leaf value can the computer be sure of the root value. You must answer each question optimally (i.e. you should not make use of the knowledge of what the computer's  $(i+1)$ st query will be when you answer the  $i$ th query).

#### Input

In the first line of input the number  $h$  is given ( $1 \leq h \leq 15$ ). In the second line a space-separated list of  $2^h$  numbers are given. They are a permutation of the numbers  $1, 2, \dots, 2^h$ , and they represent the order of asked leaves (leaves of a tree are indexed from left to right).

#### Output

On a single line write a space-separated sequence of 0's and 1's corresponding to the values of leaves in the given order of being asked. If there are multiple solutions, write any of them. Do not output a response for the last query.

#### Example

**Input :**

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

**Output :**

```
1 1 1 1 0 0 1
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-01-10

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: MIT 1st Team Contest 2007

## SPOJ Problem Set (classical)

### 2323. Broken Compass

#### Problem code: COMPASS

A group of adventurers are on an expedition to reach the North Pole. The only instrument they have is a compass that points to the pole. However, the compass is broken and although its measurements are consistent, the direction it points to is some fixed but unknown angle away from true North. For example, if the error angle is 90 degrees, the compass will always point East at times when it should point North. This error angle may be zero, in which case the compass is not broken.

#### Input

To overcome this difficulty the group decided to take measurements at several different points and try to recover the location of the North pole from that. For simplicity, we assume that the region around the North pole is a plane in which a coordinate system is introduced. Each point is then described by a pair of real numbers  $(x,y)$ ,  $x,y \in [-200, 200]$ . One of those points (not necessarily  $(0,0)$ ) is the location of the pole. The compass would always point to that location if it were not broken. Instead, it always points a fixed angle away from the true direction to the pole. In this problem we assume that the magnetic pole is the same as the geographic pole and that it is a point source.

#### Output

The first line of input specifies one integer number  $N$ ,  $N < 10$ , the number of measurements taken. Each of the next  $N$  lines contains four space separated real numbers: the first two are the  $x$  and  $y$  coordinates of the point at which the measurement was taken, the third and fourth are  $(u_x, u_y)$ , the direction of a unit vector indicating where the compass needle points. There should be only one line of output that should contain two real numbers separated by space: the  $x$  and  $y$  coordinates of the pole. Your output is considered correct if it is within an additive 0.01 of the correct answer. All measurements are consistent and it is always possible to determine the location of the North pole from them. None of the measurements is made on the pole.

#### Example

**Input :**

4

```
1.000000 0.000000 -0.000000 -1.000000
-1.000000 0.000000 0.000000 1.000000
0.000000 1.000000 1.000000 0.000000
0.000000 -1.000000 -1.000000 0.000000
```

**Output :**

```
0.000000 0.000000
```

---

Added by: Jelani Nelson (Minilek)  
Date: 2008-01-10  
Time limit: 30s  
Source limit: 50000B  
Languages: All  
Resource: MIT 1st Team Contest 2007

## SPOJ Problem Set (main)

### 2324. Mario

#### Problem code: MARIOGAM

Mario lives in an  $N \times M$  maze grid. In this maze there are coin boxes, monsters, pipe systems, and walls. Whenever Mario enters a cell containing a coin box, he jumps to hit the box and gets as many coins as there are in the box (coin boxes do not disappear or lose coins after being hit). When Mario enters a cell with a monster, he loses a life. Pipe systems are like teleporters: for each system there is exactly one exit with at least one (but possibly several) entrances leading to that exit. When Mario walks into the entrance to a pipe system he is teleported to that pipe system's unique exit. Walking into a pipe system's exit does nothing special. Finally, Mario cannot walk into walls.

Mario decides to play a game. In the beginning of the game he starts with three lives at some given position, and at each time step he looks at all neighboring cells (excluding walls) and chooses one neighboring cell uniformly at random to walk to ( $x$  neighbors  $y$  if  $x$  is directly above, below, to the left, or to the right of  $y$ ). If Mario has no non-wall neighboring cells then he stays at his current location. The game is over when either Mario is out of lives or it is impossible for him to collect more coins. Help Mario figure out the expected number of coins he will earn in one play of the game.

#### Input

The first line of the input is " $N M$ " ( $1 \leq N, M \leq 15$ ), giving the dimensions of the maze. What follows are  $N$  lines, each of which are  $M$  characters in length. The  $i$ th line displays the contents of the cells in the  $i$ th row of the maze. Mario starts in the unique cell with an '\$' (which, beside holding Mario, is otherwise an empty cell). Cells with monsters are designated with '!'. Cells with coin boxes are represented by a number between 0 and 9 (inclusive), which is the number of coins in that coin box. Each pipe system is associated with a distinct letter between 'a' and 'z' (inclusive). A pipe system's entrances are designated with lower case letters, and the unique exit for a given pipe system has the corresponding capitalized letter (e.g. a pipe system with entrances labeled 'c' has exactly one exit, and it is labeled 'C'). Every pipe system appearing in the maze is guaranteed to have exactly one exit and at least one entrance. The character '#' designates a wall, and '.' designates an empty cell that Mario can just walk through.

#### Output

If the expected number of coins Mario collects is infinite, output -1. Otherwise, output a single real number, the expected number of coins Mario collects before the game is over. Your answer should be accurate to within either an absolute or relative error of  $10^{-6}$  of the actual answer. Your output should be followed by a newline.

#### Example

**Input :**  
2 3  
\$1!

a.A

**Output :**

3.000000000

---

Added by: Jelani Nelson (Minilek)

Date: 2008-01-10

Time limit: 30s

Source limit:50000B

Languages: All

Resource: MIT 1st Team Contest 2007

## SPOJ Problem Set (main)

### 2325. String Distance

#### Problem code: STRDIST

Let  $A = a_1 a_2 \dots a_k$  and  $B = b_1 b_2 \dots b_l$  be strings of lengths  $k$  and  $l$ , respectively. The string distance between  $A$  and  $B$  is defined in the following way ( $d[i, j]$  is the distance of substrings  $a_1 \dots a_i$  and  $b_1 \dots b_j$ , where  $0 \leq i \leq k$  and  $0 \leq j \leq l$  --  $i$  or  $j$  being 0 represents the empty substring). The definition for  $d[i, j]$  is  $d[0, 0] = 0$  and for  $(i, j) \neq (0, 0)$   $d[i, j]$  is the minimum of all that apply:

- $d[i, j - 1] + 1$ , if  $j > 0$
- $d[i - 1, j] + 1$ , if  $i > 0$
- $d[i - 1, j - 1]$ , if  $i > 0, j > 0$ , and  $a_i = b_j$
- $d[i - 1, j - 1] + 1$ , if  $i > 0, j > 0$ , and  $a_i \neq b_j$
- $d[i - 2, j - 2] + 1$ , if  $i \geq 2, j \geq 2$ ,  $a_i = b_{j-1}$ , and  $a_{i-1} = b_j$

The distance between  $A$  and  $B$  is equal to  $d[k, l]$ .

For two given strings  $A$  and  $B$ , compute their distance knowing that it is not higher than 100.

#### Input

In the first line,  $k$  and  $l$  are given, giving the lengths of the strings  $A$  and  $B$  ( $1 \leq k, l \leq 10^5$ ). In the second and third lines strings  $A$  and  $B$ , respectively, are given.  $A$  and  $B$  contain only lowercase letters of the English alphabet.

#### Output

In the first line, write one number, the distance between  $A$  and  $B$ , followed by a newline.

#### Example

**Input :**

```
8 8
computer
kmpjutre
```

**Output :**

```
4
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-01-10

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: MIT 1st Team Contest 2007



## SPOJ Problem Set (classical)

### 2412. Arranging Amplifiers

#### Problem code: ARRANGE

Scientists at the TIFR, Mumbai, are doing some cutting edge research on the Propagation of Signals. A young researcher comes up with a method of progressively amplifying signals, as they progress along a path. The method involves the placing of Amplifiers at regular distances along the line. Each amplifier is loaded with a number  $a(i)$ , which is called its amplification factor. The method of amplification is simple: an amplifier which receives a signal of strength  $X$ , and has  $Y$  loaded in it, results in a signal of strength  $Y^X$  [ $Y$  to the power  $X$ ]. In course of his research, the young scientist tries to find out, that given a set of  $n$  amplifiers loaded with  $a(0)$ ,  $a(1)$ ,  $a(2)$ , ...,  $a(n-1)$ , which particular permutation of these amplifiers, when placed at successive nodes, with the initial node given a signal of strength 1, produces the strongest output signal.

this is better illustrated by the following example : 5 6 4

$4^{(5^{(6^1)})}$  is the strength of the strongest signal, which is generated by putting amplifier loaded with 6 in first place, 5 in second place and 4 in third place.

Given a list of integers specifying the set of amplifiers at hand, you must find out the order in which they must be placed, to get the highest signal strength. In case there exist multiple permutations with same output, you should print the one which has bigger amplifiers first.

#### Input

First line of input contains  $T$ , the number of test cases. For each test case first line contains a number  $n_i$ , which is equal to the number of amplifiers available. Next line contains  $n$  integers, separated by spaces which denote the values with which the amplifiers are loaded.

#### Output

Output contains  $T$  lines, one for each test case. Each line contains  $n_i$  integers, denoting the order in which the amplifiers should be kept such that the result is strongest.

#### Example

**Input :**

```
2
3
5 6 4
2
2 3
```

**Output :**

```
6 5 4
2 3
```

## Constraints and Limits

$T \leq 20$ ,  $N_i \leq 10^5$ .

Each amplifier will be loaded with a positive integer  $p$ ,  $0 < p \leq 10^9$ .

No two amplifier  $> 1$  shall be loaded with the same integer.

---

Added by: Ajay Somani

Date: 2008-02-04

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: CodeCraft 08 Anshuman Singh

## **SPOJ Problem Set (classical)**

### **2413. Building Beacons**

#### **Problem code: BUILD**

A Millionaire Eccentric Mathematician purchases a small Island, to build his residence. In order to keep away Trespassers, he decides to Build some Beacons (Towers) on the perimeter of the Island. To build these Beacons, he visits the Mainland to purchase Stone.

Being obsessed with Prime Numbers, the stone blocks he orders are all Regular Tridecagons (13 Sides). However, their heights are variable. On delivery of the Blocks, he orders them to be flattened perfectly from the top and the bottom, so that the Tridecagonal shape is viewable from the Top (or Bottom), in such a way that the Height of each block measures to a power of 2. The stones, procured from various sources, are of Variable strength. He intends to build the Beacons by placing Stone Blocks one over the other. The heights of the Towers are specified by the Mathematician, and they are also Prime Numbers. He instructs the Architect to make sure that once the Beacons are complete, the strengths of the used stones add up to the Maximum Possible Number.

> The Architect, not knowing how the job can be done, or even whether it CAN be done, with such complicated restrictions, approaches you to find this out for him.

#### **Input<h3>**

**First line of input contains a positive integer T, the number of test cases. The first line of each test case contains a positive integer K, equal to the total number of stones available. This line is followed by K lines, each containing a pair of positive integers X,Y. Here X denotes the height of that stone (here the height would be  $2^X$ ) and Y denotes its value. Followed is a line containing an integer N, the number of towers. Each of the next N lines contain a single positive number, which is the height H of the corresponding tower the mathematician wants to build.**

#### **Output**

**Output contains T lines, one for each test case, containing a number denoting the maximum sum total of strengths of rocks used to construct the Beacons if solution is possible, else the message "Plan Failed!".**

## Example

**Input :**

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

**Output :**

```
7
```

## Constraints and Limits

$T \leq 11$ ,  $H < 10^{281}$ ,  $0 \leq X \leq 977$ ,  $0 < Y \leq 977$ ,  $0 \leq k \leq 977$ ,  $N \leq 97$

---

**Added by:** Ajay Somani

**Date:** 2008-02-05

**Time limit:** 4s

**Source  
limit:** 50000B

**Languages:** All

**Resource:** CodeCraft 08, Problem Setter: Gaurav Agarwal, Anshuman Singh

## SPOJ Problem Set (classical)

### 2414. Calculate The Cost

#### Problem code: CCOST

In a small Village near the Himalayas, there is a rich Land-Owner, in Possession of a vast, rectangular tract of land. Unknown to him, a Major Oil Corporation has verified the existence of a vast Oil Resource beneath the land owned by him.

>

> The Oil Company sends a Man to negotiate the purchase of a rectangular field from within the landowner's land, with sides parallel to those of his area. The Landowner, valuing his land according to the trees growing in it and the area to be purchased, gives the company man a Map of his Land, marking the location of trees of different types, and a list of the worth of each type of tree.

>

To ensure the most economic purchase of land with the required dimensions, the Company Man provides you with the data in his possession, and alongwith that, a list of the land areas that he considers good by his judgement.

>

You must provide, for each land area that he has listed, the Sum Total of the values of the Trees that lie Within or On the Boundary of that land area.

#### Input

The first line of the input contains an integer T, which is the number of test cases. For each test case, the first line contains an integer n, equal to the number of trees in the area. This line is followed by n lines each containing 3 integers separated by spaces which are coordinate of the tree ( x, y ) and value of that tree. Following this is an integer R, equal to the number of proposals of land areas given by the Company Man. Next R lines contain 4 integers each (x1, y1, x2, y2) which are the coordinates of lower left ( x1,y1 ) and upper right ( x2, y2 ) corner of the rectangular area.

#### Output

For each test case, your program should output R lines containing the sum of values of the Trees which lie inside or on the corresponding rectangular plot. There should NOT BE any blank lines between output of different test cases.

#### Example

Input :

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

Output :

2  
9

## Constraints and Limits

$T \leq 10$ ,  $n \leq 10^5$ ,  $r \leq 50000$ ,  $0 \leq x, y \leq 10^7$ , value of any tree  $\leq 10^4$ .

For any rectangular area  $0 \leq x1 \leq x2 \leq 10^7$ ,  $0 \leq y1 \leq y2 \leq 10^7$

**Note 1:** There can be more than one trees at the same point.

> **Note 2:** The input data is large ( about 15 MB ), Be careful about your input output routines.

>.

---

Added  
by: Ajay Somani

Date: 2008-02-05

Time limit: 8s

Source limit: 50000B

Languages: All

Resource: CodeCraft 08, Problem Setter: Ajay Somani, Anshuman Singh

## SPOJ Problem Set (classical)

### 2415. Kirchhof Law

#### Problem code: RESIST

#### Input

Multiple test cases. For each test case:

The first line contains integers  $N$  and  $M$ ;  $N$  is a number of nodes in the circuit ( $2 < N \leq 100$ ),  $M$  is the number of resistors ( $0 \leq M \leq 300$ ). Each of the next  $M$  lines consists of three integers  $A_i$ ,  $B_i$  and  $R_i$  -- description of a resistor that has resistance  $R_i$  connecting the nodes  $A_i$  and  $B_i$  ( $1 \leq A_i, B_i \leq N$ ;  $1 \leq R_i \leq 100$ ).

Input terminates by EOF.

#### Output

For each test case, output the total resistance between the nodes 1 and  $N$  rounded within two digits after a decimal points.

#### Example

**Input :**

```
4 5
1 2 15
2 4 5
1 3 10
3 4 10
2 3 1
```

**Output :**

```
9.40
```

---

Added by: Blue Mary

Date: 2008-02-05

Time limit: 1s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Timus Online Judge, test data by g201513

## SPOJ Problem Set (classical)

### 2418. Flying Frogs

#### Problem code: FFROG

WiseFrog, The King of FrogLand is on his Deathbed. He has 2 Sons, SensibleFrog and SmartFrog. Both of them are "Infinitely Intelligent". To decide who will succeed him as King, he devises a Strategy Game for the two Sons-

>

> An Arena is constructed, in the form of a Rectangle, having  $m \times n$  Square Areas. They are labelled as  $(i,j)$ , starting from the Upper Left extremity of the Arena [ $i=0,1,2,\dots,n-1$ ;  $j=0,1,2,\dots,m-1$ ]. The Squares in the Arena are filled with Flying Frogs, in a Random Manner, such that there can be any number of Frogs in each square.

>

> Once the Arena is ready, the 2 Frog Princes begin to play the Game, which is played in the following manner: SensibleFrog, being the King's favourite, starts the Game.

>

> Each Prince takes his turn alternately. In his turn, he is permitted a maximum of  $K$  moves, and a minimum of 1 move. A "Move" is defined as the Issuing of an Order to any Frog of his choice. The "order" consists of the Direction to jump in, and the Number of Squares to Cover ( which should be positive ), the directions of movement permitted being Up and Left Only. However, the Order must not be such that it causes the Frog to land outside the Arena. Being Flying Frogs, the frogs in the Arena can jump any distance without trouble.

>

> If there arrives a situation where the Prince having his turn does not have ANY move Possible ( that is, ALL the Flying Frogs are already at the top-left most square of the arena ), the other Prince is declared the Winner. Given all the Starting Conditions, your task is to find out who becomes the King of FrogLand.

>

#### Input<h3>

First line of input contains an integer  $T$ , equal to the number of test cases. Followed is the description of each of the  $T$  test cases and you are required to process all test cases. First line of each test case contains three integers  $m,n,k$  ( in this order ). Each of the next  $m$  lines contain  $n$  integers separated by spaces.  $J$ th integer in  $i$ th line corresponds to the number of Flying Frogs in Square  $(i,j)$  in the arena.

#### Output

Output contains one line for each test case. You have to output "SensibleFrog Wins!." if SensibleFrog wins and "SmartFrog Wins!." otherwise.



## Example

### Input :

```
3
1 1 1
837465
2 2 1
0 0
0 1
2 2 2
0 0
0 2
```

### Output :

```
SmartFrog Wins!.
SmartFrog Wins!.
SensibleFrog Wins!.
```

## Constraints and Limits

**$T \leq 20$ ,  $1 \leq m, n \leq 1000$ ,  $m * n \leq 10^5$ ,  $1 \leq k \leq 10^9$ ,  $0 \leq$   
Number of Frogs in a square  $\leq 10^{100}$ .**

**> The total input data in each of the input file doesn't exceed 5 MB.**

---

|               |   |
|---------------|---|
| Added         | Ajay Somani                               |
| by:<td>       |   |
| Date:         | 2008-02-05                                |
| Time limit:   | 4s  |
| Source limit: | 50000B                                    |
| Languages:    | All                                       |
| Resource:     | CodeCraft 08, Problem Setter: Ajay Somani |

## SPOJ Problem Set (classical)

### 2419. G-Line Grid

#### Problem code: GLGRID

The 21st century introduces the multicores. As a result a research is going on in parallel Computing. With time the number of processor would grow very large. As of now, Professor Biloo at IIIT asks a student to implement the following code on multiple G-line processors.

>

```
for (i=1; i<=x; i++) {
    for (j=1; j<=x; j++) {
        for (k=1; k<=a; k++) {
            z=z%y;
        }
    }
    for (j=1; j<=b; j++) {
        z=zy;
    }
}
for (i=1; i<=c; i++) {
    z=z%y;
}
```

>

The students experiments and finds that the only significant operations are the modulus(%) and division(/) operation which take almost equal time. The time taken by other operations may be ignored in the order analysis. He finds a algorithm to solve the problem in which these operations can be carried out in random order. For his testing he chooses M processors . Each processor will carry out exactly M operations (% or /) .The performance is optimal when such a scheme exactly covers all the operations.

Puzzled, the student finds that this can only be done for some specific values of x for given a,b and c. He wants to trick the professor, so he needs few values of x for which his algorithm works. However, to make the professor feel that he manually did it these values of x need to be as small as possible.

>

> Given the values of a,b,c and k, output the first k values of x, for which the student's algorithm works.

>

> **Note:** The value of x should be greater than or equal to 0.

>

#### Input<h3>

The first line of input contains an integer t , the number of testcases. For each testcase , there is exactly one line which contains 4 space separated a,b,c and k.

## Output

For each test case, output the corresponding k values of x, each in successive different lines.

## Example

**Input :**

```
1
1 2 1 4
```

**Output :**

```
0
1
2
3
```

## Constraints and Limits

$t \leq 10$ . The values in the output  $v_i \leq 10^{12}$ . Each of the intermediate values will fit in a 64 bit variable. The values a,b,c would be such that  $0 \leq a,b,c \leq 100$  and  $b^2 - 4ac \geq 0$ .  $k \leq 1000$ .

> Note : <b> Test data to this problem was modified on Feb 7.

> Note 2: <b> There were some mistakes in the test data discovered on March 11, 2008. New tricky cases provided by Blue Mary are also put up now and some "Accepted" solutions have received wrong answer. My apologies to one and all for the mistakes.

---

Added by: Ajay Somani

Date: 2008-02-05

Time limit: 2s

Source  
limit: 50000B

Languages: All

Resource: CodeCraft 08 Anshuman  
Singh

## **SPOJ Problem Set (classical)**

### **2420. Hospital at Hands**

#### **Problem code: HHAND**

In a remote part of the Country, there lies a group of towns, quite far from any other areas. These towns are connected by a set of roads, having the property that there is exactly one path connecting any two towns, and every town is connected.

>

> Apollo Hospitals Ltd. decides to invest in this area, and build some Hospitals. Their analyst has a monumental task ahead of him. His job is to find out a Set of continuous towns, from among them, to build one hospital in each. The path connecting the first town to the last town in the set (which obviously passes through all the remaining ones) should not be more than length L, to avoid inconvenience to the visiting doctors. Also, the analyst has to make sure that his selection of target towns is such that the people of the area have to cover the least distance to reach the hospital closest to them.

>

> Thus, the towns where Hospitals will be built have to be chosen keeping in mind that the sum of distances that people from each town will need to cover, in order to reach the Hospital closest to them, should be Minimum. You have to find this minimum sum.

>

#### **Input<h3>**

**First line of input contains an integer T which is equal to the number of test cases. You are required to process all test cases. Each test case starts with 2 space separated integers N,L. N denotes the number of towns and L is the length of path connecting first and last town in the set. Next N-1 lines follow each contains two space separated integers a and b denoting a road between A and B. A and B are 0 based.**

#### **Output**

**Output consists of T lines. I<sup>th</sup> line in the output corresponds to the minimum sum total of the distances of all the towns with the nearest hospital for the I<sup>th</sup> test case.**

#### **Example**

**Input :**

2

3 1

0 1

1 2  
4 1  
0 1  
1 2  
2 3

**Output :**

1  
2

### **Constraints and Limits**

**$T \leq 30$ ,  $n \leq 10000$ ,  $0 < L \leq 100$**

---

**Added by:** Ajay Somani

**Date:** 2008-02-05

**Time limit:** 5s

**Source  
limit:** 50000B

**Languages:** All

**Resource:** CodeCraft 08 Aryan-Gaurav,Ajay  
Somani

## SPOJ Problem Set (classical)

### 2422. Jazzy Job

#### Problem code: JAZZYJOB

With the magnification of the Energy Crisis, Chemists have decided to re-examine the existing procedures of preparation of various Chemical Substances.

>

> As part of this Project, they list all the elements that they commonly find as raw material (Initial Reactants), and the ones that they intend to produce (Final Products). They also prepare an extensive list of the various known reactions/processes that are used to convert one substance to another.

>

> One major issue that they find is that the Initiation of many reactions needs absurdly large amounts of energy. They wish to keep low the activation energies used in the new procedures.

>

> Knowing all this, they now attempt to find out such methods of preparing the target substances :

> (1) in which the highest value of activation energy needed by any of the reactions that make up the path, in any of the methods, does not exceed a given upper value,

> (2) which minimizes the Total reactions/procedures performed in All the (Initial Reactant) --> (Final Product) conversions.

>

> Each substance, on being given a specific amount of energy, converts into some other substance. The formed substance is unique for a particular value of Energy. The process of creating each successive Target Substance (Final Product) starts from one of the Source Substances Only, and leaves no by-products.

>

> Your task is to find the minimum value of upper bound such that all final products are obtainable with that upper bound and for this minimum value, find out the minimum number of conversions to get all the final products.

>

> **Note:** None of the procedures are Reversible, unless explicitly stated. Also, if a procedure is reversible, the Energy requirement may or may not be same. You may assume that there is a limitless supply of the Initial Reactants.

>

#### Input

**The first line contains an integer  $t$  which is the number of test cases.**

**Each test case begins with a line containing three integers : number of Initial reactants( $S$ ), Final Products( $D$ ) and the total number of elements ( $N$ ). Then  $S+D$  lines follow, first  $S$  lines contain IDs of Initial reactant ( 0 based ) and next  $D$  lines contain ID's of Final products ( 0 based).**

**Then follows a line containing an integer  $R$  which is number of reactions possible. Then follow  $R$  lines, each containing three integers,**

the Substance(S), the converted substance(C) and the activation energy(A) units required for the reaction.  $0 \leq S, C < n$ .

## Output

For each test case , output in a different line ,2 integers (a,b) separated by spaces where a is the minimum upper value and b is the minimum number of conversions required for corresponding a. In case that all final products are not obtainable for any value of upper bound, Print a single line with message "Excessive Energy."

## Example

**Input :**

```
1
2 2 6
1
3
0
3
6
1 2 2
2 4 3
4 5 1
4 2 2
3 0 4
5 0 1
```

**Output :**

```
3 4
```

## Constraints and Limits

$N \leq 10000$ ,  $S \leq N$ ,  $D \leq N$ ,  $R < 100000$   $0 < A < 10000000000$

---

Added by: Ajay Somani

Date: 2008-02-05

Time limit: 4s

Source  
limit: 50000B

Languages: All

Resource: CodeCraft 08  
Aryan-Gaurav

## SPOJ Problem Set (classical)

### 2423. Minimal Triangulations of Graphs

#### Problem code: MINTRIAN

Check whether the given graph is chordal.

#### Input

The first line contains an integer  $1 \leq t \leq 200$  denoting the number of test cases. Then  $t$  graphs are given (not necessarily connected). Each graph is described by two lines. The first line contains a string of the form:  $n=\text{nodes}, m=\text{edges}$ : The second line gives the edges of the graph separated by commas. Each edge is given as a pair of vertices:  $\{u,v\}$ . Vertices of the graph are denoted with integers  $0, \dots, n-1$ .

#### Output

For each test case print YES if the graph is chordal, or NO if it isn't.

#### Example

**Input :**

```
2
n=6,m=4
{0,1} {2,3} {3,4} {3,5}
n=6,m=7
{0,3} {1,2} {1,3} {2,4} {2,5} {3,4} {3,5}
```

**Output :**

```
YES
NO
```

---

Added by: Tomasz Goluch

Date: 2008-02-05

Time limit: 60s

Source limit: 50000B

Languages: All



## SPOJ Problem Set (classical)

### 2426. Palindromes

#### Problem code: PLD

A palindrome is a word, phrase, number or other sequence of units that has the property of reading the same in either direction, e.g. 'racecar', 'solos'.

#### Task

You are given a number  $k$  ( $2 \leq k \leq 30000$ ) and a non-empty string  $S$  whose length does not exceed 30000 lowercase letters.

We say two palindromes are different when they start from different positions. How many different palindromes of the length  $k$  does  $S$  contains?

#### Input

The first line contains  $K$ . The second line contains  $S$ .  $K$  does not exceed the length of  $S$ .

#### Output

The first and only line should consist of a single number - the number of palindromes found.

#### Example

**Input :**

5

ababab

**Output :**

2

---

Added by: Chinh Nguyen

Date: 2008-02-07

Time limit: 0.5s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 2450. Counting Rabbits

#### Problem code: RABBIT1

Rabbits are incredible animals. One of their more interesting characteristics is related with their reproduction. If we keep a couple of adult rabbits in optimal conditions of life, it is scientifically proved that, each month, that couple is capable of procreating a new couple of young rabbits. You should know that only the adult couples may procreate and that the time taken by a young couple of rabbits to grow (that is, to become adult) is of 1 month. For the convenience of this task, we will be dealing with immortal rabbits.

Farmer Luis (FL) is a great admirer of rabbits. FL bought in the market 1 couple of adult rabbits (alive, of course) and now wants to raise as many rabbits as he can. Unfortunately, there is a little problem, FL has boxes where he can only put exactly  $2^M$  ( $1 \leq M \leq 20$ ) couples of rabbits (neither more nor less). FL can use as many boxes as he wishes as long as he fulfils the condition above. FL would like to know how many couples of rabbits he will not be able to put inside boxes if he raises rabbits for  $N$  ( $1 \leq N \leq 2147483647$ ) months and then tries to 'box' them (put them inside boxes). You should help FL with these calculations. You must consider that FL starts with 1 adult couple of rabbits the 1st month, and that couples of rabbits reproduce and grow as stated in the 1st paragraph.

#### Input

Line 1:  $C$  ( $1 \leq C \leq 100$ ), the number of calculations your program will be requested to do

Lines 2- $C+1$ : two integers  $N$  and  $M$  (in that order)

#### Output

Lines 1- $C$ : on each line print  $S$ , which is the number of rabbits FL will not be able to 'box' for calculation #  $i$

#### Example

**Input :**

```
1
5 2
```

**Output :**

```
0
```

Output explanation:

After growing couples of rabbits during 5 months, FL has 5 adult couples and 3 young couples (8 couples in total). FL has boxes where can put  $2^2 = 4$  couples of rabbits, so he can use 2 boxes to 'box' all the 8 couples. If FL had instead grown couples of rabbits for 4 months, he would have 5 couples in total; thus 1 couple would have remained un-'boxed' (the answer would have been 1).

---

Added by: Abel Nieto Rodriguez  
Date: 2008-02-14  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: Mindbend 2002 Programming Contest

## SPOJ Problem Set (classical)

### 2485. Phone Lines

#### Problem code: PHONELIN

There are several cities and towers on a straight line. Towers can be set to connection-accepting by paying a cost. We are given the location (on the X-axis), of the towers and the cities. Our job is to set up certain towers as connection-accepting. Now every city, pays you an amount equal to **D - distance\_travelled\_by\_data**, for every unit of data (for every tower) it can send. ( $\text{distance\_travelled\_by\_data} = \text{cityX} - \text{towerX}$ ); Our job here is to setup connections on different towers to get maximal profit.

Each city when it wants to route some data to a tower works with the following algorithm:

- (1) Find the nearest tower to the left of the city.
- (2) If it is within the range 'D', it sends the data to that tower. If this tower exceeds the range D, or if the tower doesn't accept connections, the city can't send the data and stops immediately. (Doesn't check the next available tower);
- (3) If the data is sent successfully: Then the city
  - (3.1) Skips three towers. (Doesn't care if these three towers are connection-accepting or not);
  - (3.2) Tries to send data to the next tower (the fourth one after the skipping), by using step (2);

Input format:

Input consists of multiple testcases.

First line of each test case, contains two integers: D C T; The range, the number of cities and the number of towers, respectively.

Second line contains exactly C integers saying the location of the cities (on the X-axis).

The next T lines contain exactly two integers: location[i] connection-cost[i]; which is the position of tower i, and the cost to setup tower i as connection-accepting;

The input ends with a line: "-1 -1 -1"

Output format:

For each test case, output a single line saying the maximum amount of profit you can make.

Constraints:

Now two points (towers or cities), will have the same X-coordinate.  $T, C \leq 100$ .

Sample Input:

```
4 9 6
23
43
18
15
29
50
41
31
40
32 2
26 0
46 7
```

```
48 0
50 3
38 1
-1 -1 -1
```

Sample Output:

5

---

Added by: Prasanna  
Date: 2008-02-25  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: ByteCode 2008

## SPOJ Problem Set (classical)

### 2523. Misspelling

#### Problem code: GNY07A

Misspelling is an art form that students seem to excel at. Write a program that removes the  $n$ th character from an input string.

#### Input

The first line of input contains a single integer  $N$ , ( $1 \leq N \leq 1000$ ) which is the number of datasets that follow.

Each dataset consists of a single line of input containing  $M$ , a space, and a single word made up of uppercase letters only.  $M$  will be less than or equal to the length of the word. The length of the word is guaranteed to be less than or equal to 80.

#### Output

For each dataset, you should generate one line of output with the following values: The dataset number as a decimal integer (start counting at one), a space, and the misspelled word. The misspelled word is the input word with the indicated character deleted.

#### Example

**Input :**

```
4
4 MISPELL
1 PROGRAMMING
7 CONTEST
3 BALLOON
```

**Output :**

```
1 MISPELL
2 ROGRAMMING
3 CONTES
4 BALOON
```

---

Added by: Marco Gallotta

Date: 2008-03-11

Time limit: 60s

Source limit: 50000B

Languages: All

Resource: ACM Greater New York Regionals 2007

# SPOJ Problem Set (classical)

## 2524. Conversions

### Problem code: GNY07B

Conversion between the metric and English measurement systems is relatively simple. Often, it involves either multiplying or dividing by a constant. You must write a program that converts between the following units:

| Type          | Metric           | English equivalent |
|---------------|------------------|--------------------|
| <b>Weight</b> | 1.000 kilograms  | 2.2046 pounds      |
|               | 0.4536 kilograms | 1.0000 pound       |
| <b>Volume</b> | 1.0000 liter     | 0.2642 gallons     |
|               | 3.7854 liters    | 1.0000 gallon      |

### Input

The first line of input contains a single integer N, ( $1 \leq N \leq 1000$ ) which is the number of datasets that follow.

Each dataset consists of a single line of input containing a floating point (double precision) number, a space and the unit specification for the measurement to be converted. The unit specification is one of kg, lb, l, or g referring to kilograms, pounds, liters and gallons respectively.

### Output

For each dataset, you should generate one line of output with the following values: The dataset number as a decimal integer (start counting at one), a space, and the appropriately converted value rounded to 4 decimal places, a space and the unit specification for the converted value.

### Example

**Input :**

```
5
1 kg
2 l
7 lb
3.5 g
0 l
```

**Output :**

```
1 2.2046 lb
2 0.5284 g
3 3.1752 kg
4 13.2489 l
5 0.0000 g
```

---

Added by: Marco Gallotta  
Date: 2008-03-11  
Time limit: 60s  
Source limit: 50000B  
Languages: All  
Resource: ACM Greater New York Regionals 2007



# SPOJ Problem Set (classical)

## 2525. Encoding

### Problem code: GNY07C

Chip and Dale have devised an encryption method to hide their (written) text messages. They first agree secretly on two numbers that will be used as the number of rows (R) and columns (C) in a matrix. The sender encodes an intermediate format using the following rules:

1. The text is formed with uppercase letters [A-Z] and <space>.
2. Each text character will be represented by decimal values as follows:

<space> = 0, A = 1, B = 2, C = 3, ..., Y = 25, Z = 26

The sender enters the 5 digit binary representation of the characters' values in a spiral pattern along the matrix as shown below. The matrix is padded out with zeroes (0) to fill the matrix completely. For example, if the text to encode is: "ACM" and R=4 and C=4, the matrix would be filled in as follows:

[IMAGE]

A = 00001, C = 00011, M = 01101  
(one extra 0)

The bits in the matrix are then concatenated together in row major order and sent to the receiver. The example above would be encoded as: 0000110100101100

## Input

The first line of input contains a single integer N, ( $1 \leq N \leq 1000$ ) which is the number of datasets that follow.

Each dataset consists of a single line of input containing R ( $1 \leq R \leq 20$ ), a space, C ( $1 \leq C \leq 20$ ), a space, and a text string consisting of uppercase letters [A-Z] and <space>. The length of the text string is guaranteed to be  $\leq (R*C)/5$ .

## Output

For each dataset, you should generate one line of output with the following values: The dataset number as a decimal integer (start counting at one), a space, and a string of binary digits ( $R*C$ ) long describing the encoded text. The binary string represents the values used to fill in the matrix in row- major order. You may have to fill out the matrix with zeroes (0) to complete the matrix.

## Example

Input :

```
4
4 4 ACM
5 2 HI
2 6 HI
5 5 HI HO
```

**Output :**

```
1 0000110100101100
2 0110000010
3 010000001001
4 0100001000011010110000010
```

---

Added by: Marco Gallotta

Date: 2008-03-11

Time limit: 60s

Source limit:50000B

Languages: All

Resource: ACM Greater New York Regionals 2007

# SPOJ Problem Set (classical)

## 2526. Decoding

### Problem code: GNY07D

Chip and Dale have devised an encryption method to hide their (written) text messages. They first agree secretly on two numbers that will be used as the number of rows (R) and columns (C) in a matrix. The sender encodes an intermediate format using the following rules:

1. The text is formed with uppercase letters [A-Z] and <space>.
2. Each text character will be represented by decimal values as follows:

<space> = 0, A = 1, B = 2, C = 3, ..., Y = 25, Z = 26

The sender enters the 5 digit binary representation of the characters' values in a spiral pattern along the matrix as shown below. The matrix is padded out with zeroes (0) to fill the matrix completely. For example, if the text to encode is: "ACM" and R=4 and C=4, the matrix would be filled in as follows:

[IMAGE]

A = 00001, C = 00011, M = 01101  
(one extra 0)

The bits in the matrix are then concatenated together in row major order and sent to the receiver. The example above would be encoded as: 0000110100101100

## Input

The first line of input contains a single integer N, ( $1 \leq N \leq 1000$ ) which is the number of datasets that follow.

Each dataset consists of a single line of input containing R ( $1 \leq R \leq 20$ ), a space, C ( $1 \leq C \leq 20$ ), a space, and a string of binary digits that represents the contents of the matrix (R \* C binary digits). The binary digits are in row major order.

## Output

For each dataset, you should generate one line of output with the following values: The dataset number as a decimal integer (start counting at one), a space, and the decoded text message. You should throw away any trailing spaces and/or partial characters found while decoding.

## Example

Input :

```
4
4 4 0000110100101100
5 2 0110000010
2 6 010000001001
5 5 0100001000011010110000010
```

**Output :**

```
1 ACM
2 HI
3 HI
4 HI HO
```

---

Added by: Marco Gallotta

Date: 2008-03-11

Time limit: 60s

Source limit:50000B

Languages: All

Resource: ACM Greater New York Regionals 2007

## SPOJ Problem Set (classical)

### 2527. Flipping Burned Pancakes

#### Problem code: GNY07E

The cook at the *Frobbozz Magic Pancake House* sometimes falls asleep on the job while cooking pancakes. As a result, one side of a stack of pancakes is often burned. Clearly, it is bad business to serve visibly burned pancakes to the patrons. Before serving, the waitress will arrange the stacks of pancakes so that the burned sides are facing down. You must write a program to aid the waitress in stacking the pancakes correctly.

We start with a stack of  $N$  pancakes of distinct sizes, each of which is burned on one side. The problem is to convert the stack to one in which the pancakes are in size order with the smallest on the top and the largest on the bottom and burned side down for each pancake. To do this, we are allowed to flip the top  $k$  pancakes over as a unit (so the  $k$ -th pancake is now on top and the pancake previously on top is now in the  $k$ -th position and the burned side goes from top to bottom and vice versa).

For example (+ indicates burned bottom, - a burned top):

```
+1 -3 -2 [flip 2] => +3 -1 -2 [flip 1] => -3 -1 -2 [flip 3] =>
+2 +1 +3 [flip 1] => -2 +1 +3 [flip 2] => -1 +2 +3 [flip 1] => +1 +2 +3
```

You must write a program which finds a sequence of at most  $(3n - 2)$  flips, which converts a given stack of pancakes to a sorted stack with burned sides down.

### Input

The first line of the input contains a single decimal integer,  $N$ , the number of problem instances to follow. Each of the following  $N$  lines gives a separate dataset as a sequence of numbers separated by spaces. The first number on each line gives the number,  $M$ , of pancakes in the data set. The remainder of the data set is the numbers 1 through  $M$  in some order, each with a plus or minus sign, giving the initial pancake stack. The numbers indicate the relative sizes of the pancakes and the signs indicate whether the burned side is up (-) or down (+).  $M$  will be, at most, 30.

### Output

For each dataset, you should generate one line of output with the following values: The dataset number as a decimal integer (start counting at one), a space, the number of flips ( $K$ , where  $K \geq 0$ ) required to sort the pancakes and a sequence of  $K$  numbers, each of which gives the number of pancakes to flip on the corresponding sorting step. There may be several correct solutions for some datasets. For instance 3 2 3 is also a solution to the first problem below.

### Example

Input :

```
3
3 +1 -3 -2
4 -3 +1 -2 -4
5 +1 +2 +3 +4 -5
```

**Output :**

```
1 6 2 1 3 1 2 1
2 6 4 1 4 3 1 2
3 3 5 1 5
```

---

Added by: Marco Gallotta

Date: 2008-03-11

Time limit: 60s

Source limit:50000B

Languages: All

Resource: ACM Greater New York Regionals 2007

## SPOJ Problem Set (classical)

### 2528. Monkey Vines

#### Problem code: GNY07F

Deep in the Amazon jungle, exceptionally tall trees grow that support a rich biosphere of figs and juniper bugs, which happen to be the culinary delight of brown monkeys.

Reaching the canopy of these trees requires the monkeys to perform careful navigation through the tall tree's fragile vine system. These vines operate like a see-saw: an unbalancing of weight at any vine junction would snap the vine from the tree, and the monkeys would plummet to the ground below. The monkeys have figured out that if they work together to keep the vines properly balanced, they can *all* feast on the figs and juniper bugs in the canopy of the trees.

A *vine junction* supports exactly two *sub-vines*, each of which must contain the same number of monkeys, or else the vine will break, leaving a pile of dead monkeys on the jungle ground. For purposes of this problem, a *vine junction* is denoted by a pair of matching square brackets [ ], which may contain nested information about junctions further down its *sub-vines*. The nesting of vines will go no further than **25** levels deep.

[IMAGE]

You will write a program that calculates the *minimum* number of monkeys required to balance a particular vine configuration. There is **always** at least one monkey needed, and, multiple monkeys may hang from the same vine.

#### Input

The first line of input contains a single integer N, ( $1 \leq N \leq 1000$ ) which is the number of datasets that follow.

Each dataset consists of a single line of input containing a vine configuration consisting of a string of [ and ] characters as described above. The length of the string of [ and ] will be greater than or equal to zero, and less than or equal to 150.

#### Output

For each dataset, you should generate one line of output with the following values: The dataset number as a decimal integer (start counting at one), a space, and the minimum number of monkeys required to reach the canopy successfully. Assume that all the hanging vines are reachable from the jungle floor, and that all monkeys jump on the vines at the same time.

#### Example

Input :

3

[ ]

[ [ ] [ [ ] ] ]

**Output :**

1 2  
2 1  
3 8

---

Added by: Marco Gallotta

Date: 2008-03-11

Time limit: 60s

Source limit:50000B

Languages: All

Resource: ACM Greater New York Regionals 2007



## SPOJ Problem Set (classical)

### 2529. Model Rocket Height

#### Problem code: GNY07G

Just when you thought we had run out of model rocket height problems...

Yet another method used to determine the height achieved by a model rocket is the vertical line method. Two observers A and B are spaced  $D$  feet apart along a base line along one edge of the flat test field. The launch platform is equidistant from observers A and B and  $L$  feet from the base line. Each observer has a theodolite or some other device for measuring angle above the horizontal (elevation angle) of a distant object and the azimuth angle (the angle the vertical plane of the sight line makes with the line from A through B measured counter-clockwise). Each measuring device is on a stand. A's device is  $HA$  feet above the level of the launch platform and B's device is  $HB$  feet above the level of the launch platform. When a rocket is fired, near the top of its flight, it deploys a parachute and emits a puff of smoke. Each observer measures the elevation angle and azimuth angle of the puff of smoke from their location. If the peak location is on the wrong side of the baseline or outside the lines determined by A and B perpendicular to the base line, it is out of bounds and disqualified. From this information, the height of the rocket may be determined as follows:

Each sight line determines a vertical plane. These two planes intersect in a vertical line (thus the name of the method). Each sight line intersects this vertical line in a point. If these points are more than  $ERRDIST$  feet apart, an error is assumed and the flight is rejected. Otherwise, the point halfway between the two points where a sight line intersects the vertical line is computed. The rocket height is the distance of this midpoint above the launch platform.

You must write a program which, given the parameters  $D$  (the distance in feet between observers A and B),  $L$  (the distance in feet from the base line to the launch platform),  $HA$  (the distance of the measuring device A above the launch platform in feet),  $HB$  (the distance of the measuring device B above the launch platform in feet),  $ERRDIST$  (the maximum distance between the intersection points of a sight line with the vertical line),  $a$  (the elevation angle of the rocket in degrees measured by the left observer A),  $b$  (the elevation angle of the rocket in degrees observed by the right observer B),  $g$  (the azimuth angle in degrees measured by the left observer A) and  $d$  (the azimuth angle in degrees measured by the right observer B), computes the height of the rocket above the launch platform in feet to the nearest foot.

#### Input

The first line of input contains a single integer  $N$ , ( $1 \leq N \leq 1000$ ) which is the number of datasets that follow.

The second line contains the parameters  $D$ ,  $L$ ,  $HA$ ,  $HB$  and  $ERRDIST$  in that order as (floating point) decimal values. These values would be measured once at the beginning of the day and remain fixed through all rocket shots.

Each succeeding line of input represents a single dataset. Each dataset will contain the angles  $a$ ,  $b$ ,  $g$  and  $d$  in that order (measured in degrees) as (floating point) decimal values for a rocket shot.

## Output

For each dataset of four angles, the output consists of a single line . If angles a, b and g are not strictly between 0 and 90 degrees or d is not strictly between 90 degrees and 180 degrees, the line should contain the dataset number, a space and the word "DISQUALIFIED" (without the quotes). Otherwise, if the distance between the intersection points of a sight line with the vertical line is more that ERRDIST feet, the line should contain the dataset number, a space and the word "ERROR" (without the quotes). Otherwise, the line should contain the dataset number, a space and the height above the launch platform in feet to the nearest foot.

## Example

### Input :

```
4
100.0 300.0 5.25 2.92 5.00
40.1 36.2 35.3 151.6
64.9 71.1 15.7 160.1
44.9 41.2 33.1 152.5
44.9 41.2 33.1 52.5
```

### Output :

```
1 50
2 ERROR
3 58
4 DISQUALIFIED
```

---

Added by: Marco Gallotta

Date: 2008-03-11

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM Greater New York Regionals 2007

## SPOJ Problem Set (classical)

### 2530. Tiling a Grid With Dominoes

#### Problem code: GNY07H

We wish to tile a grid 4 units high and  $N$  units long with rectangles (dominoes) 2 units by one unit (in either orientation). For example, the figure shows the five different ways that a grid 4 units high and 2 units wide may be tiled.

[IMAGE]

Write a program that takes as input the width,  $W$ , of the grid and outputs the number of different ways to tile a 4-by- $W$  grid.

#### Input

The first line of input contains a single integer  $N$ , ( $1 \leq N \leq 1000$ ) which is the number of datasets that follow.

Each dataset contains a single decimal integer, the width,  $W$ , of the grid for this problem instance.

#### Output

For each problem instance, there is one line of output: The problem instance number as a decimal integer (start counting at one), a single space and the number of tilings of a 4-by- $W$  grid. The values of  $W$  will be chosen so the count will fit in a 32-bit integer.

#### Example

**Input :**

```
3
2
3
7
```

**Output :**

```
1 5
2 11
3 781
```

---

Added by: Marco Gallotta

Date: 2008-03-12

Time limit: 60s

Source limit: 50000B

Languages: All

Resource: ACM Greater New York Regionals 2007

## SPOJ Problem Set (classical)

### 2531. Spatial Concepts Test

#### Problem code: GNY07I

The Flathead Testing Corporation (FTC) supplies various tests for Human Resources departments at many companies. One type of test they supply includes spatial concepts questions such as:

When the following figure is folded back on the interior lines it forms a cube.

[IMAGE]

Which of the following could be an image of one corner of the resulting cube?

[IMAGE]

Unfortunately, FTC was recently embarrassed when one such question on a test had no solution among the choices and another (given in the example) had two solutions among the choices (1 and 3).

FTC needs a routine which will read in a specification of the unfolded cube and specifications of corner views and determine, for each corner view, whether it is a view of a corner of the cube specified in the unfolded part.

FTC uses the following images as faces of each cube. Each image is symmetrical about the vertical axis and has a distinguished end (up in each image).

[IMAGE]

The unfolded cube is specified by a string of six pairs of a letter indicating the image on the face and a number indicating the orientation of the distinguished end of the face: 1 is up, 2 is right, 3 is down and 4 is left. The faces are specified in the order given in the following figure with the orientations indicated in the square to the right:

[IMAGE] [IMAGE]

So the unfolded cube in the example is specified as "F3E4E2D3C2F3". FTC has a routine which reads this specification and generates the unfolded image for the question.

The answer images are specified by three pairs of a letter and a digit indicating a face image and an orientation as indicated in the following diagram. The faces are specified in the order top, right, left (indicated by numbers in brackets in the figures), that is clockwise around the center vertex starting at the top. The orientation of the distinguished end of each face is indicated by the numbers on the edges in the diagram. They circle each face clockwise, starting at the center vertex.

[IMAGE]

For the example, the answer figures are specified as "C2D2F2", "E3F3C4", "F2C2D2", "D1E1F3" and "E1C1E1". Again, FTC has a routine which reads this specification and generates each answer image for the question. They just need your routine to make sure there is exactly one correct answer to each question.

## Input

The first line of input contains a single integer  $N$ , ( $1 \leq N \leq 1000$ ) which is the number of datasets that follow.

Each dataset consists of six lines of input. The first line of input is the specification for the folded out cube as described above. This line is followed by five lines, each of which gives the specification of one answer image as described above.

## Output

For each dataset, output on a single line the dataset number, (1 through  $N$ ), a blank, the number of answers which are solutions of the problem (corners of the cube specified in the folded out line), a blank and five 'Y' or 'N' characters separated by a blank indicating which of the answer images was a solution ('Y' for a solution, 'N' for not a solution).

## Example

### Input :

```
2
F3E4E2D3C2F3
C2D2F2
E3F3C4
F2C2D2
D1E1F3
E1C1E1
A2F4F1A3A3C4
C3A4A2
F3F4A1
F3C4A1
A2C3A2
A4A4F1
```

### Output :

```
1 2 Y N Y N N
2 0 N N N N N
```

---

Added by: Marco Gallotta

Date: 2008-03-12

Time limit: 60s

Source limit: 50000B

Languages: All

Resource: ACM Greater New York Regionals 2007

## SPOJ Problem Set (classical)

### 2565. Another Permutation Problem

#### Problem code: PERMUT3

Given a permutation of  $n$  elements  $(1, 2, \dots, n)$ :  $A = (a_1, a_2, \dots, a_n)$ . We define a sequence  $P(A) = (p_1, p_2, \dots, p_{n-1})$  where  $p_i = 0$  if  $a_i > a_{i+1}$  and  $p_i = 1$  if  $a_i < a_{i+1}$ . Given a permutation  $B$ , find the number of all permutations  $C$  where  $P(C) = P(B)$  including the permutation  $B$  itself.

The length of your solution should not be more than 0.5kB.

#### Input

Multiple test cases. For each test case:

The first line contains an integer  $n$  ( $1 \leq n \leq 100$ ). The second line contains  $n$  integers representing the permutation, all of which are separated by single spaces.

Input terminates by a single zero.

#### Output

For each test case:

The output contains a single line with a single integer - the number of the permutations having the same value for  $P(A)$  when given the permutation  $A$ .

#### Example

Input :

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

Output :

```
1
5
```

---

Added by: Blue Mary

Date: 2008-03-21

Time limit: 6s

Source limit: 512B

Languages: All except: C99 strict

Resource: ACM Southeastern European Regional Contest 2001

## SPOJ Problem Set (classical)

### 2648. Archiver

#### Problem code: KPARCH

One of your friends wants to write his own archiver. He is going to replace neighboring equal substrings with only one copy. For example, he is going to change substring "AA" with something like "2(A)" and if "A" is long enough it will reduce the file size.

But, before performing any coding stuff he wants to know how many such double substrings are there in the input file.

He asks you to help him, because this task is very difficult for him.

#### Input

Input file contains the text to be archived. It will only contain Latin letters (big and small). Its size will not exceed 200000 symbols. Letters are case sensitive, i.e. "X" is not equal to "x".

#### Output

Write a number of substrings of input text which can be written as "AA", i.e. consist of two equal concatenated parts.

#### Example

**Input :**

abcdefg

**Output :**

0

**Input :**

blabla

**Output :**

1

**Input :**

aCacaacaa

**Output :**

4

---

Added by: Pavel Kuznetsov

Date: 2008-04-11

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: IT Festival Arkhangelsk 2007

## SPOJ Problem Set (classical)

### 2649. Weird sorting

#### Problem code: KPSORT

You are given  $N$  integer numbers  $a_1, a_2, \dots, a_N$ . All you need to do is to sort them in non-decreasing order.

The bad thing is you are only allowed to perform one action. You can pick any number in the sequence and then reverse all elements to the left and to the right of it.

For example, suppose you were given the sequence (7, 1, 3, 9, 8) then, depending on the picked number you'll get the following results:

| Picked number | Resulting sequence |
|---------------|--------------------|
| 7             | (7, 8, 9, 3, 1)    |
| 1             | (7, 1, 8, 9, 3)    |
| 3             | (1, 7, 3, 8, 9)    |
| 9             | (3, 1, 7, 9, 8)    |
| 8             | (9, 3, 1, 7, 8)    |

In this problem you are to figure out whether the given sequence can be sorted or not, applying allowed action zero or more times.

#### Input

Input will contain multiple test cases (not more than 100). Each case will start with the number of elements in the sequence  $N$  ( $1 \leq N \leq 100$ ), followed by the  $N$  integers not exceeding 1000 by the absolute value. Input ends with the value  $N = 0$ .

#### Output

For each test case write "1" if corresponding sequence can be sorted and "0" otherwise. Output must not contain spaces or line breaks.

#### Example

**Input :**

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

**Output :**

```
10
```

---



Added by: Pavel Kuznetsov  
Date: 2008-04-12  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: IT Festival Arkhangelsk 2007

## SPOJ Problem Set (classical)

### 2658. Art of War

#### Problem code: WAR

The *Warring States Period* (473-221 BC) refers to the centuries of turmoil following the Spring and Autumn Period. China was divided into many little kingdoms that were constantly fighting with each other. Unlike in previous ages, when chivalry played an important role in battles and the states fought mostly for balance of power or to resolve disputes, in this period the aim of battle was to conquer and completely annihilate the other states. Eventually seven states, known as the “Seven Great Powers” rose to prominence: Qi, Chu, Yan, Han, Zhao, Wei, and Qin. After numerous alliances and counter-alliances, Qin defeated all the other states one by one, putting an end to the Warring States Period.

You are given a map that shows the position of the capital for each state, and the borders between the states as a series of line segments. Your job is to determine which states were fighting with each other. This is pretty easy to determine - if two states had a common border, then they were fighting.

#### Input

The input contains several blocks of test cases. Each case begins with a line containing two integers: the number  $1 \leq n \leq 600$  of states, and the number  $1 \leq m \leq 4000$  of border segments. The next  $n$  lines describe the coordinates of capitals, there are two integers in each line. The next  $m$  lines after that describe the  $m$  border segments. Each line contains four integers  $x_1, y_1, x_2$  and  $y_2$  meaning that there is a border segment from  $(x_1, y_1)$  to  $(x_2, y_2)$ . (It is not given in the input what the two states on the two sides of the border are, but it can be deduced from the way the borders go.)

Each state is enclosed by a continuous borderline. The states are surrounded by an infinite wasteland, thus a border segment either separates two states, or a state from the wasteland. It is not possible that the same state is on both sides of a border segment, or the wasteland is on both sides of a border segment. There is exactly one capital in each state, and there is no capital in the wasteland. The border segments do not cross each other, they can meet only at the end points.

The input is terminated by a block with  $n = m = 0$ .

#### Output

For each test case, you have to output  $n$  lines that describe the enemies of the  $n$  states (recall that if two states share a border, then they are enemies). Each line begins with an integer, the number  $x$  of enemies the given state has. This number is followed by  $x$  numbers identifying the enemies of the state. These numbers are between 1 and  $n$  and number 1 refers to the first capital appearing in the input, number  $n$  refers to the last.

## Example

### Input :

```
4 12
3 2
11 8
12 17
1 19
0 0 10 0
10 0 20 0
20 0 20 10
20 10 20 20
20 20 10 20
10 20 0 20
0 20 0 10
0 10 0 0
10 0 10 10
0 10 10 10
20 10 10 10
10 20 10 10
4 16
170 13
24 88
152 49
110 130
60 60 140 60
140 60 140 140
140 140 60 140
60 140 60 60
0 0 200 0
200 0 200 200
200 200 0 200
0 200 0 0
40 40 160 40
160 40 160 160
160 160 40 160
40 160 40 40
20 20 180 20
180 20 180 180
180 180 20 180
20 180 20 20
0 0
```

### Output :

```
2 2 4
2 1 3
2 2 4
2 1 3
1 2
2 1 3
2 2 4
1 3
```

---

Added by: Blue Mary  
Date: 2008-04-19  
Time limit: 25s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: ACM Central European Programming Contest 2004(unofficial test data)

## SPOJ Problem Set (classical)

### 2661. Illumination

#### Problem code: ILLUM

Two cubes and a light bulb are placed in a three-dimensional euclidean space. You are expected to find out if one of them casts shadow on the other one and if so, calculate the area of this shadow.

#### Input

Multiple test cases. For each test case:

The first line of the input contains the coordinates of the bulb. It is followed by two groups of four lines each that describe the cubes. Each line of the cube description contains the coordinates of a vertex (see the figure where the vertices are marked and labeled in the same order as they are given in the input).

[IMAGE]

All the coordinates are given with 5 digits after decimal point. It is guaranteed that the cubes do not intersect, the light bulb is outside both of them, and doesn't lie on any of the planes that contain their faces. A light bulb should be regarded as a point light source.

Input terminates by EOF.

#### Output

For each test case:

The output should contain a single line with two numbers separated with a space character. The first one is the number of the cube that has a shadow on it (1 or 2). The second is the area of the shadow. If none of the given cubes casts shadow on the other the output should contain a single number -1.

**Note:** if your output has an error with absolute value less than  $10^{-2}$ , it will be judged as Accepted. i.e. You may output any number of digits after decimal point.

#### Example

**Input :**

```
-1.00000 1.00000 1.00000
0.00000 0.00000 0.00000
2.00000 0.00000 0.00000
0.00000 2.00000 0.00000
0.00000 0.00000 2.00000
5.00000 0.00000 0.00000
7.00000 0.00000 0.00000
5.00000 2.00000 0.00000
5.00000 0.00000 2.00000
0.00000 0.00000 0.00000
1.00000 1.00000 1.00000
```

```
2.00000 1.00000 1.00000
1.00000 2.00000 1.00000
1.00000 1.00000 2.00000
-1.00000 -1.00000 -1.00000
-1.00000 -2.00000 -1.00000
-2.00000 -1.00000 -1.00000
-1.00000 -1.00000 -2.00000
```

**Output :**

```
2 4.000
-1
```

---

Added by: Blue Mary

Date: 2008-04-19

Time limit: 2s

Source limit:50000B

Languages: All except: C99 strict

Resource: ACM/ICPC NEERC Moscow Subregional Contest 2007

## SPOJ Problem Set (classical)

### 2662. Put a Point in a Hyperspace

**Problem code: PUTIN**

#### Input

Multiple test cases, the number of them is given in the very first line.

For each test case:

The first line contains 3 space-separated integers  $K$  ( $2 \leq K \leq 30$ ),  $S$  ( $2 \leq S \leq 10000$ ),  $M$  ( $0 \leq M \leq 20$ ).  $M$  lines follow, each contains  $K$  non-negative integers  $a_{ij}$  ( $1 \leq i \leq M$ ,  $1 \leq j \leq K$ ), which shows that there is one point  $(a_{i1}, a_{i2}, \dots, a_{iK})$  in the  $K$ -D hyperspace. No two point will be the same, and none of them lies on any (coordinate) axis.

#### Output

For each test case:

Output a single integer which shows the number of the points  $B(b_1, b_2, \dots, b_K)$  in the hyperspace satiesfied the following constraints:

- $B$  is not on any (coordinate) axis.
- For each  $1 \leq i \leq M$ , there exist  $j$ ,  $1 \leq j \leq K$ , such that  $b_j < a_{ij}$ .
- For each  $1 \leq j \leq K$ ,  $b_j$  is a non-negative integer.
- The sum of  $b_j$  doesn't exceed  $S$ .

#### Example

**Input :**

```
1
2 4 2
1 3
2 1
```

**Output :**

```
2
```

**Hint**

The two points are  $(1,1)$  and  $(1,2)$ .

---

Added by: Blue Mary  
Date: 2008-04-19  
Time limit: 90s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: ACM/ICPC NEERC Northern Subregion Contest 2003; description by Blue Mary



## SPOJ Problem Set (classical)

### 2666. Query on a tree IV

#### Problem code: QTREE4

You are given a tree (an acyclic undirected connected graph) with  $N$  nodes, and nodes numbered  $1, 2, 3, \dots, N$ . Each edge has an integer value assigned to it (note that the value can be negative). Each node has a color, white or black. We define  $\text{dist}(a, b)$  as the sum of the value of the edges on the path from node  $a$  to node  $b$ .

All the nodes are white initially.

We will ask you to perform some instructions of the following form:

- **C a** : change the color of node  $a$ . (from black to white or from white to black)
- **A** : ask for the maximum  $\text{dist}(a, b)$ , both of node  $a$  and node  $b$  must be white ( $a$  can be equal to  $b$ ). Obviously, as long as there is a white node, the result will always be non negative.

#### Input

- In the first line there is an integer  $N$  ( $N \leq 100000$ )
- In the next  $N-1$  lines, the  $i$ -th line describes the  $i$ -th edge: a line with three integers  $a$   $b$   $c$  denotes an edge between  $a$ ,  $b$  of value  $c$  ( $-1000 \leq c \leq 1000$ )
- In the next line, there is an integer  $Q$  denotes the number of instructions ( $Q \leq 100000$ )
- In the next  $Q$  lines, each line contains an instruction "C  $a$ " or "A"

#### Output

For each "A" operation, write one integer representing its result. If there is no white node in the tree, you should write "They have disappeared."

#### Example

**Input :**

```
3
1 2 1
1 3 1
7
A
C 1
A
C 2
A
C 3
A
```

**Output :**

```
2
2
0
They have disappeared.
```

**Some new test data cases were added on Apr.29.2008, all the solutions have been rejudged.**

---

Added by: Qu Jun  
Date: 2008-04-25  
Time limit: 1s-6s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: william

## SPOJ Problem Set (classical)

### 2668. Polygon

#### Problem code: POLYSSQ

You are given  $N$  different points in the plane. No any 3 of them are collinear. Write a program that finds out the smallest area of a convex polygon with  $K$  vertices which are taken from the given points.

#### Input

Two integers,  $N$  and  $K$ , are written on the first line in the standard input. It follows  $N$  lines, each containing a pair of coordinates for the corresponding given point. Every two numbers on a line in the input are separated by a space. Constraints:  $0 < N < 50$ ,  $0 < K < 11$ . The coordinates of the given points are nonnegative integers, less than 9999.

#### Output

Your program has to output an integer that is equal to the integer part of minimal area. If there does not exist any convex polygon as is described above, your program has to output 0.

#### Example

**Input :**

```
4 3
0 0
1 1
0 10
10 0
```

**Output :**

```
5
```

---

Added by: Chinh Nguyen

Date: 2008-04-26

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Bulgarian OI

## SPOJ Problem Set (classical)

### 2699. Recursive Sequence (Version II)

#### Problem code: SPP

Sequence  $(a_i)$  of natural numbers is defined as follows:

$$a_i = b_i \text{ (for } i \leq k)$$

$$a_i = c_1 a_{i-1} + c_2 a_{i-2} + \dots + c_k a_{i-k} \text{ (for } i > k)$$

where  $b_j$  and  $c_j$  are given natural numbers for  $1 \leq j \leq k$ . Your task is to compute  $a_m + a_{m+1} + a_{m+2} + \dots + a_n$  for given  $m \leq n$  and output it modulo a given positive integer  $p$ .

#### Input

On the first row there is the number  $C$  of test cases (equal to about 50).

Each test contains four lines:

$k$  - number of elements of  $(c)$  and  $(b)$  ( $1 \leq k \leq 15$ )

$b_1, \dots, b_k$  -  $k$  natural numbers where  $0 \leq b_j \leq 10^9$  separated by spaces

$c_1, \dots, c_k$  -  $k$  natural numbers where  $0 \leq c_j \leq 10^9$  separated by spaces

$m, n, p$  - natural numbers separated by spaces ( $1 \leq m \leq n \leq 10^{18}$ ,  $1 \leq p \leq 10^8$ )

#### Output

Exactly  $C$  lines, one for each test case:  $(a_m + a_{m+1} + a_{m+2} + \dots + a_n)$  modulo  $p$ .

#### Example

**Input :**

```
1
2
1 1
1 1
2 10 1000003
```

**Output :**

```
142
```

---

Added by: Blue Mary

Date: 2008-05-15

Time limit: 7s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Problem SEQ

## SPOJ Problem Set (classical)

### 2709. Untitled Problem

#### Problem code: UNTITLED

We consider a sequence  $S_1$  is **equal** to a sequence  $S_2$ , if and only if they satisfy the following conditions:

- The length of them are equal.
- Let  $Len$  be the length of them. For each  $i, j (1 \leq i, j \leq Len, i \neq j)$ : If  $S_1[i]$  is smaller than  $S_1[j]$ ,  $S_2[i]$  must be smaller than  $S_2[j]$ ; If  $S_1[i]$  is greater than  $S_1[j]$ ,  $S_2[i]$  must greater than  $S_2[j]$ .

Now you are given a sequence  $S$  and another  $N$  sequences  $T_1, T_2 \dots T_N$ .

We say position  $i$  is **OK**, if and only if  $S[1..i]$  contains a suffix which is **equal** to a sequence from  $\{T_1, T_2 \dots T_N\}$ . You need to print the positions which is **OK** in increasing order.

#### Input

Multiple test cases, the number of them(no more than 3) is given in the very first line.

For each test case:

- The first line contains an integer  $M$  ( $M > 1$ ) which denote the number of sequences. **i.e.**  $M = N + 1$ .
- $M * 2$  lines follow, each two lines describe one sequence. For each two lines, the first line contains an integer  $L$  which denote the length of this sequence. The second line contains  $L$  integers(all the integers don't exceed  $2^{31}-1$ ) that represent this sequence. The first sequence described is  $S$ , the next  $N$  sequences represent  $T_1 \dots T_N$ .
- You can assume that there are no same integer in any one sequence.
- The length of  $S$  is no more than 400000, and the total length of  $T$  is no more than 100000.

#### Output

For each test case: Print the positions which is **OK** in increasing order.

#### Example

Input :

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

4 5  
2  
10 1

**Output :**

1  
2  
3

---

Added by: Qu Jun

Date: 2008-05-19

Time limit: 8s

Source limit:50000B

Languages: All except: C99 strict

Resource: Based on a problem from USACO 2005 Dec Gold Division

## SPOJ Problem Set (classical)

### 2713. Can you answer these queries IV

#### Problem code: GSS4

You are given a sequence A of N ( $N \leq 100,000$ ) positive integers. Their sum will be less than  $10^{18}$ . On this sequence you have to apply M ( $M \leq 100,000$ ) operations:

- (A) For given x,y, for each element between the x-th and the y-th ones (inclusively, counting from 1), modify it to its positive square root (rounded down to the nearest integer).
- (B) For given x,y, query the sum of all the elements between the x-th and the y-th ones (inclusively, counting from 1) in the sequence.

#### Input

Multiple test cases, please proceed them one by one. Input terminates by EOF.

For each test case:

The first line contains an integer N. The following line contains N integers, representing the sequence  $A_1 \dots A_N$ .

The third line contains an integer M. The next M lines contain the operations in the form "i x y".  $i=0$  denotes the modify operation,  $i=1$  denotes the query operation.

#### Output

For each test case:

Output the case number (counting from 1) in the first line of output. Then for each query, print an integer as the problem required.

Print a blank line after each test case.

See the sample output for more details.

#### Example

**Input :**

```
5
1 2 3 4 5
5
1 2 4
0 2 4
1 2 4
0 4 5
1 1 5
4
10 10 10 10
3
```

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

**Output :**

Case #1:

```
9
4
6
```

Case #2:

```
40
26
```

---

Added by: [Trichromatic] XilinX

Date: 2008-05-21

Time limit: 5s

Source limit:50000B

Languages: All except: C99 strict ERL JS PERL 6

Resource: Own problem, used in ACM/ICPC Regional Contest, Shanghai 2011 preliminary



## SPOJ Problem Set (classical)

### 2714. Cow Cars

#### Problem code: COWCAR

$N$  ( $1 \leq N \leq 50,000$ ) cows conveniently numbered  $1, \dots, N$  are driving in separate cars along a highway in Cowtopia. Cow  $i$  can drive in any of  $M$  different high lanes ( $1 \leq M \leq N$ ) and can travel at a maximum speed of  $S_i$  ( $1 \leq S_i \leq 1,000,000$ ) km/hour.

After their other bad driving experience, the cows hate collisions and take extraordinary measures to avoid them. On this highway, cow  $i$  reduces its speed by  $D$  ( $0 \leq D \leq 5,000$ ) km/hour for each cow in front of it on the highway (though never below 0 km/hour). Thus, if there are  $K$  cows in front of cow  $i$ , the cow will travel at a speed of  $\max(S_i - D \cdot K, 0)$ . While a cow might actually travel faster than a cow directly in front of it, the cows are spaced far enough apart so crashes will not occur once cows slow down as described.

Cowtopia has a minimum speed law which requires everyone on the highway to travel at a minimum speed of  $L$  ( $1 \leq L \leq 1,000,000$ ) km/hour, so sometimes some of the cows will be unable to take the highway if they follow the rules above. Write a program that will find the maximum number of cows that can drive on the highway while obeying the minimum speed limit law.

#### Input

The first line contains the four integers  $N$ ,  $M$ ,  $D$ , and  $L$ . For the next  $N$  lines, line  $i+1$  contains the integer  $S_i$ .

#### Output

Print a single integer denoting the maximum number of cows that can take the highway.

#### Example

**Input :**

```
3 1 1 5
5
7
5
```

**Output :**

```
2
```

We can obtain two cows by putting either cow with speed 5 first and the cow with speed 7 second.

---

Added by: Neal Wu  
Date: 2008-05-22  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: USACO Open 2008

## SPOJ Problem Set (classical)

### 2715. Glasnici

#### Problem code: GLASNICI

A long straight road connects two villages. Along the road,  $N$  messengers are stationed and, when needed, they exchange messages using mostly their legs, but also their vocal cords and ears. The first messenger (the closest to the first village) has a radio-receiver which he uses to keep track of current ongoings in the country. When he finds out who has been evicted from whichever reality show is currently popular, he starts running as fast as he can to share the unfortunate (or fortunate) news with everyone else. While running, he shouts the name of the evicted person so that any fellow messengers that are close enough can hear him. Meanwhile, the remaining messengers do not merely sit and wait, but also run themselves, all with the selfless goal of sharing the news with everyone as fast as possible. The running and shouting proceeds as follows:

- Each of the messengers may run whenever, in either direction, at a speed of at most 1 unit per second, or may decide not to run at all and stand still.
- All messengers that know the news shout it at all times. One messenger can hear another messenger shouting (and learn the news) if the distance between them is at most  $K$  units.

Write a program that, given the initial locations of the messengers, determines the least amount of time (in seconds) needed for all messengers to learn the news. The location of every messenger is given with a positive real number - the distance from the first village. As mentioned above, initially only the first messenger knows the news.

#### Input

The first line contains the integer  $T$  ( $1 \leq T \leq 25$ ), the number of test cases. Then for each test case, the first line contains the real number  $K$  ( $0 \leq K \leq 1,000,000$ ), the largest distance at which two messengers can hear each other, and the integer  $N$  ( $1 \leq N \leq 100,000$ ), the number of messengers. Each of the following  $N$  lines contains one real number  $D$  ( $0 \leq D \leq 1,000,000,000$ ), the distance of one messenger from the first village. The distances will be sorted in ascending order. It is possible for multiple messengers to be at the same location.

#### Output

For each test case, output a real number, the least time for all messengers to learn the news. Your output needs to be within 0.01 of the official output.

#### Example

Input :

```
2
3.000 2
0.000
6.000
2.000 4
0.000
4.000
```

4.000  
8.000

**Output :**

1.500  
1.000

**Warning: large input/output data.**

---

Added by: Neal Wu

Date: 2008-05-23

Time limit: 20s

Source limit:50000B

Languages: All

Resource: Croatian Olympiad in Informatics 2008

## SPOJ Problem Set (classical)

### 2716. Maximal Quadrilateral Area

#### Problem code: QUADAREA

You are trying to build a house, but unfortunately you currently have only four available walls with side lengths  $a$ ,  $b$ ,  $c$ , and  $d$ . You want your house to be as big as possible, so you would like to know the largest possible area of any quadrilateral you can construct with these four side lengths.

#### Input

The first line contains the integer  $T$  ( $1 \leq T \leq 2,000$ ), the number of tests. Each test contains a single line with four real numbers:  $a$ ,  $b$ ,  $c$ , and  $d$  ( $0 < a, b, c, d < 1,000$ ). Note that it will always be possible to form a valid quadrilateral with these lengths; that is, the sum of any three side lengths will be strictly larger than the other one.

#### Output

For each test case, print a single line containing the largest possible area. Your output will be accepted if it is within 0.01 of the official answer.

#### Example

**Input :**

2

1 2 1 2

0.5 0.5 0.5 0.5

**Output :**

2.00

0.25

For the first test case, it is optimal to construct a rectangle, and for the second, a square is optimal.

---

Added by: Neal Wu

Date: 2008-05-24

Time limit: 1s

Source limit: 50000B

Languages: All

## **SPOJ Problem Set (classical)**

### **2727. Army Strength**

#### **Problem code: ARMY**

The next MechaGodzilla invasion is on its way to Earth. And once again, Earth will be the battleground for an epic war.

MechaGodzilla's army consists of many nasty alien monsters, such as Space Godzilla, King Gidorah, and MechaGodzilla herself.

To stop them and defend Earth, Godzilla and her friends are preparing for the battle.

#### **Problem specification**

Each army consists of many different monsters. Each monster has a strength that can be described by a positive integer. (The larger the value, the stronger the monster.)

The war will consist of a series of battles. In each battle, the weakest of all the monsters that are still alive is killed.

If there are several weakest monsters, but all of them in the same army, one of them is killed at random. If both armies have at least one of the weakest monsters, a random weakest monster of MechaGodzilla's army is killed.

The war is over if in one of the armies all monsters are dead. The dead army lost, the other one won.

You are given the strengths of all the monsters. Find out who wins the war.

#### **Input specification**

The first line of the input file contains an integer T specifying the number of test cases. Each test case is preceded by a blank line.

Each test case starts with line containing two positive integers NG and NM - the number of monsters in Godzilla's and in MechaGodzilla's army. Two lines follow. The first one contains NG positive integers - the strengths of the monsters in Godzilla's army. Similarly, the second one contains NM positive integers - the strengths of the monsters in MechaGodzilla's army.

#### **Output specification**

For each test case, output a single line with a string that describes the outcome of the battle.

If it is sure that Godzilla's army wins, output the string "Godzilla".

If it is sure that MechaGodzilla's army wins, output the string "MechaGodzilla".

Otherwise, output the string "uncertain".

## Example

**input :**

2

1 1

1

1

3 2

1 3 2

5 5

**output :**

Godzilla

MechaGodzilla

## Hint

In the first test case, there are only two monsters, and they are equally strong. In this situation, MechaGodzilla's monster is killed and the war ends.

In the second test case, the war will consist of three battles, and in each of them one of Godzilla's monsters dies.

For all the test cases, **int** in C/C++/Java or **longint** in Pascal is enough.

---

Added by: Blue Mary

Date: 2008-05-24

Time limit: 1s-2s

Source limit: 50000B

Languages: All except: C99 strict

Resource: IPSC 2008

## SPOJ Problem Set (classical)

### 2728. Breaking in

#### Problem code: BREAK

Mayco has recently been hired as a security consultant for a well-known software company. At the moment, he's working on his first assignment - trying to determine which of the company's servers would be the best targets for potential attackers. It is a bit difficult, though, because some of the servers "trust" some of the others. If an attacker compromises a server, he or she can also freely access all servers that trust it (and servers that trust them, and so on).

By definition, the importance of a server  $S$  is the number of servers the attacker would be able to access if he compromised  $S$ . The most important servers are those with the highest importance. (Note that there can be more than one most important server. This is also illustrated in the example below.)

#### Problem specification

The network consists of  $N$  computers, numbered 1 to  $N$ , inclusive. The trust between computers is described by  $M$  ordered pairs  $(A,B)$  of numbers, denoting that computer  $A$  trusts computer  $B$ . The trust is not assumed to be mutual - i.e., if a computer  $A$  trusts computer  $B$ , it does not necessarily imply that computer  $B$  trusts computer  $A$ .

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case starts with a line containing the numbers  $N$  and  $M$  ( $1 \leq N \leq 9000$ ,  $1 \leq M \leq 52000$ ). Each of the following  $M$  lines contains two integers,  $A$  and  $B$ , denoting that computer  $A$  trusts computer  $B$ .

#### Output specification

For each test case, the output shall contain one line with the numbers of all of the most important servers. The numbers must be listed in increasing order and separated by single spaces.

#### Example

**input :**

2

5 4  
3 1  
3 2  
4 3  
5 3

6 5  
1 2



```
2 3
3 1
1 4
5 6
```

**output :**

```
1 2
4
```

## Note

Blue Mary has found a pruning which will make the program very efficient. So the time limit of the hard test case is changed from 60 seconds to 15 seconds. If you have some even harder test case, please send it to me, and I'll add it to the standard input file.

---

Added by: Blue Mary  
Date: 2008-05-24  
Time limit: 1s-15s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2008

## SPOJ Problem Set (classical)

### 2731. Inventing Test Data

#### Problem code: INVENT

Preparing a problem set is a very hard task. There are always issues with clarity of problem statements, bugs in our solutions, input or output data, and so on. Sometimes, despite our best efforts, these issues are only found during the contest, and this can really spoil it.

To prevent this from happening in the future, we already started to prepare data for IPSC 2009, and we decided to use your help in doing so. Currently we are working on a simple textbook problem: "Given a weighted undirected complete graph, find its minimum spanning tree." (See the Definitions below if you are not sure what a spanning tree is.)

Almost everything is already prepared for this problem: the problem statement, our solution, and also the desired output data. The only (and quite important) thing left is the input data. But creating it is not as simple as it looks.

The bad thing that can happen is that a graph can have more than one minimum spanning tree. If we used such a graph in the input data, we would have to write a complicated checker. And we are too lazy to do this. Therefore we want to find an input data that avoids such cases.

Moreover, we want the test data to be good. If all the other edges were much more expensive, the minimum spanning tree would be obvious, and many incorrect algorithms would be able to find it. Therefore we want all the edge weights to be as small as possible.

#### Definitions

A graph is a set of nodes, and a set of links. Each link connects two nodes. Each pair of nodes is connected by at most one link. Each link is assigned a positive integer (its weight). The sum of the weights of all links in a graph is the weight of that graph.

If every two nodes are connected by a link we say that the graph is complete.

A sequence of nodes  $v_0, \dots, v_n$  such that for each  $i$  the nodes  $v_i$  and  $v_{i+1}$  are connected by a link, is called a path.

If every two nodes in a graph are connected by a path, we say that the graph is connected.

If there is exactly one path between any two nodes we say that graph is a tree.

A spanning subgraph of a connected graph  $G$  is a connected graph that contains all nodes of  $G$  and some (not necessarily all) of its links.

A spanning subgraph  $T$  of a graph  $G$  is called the minimum spanning tree of  $G$  if and only if no other spanning subgraph has a smaller weight.

Note that a given graph can have more than one spanning tree. Also note that a spanning tree is always a tree.

## Problem specification

Given a weighted tree  $T$ , you are to find the minimum possible weight of a complete graph  $G$  such that  $T$  is the only minimum spanning tree of  $G$ .

## Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

First line of each test case contains an integer  $N$  ( $N \leq 15000$ ) - number of nodes in the tree. The nodes are numbered from 1 to  $N$ , inclusive. The following  $N - 1$  lines contain a description of the tree. Each of these lines contains three integers  $a_i, b_i, w_i$  ( $1 \leq a_i, b_i \leq N, 1 \leq w_i \leq 10000$ ) meaning that node  $a_i$  is connected with node  $b_i$  by a link with weight  $w_i$ .

## Output specification

For each test case, the output shall contain one line containing one integer - the minimum possible weight of a complete graph such that the given tree is its unique minimal spanning tree.

## Example

**Input :**

2

3

1 2 4

2 3 7

4

1 2 1

1 3 1

1 4 2

**output :**

19

12

## Hint

In the first test case, we have to add a link between nodes 1 and 3 with weight at least 8.

In the second test case, the optimal graph contains the link 2 - 3 with weight 2, and links 2 - 4 and 3 - 4 with weights 3 each.

---

Added by: Blue Mary  
Date: 2008-05-24  
Time limit: 1s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: IPSC 2008

## SPOJ Problem Set (classical)

### 2733. K Equal Digits

#### Problem code: KEQ

Every once in a while, Mishka Jabereen sends an interesting mathematical puzzle to his friends. This week's puzzle will be about so-called "repetitive" numbers - the ones whose decimal expansion has just one kind of digit in it. (Examples of such numbers include 7, 11, and 5555.) The puzzle is about finding the largest repetitive number subject to two additional restrictions:

- (A) It must be divisible by at least one number from a given set.
- (B) It can not have more than a given number of digits.

A concrete example of such a problem statement would be: Find the largest repetitive number with at most 47 digits, which is divisible by 42 or 47! Mishka is currently playing around with a few such problem statements and he'd like to know all the answers, so that he can choose the nicest one.

#### Problem specification

A puzzle is described by a number  $K$ , the maximal number of digits allowed in the repetitive number, and a set of numbers  $d_1, d_2, \dots, d_R$ . Your task is to find the greatest repetitive number  $X$  that has at most  $K$  digits when written in decimal notation, and it is divisible by at least one of the  $d_i$ .

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case starts with a line containing the numbers  $K$  ( $1 \leq K \leq 10^9$ ) and  $R$  ( $1 \leq R \leq 7$ ). The next  $R$  lines contain the numbers  $d_i$  ( $1 \leq d_i \leq 10^{14}$ ).

#### Output specification

We can describe a repetitive number by specifying its number of digits  $N$  and the digit  $D$  it contains.

For each test case, the output shall contain one line containing two integers  $N$  and  $D$  that describe the largest repetitive number that satisfies the conditions from the problem statement.

#### Example

input :

3

47 2

42

47

99 4

123

234  
345  
456

3 1  
4700

**output :**

46 9  
96 6  
1 0

Note that in the third test case "3 0" would not be a correct answer, as "000" is not a valid integer.

Blue Mary's Note: This problem can be solved in a very short time but a naive solution may not terminate within 5 hours. Thanks to Robert Gerbicz's help.

Another note: some new test case are added on Jun.6, 2010.

---

Added by: [Trichromatic] XilinX

Date: 2008-05-24

Time limit: 17s

Source limit:50000B

Languages: All except: C99 strict ERL TECS JS

Resource: IPSC 2008

## SPOJ Problem Set (classical)

### 2734. Large party

#### Problem code: LARGE

Irena and Sirup are organizing their engagement party next weekend. They want to invite almost everybody. They have just bought a very big round table for this occasion. But they are now wondering how should they distribute people around the table. Irena claimed that when there are more than  $K$  women next to each other, this group will chat together for the whole night and won't talk to anybody else.

Sirup had no other choice but to agree with her. However, being a mathematician, he quickly became fascinated by all the possible patterns of men and women around the table.

#### Problem specification

There will be  $N$  people sitting at the round table. Some of them will be men and the rest will be women.

Your task is to count in how many ways it is possible to assign the places to men and women in such a way that there will not be more than  $K$  women sitting next to each other.

If one assignment can be made from another one by rotating all the people around the table, we consider them equal (and thus count this assignment only once).

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

The input for each test case consists of a single line that contains the two integers  $N$  ( $1 \leq N < 1000$ ) and  $K$ .

#### Output specification

For each test case output a single line with one integer - the number of ways how to distribute people around the table, modulo 100000007.

#### Example

input :

3

3 1

3 3

4 1

**output :**

2  
4  
3

**Hint:**

In the first test case there are two possibilities: MMM or MMW (M is a man, W is a woman).

In the second test case there are two more possibilities: MWW and WWW.

In the third test case the three possibilities are: MMMM, MMMW, and MWMW.

**A Note:** There are almost 1000 test cases, most of which are randomly generated (huge) ones.

---

Added by: [Trichromatic] XilinX

Date: 2008-05-24

Time limit: 8s

Source limit:50000B

Languages: All except: C99 strict ERL TECS JS

Resource: IPSC 2008



## **SPOJ Problem Set (classical)**

### **2735. Simplify the Railroad System**

#### **Problem code: RAIL**

The Slovak national railroad company has recently built new tracks. They want to update their railroad map according to these changes. But they want the map to be as simple as possible. So they decided to remove from the map all the stations that have exactly two other direct connections to other stations (i.e., a single railroad passing through the station).

#### **Problem specification**

You will be given the complete map of Slovak railroads. It consists of railway stations numbered from 1 to  $N$ , and railroad segments between some pairs of these stations. For each railroad segment we are given its length.

Your task is to remove all such stations that are directly connected with exactly two other stations, and output the new map. The new map must contain correct distances between the remaining stations.

#### **Input specification**

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case begins with a line with two integers  $N$  ( $1 \leq N \leq 2000$ ) and  $M$  ( $1 \leq M \leq 3000$ ). The number  $N$  denotes the number of stations and  $M$  is the number of railroad segments.  $M$  lines follow, each with 3 integers  $a$ ,  $b$ , and  $c$  ( $1 \leq a, b \leq N$ ) specifying that there is a railroad segment of length  $c$  connecting stations  $a$  and  $b$ .

You can assume that in each test case there is a path between every two stations, and there is at most one railroad between any pair of cities directly. Also, there will always be at least 2 stations that are not directly connected to exactly two other stations.

#### **Output specification**

For each test case, the output shall consist of multiple lines. The first line shall contain a positive integer  $K$  - the number of railroads on the simplified map. Each of the next  $K$  lines shall contain three integers  $a$ ,  $b$  ( $a$  must be no more than  $b$ ), and  $c$  stating that there is a railroad of length  $c$  between stations  $a$  and  $b$  on the simplified map.

The railroads should be listed in lexicographic order, i.e. the railroad with less  $a$  should be listed first, if two railroads have the same  $a$ , then the one with less  $b$  should be listed first. If two railroad have the same  $a$  and  $b$ , the one with less  $c$  should be listed first.

Print a blank line between outputs for different test cases.

## Example

**input :**

2

3 2  
1 2 1  
2 3 1

4 4  
1 2 1  
2 3 2  
3 4 3  
4 2 1

**output :**

1  
1 3 2

2  
1 2 1  
2 2 6

## Hint

In the first case we removed station 2 because it had exactly 2 direct connections.

In the second case we removed stations 3 and 4. We see that there is now a railroad from station 2 back to itself.

For all the test cases, **int** in C/C++/Java or **longint** in Pascal is enough.

---

Added by: Blue Mary  
Date: 2008-05-24  
Time limit: 1s-2s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2008

## SPOJ Problem Set (classical)

### 2737. Perfect Rhyme

#### Problem code: PRHYME

*A perfect rhyme is not a crime,  
it is something that exceeds time,  
a bit of science, a piece of art,  
soft as a pillow, sharp as a dart.*

Everyone tried it, but only few chosen ones succeeded. It is a hard task with an unclear path, but a famous end - should you reach it. Many compare it to finding the Holy Grail, or even to finding Waldo. The task is to find a perfect rhyme.

#### Problem specification

Given is a wordlist **L**, and a word **w**. Your task is to find a word in **L** that forms a perfect rhyme with **w**. This word **u** is uniquely determined by these properties:

- It is in **L**.
- It is different from **w**.
- Their common suffix is as long as possible.
- Out of all words that satisfy the previous points, **u** is the lexicographically smallest one.

#### Notes

A prefix of a word is any string that can be obtained by repeatedly deleting the last letter of the word. Similarly, a suffix of a word is any string that can be obtained by repeatedly deleting the first letter of the word.

For example, consider the word *different*.

This word is both its own prefix and suffix. Its longest other prefix is *differen*, and its longest other suffix is *ifferent*. The string *rent* is its yet another, even shorter suffix. The strings *eent* and *iffe* are neither prefixes nor suffixes of the word *different*.

Let **u** and **v** be two different words. We say that **u** is lexicographically smaller than **v** if either **u** is a prefix of **v**, or if *i* is the first position where they differ, and the *i*-th letter of **u** is earlier in the alphabet than the *i*-th letter of **v**.

For example, *dog* is smaller than *dogs*, which is smaller than *dragon* (because *o* is less than *r*).

#### Input specification

The input file consists of two parts. The first part contains the wordlist **L**, one word per line. Each word consists of lowercase English letters only, and no two words are equal.

The first part is terminated by an empty line.

The second part follows, with one query word **w** per line.

You may assume that in either part of the input, the length of a word will be no more than 30. And the number of words in each part of the input will be no more than 250000. The input file will be less than 5MB.

## Output specification

For each query in the input file output a single line with its perfect rhyme. The output must be in lowercase.

## Example

**input :**  
perfect  
rhyme  
crime  
time

crime  
rhyme

**output :**  
time  
crime

In the second test case, there were two candidates that had an equally long common suffix (crime and time), the lexicographically smaller one was chosen.

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary  
Date: 2008-05-26  
Time limit: 20s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2008

## SPOJ Problem Set (classical)

### 2742. Summing Sums

#### Problem code: SUMSUMS

The  $N$  ( $1 \leq N \leq 50,000$ ) cows, conveniently numbered  $1, 2, \dots, N$ , are trying to learn some encryption algorithms. After studying a few examples, they have decided to make one of their own! However, they are not very experienced at this, so their algorithm is very simple:

Each cow  $i$  is given a starting number  $C_i$  ( $0 \leq C_i < 90,000,000$ ), and then all the cows perform the following process in parallel:

- First, each cow finds the sum of the numbers of the other  $N-1$  cows.
- After all cows are finished, each cow replaces her number with the sum she computed. To avoid very large numbers, the cows will keep track of their numbers modulo  $98,765,431$ .

They told Canmuu the moose about it in November; he was quite impressed. Then one foggy Christmas Eve, Canmuu came to say:

"Your algorithm is too easy to break! You should repeat it  $T$  ( $1 \leq T \leq 1,414,213,562$ ) times instead."

Obviously, the cows were very frustrated with having to perform so many repetitions of the same boring algorithm, so after many hours of arguing, Canmuu and the cows reached a compromise: You are to calculate the numbers after the encryption is performed!

#### Input

- Line 1: Two space-separated integers:  $N$  and  $T$ .
- Lines  $2..N+1$ : Line  $i+1$  contains a single integer:  $C_i$ .

#### Output

- Lines  $1..N$ : Line  $i$  contains a single integer representing the number of cow  $i$  (modulo  $98,765,431$ ) at the end of the encryption.

#### Example

**Input :**

```
3 4
1
0
4
```

**Output :**

```
26
25
29
```

The following is a table of the cows' numbers for each turn:

| Turn | Cows' numbers |      |      |
|------|---------------|------|------|
|      | Cow1          | Cow2 | Cow3 |
| 0    | 1             | 0    | 4    |
| 1    | 4             | 5    | 1    |
| 2    | 6             | 5    | 9    |
| 3    | 14            | 15   | 11   |
| 4    | 26            | 25   | 29   |

**Warning: large input/output data.**

---

Added by: Neal Wu

Date: 2008-05-28

Time limit: 1s

Source limit:50000B

Languages: All

Resource: USACO Chn 2007

## SPOJ Problem Set (classical)

### 2743. Prefix Tiling

#### Problem code: PRETILE

You are given a string  $S$  with  $N$  ( $1 \leq N \leq 100,000$ ) characters from 'A' to 'Z', inclusive. For an integer  $L$  between 1 and  $N$ , inclusive, we define  $\text{match}(L)$  as the length of the longest prefix of  $S$  that can be tiled by the length- $L$  prefix of  $S$ ; more specifically,  $\text{match}(L)$  is the smallest 0-based index  $k$  such that  $S[k] \neq S[k \bmod L]$ , or  $N$  if no such  $k$  exists. For example, when  $S = \text{"ABCAB"}$ ,  $\text{match}(1) = 1$ ,  $\text{match}(3) = 5$ , and  $\text{match}(4) = 4$ . Compute the sum  $\text{match}(1) + \text{match}(2) + \dots + \text{match}(N)$ .

#### Input

The first line contains the integer  $T$  ( $1 \leq T \leq 10$ ), the number of tests. For each test, there is a single line containing the string  $S$ .

#### Output

For each test case, print a single line containing one integer: the value of  $\text{match}(1) + \text{match}(2) + \dots + \text{match}(N)$ .

#### Example

**Input :**

```
2
ABCAB
ZZZZZZ
```

**Output :**

```
17
36
```

For the first test case,  $\text{match}(1) + \text{match}(2) + \text{match}(3) + \text{match}(4) + \text{match}(5) = 1 + 2 + 5 + 4 + 5 = 17$ . For the second, the sum is equal to  $6 * 6 = 36$ .

**Warning: large input/output data.**

---

Added by: Neal Wu

Date: 2008-05-28

Time limit: 1s-2s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 2815. Increasing Subsequences

#### Problem code: INCSEQ

Given a sequence of  $N$  ( $1 \leq N \leq 10,000$ ) integers  $S_1, \dots, S_N$  ( $0 \leq S_i < 100,000$ ), compute the number of increasing subsequences of  $S$  with length  $K$  ( $1 \leq K \leq 50$  and  $K \leq N$ ); that is, the number of  $K$ -tuples  $i_1, \dots, i_K$  such that  $1 \leq i_1 < \dots < i_K \leq N$  and  $S_{i_1} < \dots < S_{i_K}$ .

#### Input

The first line contains the two integers  $N$  and  $K$ . The following  $N$  lines contain the integers of the sequence in order.

#### Output

Print a single integer representing the number of increasing subsequences of  $S$  of length  $K$ , modulo 5,000,000.

#### Example

**Input :**

```
4 3
1
2
2
10
```

**Output :**

```
2
```

The two 3-tuples are (1, 2, 4) and (1, 3, 4), both corresponding to the subsequence 1, 2, 10.

---

Added by: Neal Wu

Date: 2008-06-20

Time limit: 1s-2s

Source limit: 50000B

Languages: All

Resource:



## SPOJ Problem Set (classical)

### 2826. Round-Robin Scheduling

#### Problem code: RRSCHED

A computer processor is given  $N$  tasks to perform ( $1 \leq N \leq 50,000$ ). The  $i$ -th task requires  $T_i$  seconds of processing time ( $1 \leq T_i \leq 1,000,000,000$ ). The processor runs the tasks as follows: each task is run in order, from 1 to  $N$ , for 1 second, and then the processor repeats this again starting from task 1. Once a task has been completed, it will not be run in later iterations. Determine, for each task, the total running time elapsed once the task has been completed.

#### Input

The first line of the input contains the integer  $N$ , and the next  $N$  lines contain the integers  $T_1$  through  $T_N$ .

#### Output

Output  $N$  lines, the  $i$ -th of which contains an integer representing the time elapsed when task  $i$  has been processed.

#### Example

**Input :**

```
5
8
1
3
3
8
```

**Output :**

```
22
2
11
12
23
```

The second task is completed during the first iteration, finishing 2 seconds in. On the third iteration, the third and fourth tasks complete at 11 seconds and 12 seconds, respectively. Finally, on the eighth iteration, the first and last tasks complete at 22 seconds and 23 seconds, respectively.

**Warning: large input/output data.**

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(See this post for more information.)

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Added by: Neal Wu  
Date: 2008-07-02  
Time limit: 1s-2s  
Source limit: 50000B  
Languages: All  
Resource: TopCoder High School SRM 52 (with raised constraints)

## SPOJ Problem Set (classical)

### 2833. Super Dice Game

#### Problem code: SDGAME

Alice and Bob are playing a game. The game consists of a circular track of  $M$  ( $2 \leq M \leq 1,000,000,000$ ) cells labeled 0 through  $M - 1$ . Initially both players start at cell 0. The game progresses by having each player take turns rolling one of  $N$  ( $1 \leq N \leq 10,000$ ) 'super-dice' labeled 0 through  $N - 1$ . The actual mechanics of the 'super-dice' is not very well understood; however, it is known that they will only ever turn up a number between 0 and 1,000,000,000 inclusive after a roll. After rolling the super-dice the number of spaces a player moves is determined by the product of a contiguous subsequence of the values shown on the dice (There are special rules for determining the range that vary each move that will not be discussed).

To make matters more complicated, after any turn if Alice and Bob land on the same cell the value shown on all dice is multiplied by the label of the cell they are on. Note in this way it is possible for some dice to show numbers greater than 1,000,000,000. This multiplier does not apply to future rolls.

After playing this game for a while, Alice and Bob have grown frustrated because the calculations became too difficult. Given the series of  $R$  ( $1 \leq R \leq 100,000$ ) dice rolls and ranges, help Alice and Bob determine their position after each move. Assume that all dice start out showing 1.

#### Input

The first line contains  $R$ ,  $N$ , and  $M$  each separated by a space.  $R$  lines follow. Each line will contain  $d$   $v$   $a$   $b$  separated by a space.  $d$  indicates the label of the dice rolled.  $v$  indicates the value shown on the dice.  $a$  and  $b$  indicate the range of dice used to determine the move distance.

#### Output

$R$  lines containing the position of the player that just rolled after their roll.

#### Example

##### Input :

```
6 4 20
1 5 1 1
3 10 2 3
2 3 0 3
1 2 0 3
1 5 1 2
0 7 0 1
```

##### Output :

```
5
10
15
10
10
0
```

**Output Explanation:**

For your assistance, here is the state of the dice after each turn:

```
[1, 5, 1, 1]
[1, 5, 1, 10]
[1, 5, 3, 10]
[1, 2, 3, 10]
[10, 50, 30, 100]
[7, 50, 30, 100]
```

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: Mark Gordon

Date: 2008-07-05

Time limit: 2s-10s

Source limit: 50000B

Languages: All

Resource: own problem

## SPOJ Problem Set (classical)

### 2835. Memory Limit Exceeded

#### Problem code: MLE

Given  $n$  points on X-Y plane. To each point, you are to find the other point who is closest to it with respect to the Euclidean distance.

#### Input

$T$  ( $\leq 15$ ) test cases. Each starts with an integer  $n$  ( $2 \leq n \leq 100000$ ). Then  $n$  lines follow. Each contains two space-separated integers, the X and Y coordinate of the corresponding point, respectively. No two points in one test case will coincide.

#### Output

For each test case, output  $n$  lines. The  $i$ -th of them should contain the squared distance between the  $i$ -th point from the input and its nearest neighbour.

#### Example

**Input :**

```
2
10
17 41
0 34
24 19
8 28
14 12
45 5
27 31
41 11
42 45
36 27
15
0 0
1 2
2 3
3 2
4 0
8 4
7 4
6 3
6 1
8 0
11 0
12 2
13 1
14 2
15 0
```

**Output :**

```
200
```

100  
149  
100  
149  
52  
97  
52  
360  
97  
5  
2  
2  
2  
5  
1  
1  
2  
4  
5  
5  
2  
2  
2  
5

**Warning: enormous input/output data, be careful with certain languages**

Note: In Sphere Online Judge system, "Memory Limit Exceeded" will be shown as "Runtime Error(other)", with the 0.00 second run-time & 92-200k memory used, or "Runtime Error(SIGSEGV)" with 250M memory used.

---

Added by: Blue Mary

Date: 2008-07-08

Time limit: 23s

Source limit:50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Wrocław 2008

## SPOJ Problem Set (classical)

### 2852. Broken Keyboard

#### Problem code: BROKEN

Bruce Force's keyboard is broken, only a few keys are still working. Bruce has figured out he can still type texts by switching the keyboard layout whenever he needs to type a letter which is currently not mapped to any of the  $m$  working keys of the keyboard.

You are given a text that Bruce wishes to type, and he asks you if you can tell him the maximum number of consecutive characters in the text which can be typed without having to switch the keyboard layout. For simplicity, we assume that each key of the keyboard will be mapped to exactly one character, and it is not possible to type other characters by combination of different keys. This means that Bruce wants to know the length of the largest substring of the text which consists of at most  $m$  different characters.

#### Input

The input contains several test cases, each test case consisting of two lines. The first line of each test case contains the number  $m$  ( $1 \leq m \leq 128$ ), which specifies how many keys on the keyboard are still working. The second line of each test case contains the text which Bruce wants to type. You may assume that the length of this text does not exceed 1 million characters. Note that the input may contain space characters, which should be handled like any other character.

The last test case is followed by a line containing one zero.

#### Output

For each test case, print one line with the length of the largest substring of the text which consists of at most  $m$  different characters.

#### Example

**Input :**

```
5
This can't be solved by brute force.
1
Mississippi
0
```

**Output :**

```
7
2
```

---

Added by: Adrian Kuegel  
Date: 2008-07-12  
Time limit: 10s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2008



## SPOJ Problem Set (classical)

### 2853. Decode the Strings

#### Problem code: PDECODE

Bruce Force has had an interesting idea how to encode strings. The following is the description of how the encoding is done:

Let  $x_1, x_2, \dots, x_n$  be the sequence of characters of the string to be encoded.

1. Choose an integer  $m$  and  $n$  pairwise distinct numbers  $p_1, p_2, \dots, p_n$  from the set  $\{1, 2, \dots, n\}$  (a permutation of the numbers  $1$  to  $n$ ).
2. Repeat the following step  $m$  times.
3. For  $1 \leq i \leq n$  set  $y_i$  to  $x_{p_i}$ , and then for  $1 \leq i \leq n$  replace  $x_i$  by  $y_i$ .

For example, when we want to encode the string "hello", and we choose the value  $m = 3$  and the permutation  $2, 3, 1, 5, 4$ , the data would be encoded in 3 steps: "hello" -> "elhol" -> "lhelo" -> "helol".

Bruce gives you the encoded strings, and the numbers  $m$  and  $p_1, \dots, p_n$  used to encode these strings. He claims that because he used huge numbers  $m$  for encoding, you will need a lot of time to decode the strings. Can you disprove this claim by quickly decoding the strings?

#### Input

The input contains several test cases. Each test case starts with a line containing two numbers  $n$  and  $m$  ( $1 \leq n \leq 80$ ,  $1 \leq m \leq 10^9$ ). The following line consists of  $n$  pairwise different numbers  $p_1, \dots, p_n$  ( $1 \leq p_i \leq n$ ). The third line of each test case consists of exactly  $n$  characters, and represent the encoded string. The last test case is followed by a line containing two zeros.

#### Output

For each test case, print one line with the decoded string.

#### Example

**Input :**

```
5 3
2 3 1 5 4
helol
16 804289384
13 10 2 7 8 1 16 12 15 6 5 14 3 4 11 9
scssoet tcaede n
8 12
5 3 4 2 1 8 6 7
encoded?
0 0
```

**Output :**

```
hello
second test case
encoded?
```

---

Added by: Adrian Kuegel

Date: 2008-07-12

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: University of Ulm Local Contest 2008

## SPOJ Problem Set (classical)

### 2855. Forest

#### Problem code: FOREST2

Bruce Force is standing in the forest. He wonders what is the tree trunk the farthest away which is not blocked from his view by other tree trunks.

Bruce has made a map of the trees in the forest. The map shows his current position as the origin of a cartesian coordinate system. Tree  $i$  is shown on the map as a circle with the center  $(x_i, y_i)$  and radius  $r_i$ . You may assume that a tree trunk is visible if and only if there exists a line segment on the map from the origin  $(0,0)$  to a point on the border of the circle representing the tree trunk, where the line segment does not intersect or touch another circle.

#### Input

The input contains several test cases. The first line of each test case contains one number  $n$  ( $1 \leq n \leq 1000$ ), where  $n$  specifies how many trees are on the map. The following  $n$  lines contain 3 integers  $x_i, y_i, r_i$  each, ( $-10000 \leq x_i, y_i \leq 10000$ ,  $1 \leq r_i \leq 1000$ ) where  $(x_i, y_i)$  is the center of the circle representing tree trunk  $i$ , and  $r_i$  is the radius of the circle. You may assume that no two circles in the input intersect, i.e., for any two circles, the distance between their centers is more than the sum of their radii. Moreover, you may assume that no circle contains the origin.

The last test case is followed by a line containing one zero.

#### Output

For each test case, print one line with the maximum euclidean distance from the origin to a visible tree. The distance to a tree should be measured using the point of the tree closest to the origin, no matter if this point is in fact visible or not.

Round the answer to 3 digits after the decimal point.

#### Example

**Input :**

```
3
10 10 11
1 1 1
-20 -10 20
5
1 2 2
-2 1 1
2 -1 1
-1 -2 2
10000 -10000 1000
0
```

**Output :**

```
3.142
1.236
```

---

Added by: Adrian Kuegel  
Date: 2008-07-12  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: University of Ulm Local Contest 2008

## SPOJ Problem Set (classical)

### 2856. Help Bob

#### Problem code: HELPBOB

Bob loves Pizza but is always out of money. One day he reads in the newspapers that his favorite pizza restaurant, Alfredo's Pizza Restaurant, is running a competition: they will donate a big pizza to the first person who will tell them the lowest price per area that can be achieved by buying any of the pizzas at most once. "That task is easy!", thinks Bob, "For each pizza I just calculate the average price and the lowest quotient will be the answer."

Unfortunately the problem is a bit more complicated: with some pizzas Alberto gives out discount coupons for getting another pizza cheaper and even worse, those coupons can be combined. The pizzas have to be bought one after the other, and it is not possible to use a coupon to get a discount retrospectively for a pizza which has already been bought. Can you help Bob to become the first to solve this task and to get a pizza for free?

#### Input

The input file contains several test cases. Each test case starts with a number  $m$ , the number of pizzas Alfredo offers. Input is terminated by  $m=0$ . Otherwise,  $1 \leq m \leq 15$ . Then follow  $m$  lines describing the pizzas. Each of those following lines describes pizza  $i$  ( $1 \leq i \leq m$ ) and starts with 3 integer numbers  $p_i$ ,  $a_i$  and  $n_i$  specifying the price of the pizza, its area and the number of discount coupons you get when buying it,  $1 \leq p_i \leq 10000$ ,  $1 \leq a_i \leq 10000$  and  $0 \leq n_i < m$ . Then follow  $n_i$  pairs of integer numbers  $x_{i,j}$  and  $y_{i,j}$  specifying the index  $x_{i,j}$  ( $1 \leq x_{i,j} \leq m$ ,  $x_{i,j} \neq i$ ) of the pizza you get a discount coupon for and the discount in percentage terms  $y_{i,j}$  ( $1 \leq y_{i,j} \leq 50$ ) you get when buying pizza  $x_{i,j}$ . You may assume that for each  $i$  the values  $x_{i,j}$  are pairwise distinct.

#### Output

For each test case print one line containing the lowest price per area that can be achieved by buying any of the pizzas at most once. Round this number to 4 places after the decimal point. Note that you can combine an arbitrary number of discount coupons: for a pizza with price 10 and two rabatt coupons for that pizza with a 50 and a 20 on it, you would only have to pay  $10 * 0.8 * 0.5 = 4$  monetary units.

#### Example

Input :

```
1
80 30 0
2
200 100 1 2 50
200 100 0
5
100 100 2 3 50 2 50
100 100 1 4 50
100 100 1 2 40
```

```
600 600 1 5 10
1000 10 1 1 50
0
```

**Output :**

```
2.6667
1.5000
0.5333
```

---

Added by: Adrian Kuegel

Date: 2008-07-12

Time limit: 5s

Source limit:50000B

Languages: All

Resource: University of Ulm Local Contest 2008

## SPOJ Problem Set (classical)

### 2877. Another understanding of Super Dice Game

#### Problem code: SDGAME2

When we were trying to solve the problem SDGAME, we got a misunderstanding of it. We didn't get AC until we were told the original meaning. But we think our kind of understanding is also interesting and is worthy of doing. So enjoy the problem.

Alice and Bob are playing a game. The game consists of a circular track of  $M$  ( $2 \leq M \leq 1,000,000,000$ ) cells labeled 0 through  $M - 1$ . Initially both players start at cell 0. The game progresses by having each player take turns rolling one of  $N$  ( $1 \leq N \leq 10,000$ ) 'super-dice' labeled 0 through  $N - 1$ . The actual mechanics of the 'super-dice' is not very well understood; however, it is known that they will only ever turn up a number between 0 and 1,000,000,000 inclusive after a roll. After rolling the super-dice the number of spaces a player moves is determined by the product of a contiguous subsequence of the values shown on the dice (**which are available**) (There are special rules for determining the range that vary each move that will not be discussed). **If all the values are unavailable, the player moves one space. If the number on the dice is more than 1,000,000,000 or less than 0, the dice is unavailable.**

To make matters more complicated, after any turn if Alice and Bob land on the same cell the value shown on all dice (**neither available nor unavailable**) is multiplied by the label of the cell they are on. Note in this way it is possible for some dice to show numbers greater than 1,000,000,000.

After playing this game for a while, Alice and Bob have grown frustrated because the calculations became too difficult. Given the series of  $R$  ( $1 \leq R \leq 100,000$ ) dice rolls and ranges, help Alice and Bob determine their position after each move. Assume that all dices start out showing 1 **and all dices are available**.

#### Input

The first line contains  $R$ ,  $N$ , and  $M$  each separated by a space.  $R$  lines follow. Each line will contain  $d$   $v$   $a$   $b$  separated by a space.  $d$  indicates the label of the dice rolled.  $v$  indicates the value shown on the dice.  $a$  and  $b$  indicate the range of dice used to determine the move distance.

#### Output

$R$  lines containing the position of the player that just rolled after their roll.

#### Example

Input :

```
6 4 4
0 1000000000 1 1
1 999999998 1 1
2 500000000 3 3
0 1 2 2
3 1 0 3
0 6 0 3
```

**Output :**

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

**Output Explanation:**

For your assistance, here is the state of the dice after each turn: (\* means unavailable)

Before all rolls:  
[1,1,1,1] (0,0)

After first roll:  
[1000000000,1,1,1] (1,0)

After second roll:  
[1000000000,999999998,1,1] (1,2)

After third roll:  
[1000000000,999999998,500000000,1] (2,2)

All dices multiply 2:  
[\*,\*,1000000000,2] (2,2)

After forth roll:  
[1,\*,1000000000,2] (2,2)

All dices multiply 2:  
[2,\*,\*,4] (2,2)

After fifth roll:  
[2,\*,\*,1] (0,2)

After sixth roll:  
[6,\*,\*,1] (0,0)

All dices multiply 0:  
[0,0,0,0] (0,0)

## Test data has been updated, all submissions have been rejudged

---

Added by: Zhang Taizhi

Date: 2008-07-24

Time limit: 2s-4s

Source limit:50000B

Languages: All except: C99 strict

Resource: Based on 2833. Super Dice Game



## SPOJ Problem Set (classical)

### 2878. Knights of the Round Table

#### Problem code: KNIGHTS

Being a knight is a very attractive career: searching for the Holy Grail, saving damsels in distress, and drinking with the other knights are fun things to do. Therefore, it is not very surprising that in recent years the kingdom of King Arthur has experienced an unprecedented increase in the number of knights. There are so many knights now, that it is very rare that every Knight of the Round Table can come at the same time to Camelot and sit around the round table; usually only a small group of the knights is there, while the rest are busy doing heroic deeds around the country.

Knights can easily get over-excited during discussions-especially after a couple of drinks. After some unfortunate accidents, King Arthur asked the famous wizard Merlin to make sure that in the future no fights break out between the knights. After studying the problem carefully, Merlin realized that the fights can only be prevented if the knights are seated according to the following two rules:

- \* The knights should be seated such that two knights who hate each other should not be neighbors at the table. (Merlin has a list that says who hates whom.) The knights are sitting around a round table, thus every knight has exactly two neighbors.

- \* An odd number of knights should sit around the table. This ensures that if the knights cannot agree on something, then they can settle the issue by voting. (If the number of knights is even, then it can happen that "yes" and "no" have the same number of votes, and the argument goes on.)

Merlin will let the knights sit down only if these two rules are satisfied, otherwise he cancels the meeting. (If only one knight shows up, then the meeting is canceled as well, as one person cannot sit around a table.) Merlin realized that this means that there can be knights who cannot be part of any seating arrangements that respect these rules, and these knights will never be able to sit at the Round Table (one such case is if a knight hates every other knight, but there are many other possible reasons). If a knight cannot sit at the Round Table, then he cannot be a member of the Knights of the Round Table and must be expelled from the order. These knights have to be transferred to a less-prestigious order, such as the Knights of the Square Table, the Knights of the Octagonal Table, or the Knights of the Banana-Shaped Table. To help Merlin, you have to write a program that will determine the number of knights that must be expelled.

#### Input

The input contains several blocks of test cases. Each case begins with a line containing two integers  $1 \leq n \leq 1000$  and  $1 \leq m \leq 1000000$ . The number  $n$  is the number of knights. The next  $m$  lines describe which knight hates which knight. Each of these  $m$  lines contains two integers  $k_1$  and  $k_2$ , which means that knight number  $k_1$  and knight number  $k_2$  hate each other (the numbers  $k_1$  and  $k_2$  are between 1 and  $n$ ).

The input is terminated by a block with  $n = m = 0$ .

## Output

For each test case you have to output a single integer on a separate line: the number of knights that have to be expelled.

## Example

**Input :**

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

**Output :**

```
2
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2008-07-24

Time limit: 10s

Source limit: 50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Budapest 2005

## SPOJ Problem Set (classical)

### 2879. The Cow Doctor

#### Problem code: DOCTOR

Texas is the state having the largest number of cows in the US: according to the 2005 report of the National Agricultural Statistics Service, the bovine population of Texas is 13.8 million. This is higher than the population of the two runner-up states combined: there are only 6.65 million cows in Kansas and 6.35 millions cows in Nebraska.

There are several diseases that can threaten a herd of cows, the most feared being "Mad Cow Disease" or Bovine Spongiform Encephalopathy (BSE); therefore, it is very important to be able to diagnose certain illnesses. Fortunately, there are many tests available that can be used to detect these diseases.

A test is performed as follows. First a blood sample is taken from the cow, then the sample is mixed with a test material. Each test material detects a certain number of diseases. If the test material is mixed with a blood sample having any of these diseases, then a reaction takes place that is easy to observe. However, if a test material can detect several diseases, then we have no way to decide which of these diseases is present in the blood sample as all of them produce the same reaction. There are materials that detect many diseases (such tests can be used to rule out several diseases at once) and there are tests that detect only a few diseases (they can be used to make an accurate diagnosis of the problem).

The test materials can be mixed to create new tests. If we have a test material that detects diseases A and B; and there is another test material that detects diseases B and C, then they can be mixed to obtain a test that detects diseases A, B, and C. This means that if we have these two test materials, then there is no need for a test material that tests diseases A, B, and C-such a material can be obtained by mixing these two.

Producing, distributing, and storing many different types of test materials is very expensive, and in most cases, unnecessary. Your task is to eliminate as many unnecessary test materials as possible. It has to be done in such a way that if a test material is eliminated, then it should be possible to mix an equivalent test from the remaining materials. ("Equivalent" means that the mix tests exactly the same diseases as the eliminated material, not more, not less).

#### Input

The input contains several blocks of test cases. Each case begins with a line containing two integers: the number  $1 \leq n \leq 300$  of diseases, and the number  $1 \leq m \leq 200$  of test materials. The next  $m$  lines correspond to the  $m$  test materials. Each line begins with an integer, the number  $1 \leq k \leq 300$  of diseases that the material can detect. This is followed by  $k$  integers describing the  $k$  diseases. These integers are between 1 and  $n$ .

The input is terminated by a block with  $n = m = 0$ .

## Output

For each test case, you have to output a line containing a single integer: the maximum number of test materials that can be eliminated.

## Example

### Input :

```
10 5
2 1 2
2 2 3
3 1 2 3
4 1 2 3 4
1 4
3 7
1 1
1 2
1 3
2 1 2
2 1 3
2 3 2
3 1 2 3
0 0
```

### Output :

```
2
4
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2008-07-24

Time limit: 10s

Source limit: 50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Budapest 2005

## SPOJ Problem Set (classical)

### 2881. Find the Clones

#### Problem code: CLONE

Doubleville, a small town in Texas, was attacked by the aliens. They have abducted some of the residents and taken them to the a spaceship orbiting around earth. After some (quite unpleasant) human experiments, the aliens cloned the victims, and released multiple copies of them back in Doubleville. So now it might happen that there are 6 identical person named Hugh F. Bumblebee: the original person and its 5 copies. The Federal Bureau of Unauthorized Cloning (FBUC) charged you with the task of determining how many copies were made from each person. To help you in your task, FBUC have collected a DNA sample from each person. All copies of the same person have the same DNA sequence, and different people have different sequences (we know that there are no identical twins in the town, this is not an issue).

#### Input

The input contains several blocks of test cases. Each case begins with a line containing two integers: the number  $1 \leq n \leq 20000$  people, and the length  $1 \leq m \leq 20$  of the DNA sequences. The next  $n$  lines contain the DNA sequences: each line contains a sequence of  $m$  characters, where each character is either 'A', 'C', 'G' or 'T'.

The input is terminated by a block with  $n = m = 0$ .

#### Output

For each test case, you have to output  $n$  lines, each line containing a single integer. The first line contains the number of different people that were not copied. The second line contains the number of people that were copied only once (i.e., there are two identical copies for each such person.) The third line contains the number of people that are present in three identical copies, and so on: the  $i$ -th line contains the number of persons that are present in  $i$  identical copies. For example, if there are 11 samples, one of them is from John Smith, and all the others are from copies of Joe Foobar, then you have to print '1' in the first and the tenth lines, and '0' in all the other lines.

#### Example

**Input :**

```
9 6
AAAAAA
ACACAC
GTTTTG
ACACAC
GTTTTG
ACACAC
ACACAC
TCCCCC
TCCCCC
0 0
```

**Output :**

1  
2  
0  
1  
0  
0  
0  
0  
0  
0

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2008-07-24

Time limit: 10s

Source limit: 50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Budapest 2005

## SPOJ Problem Set (classical)

### 2882. The Warehouse

#### Problem code: WARE

Secret Agent OmeGa-7 has found the secret weapon warehouse of the mad scientist Dr. Matroid. The warehouse is full of large boxes (possibly with deadly weapons inside the boxes). While inspecting the warehouse, OmeGa-7 accidentally triggered the alarm system. The warehouse has a very effective protection against intruders: if the alarm is triggered, then the floor is filled with deadly acid. Therefore, the only way OmeGa-7 can escape is to climb onto the boxes and somehow reach the exit on top of them. The exit is a hole in the ceiling, if OmeGa-7 can climb through this hole then he can escape using the helicopter parked on the roof. There is a ladder and a box below the hole, thus the goal is to reach this box.

The floor of the warehouse can be divided into a grid containing  $n * n$  cells, the size of each cell is 1 meter \* 1 meter. Each cell is either fully occupied by one box or unoccupied. Each box is rectangular: the size of the base is 1 meter \* 1 meter, and the height is either 2, 3, or 4 meters. In figure (a), you can see an example warehouse, where the numbers show the height of the boxes, E shows the exit, and the circle shows that Secret Agent OmeGa-7 is currently on the top of that box.

[IMAGE]

OmeGa-7 can do two things:

If he is standing on top of a box, and in an adjacent cell there is another box, then he can move to the top of this other box. For example, in the situation depicted in figure (a), he can move either to north or east, but not to west or south. Note that only these four directions are allowed, diagonal moves are not possible. The height difference between the two boxes does not matter.

The second thing OmeGa-7 can do is that he can topple the box he is standing on in one of the four directions. The effect of toppling is best shown by an example: in the situation shown in figure (b), he can topple the box west (figure (c)) or north (figure (d)). If a box of height  $h$  is toppled north (west, south, etc.) then it will occupy  $h$  consecutive cells to the north (west, south, etc.) of its original position. The original position will be unoccupied (but can be later occupied again by toppling another box). A box can only be toppled if the cells where it will fall are unoccupied. For example, in figure (a), the box where OmeGa-7 is standing cannot be toppled in any of the four directions.

By toppling a box, OmeGa-7 jumps one step in the direction that the box is toppled (see figures (c) and (d)). If a box is toppled, then it cannot be toppled again later. Recall that there is a box below the exit (at the cell marked with E in the figure), thus it is not possible to topple a box over this cell. The alarm system will soon release mutant poisonous biting bats, so OmeGa-7 has to leave the warehouse as quickly as possible. You have to help him by writing a program that will determine the minimum number of steps required to reach the exit. Moving to an adjacent box, or toppling a box is counted as one step.

## Input

The input contains several blocks of test cases. The first line of each block contains three integers: the size  $1 \leq n \leq 8$  of the warehouse, and two integers  $i, j$  that describe the starting position of the secret agent. These numbers are between 1 and  $n$ ; the row number is given by  $i$ , the column number is given by  $j$ . The next  $n$  lines describe the warehouse. Each line contains a string of  $n$  characters. Each character corresponds to a cell of the warehouse. If the character is '.', then the cell is unoccupied. The characters '2', '3' and '4' correspond to boxes of height 2, 3 and 4, respectively. Finally, the character 'E' shows the location of the exit.

The input is terminated by a block with  $n = i = j = 0$ .

## Output

For each test case, you have to output a single line containing an integer: the minimum number of steps required to reach the exit. If it is not possible to reach the exit, then output the text 'Impossible.' (without quotes).

## Example

### Input :

```
5 5 3
.2...E
...2.
4....
....4
..2..
0 0 0
```

### Output :

```
18
```

---

Added by: Blue Mary

Date: 2008-07-24

Time limit: 1s

Source limit: 50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Budapest 2005



## SPOJ Problem Set (classical)

### 2883. Widget Factory

#### Problem code: WIDGET

The widget factory produces several different kinds of widgets. Each widget is carefully built by a skilled widgeteer. The time required to build a widget depends on its type: the simple widgets need only 3 days, but the most complex ones may need as many as 9 days.

The factory is currently in a state of complete chaos: recently, the factory has been bought by a new owner, and the new director has fired almost everyone. The new staff know almost nothing about building widgets, and it seems that no one remembers how many days are required to build each different type of widget. This is very embarrassing when a client orders widgets and the factory cannot tell the client how many days are needed to produce the required goods. Fortunately, there are records that say for each widgeteer the date when he started working at the factory, the date when he was fired and what types of widgets he built. The problem is that the record does not say the exact date of starting and leaving the job, only the day of the week. Nevertheless, even this information might be helpful in certain cases: for example, if a widgeteer started working on a Tuesday, built a Type 41 widget, and was fired on a Friday, then we know that it takes 4 days to build a Type 41 widget. Your task is to figure out from these records (if possible) the number of days that are required to build the different types of widgets.

#### Input

The input contains several blocks of test cases. Each case begins with a line containing two integers: the number  $1 \leq n \leq 300$  of the different types, and the number  $1 \leq m \leq 300$  of the records. This line is followed by a description of the  $m$  records. Each record is described by two lines. The first line contains the total number  $1 \leq k \leq 10000$  of widgets built by this widgeteer, followed by the day of week when he/she started working and the day of the week he/she was fired. The days of the week are given by the strings 'MON', 'TUE', 'WED', 'THU', 'FRI', 'SAT' and 'SUN'. The second line contains  $k$  integers separated by spaces. These numbers are between 1 and  $n$ , and they describe the different types of widgets that the widgeteer built. For example, the following two lines mean that the widgeteer started working on a Wednesday, built a Type 13 widget, a Type 18 widget, a Type 1 widget, again a Type 13 widget, and was fired on a Sunday.

```
4 WED SUN
13 18 1 13
```

Note that the widgeteers work 7 days a week, and they were working on every day between their first and last day at the factory (if you like weekends and holidays, then do not become a widgeteer!).

The input is terminated by a test case with  $n = m = 0$ .

## Output

For each test case, you have to output a single line containing  $n$  integers separated by spaces: the number of days required to build the different types of widgets. There should be no space before the first number or after the last number, and there should be exactly one space between two numbers. If there is more than one possible solution for the problem, then write 'Multiple solutions.' (without the quotes). If you are sure that there is no solution consistent with the input, then write 'Inconsistent data.' (without the quotes).

## Example

### Input :

```
2 3
2 MON THU
1 2
3 MON FRI
1 1 2
3 MON SUN
1 2 2
10 2
1 MON TUE
3
1 MON WED
3
0 0
```

### Output :

```
8 3
Inconsistent data.
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2008-07-24

Time limit: 10s

Source limit: 50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Budapest 2005

## SPOJ Problem Set (classical)

### 2884. Martian Mining

#### Problem code: MARTIAN

The NASA Space Center, Houston, is less than 200 miles from San Antonio, Texas (the site of the ACM Finals this year). This is the place where the astronauts are trained for Mission Seven Dwarfs, the next giant leap in space exploration. The Mars Odyssey program revealed that the surface of Mars is very rich in yeyenum and bloggium. These minerals are important ingredients for certain revolutionary new medicines, but they are extremely rare on Earth. The aim of Mission Seven Dwarfs is to mine these minerals on Mars and bring them back to Earth.

The Mars Odyssey orbiter identified a rectangular area on the surface of Mars that is rich in minerals. The area is divided into cells that form a matrix of  $n$  rows and  $m$  columns, where the rows go from east to west and the columns go from north to south. The orbiter determined the amount of yeyenum and bloggium in each cell. The astronauts will build a yeyenum refinement factory west of the rectangular area and a bloggium factory to the north. Your task is to design the conveyor belt system that will allow them to mine the largest amount of minerals.

There are two types of conveyor belts: the first moves minerals from east to west, the second moves minerals from south to north. In each cell you can build either type of conveyor belt, but you cannot build both of them in the same cell. If two conveyor belts of the same type are next to each other, then they can be connected. For example, the bloggium mined at a cell can be transported to the bloggium refinement factory via a series of south-north conveyor belts.

The minerals are very unstable, thus they have to be brought to the factories on a straight path without any turns. This means that if there is a south-north conveyor belt in a cell, but the cell north of it contains an east-west conveyor belt, then any mineral transported on the south-north conveyor belt will be lost. The minerals mined in a particular cell have to be put on a conveyor belt immediately, in the same cell (thus they cannot start the transportation in an adjacent cell). Furthermore, any bloggium transported to the yeyenum refinement factory will be lost, and vice versa.

[IMAGE]

Your program has to design a conveyor belt system that maximizes the total amount of minerals mined, i.e., the sum of the amount of yeyenum transported to the yeyenum refinery and the amount of bloggium transported to the bloggium refinery.

#### Input

The input contains several blocks of test cases. Each case begins with a line containing two integers: the number  $1 \leq n \leq 500$  of rows, and the number  $1 \leq m \leq 500$  of columns. The next  $n$  lines describe the amount of yeyenum that can be found in the cells. Each of these  $n$  lines contains  $m$  integers. The first line corresponds to the northernmost row; the first integer of each line corresponds to the westernmost cell of the row. The integers are between 0 and 1000. The next  $n$  lines describe in a similar fashion the amount of bloggium found in the cells.

The input is terminated by a block with  $n = m = 0$ .

## Output

For each test case, you have to output a single integer on a separate line: the maximum amount of minerals that can be mined.

## Example

### Input :

```
4 4
0 0 10 9
1 3 10 0
4 2 1 3
1 1 20 0
10 0 0 0
1 1 1 30
0 0 5 5
5 10 10 10
0 0
```

### Output

```
98
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2008-07-24

Time limit: 10s

Source limit: 50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Budapest 2005

## SPOJ Problem Set (classical)

### 2885. Word Rings

#### Problem code: WORDRING

A word ring is a sequence of words where the last two letters of each word are the same as the first two letters of the next word (and the last two letters of the last word are the same as the first two letters of the first word). For example, the following sequence is a word ring:

```
intercommunicational
alkylbenzenesulfonate
tetraiodophenolphthalein
```

Your task is to write a program that, given a list of words, finds a word ring. You have to make the word ring as impressive as possible: the average length of the words in the ring has to be as large as possible. In the above example, the average length is  $(20 + 21 + 24)/3 = 21.6666$ , which makes it somewhat impressive. Note that each word can be used at most once in the ring, and the ring can consist of a single word.

#### Input

The input contains several blocks of test cases. Each case begins with a line containing a single integer  $1 \leq n \leq 100000$ , the number of possible words that can be used. The next  $n$  lines contain these words. The words contain only the characters 'a'-'z' and the length of each word is at most 1000.

The input is terminated by a block with  $n = 0$ .

#### Output

For each test case in the input, you have to output a single number on a separate line: the maximum average length of a ring composed from (a subset of) the words given in the input. The average length should be presented as a real number with two digits of precision. If it is not possible to compose a ring from these words, then output 'No solution.' (without quotes). To avoid rounding problems, we accept solutions with a maximum of 0.01(positive or negative) error.

#### Example

**Input :**

```
3
intercommunicational
alkylbenzenesulfonate
tetraiodophenolphthalein
0
```

**Output :**

```
21.66
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary  
Date: 2008-07-24  
Time limit: 13s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: ACM Central European Programming Contest, Budapest 2005

## SPOJ Problem Set (classical)

### 2898. Party of Cloaked Killers

#### Problem code: PARTY2

$N$  ( $1 \leq N \leq 100000$ ) perfect killers (we number them 1, 2, 3, ...,  $N$ ) meet at Blue Mary's house. Every killer has a kind of skill - cloak. No one can see them when they are cloaked - except only a small group of people, which will be discussed later.

We can group these killers into  $M$  ( $M \geq 3$ ) groups, called group No.1, group No.2, group No.3, etc. If killer A is in group No.  $x$  and killer B is in group No.  $(x \% M + 1)$ , A can see B even if B is cloaked. This prevent killers from doing some bad things without the risk of being punished.

To keep their identity secret, every killer keep cloaked during the party. After the party, Blue Mary asked everyone a question, "Which killers can you see in the party?" Although some killers forget some person they have ever seen during the party, Blue Mary collects extremely much information. Now she needs you help to determine the value of  $M$ , because no killer is willing to share this value with her.

#### Input

Ten test cases(given one after another, you have to process all!). For each test case:

The first line contains two integers  $N$  and  $E$  ( $1 \leq E \leq 180000$ ).  $E$  lines follow, each line contains two space-separated integers  $A$  and  $B$  - killer No.  $A$  can see killer No.  $B$  even if he is cloaked.

#### Output

For each test case, output one line:

If the information given is contradictory, output one line "-1 -1". Otherwise output the largest and the smallest possible value of  $M$ , separated by a single space.

#### Example

**Input :**

```
6 5
1 2
2 3
3 4
4 1
3 5
3 3
1 2
2 1
2 3
[and 8 test cases more]
```

**Output :**

4 4

-1 -1

[and 8 test cases more]

**Warning: large input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2008-07-30

Time limit: 3s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2008, Day 1; Translate by Blue Mary



## SPOJ Problem Set (classical)

### 2899. Volunteers

#### Problem code: VOL

ACM ICPC World Finals 2009, sponsored by IBM and hosted by KTH, Royal Institute of Technology will be held in Stockholm, Sweden. This contest will last for  $N$  ( $1 \leq N \leq 1000$ ) days. We need at least  $A_i$  volunteers in the  $i$ -th day. Now there are  $M$  ( $1 \leq M \leq 10000$ ) kind of volunteers. The  $i$ -th type of volunteers will work from  $S_i$ -th day to  $T_i$ -th day, we will pay them  $\$C_i$ . Now your task is to minimize the money KTH pay for all the volunteers.

#### Input

Ten test cases(given one after another, you have to process all!). For each test case:

The first line contains two space-separated integers  $N$  and  $M$ . The second line contains  $N$  nonnegative integers  $A_i$ .  $M$  lines follow, each contains three integers  $S_i$ ,  $T_i$  and  $C_i$ . You may assume you can hire almost unlimited number of every type of volunteers.

*Tip:* During your calculation, **int** in C/C++/Java or **longint** in Pascal is enough.

#### Output

For each test case:

Output one line with an integer - the minimum cost.

#### Example

**Input :**

```
3 3
2 3 4
1 2 2
2 3 5
3 3 2
[and 9 test cases more]
```

**Output :**

```
14
[and 9 test cases more]
```

---

Added by: Blue Mary

Date: 2008-07-30

Time limit: 13s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Chinese National Olympiad in Informatics 2008, Day 1

## SPOJ Problem Set (classical)

### 2901. One Geometry Problem

#### Problem code: GEOPROB

This is a problem of Euclidean Geometry. See the figure below.

[IMAGE]

Your task is as follows: given the lengths of segments b, c, and d, calculate the length of segment a.

#### Input

The input begins with the number t of test cases in a single line ( $t \leq 300$ ). In each of the next t lines there are three integers b, c and d ( $0 \leq b, c \text{ and } d \leq 10^{200}$  ;  $b, d < c$ ) separated by a space.

#### Output

For every test case print the length of the segment a, one number per line.

#### Example

**Input :**

```
2
3 8 5
10 18 12
```

**Output :**

```
8
14
```

---

Added by: Frank Rafael Arteaga

Date: 2008-07-30

Time limit: 0.5s-1s

Source limit: 4000B

Languages: All

Resource: My own Resource

## SPOJ Problem Set (classical)

### 2903. Transportation

#### Problem code: TRANSP1

Blue Mary, the queen of Protoss, is planning a war against Zerg. Before the war she plans to make her base as safe as possible. Now there are  $N$  ( $1 \leq N \leq 60$ ) nexuses available in the region controlled by Protoss, numbered 1, 2, ...,  $N$ . (Those who don't know what nexus is, please visit Blizzard Entertainment.) All the mineral and vespene gas stored in nexus  $i$  can be transported directly to nexus  $S_i$ . ( $i$  and  $S_i$  won't be the same.) Blue Mary's base is nexus 1, So all the mineral and vespene gas can be transported to base 1 directly or indirectly.

Blue Mary defines the safety of nexus  $i$ ,  $R(i)$ , as the following:

$C_i$  and  $k$  are numeral constants which will be given in the input file.

Suppose for a fixed  $i$ , set  $T = \{P_1, P_2, P_3, \dots, P_w\}$ , then  $x$  is a member of  $T$  if and only if  $S_x$  is  $i$ . Any two  $P_j$ s must be different.

Now Blue Mary wants to modify at most  $M$  ( $0 \leq M \leq N$ )  $S_i$ s, so that the safety of her base  $R(1)$  is maximized. To be a terran captive, also a great programmer, you must help her to solve this problem. Price is your life. Be careful! Blue Mary tells you that  $S_1$  can't be modified. Don't ask your queen about the reason please.

#### Input

Ten test cases(given one after another, you have to process all!). For each test case:

The first line contains  $N$ ,  $M$  and a real number  $k$  ( $0.3 \leq k < 1$ ). The second line contains  $N$  space separated integers  $S_i$ . The third line contains  $N$  positive real numbers  $C_i$ .

There is a single blank line between consecutive test cases.

#### Output

For each test case:

A single line - the maximized safety of nexus 1, rounded to two decimal places.

#### Example

**Input :**

```
4 1 0.5
2 3 1 3
10.0 10.0 10.0 10.0
```

[and 9 test cases more]

**Output :**

30.00

[and 9 test cases more]

## Hint

Before modifying, the safety of the 4 bases are 22.8571, 21.4286, 25.7143, 10, respectively.

After modifying  $S_2$  to 1, the safety of the 4 bases are 30, 25, 15, 10, respectively.

---

Added by: [Trichromatic] XilinX

Date: 2008-08-01

Time limit: 13s

Source limit: 50000B

Languages: All except: C99 strict ERL TECS JS

Resource: Chinese National Olympiad in Informatics 2008, Day 2

## SPOJ Problem Set (classical)

### 2905. Not a Triangle

#### Problem code: NOTATRI

You have  $N$  ( $3 \leq N \leq 2,000$ ) wooden sticks, which are labeled from 1 to  $N$ . The  $i$ -th stick has a length of  $L_i$  ( $1 \leq L_i \leq 1,000,000$ ). Your friend has challenged you to a simple game: you will pick three sticks at random, and if your friend can form a triangle with them (degenerate triangles included), he wins; otherwise, you win. You are not sure if your friend is trying to trick you, so you would like to determine your chances of winning by computing the number of ways you could choose three sticks (regardless of order) such that it is impossible to form a triangle with them.

#### Input

The input file consists of multiple test cases. Each test case starts with the single integer  $N$ , followed by a line with the integers  $L_1, \dots, L_N$ . The input is terminated with  $N = 0$ , which should not be processed.

#### Output

For each test case, output a single line containing the number of triples.

#### Example

**Input :**

```
3
4 2 10
3
1 2 3
4
5 2 9 6
0
```

**Output :**

```
1
0
2
```

For the first test case,  $4 + 2 < 10$ , so you will win with the one available triple. For the second case,  $1 + 2$  is equal to 3; since degenerate triangles are allowed, the answer is 0.

---

Added by: Neal Wu  
Date: 2008-08-03  
Time limit: 2s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 2906. GCD2

#### Problem code: GCD2

Frank explained its friend Felman the algorithm of Euclides to calculate the GCD of two numbers. Then Felman implements it algorithm

```
int gcd(int a, int b)
{
    if (b==0)
        return a;
    else
        return gcd(b,a%b);
}
```

and it proposes to Frank that makes it but with a little integer and another integer that has up to 250 digits.

Your task is to help Frank programming an efficient code for the challenge of Felman.

#### Input

The first line of the input file contains a number representing the number of lines to follow. Each line consists of two number A and B ( $0 \leq A \leq 40000$  and  $A \leq B < 10^{250}$ ).

#### Output

Print for each pair (A,B) in the input one integer representing the GCD of A and B.

#### Example

**Input :**

```
2
2 6
10 11
```

**Output :**

```
2
1
```

---

Added by: Frank Rafael Arteaga

Date: 2008-08-04

Time limit: 0.5s

Source limit: 1000B

Languages: All except: C99 strict JAVA PERL PYTH RUBY PHP LISP sbcl LISP clisp

Resource: My own Resource

## SPOJ Problem Set (classical)

### 2916. Can you answer these queries V

#### Problem code: GSS5

You are given a sequence  $A[1], A[2], \dots, A[N]$  . (  $|A[i]| \leq 10000$  ,  $1 \leq N \leq 10000$  ). A query is defined as follows:  $\text{Query}(x1,y1,x2,y2) = \text{Max} \{ A[i]+A[i+1]+\dots+A[j] ; x1 \leq i \leq y1 , x2 \leq j \leq y2 \text{ and } x1 \leq x2 , y1 \leq y2 \}$  . Given  $M$  queries ( $1 \leq M \leq 10000$ ), your program must output the results of these queries.

#### Input

The first line of the input consist of the number of tests cases  $\leq 5$ . Each case consist of the integer  $N$  and the sequence  $A$ . Then the integer  $M$ .  $M$  lines follow, contains 4 numbers  $x1, y1, x2, y2$ .

#### Output

Your program should output the results of the  $M$  queries for each test case, one query per line.

#### Example

**Input :**

```
2
6 3 -2 1 -4 5 2
2
1 1 2 3
1 3 2 5
1 1
1
1 1 1 1
```

**Output :**

```
2
3
1
```

---

Added by: Frank Rafael Arteaga

Date: 2008-08-06

Time limit: 1s

Source  
limit: 50000B

Languages: All except: C99 strict

Resource: K.-Y. Chen and K.-M. Chao, On the Range Maximum-Sum Segment Query Problem, 2007.

## SPOJ Problem Set (tutorial)

### 2939. Query on a tree V

#### Problem code: QTREE5

You are given a tree (an acyclic undirected connected graph) with  $N$  nodes. The tree nodes are numbered from 1 to  $N$ . We define  $\text{dist}(a, b)$  as the number of edges on the path from node  $a$  to node  $b$ .

Each node has a color, white or black. All the nodes are black initially.

We will ask you to perform some instructions of the following form:

- $0\ i$  : change the color of  $i$ -th node (from black to white, or from white to black).
- $1\ v$  : ask for the minimum  $\text{dist}(u, v)$ , node  $u$  must be white ( $u$  can be equal to  $v$ ). Obviously, as long as node  $v$  is white, the result will always be 0.

#### Input

- In the first line there is an integer  $N$  ( $N \leq 100000$ )
- In the next  $N-1$  lines, the  $i$ -th line describes the  $i$ -th edge: a line with two integers  $a\ b$  denotes an edge between  $a$  and  $b$ .
- In the next line, there is an integer  $Q$  denotes the number of instructions ( $Q \leq 100000$ )
- In the next  $Q$  lines, each line contains an instruction " $0\ i$ " or " $1\ v$ "

#### Output

For each " $1\ v$ " operation, print one integer representing its result. If there is no white node in the tree, you should write "-1".

#### Example

**Input :**

```
10
1 2
1 3
2 4
1 5
1 6
4 7
7 8
5 9
1 10
10
0 6
0 6
0 6
1 3
0 1
0 1
1 3
1 10
```



1 4  
1 6

**Output :**

2  
2  
2  
3  
0

---

Added by: Qu Jun

Date: 2008-08-13

Time limit: 6s

Source limit:50000B

Languages: All

Resource: XunYunbo, modified from ZJOI07

## SPOJ Problem Set (classical)

### 2940. Untitled Problem II

#### Problem code: UNTITLE1

You are given a sequence of  $N$  integers  $A_1, A_2 \dots A_N$ . ( $-10000 \leq A_i \leq 10000$ ,  $N \leq 50000$ )

Let  $S_i$  denote the sum of  $A_1 \dots A_i$ . You need to apply  $M$  ( $M \leq 50000$ ) operations:

- $0 \ x \ y \ k$ : increase all integers from  $A_x$  to  $A_y$  by  $k$  ( $1 \leq x \leq y \leq N$ ,  $-10000 \leq k \leq 10000$ ).
- $1 \ x \ y$ : ask for  $\max\{S_i \mid x \leq i \leq y\}$ . ( $1 \leq x \leq y \leq N$ )

#### Input

- In the first line there is an integer  $N$ .
- The following line contains  $N$  integers that represent the sequence.
- The third line contains an integer  $M$  denotes the number of operations.
- In the next  $M$  lines, each line contains an operation " $0 \ x \ y \ k$ " or " $1 \ x \ y$ ".

#### Output

For each " $1 \ x \ y$ " operation, print one integer representing its result.

#### Example

**Input :**

```
5
238 -9622 5181 202 -6943
5
1 3 4
0 5 5 4846
1 3 5
0 3 5 -7471
1 3 3
```

**Output :**

```
-4001
-4001
-11674
```

**Use signed 64-bit integer :)**

---

**Added by:** Qu Jun  
**Date:** 2008-08-14  
**Time limit:** 4s  
**Source**  
**limit:** 50000B  
**Languages:** All  
**Resource:** Not an own  
problem

## SPOJ Problem Set (classical)

### 2944. Emmons

#### Problem code: SHOOTING

After the end of all the shooting competitions in XXIX Olympic Games in Beijing, Matthew Emmons will be known to more and more people because of his last - which is also his worst - shooting in the 50m Rifle 3\*40 Men competitions. Four years before in Athens, he shot a wrong target and lost the gold medal which is almost at hands in the 50m Rifle 3\*40 Men competition.

**The following is Blue Mary's imagination :P**

Emmons decides to practise shooting more assiduously. Because he is an excellent shooter, only 1 year later, he can even shoot precisely without collimation! To him, getting the gold medal of 50m Rifle 3\*40 Men in XXX Olympic Games doesn't have any difficulty now.

His wife - Katerina Emmons, also a well-known excellent shooter - make a game to keep his interests with shot. The player has  $n$  ( $1 \leq n \leq 2000$ ) bullets, each one has a value (a integer whose absolute value is less than 10000). There are  $m$  ( $1 \leq m \leq n$ ) targets, each with a point counter next to it. In the beginning of the game, all the counter are set to integer 1.

During the game, the player must choose a bullet and shoot any target. He must use all the bullet, each with at least(of course, at most) 1 time. And each target must be shot at least one time.

If the player shoot a target with a bullet valued  $X$ , the counter of the target will multiplied by  $X$ .

The final score of the game is sum of all the  $m$  counters.

Now Matthew needs your help to make his final score as high as possible. After that, he will show you his excellent shooting skills to get this score.

**P.S.** Even the things above is my imagination, I hope Matthew Emmons has good luck and wins the gold medal of 50m Rifle 3\*40 Men in XXX Olympics in London.

#### Input

Multiple test cases, the number of them ( $\leq 50$ ) is given in the very first line.

For each test case:

The first line contains two integers  $n$  and  $m$ . The second line contains  $n$  integers, the value for each bullet.

#### Output

For each test case:

The first and the only line contains a single integer - the highest possible final score.

## Example

### Input :

```
3
10 2
0 -1 -2 0 1 2 3 2 10 1
10 3
0 -1 -2 0 1 2 3 2 10 1
5 3
10 0 0 -1 -1
```

### Output :

```
240
241
11
```

### Hint :

For the first example, a possible solution is  $(0,0) (-1,-2,1,2,3,2,10,1)$ .

For the second example, a possible solution is  $(0,0) (1,1) (-1,-2,2,3,2,10)$ .

---

Added by: Blue Mary

Date: 2008-08-21

Time limit: 60s

Source limit:50000B

Languages: All except: C99 strict

Resource: Chinese Team Selection Contest for IOI 2006, with description modified

## SPOJ Problem Set (classical)

### 2946. Eclipse

#### Problem code: ECLIPSE

Every so often we hear on the news that there is going to be either a solar or lunar eclipse. Eclipses have a long history dating back well into the BC's. Astronomers study total solar eclipses very closely as they provide the rare opportunity to observe the corona.

An eclipse occurs when two celestial bodies and a star are (nearly) linearly aligned and the shadow cast by the one body intersects the other body, creating darkness on the latter body.

We are interested in determining when a solar eclipse will next occur. In Figure 1 you can see two labelled regions. The umbra is the area of total darkness -- a body in this region will experience a total solar eclipse. The penumbra is the area of partial darkness -- a body in this region will experience a partial solar eclipse.

You will be given the size and location of a star and two celestial bodies. Your task is to determine if the first celestial body creates a solar eclipse on the second celestial body. If it does then you are to determine whether it is a total or partial eclipse and whether the entire body is in eclipse. If part of the body is experiencing total eclipse while the entire body is experiencing at least a partial eclipse, we are only interested in the part that is in total eclipse.

Consider a scaled model of our solar system with the sun at the origin (0, 0, 0) with radius 700, the moon at position (49900, 1000, 149700) with radius 2 and Earth at position (50000, 1000, 150000) with radius 7. In Figure 1, the sun would be the star on the left and the moon would be the smaller body on the right. Part of Earth would then fall in the black umbra region and hence partly experience a total solar eclipse.

For any body:

- $1 \leq r \leq 10^6$
- $0 \leq x, y, z \leq 10^9$

It is guaranteed that any two bodies will be at least 1 unit apart, and that moving any one of the bodies by 1 unit (in any direction) will not change the answer.

[IMAGE]

#### Input

A test case is described by three lines, each describing the size and location of a single body. The first line contains four space-separated integers  $x_s$ ,  $y_s$ ,  $z_s$  and  $r_s$ , describing the center ( $x_s$ ,  $y_s$ ,  $z_s$ ) and radius  $r_s$  of the star. The following two lines define the two celestial bodies in the same manner.

Test cases follow directly after one another with a -1 representing the end of the test cases.

## Output

Each test case has a single line of output describing the type of eclipse for that case. If the second celestial body listed in the test case is experiencing an eclipse, then one of the following lines must be output:

- Entire total solar eclipse
- Part total solar eclipse
- Entire partial solar eclipse
- Part partial solar eclipse

If there is no solar eclipse, the line "No solar eclipse" must be output.

## Example

### Input :

```
0 0 0 700
49900 1000 149700 2
50000 1000 150000 7
0 0 0 10
50 0 100 40
60 0 200 1
-1
```

### Output :

```
Part total solar eclipse
Entire total solar eclipse
```

---

Added by: Marco Gallotta

Date: 2008-08-27

Time limit: 30s

Source limit:50000B

Languages: All

Resource: ACM Southern African Regionals 2007

## SPOJ Problem Set (classical)

### 2962. Painting Blocks (Act I)

#### Problem code: PAINTBLK

$n$  blocks are put in a line. You have  $k$  ( $1 \leq k \leq 15$ ) kinds of dope, the  $i$ -th dope is enough to paint  $c_i$  ( $1 \leq c_i \leq 5$ ) blocks. You may assume the sum of all the  $c_i$  equals to  $n$ . Your task is to calculate the number of ways to paint the blocks with these kinds of dope, such that no two adjacent blocks are painted with the same kind of dope.

#### Input

Ten test cases(given one after another, you have to process all!). For each test case, the first line contains an integer  $k$ , the second line contains  $k$  integers,  $c_1, c_2, \dots, c_k$ .

#### Output

Ten lines, each contains an integer, the number of ways modulo 1000000007.

#### Example

**Input :**

```
3
1 2 3
5
2 2 2 2 2
10
1 1 2 2 3 3 4 4 5 5
[and 7 test cases more]
```

**Output :**

```
10
39480
85937576
[and 7 test cases more]
```

---

Added by: Blue Mary  
Date: 2008-09-01  
Time limit: 3s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: :P



## SPOJ Problem Set (classical)

### 2963. Painting Blocks (Act II)

#### Problem code: PAINTBLC

$n$  blocks are put in a line. You have  $k$  ( $1 \leq k \leq 15$ ) kinds of dope, the  $i$ -th dope is enough to paint  $c_i$  ( $1 \leq c_i \leq 6$ ) blocks. You may assume the sum of all the  $c_i$  equals to  $n$ . Your task is to calculate the number of ways to paint the blocks with these kinds of dope, such that no two adjacent blocks are painted with the same kind of dope.

#### Input

Input consists of multiple test cases, the number of them ( $\leq 2000$ ) is given in the very first line. For each test case, the first line contains an integer  $k$ , the second line contains  $k$  integers,  $c_1, c_2, \dots, c_k$ .

#### Output

For each test case, output one line with an integer, the number of ways modulo 1000000007.

#### Example

**Input :**

```
3
3
1 2 3
5
2 2 2 2 2
10
1 1 2 2 3 3 4 4 5 5
```

**Output :**

```
10
39480
85937576
```

---

Added by: Blue Mary  
Date: 2008-09-01  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: g201513

## SPOJ Problem Set (classical)

### 3002. Electrophoretic

#### Problem code: ELECTRO

Scientist Frank, majoring in electrochemistry, has developed line-shaped strange electrodes called F-electrodes. During being activated, each F-electrode causes a special potential on and between the two lines touching the F-electrode's endpoints at a right angle. Then electrically-charged particles located inside the potential area get to move in the direction parallel to the potential boundary (i.e. perpendicular to the F-electrode), either toward or against F-electrode. The moving direction can be easily controlled between the two possibles; it is also possible to get particles to pass through F-electrodes. In addition, unlike ordinary electrodes, F-electrodes can affect particles even infinitely far away, as long as those particles are located inside the potential area. On the other hand, two different F-electrodes cannot be activated at a time, since their potentials conflict strongly.

We can move particles on our will by controlling F-electrodes. However, in some cases, we cannot lead them to the desired positions due to the potential areas being limited. To evaluate usefulness of F-electrodes from some aspect, Frank has asked you the following task: to write a program that finds the shortest distances from the particles' initial positions to their destinations with the given sets of F-electrodes.

[IMAGE]

#### Input

The input consists of multiple test cases. The first line of each case contains  $N$  ( $1 \leq N \leq 100$ ) which represents the number of F-electrodes. The second line contains four integers  $x_s$ ,  $y_s$ ,  $x_t$  and  $y_t$ , where  $(x_s, y_s)$  and  $(x_t, y_t)$  indicate the particle's initial position and destination. Then the description of  $N$  F-electrodes follow. Each line contains four integers  $F_{x_s}$ ,  $F_{y_s}$ ,  $F_{x_t}$  and  $F_{y_t}$ , where  $(F_{x_s}, F_{y_s})$  and  $(F_{x_t}, F_{y_t})$  indicate the two endpoints of an F-electrode. All coordinate values range from 0 to 100 inclusive.

The input is terminated by a case with  $N = 0$ .

#### Output

Your program must output the case number followed by the shortest distance between the initial position to the destination. Output "Impossible" (without quotes) as the distance if it is impossible to lead the elementary particle to the destination. Your answers must be printed with five digits after the decimal point.

#### Example

Input :

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

0

**Output :**

Case 1: 3.00000

---

Added by: Jin Bin

Date: 2008-09-08

Time limit: 10s

Source limit:50000B

Languages: All except: C99 strict

Resource: JAG wintercamp 08, day2

## SPOJ Problem Set (classical)

### 3003. Median Filter

#### Problem code: FILTER

The median filter is a nonlinear digital filter used to reduce noise in images, sounds, and other kinds of signals. It examines each sample of the input through a *window* and then emits the *median* of the samples in the window. Roughly speaking, a window is an interval that contains a target sample and its preceding and succeeding samples; the median of a series of values is given by the middle value of the series arranged in ascending (or descending) order.

Let us focus on a typical median filter for black-and-white raster images. The typical filter uses a  $3 \times 3$  window, which contains a target pixel and the eight adjacent pixels. The filter examines each pixel in turn through this  $3 \times 3$  window, and outputs the median of the nine pixel values, i.e. the fifth lowest (or highest) pixel value, to the corresponding pixel. We should note that the output is just given by the pixel value in majority for black-andwhite images, since there are only two possible pixel values (i.e. black and white). The figure below illustrates how the filter works.

[IMAGE]

The edges of images need to be specially processed due to lack of the adjacent pixels. In this problem, we extend the original images by repeating pixels on the edges as shown in the figure below. In other words, the lacked pixels take the same values as the nearest available pixels in the original images.

[IMAGE]

You are requested to write a program that reads images to which the filter is applied, then finds the original images containing the greatest and smallest number of black pixels among all possible ones, and reports the difference in the numbers of black pixels.

#### Input

The input contains a series of test cases.

The first line of each test case contains two integers  $W$  and  $H$  ( $1 \leq W, H \leq 8$ ), which indicates the width and height of the image respectively. Then  $H$  lines follow to describe the filtered image. The  $i$ -th line represents the  $i$ -th scan line and contains exactly  $W$  characters, each of which is either '#' (representing black) or '.' (representing white).

The input is terminated by a line with two zeros.

#### Output

For each test case, print a line that contains the case number followed by the difference of black pixels. If there are no original images possible for the given filtered image, print "Impossible" instead.

Obey the format as shown in the sample output.

## Example

### Input :

```
5 5
#####
#####
#####
#####
#####
4 4
####
####
####
####
4 4
#...
....
....
...#
4 4
.#.#
#.#.
.#.#
#.#.
0 0
```

### Output :

```
Case 1: 10
Case 2: 6
Case 3: 2
Case 4: Impossible
```

---

Added by: Jin Bin

Date: 2008-09-08

Time limit: 20s

Source limit:50000B

Languages: All except: C99 strict

Resource: JAG wintercamp 08, day2

## SPOJ Problem Set (classical)

### 3004. Life Game

#### Problem code: LIFEGAME

You are working at a production plant of biological weapons. You are a maintainer of a terrible virus weapon with very high reproductive power. The virus has a tendency to build up regular hexagonal colonies. So as a whole, the virus weapon forms a hexagonal grid, each hexagon being a colony of the virus. The grid itself is in the regular hexagonal form with  $N$  colonies on each edge.

The virus self-propagates at a constant speed. Self-propagation is performed simultaneously at all colonies. When it is done, for each colony, the same number of viruses are born at every neighboring colony. Note that, after the self-propagation, if the number of viruses in one colony is more than or equal to the limit density  $M$ , then the viruses in the colony start self-attacking, and the number reduces modulo  $M$ .

Your task is to calculate the total number of viruses after  $L$  periods, given the size  $N$  of the hexagonal grid and the initial number of viruses in each of the colonies.

[IMAGE]

#### Input

The input consists of multiple test cases.

Each case begins with a line containing three integers  $N$  ( $1 \leq N \leq 6$ ),  $M$  ( $2 \leq M \leq 10^9$ ), and  $L$  ( $1 \leq L \leq 10^9$ ). The following  $2N - 1$  lines are the description of the initial state. Each non-negative integer (smaller than  $M$ ) indicates the initial number of viruses in the colony. The first line contains the number of viruses in the  $N$  colonies on the topmost row from left to right, and the second line contains those of  $N + 1$  colonies in the next row, and so on.

The end of the input is indicated by a line "0 0 0".

#### Output

For each test case, output the test case number followed by the total number of viruses in all colonies after  $L$  periods.

#### Example

**Input :**

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

```
0 0 0 0 0
0 0 0 0
0 0 1
0 0 0
```

**Output:**

Case 1: 8  
Case 2: 18

---

Added by: Jin Bin  
Date: 2008-09-08  
Time limit: 20s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: JAG wintercamp 08, day2

## SPOJ Problem Set (classical)

### 3005. Subdividing a Land

#### Problem code: LAND

Indigo Real-estate Company is now planning to develop a new housing complex. The entire complex is a square, all of whose edges are equally  $a$  meters. The complex contains  $n$  subdivided blocks, each of which is a  $b$ -meter square. Here both  $a$  and  $b$  are positive integers.

However the project is facing a big problem. In this country, a percentage limit applies to the subdivision of a land, under the pretext of environmental protection. When developing a complex, the total area of the subdivided blocks must not exceed 50% of the area of the complex; in other words, more than or equal to 50% of the newly developed housing complex must be kept for green space. As a business, a green space exceeding 50% of the total area is a *dead space*. The primary concern of the project is to minimize it.

Of course purchasing and developing a land costs in proportion to its area, so the company also wants to minimize the land area to develop as the secondary concern. You, a member of the project, were assigned this task, but can no longer stand struggling against the problem with your pencil and paper. So you decided to write a program to find the pair of minimum  $a$  and  $b$  among those which produce the minimum dead space for given  $n$ .

#### Input

The input consists of multiple test cases. Each test case comes in a line, which contains an integer  $n$ . You may assume  $1 \leq n \leq 10000$ .

The end of input is indicated by a line containing a single zero. This line is not a part of the input and should not be processed.

#### Output

For each test case, output the case number starting from 1 and the pair of minimum  $a$  and  $b$  as in the sample output.

You may assume both  $a$  and  $b$  fit into 64-bit signed integers.

#### Example

**Input :**

1  
2  
0

**Output :**

Case 1: 3 2  
Case 2: 2 1

---



Added by: Jin Bin  
Date: 2008-09-08  
Time limit: 10s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: JAG wintercamp 08, day2

## SPOJ Problem Set (classical)

### 3006. Connect Line Segments

#### Problem code: LINE

Your dear son Arnie is addicted to a puzzle named *Connect Line Segments*.

In this puzzle, you are given several line segments placed on a two-dimensional area. You are allowed to add some new line segments each connecting the end points of two existing line segments. The objective is to form a single polyline, by connecting all given line segments, as short as possible. The resulting polyline is allowed to intersect itself.

[IMAGE]

Arnie has solved many instances by his own way, but he is wondering if his solutions are the best one. He knows you are a good programmer, so he asked you to write a computer program with which he can verify his solutions.

Please respond to your dear Arnie's request.

#### Input

The input consists of multiple test cases.

Each test case begins with a line containing a single integer  $n$  ( $2 \leq n \leq 14$ ), which is the number of the initial line segments. The following  $n$  lines are the description of the line segments. The  $i$ -th line consists of four real numbers:  $x_{i,1}$ ,  $y_{i,1}$ ,  $x_{i,2}$ , and  $y_{i,2}$  ( $-100 \leq x_{i,1}, y_{i,1}, x_{i,2}, y_{i,2} \leq 100$ ).  $(x_{i,1}, y_{i,1})$  and  $(x_{i,2}, y_{i,2})$  are the coordinates of the end points of the  $i$ -th line segment.

The end of the input is indicated by a line with single "0".

#### Output

For each test case, output the case number followed by the minimum length in a line.

The output value should be printed with five digits after the decimal point.

#### Example

**Input :**

```
4
0 1 0 9
10 1 10 9
1 0 9 0
1 10 9 10
2
1.2 3.4 5.6 7.8
5.6 3.4 1.2 7.8
0
```

**Output :**

Case 1: 36.24264

Case 2: 16.84508

---

Added by: Jin Bin

Date: 2008-09-08

Time limit: 10s

Source limit:50000B

Languages: All except: C99 strict

Resource: JAG wintercamp 08, day2

## SPOJ Problem Set (classical)

### 3007. Oil Company

#### Problem code: OILCOMP

Irving & Cohen Petroleum Corporation has decided to develop a new oil field in an area. A preliminary survey has been done and they created a detailed grid map of the area which indicates the reserve of oil.

They are now planning to construct mining plants on several grid blocks according this map, but they decided not to place any two plants on adjacent positions to avoid spreading of fire in case of blaze. Two blocks are considered to be adjacent when they have a common edge. You are one of the programmers working for the company and your task is to write a program which calculates the maximum amount of oil they can mine, given the map of the reserve.

#### Input

The first line of the input specifies N, the number of test cases. Then N test cases follow, each of which looks like the following:

```
W H
r1,1 r2,1 . . . rw,1
. . .
r1,H r2,H . . . rw,H
```

The first line of a test case contains two integers W and H ( $1 \leq W, H \leq 20$ ). They specifies the dimension of the area. The next H lines, each of which contains W integers, represent the map of the area. Each integer  $r_{x,y}$  ( $0 \leq r_{x,y} < 10000$ ) indicates the oil reserve at the grid block (x, y).

#### Output

For each test case, output the case number (starting from 1) and the maximum possible amount of mining in a line. Refer to the sample output section about the format.

#### Example

**Input :**

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

**Output :**

```
Case 1: 7
Case 2: 8
```

---

Added by: Jin Bin  
Date: 2008-09-08  
Time limit: 10s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: JAG wintercamp 08, day2

## **SPOJ Problem Set (classical)**

### **3008. Finding the Top RPS Player**

#### **Problem code: RPS**

A company "ACM Foods" is preparing for opening its chain shop in a certain area, but another company "ICPC Pizza" is also planning to set up its branch shop in the same area. In general, two competitive shops gain less incomes if they are located so close to each other. Thus, if both "ACM Foods" and "ICPC Pizza" went on opening, they would be damaged financially. So, they had a discussion on this matter and made the following agreement: only one of them can branch its shop in the area. It is determined by Rock-Paper-Scissors (RPS) which to branch the shop.

ACM Foods is facing financial difficulties and strongly desires to open their new shop in that area. The executives have decided to make every effort for finding out a very strong RPS player. They believe that players who win consecutive victories must be strong players. In order to find such a player for sure, they have decided their simple strategy.

In this strategy, many players play games of RPS repeatedly, but the games are only played between players with the same number of consecutive wins. At the beginning, all the players have no wins, so any pair of players can play a game. The games can be played by an arbitrary number of pairs simultaneously. Let us call a set of simultaneous games as a turn. After the first turn, some players will have one win, and the other players will remain with no wins. In the second turn, some games will be played among players with one win, and some other games among players with no wins. For the former games, the winners will have two consecutive wins, and the losers will lose their first wins and have no consecutive wins. For the latter games, the winners will have one win, and the losers will remain with no wins. Therefore, after the second turn, the players will be divided into three groups: players with two consecutive wins, players with one win, and players with no wins. Again, in the third turn, games will be played among players with two wins, among with one win, and among with no wins. The following turns will be conducted so forth. After a sufficient number of turns, there should be a player with the desired number of consecutive wins.

The strategy looks crazy? Oh well, maybe they are confused because of their financial difficulties. Of course, this strategy requires an enormous amount of plays. The executives asked you, as an employee of ACM Foods, to estimate how long the strategy takes. Your task is to write a program to count the minimum number of turns required to find a player with  $M$  consecutive wins among  $N$  players.

#### **Input**

The input consists of multiple test cases. Each test case consists of two integers  $N$  ( $2 \leq N \leq 20$ ) and  $M$  ( $1 \leq M < N$ ) in one line.

The input is terminated by the line containing two zeroes.

## Output

For each test case, your program must output the case number followed by one integer which indicates the minimum number of turns required to find a person with M consecutive wins.

## Example

### Input :

```
2 1
10 5
15 10
0 0
```

### Output :

```
Case 1: 1
Case 2: 11
Case 3: 210
```

---

Added by: Jin Bin

Date: 2008-09-08

Time limit: 10s

Source limit:50000B

Languages: All except: C99 strict

Resource: JAG wintercamp 08, day2

## SPOJ Problem Set (classical)

### 3009. Revenge of Voronoi

#### Problem code: VORONOI

A discrete Voronoi diagram is a derivation of a Voronoi diagram. It is represented as a set of pixels. Each of the generatrices lies on the center of some pixel. Each pixel belongs to the generatrix nearest from the center of the pixel in the sense of Manhattan distance. The Manhattan distance  $d$  between two points  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by the following formula:

$$d = |x_1 - x_2| + |y_1 - y_2|$$

Your task is to find a set of generatrices which generates a given discrete Voronoi diagram. In the given diagram, each generatrix is given a unique lowercase letter as its identifier, and each pixel is represented by the identifier of the generatrix the pixel belongs to. If a pixel has multiple generatrices at the same distance from its center, it belongs to the generatrix with the most preceding identifier among them (i.e. the smallest character code).

#### Input

The input consists of multiple test cases.

Each test case begins with a line containing two integers  $W$  ( $1 \leq W \leq 32$ ) and  $H$  ( $1 \leq H \leq 32$ ), which denote the width and height of the discrete Voronoi diagram.

The following  $H$  lines, each of which consists of  $W$  letters, give one discrete Voronoi diagram. Each letter represents one pixel.

The end of input is indicated by a line with two zeros. This is not a part of any test cases.

#### Output

For each test case, print the case number and the coordinates of generatrices as shown in the sample output. Each generatrix line should consist of its identifier,  $x$ -coordinate, and  $y$ -coordinate. Generatrices should be printed in alphabetical order of the identifiers. Each coordinate is zero-based where  $(0, 0)$  indicates the center of the top-left corner pixel of the diagram.

You may assume that every test case has at least one solution. If there are multiple solutions, any one is acceptable.

Print a blank line after every test case including the last one.

#### Example

**Input :**

```
4 3
oxxx
oxxx
oxxx
```



```
4 1
null
4 4
aabb
aabb
ccdd
ccdd
0 0
```

**Output :**

Case 1:  
o 0 0  
x 2 0

Case 2:  
l 2 0  
n 0 0  
u 1 0

Case 3:  
a 0 0  
b 2 0  
c 0 2  
d 2 2

---

Added by: Jin Bin  
Date: 2008-09-08  
Time limit: 10s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: JAG wintercamp 08, day2

## SPOJ Problem Set (classical)

### 3010. Castle Wall

#### Problem code: WALL

A new lord assumed the position by the death of the previous lord in a Far Eastern province.

The new greedy lord hates concave polygons, because he believes they need much wasted area to be drawn on paper. He always wants to modify them to convex ones.

His castle is currently surrounded by a wall forming a concave polygon, when seen from the above. Of course he hates it. He believes more area could be obtained with a wall of a convex polygon. Thus he has ordered his vassals to have new walls built so they form a convex polygon.

Unfortunately, there is a limit in the budget. So it might be infeasible to have the new walls built completely. The vassals have found out that only up to  $r$  meters of walls in total can be built within the budget. In addition, the new walls must be built in such a way they connect the polygonal vertices of the present castle wall. It is impossible to build both of intersecting walls.

After long persuasion of the vassals, the new lord has reluctantly accepted that the new walls might not be built completely. However, the vassals still want to maximize the area enclosed with the present and new castle walls, so they can satisfy the lord as much as possible.

Your job is to write a program to calculate, for a given integer  $r$ , the maximum possible area of the castle with the new walls.

#### Input

The input file contains several test cases.

Each case begins with a line containing two positive integers  $n$  and  $r$ .  $n$  is the number of vertices of the concave polygon that describes the present castle wall, satisfying  $5 \leq n \leq 64$ .  $r$  is the maximum total length of new castle walls feasible within the budget, satisfying  $0 \leq r \leq 400$ .

The subsequent  $n$  lines are the  $x$ - and  $y$ -coordinates of the  $n$  vertices. The line segments  $(x_i, y_i)-(x_{i+1}, y_{i+1})$  ( $1 \leq i \leq n - 1$ ) and  $(x_n, y_n)-(x_1, y_1)$  form the present castle wall of the concave polygon. Those coordinates are given in meters and in the counterclockwise order of the vertices.

All coordinate values are integers between 0 and 100, inclusive. You can assume that the concave polygon is simple, that is, the present castle wall never crosses or touches itself.

The last test case is followed by a line containing two zeros.

#### Output

For each test case in the input, print the case number (beginning with 1) and the maximum possible area enclosed with the present and new castle walls. The area should be printed with exactly one fractional digit.

## Example

### Input :

```
5 4
0 0
4 0
4 4
2 2
0 4
8 80
45 41
70 31
86 61
72 64
80 79
40 80
8 94
28 22
0 0
```

### Output :

```
Case 1: 16.0
Case 2: 3375.0
```

---

Added by: Jin Bin

Date: 2008-09-08

Time limit: 10s

Source limit:50000B

Languages: All except: C99 strict

Resource: JAG wintercamp 08, day2

## SPOJ Problem Set (classical)

### 3033. Help the soldier

#### Problem code: SOLDIER

Igor, a famous russian soldier, must go to war in Afghanistan (we are in late 80's). His superiors allowed him to buy himself his equipment. So, he must buy 6 items: helmet, bulletproof vest, trousers, boots, tunic and a firearm. This items are represented with numbers from 1 to 6. There are  $N$  ( $6 < N < 101$ ) items of this 6 types. Each item is characterized by its price  $p[i]$  (in rublas) and its quality  $q[i]$ . Igor has  $T$  ( $0 < T < 1001$ ) rublas and he wants to maximize the total quality of his equipment. The total quality is the quality of the item with the lowest quality. Help him.

#### Input

On the first line there are two integers  $N$  and  $T$ . On the lines  $2 \dots N+1$  there are 3 integers,  $type[i]$  (from 1 to 6)  $p[i]$  and  $q[i]$ . ( $0 < p[i], q[i] < T$ )

#### Output

Output the total quality.

#### Example

**Input :**

```
7 53
5 8 2
2 4 8
6 8 13
1 13 12
4 5 1
3 2 7
3 13 5
```

**Output :**

```
1
```

**Note:**

If there is no answer, output 0.  
There can be less than 6 types of items.

---

Added by: Pripoae Toni

Date: 2008-09-14

Time limit: 0.5s

Source limit: 2048B

Languages: All

Resource: Original

## SPOJ Problem Set (classical)

### 3070. How many subsequences

#### Problem code: SEQ5

Tom has again maths , and the teacher writes countless tables with exercises .... so boring. Then he remembers an old problem of informatics that he thought in a dream . He remembered , he has a number of positive integers and the job was to know how many subsequences that have between L and U distinct elements exist in that range. So the boring hour will pass quicker . But he needs your help , he is to exhausted after two hours of math with the agitated teacher .

#### Input

The first line of input file contains positive N, L, U. following N lines will contain a positive integer, each representing an element of the series.

#### Output

The first line of the output will display the number of sequences containing between L and U distinct elements.

#### Example

**Input :**

```
4 1 2
231
19
7
19
```

**Output :**

```
8
```

**Notes :**

$1 \leq L \leq U \leq N \leq 2^{20}$

The value of an item number is a positive integers  $[1, 2^{32}-1]$ ;

A subsequence is a lot of items that appear on consecutive positions in the initial row.

**Be carefull with certain languages.Large input data.**

Tom thanks you for solving this problem and he awards you with points.

---

Added by: Pripoe Toni

Date: 2008-09-29

Time limit: 0.200s-2.5s

Source limit:50000B

Languages: All

Resource: Mircea Pasoi

## SPOJ Problem Set (classical)

### 3105. Power Modulo Inverted

#### Problem code: MOD

Given 3 positive integers  $x$ ,  $y$  and  $z$ , you can find  $k = x^y \% z$  easily, by fast power-modulo algorithm. Now your task is the inverse of this algorithm. Given 3 positive integers  $x$ ,  $z$  and  $k$ , find the smallest non-negative integer  $y$ , such that  $k \% z = x^y \% z$ .

#### Input

About 600 test cases.

Each test case contains one line with 3 integers  $x$ ,  $z$  and  $k$ . ( $1 \leq x, z, k \leq 10^9$ )

Input terminates by three zeroes.

#### Output

For each test case, output one line with the answer, or "No Solution"(without quotes) if such an integer doesn't exist.

#### Example

**Input :**

```
5 58 33
2 4 3
0 0 0
```

**Output :**

```
9
No Solution
```

---

Added by: Blue Mary

Date: 2008-10-04

Time limit: 17s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Folklore, description, standard program and test data by Blue Mary

## SPOJ Problem Set (classical)

### 3106. Dictionary Subsequences

#### Problem code: DICTSUB

You have a dictionary of strings, and you want to perform some queries on the strings. In particular, you're given a single string  $T$ , and for each word  $W$  in the dictionary, you want to determine if  $W$  is a subsequence of  $T$ . A string  $B$  is a subsequence of a string  $C$  if you can remove zero or more of  $C$ 's letters to form a string equal to  $B$  (but the order of remaining letters may not be rearranged).

Each word  $W$  in the dictionary will be described in the input as a run length encoded (RLE) string. That is,  $W$  will be described by several pairs of data values, where each pair of data values consists of a positive integer  $K$  with no leading zeros and a letter  $L$ . A data pair with values  $K$  and  $L$  represents a string with  $K$  occurrences of the character  $L$ . To get the uncompressed string, we concatenate all strings represented by the data pairs. For example, the RLE string  $2A1B5C12A$  represents the string  $AABCCCCCAAAAAAAAAAAAAA$ .

#### Input

The first line of the input contains a positive integer  $C$  ( $0 < C < 10$ ), the number of test cases to follow. Each case begins with a line containing a positive integer  $D$  ( $0 < D < 10000$ ) representing the number of dictionary words and a string  $T$  with length between 1 and 10000.  $D$  lines follow, with each line containing a string with length between 1 and 200 in RLE format, which represents a dictionary word with uncompressed length between 1 and 10000. All uncompressed strings ( $T$  and dictionary words) will consist only of uppercase letters ('A'-'Z').

#### Output

Output for each case consists of several lines. There should be one line per dictionary word  $W$  (in the order of appearance in input) that will say either "YES" if  $W$  is a subsequence of  $T$ , or "NO" otherwise. Print a blank line after each test case.

#### Example

##### Input :

```
1
5 EFFERVESCECE
2E
1E1F1V1C1E
1E2F1C1R
1S2E
1P1E2F
```

##### Output :

```
YES
YES
NO
YES
NO
```

---

Added by: John Rizzo  
Date: 2008-10-04  
Time limit: 2s  
Source limit: 50000B  
Languages: All  
Resource: Al-Khawarizm 2008 - Set by eleusive



## SPOJ Problem Set (classical)

### 3107. Odd Numbers of Divisors

#### Problem code: ODDDIV

Given a positive odd integer  $K$  and two positive integers  $low$  and  $high$ , determine how many integers between  $low$  and  $high$  contain exactly  $K$  divisors.

#### Input

The first line of the input contains a positive integer  $C$  ( $0 < C < 100,000$ ), the number of test cases to follow. Each case consists of a line containing three integers:  $K$ ,  $low$ , and  $high$  ( $1 < K < 10000$ ,  $0 < low \leq high < 10^{10}$ ).  $K$  will always be an odd integer.

#### Output

Output for each case consists of one line: the number of integers between  $low$  and  $high$ , inclusive, that contain exactly  $K$  divisors.

#### Example

**Input :**

```
3
3 2 49
9 1 100
5 55 235
```

**Output :**

```
4
2
1
```

---

Added by: John Rizzo

Date: 2008-10-04

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Al-Khawarizm 2008 - Set by eleusive

## SPOJ Problem Set (classical)

### 3108. Charlesbert and Merangelou

#### Problem code: GRAPHGAM

Charlesbert and Merangelou are playing a two-player game on a game board. The game board consists of several circles, where some circles are connected to other circles. Charlesbert uses a game piece called the GoalPiece, and Merangelou uses a game piece called the ChasePiece.

The game is played as follows: at the start of the game, Charlesbert chooses a circle on the board and places the Goalpiece on it, and at the same time Merangelou places the ChasePiece on circle 1. During the next  $K$  seconds, Merangelou makes a sequence of moves (at one move per second), where a move consists of either leaving the ChasePiece on its current circle, or moving the ChasePiece from its current circle to a circle that is directly connected to it. If the ChasePiece and the GoalPiece lie on the same circle before or exactly  $K$  seconds after Charlesbert last placed the ChasePiece, Merangelou wins. Otherwise, Charlesbert chooses a new circle on the board and places the GoalPiece on it, and Merangelou will make  $K$  more moves (Charlesbert moves the GoalPiece before Merangelou makes another move). This process is repeated until the ChasePiece and the GoalPiece lie on the same circle. Note that it is possible for Merangelou to win in fewer than  $K$  moves.

Merangelou wants to win the game as quickly as possible, while Charlesbert wants to keep the game going for as long as possible. Assuming both players play optimally, find the shortest amount of time (in seconds) after which Merangelou is guaranteed to have won the game. If Merangelou cannot win the game (i.e. if Charlesbert can keep the game going forever), then print "INFINITE GAME" instead.

#### Input

The first line of the input contains a positive integer  $C$  ( $0 < C < 100$ ), the number of test cases to follow. Each case begins with a line containing a two positive integers  $M$  and  $K$  ( $1 < M < 100$ ,  $0 < K < 100$ ), representing the number of circles on the game board and the number of seconds between times that Charlesbert moves the ChasePiece. Each of the following  $M$  lines is a string of 'Y' and 'N' characters, with  $M$  characters per line. If the  $j$ th character of the  $i$ th line is 'Y', then circles  $i$  and  $j$  are connected, otherwise circles  $i$  and  $j$  are not connected. The  $j$ th character of line  $i$  will always be the same as the  $i$ th character of the  $j$ th line, and the  $k$ th character of the  $k$ th line will always be 'N'. In other words, these  $M$  lines form an adjacency matrix for the circles. The ChasePiece always starts on the first circle.

#### Output

For each case, if Merangelou can win then print the shortest amount of time required for her to win. Otherwise, print "INFINITE GAME". The output for each case should appear on its own line.

#### Example

**Input :**

```
3
5 1
NNNNY
NNNNY
NNNNY
NNNNY
YYYYN
```

4 2  
NYNN  
YNYN  
NYNY  
NNYN  
4 1  
NYNY  
YNYN  
NYNY  
YNYN

**Output :**

2  
4  
INFINITE GAME

---

Added by: John Rizzo  
Date: 2008-10-04  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: Al-Khawarizm 2008 - Set by eleusive

## SPOJ Problem Set (classical)

### 3109. Longest Common Prefix

#### Problem code: STRLCP

The LCP (Longest Common Prefix) of two strings  $A[1..la]$  and  $B[1..lb]$  is defined as follows:

$LCP(A[1..la], B[1..lb]) = \max\{L \mid L \leq la \ \&\& \ L \leq lb \ \&\& \ A[1..L] == B[1..L]\}$

Given an original string and several operations, you should write a program to process all the operations.

#### Input

The first line will be number of test cases  $T$ .

The first line of each test case is a string  $S$  with length  $L$  ( $1 \leq L \leq 100000$ ).

The second line contains an integer  $Q$  ( $1 \leq Q \leq 150000$ ), representing the number of operations.

Each of the following  $Q$  lines represents an operation:

$Q \ i \ j$ : print  $LCP(S[i..L], S[j..L])$

$R \ i \ char$ : replace the  $i$ -th character of  $S$  with  $char$

$I \ i \ char$ : insert character  $char$  after the  $i$ -th character of  $S$

#### Output

For each " $Q \ i \ j$ " operation, print the answer.

#### Example

##### Input :

```
1
madamimadam
7
Q 1 7
Q 4 8
Q 10 11
R 3 a
Q 1 7
I 10 a
Q 2 11
```

##### Output :

```
5
1
0
2
1
```

---

Added by: John Rizzo  
Date: 2008-10-04  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Al-Khawarizm 2008

## SPOJ Problem Set (classical)

### 3110. Palindromic Number

#### Problem code: PALNUM

A positive integer A is called a "palindrome number" if the reverse of the decimal representation is the same as the original one. Ex. 13231 is a palindrome number, but 13333 is not.

Given a number A ( $1 \leq A \leq 10^{18}$ ), find the number of pairs (a,b) such that a,b are both palindrome numbers, and the sum of a and b is A.

If A is 391, there are 6 ways:  $8 + 383 = 383 + 8 = 391$   $88 + 303 = 303 + 88 = 391$   $99 + 292 = 292 + 99 = 391$

#### Input

The first Line contains the number of test cases  $T \leq 10$ . Each test case contains a number A.

#### Output

Output the number of ways.

#### Example

**Input :**

1  
391

**Output :**

6

---

Added by: John Rizzo

Date: 2008-10-04

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Al-Khawarizm 2008

## SPOJ Problem Set (classical)

### 3111. Stabards

#### Problem code: STABARDS

In a galaxy far far away, there exists a silicon based form of life, who call themselves stabards. Unlike humans, the stabards are multi-gendered. Therefore, when two stabards form a partnership (known as mating in earth parlance), one stabard would be the donor of genetic material and the other would be the combinator of the genetic material. Of course, the combinator had the tougher task, to combine the genetic material and create a new stabard.

Early on, the wise stabards realized that due to the increased number of genders, every stabard was likely to waste his time trying to find a suitable partner. After that, due to the tremendous opportunity, every stabard would waste some more time trying to cheat on his partner by forming more partnerships (especially the donors since they had nothing much to do). Therefore, the wise ones made the following rules about partnerships:

1. Each stabard can form at most two partnerships.
2. In order to maintain a sense of balance, a stabard cannot play the same role (donor/combinator) in both partnerships.
3. The partnerships shall be formed such that the total number of them is maximized.

To ensure all rules are being followed, the wise ones send the stabard data every year to earth and wish to know the maximum number of partnerships that can be formed.

#### Input

For each test case, two integers M (the number of stabard genders) and N (the total number of stabards) are given on the first line. M lines follow, each consisting of M characters. The j-th character on the i-th line denotes what would happen if a stabard of gender i formed a partnership with a stabard of gender j. It will be either

'X' - such a partnership is forbidden.

'D' - stabard of gender i would be the donor.

'C' - stabard of gender i would be the combinator.

After the M lines, N space separated integers are given on a single line. The i-th integer gives the gender of the i-th stabard.

The end of the test cases is given by a line with M and N both being 0. This test case should not be processed. The total number of test cases will be  $\leq 100$ .

#### Constraints

$$0 < M \leq 100$$

$$0 < N \leq 100$$

The gender data for stabards will be symmetric and consistent. (i.e. character i on line j will not conflict with character j on line i). Two stabards of the same gender can never partner each other. (The wise ones fear this will pollute the gene pool. Moreover, big fights would break out as who would be the donor.) The gender given for each stabard will be between 0 and M-1 inclusive.

## Output

For each test case, a single integer giving the total number of partnerships. Each integer must be on its own line.

## Example

**Input :**

```
2 4
XD
CX
0 0 1 1
3 3
XDC
CXD
DCX
0 1 2
0 0
```

**Output :**

```
2
3
```

---

Added by: John Rizzo

Date: 2008-10-04

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Al-Khawarizm 2008 - Set by humblefool



## SPOJ Problem Set (classical)

### 3112. Strings

#### Problem code: STSTRING

Given two strings A and B, we define the operator  $\text{cx}$  on  $\{A,B\}$  for string C as  $C \text{ cx } \{A,B\}$ .

```
if length(A) < length(C) < length(B), then C satisfies the above operator.  
else  
    if length(A)=length(C), then C must be lexicographically greater than A.  
    if length(B)=length(C), then C must be lexicographically smaller than B.
```

#### Input

Given two strings A,B with  $\text{length}(A) \leq \text{length}(B) \leq 6$ . A,B can contain any characters between A and J (capital letters).

#### Output

Print the number of strings satisfying the above criteria. C must also satisfy criteria of A and B. Any two adjacent characters in string C may neither be the same nor consecutive (i.e. the absolute difference between the ASCII values of adjacent characters is greater than 1).

#### Example

**Input :**

```
A J  
AA BCD  
ABC DEFG
```

**Output :**

```
8  
129  
1770
```

---

Added by: John Rizzo  
Date: 2008-10-04  
Time limit: 2s  
Source limit: 50000B  
Languages: All  
Resource: Al-Khawarizm 2008 - Set by FameofLight and Challenger

## SPOJ Problem Set (classical)

### 3133. Here We Go(relians) Again

#### Problem code: GORELIAN

The Gorelians are a warlike race that travel the universe conquering new worlds as a form of recreation. Given their violent, fun-loving nature, keeping their leaders alive is of serious concern. Part of the Gorelian security plan involves changing the traffic patterns of their cities on a daily basis, and routing all Gorelian Government Officials to the Government Building by the fastest possible route.

Fortunately for the Gorelian Minister of Traffic (that would be you), all Gorelian cities are laid out as a rectangular grid of blocks, where each block is a square measuring 2520 rels per side (a rel is the Gorelian Official Unit of Distance). The speed limit between two adjacent intersections is always constant, and may range from 1 to 9 rels per blip (a blip, of course, being the Gorelian Official Unit of Time). Since Gorelians have outlawed decimal numbers as unholy (hey, if you're the dominant force in the known universe, you can outlaw whatever you want), speed limits are always integer values. This explains why Gorelian blocks are precisely 2520 rels in length: 2520 is the least common multiple of the integers 1 through 9. Thus, the time required to travel between two adjacent intersections is always an integer number of blips.

In all Gorelian cities, Government Housing is always at the northwest corner of the city, while the Government Building is always at the southeast corner. Streets between intersections might be one-way or two-way, or possibly even closed for repair (all this tinkering with traffic patterns causes a lot of accidents). Your job, given the details of speed limits, street directions, and street closures for a Gorelian city, is to determine the fastest route from Government Housing to the Government Building. (It is possible, due to street directions and closures, that no route exists, in which case a Gorelian Official Temporary Holiday is declared, and the Gorelian Officials take the day off.)

#### Gorelian city

The picture above shows a Gorelian City marked with speed limits, one way streets, and one closed street. It is assumed that streets are always traveled at the exact posted speed limit, and that turning a corner takes zero time. Under these conditions, you should be able to determine that the fastest route from Government Housing to the Government Building in this city is 1715 blips. And if the next day, the only change is that the closed road is opened to two way traffic at 9 rels per blip, the fastest route becomes 1295 blips. On the other hand, suppose the three one-way streets are switched from southbound to northbound (with the closed road remaining closed). In that case, no route would be possible and the day would be declared a holiday.

#### Input

The input consists of a set of cities for which you must find a fastest route if one exists. The first line of an input case contains two integers, which are the vertical and horizontal number of city blocks, respectively. The smallest city is a single block, or 1 by 1, and the largest city is 20 by 20 blocks. The remainder of the input specifies speed limits and traffic directions for streets between intersections, one row of street segments at a time. The first line of the input (after the dimensions line) contains the data for the northernmost east-west street segments. The next line contains the data for the northernmost row of north-south street segments. Then the next row of east-west streets, then

north-south streets, and so on, until the southernmost row of east-west streets. Speed limits and directions of travel are specified in order from west to east, and each consists of an integer from 0 to 9 indicating speed limit, and a symbol indicating which direction traffic may flow. A zero speed limit means the road is closed. All digits and symbols are delimited by a single space. For east-west streets, the symbol will be an asterisk '\*' which indicates travel is allowed in both directions, a less-than symbol '<' which indicates travel is allowed only in an east-to-west direction, or a greater-than symbol '>' which indicates travel is allowed only in a west-to-east direction. For north-south streets, an asterisk again indicates travel is allowed in either direction, a lowercase "vee" character 'v' indicates travel is allowed only in a north-to-south directions, and a caret symbol '^' indicates travel is allowed only in a south-to-north direction. A zero speed, indicating a closed road, is always followed by an asterisk. Input cities continue in this manner until a value of zero is specified for both the vertical and horizontal dimensions.

## Output

For each input scenario, output a line specifying the integer number of blips of the shortest route, a space, and then the word "blips". For scenarios which have no route, output a line with the word "Holiday".

## Example

### Input :

```
2 2
9 * 9 *
6 v 0 * 8 v
3 * 7 *
3 * 6 v 3 *
4 * 8 *
2 2
9 * 9 *
6 v 9 * 8 v
3 * 7 *
3 * 6 v 3 *
4 * 8 *
2 2
9 * 9 *
6 ^ 0 * 8 ^
3 * 7 *
3 * 6 ^ 3 *
4 * 8 *
0 0
```

### Output :

```
1715 blips
1295 blips
Holiday
```

---

Added by: Nikola P Borisov

Date: 2008-10-11

Time limit: 5s

Source limit:50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2007

## SPOJ Problem Set (classical)

### 3166. Permutation Exponentiation

#### Problem code: PERMSG

Alice, a permutation aficionado, has thought up a permutation of  $N$  ( $1 \leq N \leq 100000$ ) elements,  $P$ . So impressed with herself she has told her friend Bob about  $P$ .

Normally Alice would call it a day after creating such an impressive permutation but today she decided that she wanted to raise  $P$  to the power  $k$  as well! Unfortunately, after working on the problem for a while she gave up because it was taking too long. Not wanting her efforts to go to waste she once again tells Bob about all the elements she has determined so far. Unfortunately, she neglected to tell Bob the value  $k$ .

Bob, very interested in Alice's work, needs your help to try and determine any additional elements of  $P^k$ . Bob is suspicious of Alice's work so he also asks you to check it for errors.

#### Notes

For two permutations  $P$ ,  $Q$ , the  $i$ th element of the product,  $(P * Q)[i]$ , can be computed as  $Q[P[i]]$ .

Then  $P^k$  is simply  $P * P * \dots k \text{ times} \dots * P$ .

#### Input

The first line of input contains  $N$  ( $1 \leq N \leq 100000$ ), the number of elements in the permutation. The next line contains a permutation of the integers 0 through  $N-1$  each separated by a space. The following line will contain the result of applying the permutation  $k$  times with the exception that elements that are not known will be -1 instead.

#### Output

Print  $P^k$  as a space separated list on its own line with as many elements as possible determined. If an element can't be determined leave it as -1. If there is no  $k$  such that  $P^k$  has the values given in the input print "Inconsistent" (quotes for clarity) on its own line instead.

#### Example

**Input :**

4

1 2 3 0

3 -1 -1 -1

**Output :**

3 0 1 2

**Note:** The first four permutations generated are

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

## Example 2

**Input :**

```
4
1 2 3 0
3 -1 2 -1
```

**Output :**

Inconsistent

---

Added by: Mark Gordon

Date: 2008-10-17

Time limit: 3s

Source limit:50000B

Languages: All except: ERL JS PERL 6

Resource: Own problem

## SPOJ Problem Set (classical)

### 3184. Game of Lines

#### Problem code: LINES

Farmer John has challenged Bessie to the following game: FJ has a board with dots marked at  $N$  ( $2 \leq N \leq 200$ ) distinct lattice points. Dot  $i$  has the integer coordinates  $X_i$  and  $Y_i$  ( $-1,000 \leq X_i, Y_i \leq 1,000$ ).

Bessie can score a point in the game by picking two of the dots and drawing a straight line between them; however, she is not allowed to draw a line if she has already drawn another line parallel to it. Bessie would like to know her chances of winning, so she has asked you to help find the maximum score she can obtain.

#### Input

There will be multiple test cases. For each case, the first line contains the integer  $N$ , and each of the next  $N$  lines gives a pair of integers,  $X_i$  and  $Y_i$ . The file ends with the case  $N = 0$ , which should not be processed.

#### Output

For each test case, print a single integer representing the maximum number of lines Bessie can draw, no two of which are parallel.

#### Example

**Input :**

```
4
-1 1
-2 0
0 0
1 1
0
```

**Output :**

```
4
```

Bessie can draw lines of the following four slopes: -1, 0, 1/3, and 1.

---

Added by: Neal Wu

Date: 2008-10-19

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: USACO Feb 2008

## SPOJ Problem Set (classical)

### 3195. Doors and Penguins

#### Problem code: DOORSPEN

The organizers of the Annual Computing Meeting have invited a number of vendors to set up booths in a large exhibition hall during the meeting to showcase their latest products. As the vendors set up their booths at their assigned locations, they discovered that the organizers did not take into account an important fact -- each vendor supports either the Doors operating system or the Penguin operating system, but not both. A vendor supporting one operating system does not want a booth next to one supporting another operating system. Unfortunately the booths have already been assigned and even set up. There is no time to reassign the booths or have them moved. To make matter worse, these vendors in fact do not even want to be in the same room with vendors supporting a different operating system. Luckily, the organizers found some portable partition screens to build a wall that can separate the two groups of vendors. They have enough material to build a wall of any length. The screens can only be used to build a straight wall. The organizers need your help to determine if it is possible to separate the two groups of vendors by a single straight wall built from the portable screens. The wall built must not touch any vendor booth (but it may be arbitrarily close to touching a booth). This will hopefully prevent one of the vendors from knocking the wall over accidentally.

#### Input

The input consists of a number of cases. Each case starts with 2 integers on a line separated by a single space: D and P, the number of vendors supporting the Doors and Penguins operating system, respectively ( $1 \leq D, P \leq 500$ ). The next D lines specify the locations of the vendors supporting Doors. This is followed by P lines specifying the locations of the vendors supporting Penguins. The location of each vendor is specified by four positive integers:  $x_1, y_1, x_2, y_2$ .  $(x_1, y_1)$  specifies the coordinates of the southwest corner of the booth while  $(x_2, y_2)$  specifies the coordinates of the northeast corner. The coordinates satisfy  $x_1 < x_2$  and  $y_1 < y_2$ . All booths are rectangular and have sides parallel to one of the compass directions. The coordinates of the southwest corner of the exhibition hall is  $(0, 0)$  and the coordinates of the northeast corner is  $(15000, 15000)$ . You may assume that all vendor booths are completely inside the exhibition hall and do not touch the walls of the hall. The booths do not overlap or touch each other. The end of input is indicated by  $D = P = 0$ .

#### Output

For each case, print the case number (starting from 1), followed by a colon and a space. Next, print the sentence: It is possible to separate the two groups of vendors. if it is possible to do so. Otherwise, print the sentence: It is not possible to separate the two groups of vendors. Print a blank line between consecutive cases.

#### Example

**Input :**

```
3 3
10 40 20 50
50 80 60 90
30 60 40 70
```

```
30 30 40 40
50 50 60 60
10 10 20 20
2 1
10 10 20 20
40 10 50 20
25 12 35 40
0 0
```

**Output:**

Case 1: It is possible to separate the two groups of vendors.

Case 2: It is not possible to separate the two groups of vendors.

---

Added by: Daniel Gómez Didier

Date: 2008-10-21

Time limit: 1s-2s

Source limit:50000B

Languages: All

Resource: 2007 PUJ - Circuito de Maratones ACIS / REDIS



## SPOJ Problem Set (classical)

### 3208. Yet Another Longest Palindrome Problem

#### Problem code: PALIM

A string is called a palindrome if it's the same when read from left to right and from right to left. For example, "abdba" is a palindrome, but "abbba" is not.

Given a string, print the length of the longest consecutive sequence of characters occurrences at least once in this string, which is a palindrome.

#### Input

- Line 1: a string consists of at most 100000 characters. The ASCII code of all characters are between 32 and 127, inclusive.
- Line 2: a magical key(for security purpose).

#### Output

- Line 1: the length of the longest palindrome.
- Line 2: the magical key.

#### Example

**Input :**  
abaabbabaaba  
MAGICAL KEY

**Output :**  
6  
MAGICAL KEY

#### Restriction

Only C++ is allowed in this problem now. **In addition, you will receive "wrong answer" if your program don't start with this.** You can't use macro "#undef" in your solution as well.

If you want to solve this problem in another language, send me the header file in your language please.

**warning:** Don't try to access the memory of tester, or I will reject your solution manually, and you will lose the chance to enjoy this problem as well.

#### Hint

**hint of using tester library:** you can't read anything from stdin, and you can't print anything as well, your program will be terminated if you called answer().

**hint of viewing feedback:** You can click on "wrong answer" link to view the feedback of judge: whether your solution didn't include the testlib, or failed on sample. (if neither, your solution failed on a further test case)

## Notice

**update on Oct.24:** I had updated the header file for C++, now you will receive "Runtime Error (NZEC) " if your solution called isSame() illegally. The submissions with old version of header file are still acceptable.

**rejudge on Oct.24:** some test cases were added, three submissions were rejudged as TLE instead of AC.

---

Added by: Bin Jin

Date: 2008-10-23

Time limit: 1s

Source limit: 10240B

Languages: C++ 4.0.0-8 C++ 4.3.2

Resource: the (second??) "interactive" problem on SPOJ

## SPOJ Problem Set (classical)

### 3249. Typesettin

#### Problem code: TYPESET

Modern fonts are generally of two varieties: outline fonts, whose glyphs (the individual character shapes) are specified mathematically as a set of curves, and bitmap fonts, whose glyphs are specified as patterns of pixels. Fonts may also include embedded information such as kerning pairs (adjusting the spacing between certain pairs of glyphs, such as "AW", so that they appear spaced correctly), tracking hints (for managing inter-glyph spacing), antialiasing hints (smoothing of pixellated edges), and much more. To be sure, modern fonts are more than a simple collection of shapes, and displaying them properly is a common programming challenge.

For this problem we will concern ourselves with bitmapped fonts and a simple form of typesetting called glyph packing. Essentially, the idea is to pack the glyphs as tightly as possible while maintaining at least one horizontal pixel of separation between glyphs. For example, consider the glyphs shown to the left below for the Roman characters "P" and "J". The figure to the right shows them after glyph packing. Note that they are as close as possible without touching horizontally.

PJ

Here's another example. In this case, notice that the final glyph cannot be packed at all.

Fiji

After packing, pixels from distinct glyphs may be adjacent diagonally or vertically, but not horizontally. The following example shows that pixels may be adjacent diagonally. The "Love" test case in the example input section shows that they may be adjacent vertically.

two slashes

Glyph packing has the nice property that it's easy to build "fancy" glyphs into the font so that glyph packing creates special effects with no extra work. Look at the "Toy" example below. The same simple packing process has been applied to these glyphs as to the ones above, but the result is more dramatic:

Toy

Glyph packing has a few caveats, however, one of which we must concern ourselves with for this problem. Consider the example on the left below where a glyph for a hyphen is followed by a glyph for an underscore. Based on our one horizontal pixel of separation rule, how would this pack? Clearly something more is needed, and that something more is hinting within the glyphs themselves. Recall that in actual practice, fonts contain kerning pairs, tracking hints, etc. For our purposes, our hinting will be limited to "invisible" pixels that count as a pixel for the purpose of packing, but not for display. The center image below represents invisible pixels as open dots instead of closed dots. Now the two glyphs can be properly packed, resulting in the output shown on the right.

hidden pixels

Now for the formal definition of a proper packing: (1) Glyphs are packed as close as possible without allowing any pixels from different glyphs to be immediately horizontally adjacent; (2) Given two glyphs, they may not be packed in such a way that any pixel of the leftmost glyph at a given height ends up positioned to the right of any pixel at the same height in the rightmost glyph.

Condition (2) above is easily understood by visualizing two glyphs sitting side by side, separated by a small space. If you "squeeze" them together, condition (2) says that their pixels are not allowed to "pass through" one another. Consider the example to the left below. The center image is not the proper packing, because it violates condition (2) of the formal definition. The image on the right is the proper packing of these glyphs.

hooks

## Input

The input for this problem is sets of glyphs to be packed. In a given test case, all glyphs are the same height, and an integer, N, on the first line of the test case specifies this height. The next N lines contain the glyphs to be packed. Empty pixels in a glyph are represented by a dot '.' character. Non-empty pixels are represented by a hash mark '#' for visible pixels, and a zero '0' for invisible pixels. Glyphs are separated by a single column of space characters. The input will always consist of more than one glyph, at least one of which will always contain at least one visible pixel. A glyph will always have at least one non-empty pixel in its leftmost and rightmost column, and every glyph will have at least one non-empty pixel at the same height as at least one other glyph in the input. The minimum dimension of a glyph is 1 x 1, the maximum dimension is 20 x 20, and the maximum number of glyphs that will appear in any test case is 20. Test cases continue until a value of zero is specified for N.

## Output

For each test case, first output the number of that test case (starting with 1) on a line by itself. Then output the proper packing of the input glyphs, using the dot '.' character for empty pixels and for invisible pixels, and the hash mark '#' character for visible pixels. Omit leading and trailing empty columns (columns with no visible pixels) so that both the leftmost and rightmost output columns contain at least one visible pixel.

## Example

Input :

```
8
###. ...#
#..# ...#
#..# ...#
###. ...#
#... ...#
#... ...#
#... #..#
#... #####
8
##### .....
..#.....
..#..... ##. ....#..#
..#..... #..# .....#..#
..#..... #..# .....#..#
```

```

..#..... .##. ....###
.....#
..... #####.
8
#####
..#.....
..#.....#..#
..#.....#..#
..#.....#..#
..#.....###
.....#
..... #####.
5
0..0 0..0
0..0 0..0
### 0..0
0..0 0..0
0..0 ###
5
#.... .###.
#.... #...#
#...# #...#
#...# ....#
.###. ....#
3
### 0.0 ###
#. # 0.0 #.#
### 0.0 ###
3
0.0 ### 0.0
0.0 #.# 0.0
0.0 ### 0.0
8
#.... ....
#.... ....
#.... .##. #...# .##.
#.... #..# .#. #.# #..#
#.... #..# .#. #.# #..#
#.... #..# .#. #.# ###.
#.... .###. ..#.. #...
##### .... ..#.. .###
0

```

# Output:

```

1
###..#
#..#.#
#..#.#
###..#
#....#
#....#
#.#..#
#.####
2
#####
..#.....
..#...##..#..#
..#.#..#.#..#
..#.#..#.#..#
..#...##..#
.....#
#####.

```

```

3
.....#####
.....#.....
.....#.#.....
.....#.#.....
.....#.#.....
.....#.#.....
.....#.#.....
.....#.....
#####.....

```

```

4
.....
.....
####.....
.....
.....####

```

```

5
#.....###.
#.....#...#
#...#.#...#
#...#.....#
.###.....#

```

```

6
###.....###
#.#.....#.#
###.....###

```

```

7
###
#.#
###

```

```

8
#.....
#.....
#...##.#...#...#
#.#...#.#.#...#
#.#...#.#.#...#
#.#...#.#.###.
#...##...#...#
#####...#...###

```

---

Added by: Nikola P Borisov

Date: 2008-10-25

Time limit: 10s

Source limit:50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2007

## SPOJ Problem Set (classical)

### 3251. Slink

#### Problem code: SLINK

Slitherlink is a puzzle published by Nikoli, the Japanese company that popularized Sudoku. Slitherlink puzzles are gaining momentum, and books of Slitherlink puzzles have started showing up around the world. The puzzles are simple to understand, but can be challenging to solve. The puzzle is simply a rectangular grid of dots that forms a collection of cells, every cell being either blank or containing an integer from zero to three. The challenge is to connect the dots with line segments to form a cycle (a connected path such that every vertex has precisely two incident edges), in such a way that every cell with a value has exactly the number of incident edges as the digit it contains. Cells with no value may have any number of incident edges. A valid Slitherlink puzzle always contains sufficient non-empty cells to guarantee a unique solution. Below is an example from the Nikoli web site of a Slitherlink puzzle and its solution.

slitherlink example

It was shown by Takayuki Yato at the University of Tokyo that the general Slitherlink problem is NP-complete. (If you are not familiar with this concept, informally it means there is no "efficient" algorithm to solve the problem.) With a slight modification and some simple heuristics, however, programmatic solutions are possible. Our new puzzle, which we will term Slink, differs from Slitherlink only in that the puzzle may not have empty cells. That is, every cell must specify the number of incident edges. Below is the Slitherlink puzzle above converted to Slink (the added numbers are shown in gray). Note that the solution does not change, only the information given in the puzzle itself.

slink example

The heuristics for solving Slink arise from the nature of the puzzle itself. For example, consider a cell containing a zero. There must be no incident edges, therefore all edges incident to all zeros can be immediately removed from consideration as part of the solution path. Consider a three next to a zero. Because all the edges incident to the zero will be eliminated, the common edge shared with the three is also eliminated. But that leaves only three edges around the three, and therefore those three edges must be part of the solution path. The following table specifies the heuristic rules that must be properly applied to solve a Slink puzzle. The "x" characters between vertices mark edges that are not part of the solution path, while line segments between vertices mark edges that form part of the solution. Grey elements are the pattern the rule is based on, black elements indicate the additional edges that should be included or excluded if the rule is matched. Note that the pictured examples are for demonstration purposes only and do *not* illustrate every possible arrangement of the stated rule!

Look here for more pictures

| Examples | Rule Specification | Examples | Rule Specification |
|----------|--------------------|----------|--------------------|
|----------|--------------------|----------|--------------------|

|                  |  |   |   |
|------------------|--|---|---|
| case 1           | <p>The easiest and most obvious of all the rules. Cells containing a zero have no incident edges, so all the edges around a zero should be removed from consideration as part of the solution path.</p> <pre> 8 8 1 0 1 1 2 2 1 3 3 3 3 3 2 3 3 2 2 0 1 1 2 2 0 2 3 1 1 0 1 2 2 2 1 2 3 1 1 0 2 1 2 2 2 3 2 1 3 2 1 3 1 1 3 2 1 0 0 2 3 2 3 2 6 6 0 0 1 1 0 0 0 2 2 2 2 0 1 2 0 0 2 1 1 2 0 0 2 1 0 2 2 2 2 0 0 0 1 1 0 0 2 2 2 2 2 3 5 3 3 3 2 3 1 2 1 3 2 3 3 2 2 2 0 0 </pre> | case 2<br>case 3  | <p>If a cell contains the value <math>n</math> and only <math>n</math> incident edges remain (i.e. have not been eliminated), then the <math>n</math> remaining edges must be part of the solution path. Two examples of this occurring are shown here.</p> |
| case 4<br>case 5 | <p>If a cell contains the value <math>n</math> and <math>n</math> incident edges have already been included in the path, the remaining edges can be eliminated. Two examples of this occurring are shown here.</p>   | <pre> case 6 8 8 1 0 1 1 2 2 1 3 3 3 3 3 2 3 3 2 2 2 0 1 1 2 2 0 2 3 1 1 0 1 2 2 2 1 2 3 1 1 0 2 1 2 2 2 2 3 2 1 3 2 1 3 1 1 3 2 1 0 0 2 3 2 3 2 6 6 0 0 1 1 0 0 0 2 2 2 2 0 1 2 0 0 2 1 1 2 0 0 2 1 0 2 2 2 2 0 0 0 1 1 0 0 2 2 2 2 2 2 3 5 3 3 3 2 3 1 2 1 3 2 3 3 2 2 2 0 0 </pre> | <p>If two 3's are adjacent to one another, the common edge between the cells as well as the outer edges of both cells are part of the solution path. One example of this arrangement occurring is shown here.</p>   |
| case 7           | <p>If two 3's occur diagonally adjacent, the opposing corners as shown here must be part of the solution path. One example of such an arrangement is shown here.</p>   | case 8  | <p>If an edge enters a vertex for which only a single exit remains, that exit must be part of the solution path. One such example is shown here.</p>  |
| case 9           | <p>If a vertex has two incident edges, the other edges can be eliminated from consideration as part of the solution path. One such example is shown here.</p>  | case 10   | <p>If any vertex has three incident edges excluded, the fourth incident edge can be excluded as well. One possible arrangement of this occurring is shown here.</p>   |
| case 11          | <p>A 3 for which two of the exits are blocked as shown, such as in a corner of the puzzle, must include the two edges incident to the blocked vertex.</p>  | case 12   | <p>If the exits at one corner of a 2 are blocked, and one exit at an adjacent vertex around the 2 is also blocked, then the unblocked exit at that adjacent vertex must be part of the solution path. One example of this arrangement is shown here.</p>    |



case 13	A 1 for which the exit paths at one of its incident vertices are both blocked as shown, such as might occur in the corner of the puzzle, must also eliminate the other two edges incident to that vertex as shown.	case 14	If the solution path enters the corner of a 3, and the exit that goes away from the 3 at that same corner is blocked, then the two edges around the three incident to the opposite corner must be part of the solution path.
case 15	If a 3 and 1 are diagonally adjacent, and the corner of the 3 furthest from the 1 has the exit segments blocked as shown, then the edges incident to the far corner of the 1 becomes blocked. The opposite is also true; if the far corner of the 1 had been blocked, then the exit segments at the far corner of the 3 would become blocked in the same manner.	case 16	If the solution path enters the corner of 2 and the path leading away from the 2 at the same corner is blocked, then if one of the paths leading away from the 2 at the diagonally opposite corner is also blocked, the other edge leading away from the 2 at that same corner must be part of the solution path. One example of this arrangement occurring is shown here.
case 17	If the solution path enters the corner of a 1, and the exit that goes away from the 1 at that same corner is blocked, then the two edges around the three incident to the opposite corner must be eliminated from the solution path.		

## Input

The input for this problem is a set of Slink puzzles to be solved. The first line of a Slink problem's input contains two integers,  $r$  and  $c$ , separated by a space, the number of rows and the number of columns in the puzzle. The next  $r$  rows of the input contain  $c$  integers, space delimited, valued from 0 to 3, which specify the content of the puzzle. The minimum dimension of a puzzle is 2 by 2 cells, and the maximum dimension is 20 by 20 cells. It is guaranteed that a unique solution to every input puzzle exists and can be determined with the above rules if a rule is always applied when it can be applied. A line with values of zero for  $r$  and  $c$  marks the end of the input.

## Output

The output for this problem is a graphical representation of the Slink puzzle solution. The first data set is 1, the second data set is 2, etc. On a line by itself display the data set number, followed by the solution in exactly the format demonstrated below. Vertical edges are output as the vertical bar '|' character, horizontal edges are output as dash '-' characters, vertices where the path changes direction are output as plus signs '+', and cell numbers are always displayed with a blank to the left and to the right. Further, surround the entire output with a border made up of hash marks '#' such that the

number in the upper left cell of the puzzle always occurs four positions to the right of the border and three position below the border, and the number in the lower right cell always occurs four positions to the left of the border and three positions above the border.

## Example

### Input :

```
8 8
1 0 1 1 2 2 1 3
3 3 3 3 2 3 3 2
2 2 0 1 1 2 2 0
2 3 1 1 0 1 2 2
2 1 2 3 1 1 0 2
1 2 2 2 2 3 2 1
3 2 1 3 1 1 3 2
1 0 0 2 3 2 3 2
6 6
0 0 1 1 0 0
0 2 2 2 2 0
1 2 0 0 2 1
1 2 0 0 2 1
0 2 2 2 2 0
0 0 1 1 0 0
2 2
2 2
2 2
3 5
3 3 3 2 3
1 2 1 3 2
3 3 2 2 2
0 0
```

### Output :

```
1
#####
#
#
#      1      0      1      1 | 2      2      1      3 | #
# +---+ +---+ +---+ | +---+ +---+ #
# | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | #
# | +---+ +---+ | +---+ #
# | 2      2      0      1      1 | 2      2      0 | #
# +-----+ +-----+ #
# 2      3 | 1      1      0      1      2 | 2 | #
# +-----+ +---+ +---+ #
# | 2      1      2 | 3 | 1      1      0      2 | #
# | +---+ | +---+ | #
# | 1      2 | 2      2 | 2 | 3 | 2      1 | #
# | +---+ +---+ | +---+ | #
# | 3 | 2      1 | 3      1 | 1      3 | 2 | #
# +---+ +---+ | +---+ | #
# 1      0      0      2 | 3 | 2 | 3      2 | #
# +---+ +-----+ #
#
#
#####
2
#####
#
#
#      0      0      1      1      0      0      #
```

```

#           +-----+           #
#   0   2 | 2   2 | 2   0   #
#           +---+           +---+           #
#   1 | 2   0   0   2 | 1   #
#           |                   |           #
#   1 | 2   0   0   2 | 1   #
#           +---+           +---+           #
#   0   2 | 2   2 | 2   0   #
#           +-----+           #
#   0   0   1   1   0   0   #
#                                     #
#                                     #
#####
3
#####
#                                     #
# +-----+ #
# | 2   2 | #
# |       | #
# | 2   2 | #
# +-----+ #
#                                     #
#####
4
#####
#                                     #
# +---+ +---+ +---+ #
# | 3 | 3 | 3 | 2 | 3 | #
# |   +---+   |   |   | #
# | 1   2   1 | 3 | 2 | #
# |   +---+   +---+   | #
# | 3 | 3 | 2   2   2 | #
# +---+ +-----+ #
#                                     #
#####

```

Added by: Nikola P Borisov

Date: 2008-10-25

Time limit: 5s

Source limit:50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2007

## SPOJ Problem Set (classical)

### 3253. Electronic Document Security

#### Problem code: EDS

The Tyrell corporation uses a state-of-the-art electronic document system that controls all aspects of document creation, viewing, editing, and distribution. Document security is handled via *access control lists* (ACLs). An ACL defines a set of entities that have access to the document, and for each entity defines the set of rights that it has. Entities are denoted by uppercase letters; an entity might be a single individual or an entire division. Rights are denoted by lowercase letters; examples of rights are *a* for *append*, *d* for *delete*, *e* for *edit*, and *r* for *read*.

The ACL for a document is stored along with that document, but there is also a separate ACL *log* stored on a separate log server. All documents start with an empty ACL, which grants no rights to anyone. Every time the ACL for a document is changed, a new entry is written to the log. An entry is of the form  $ExR$ , where  $E$  is a nonempty set of entities,  $R$  is a nonempty set of rights, and  $x$  is either "+", "-", or "=". Entry  $E+R$  says to grant all the rights in  $R$  to all the entities in  $E$ , entry  $E-R$  says to remove all the rights in  $R$  from all the entities in  $E$ , and entry  $E=R$  says that all the entities in  $E$  have exactly the rights in  $R$  and no others. An entry might be redundant in the sense that it grants an entity a right it already has and/or denies an entity a right that it doesn't have. A log is simply a list of entries separated by commas, ordered chronologically from oldest to most recent. Entries are cumulative, with newer entries taking precedence over older entries if there is a conflict.

Periodically the Tyrell corporation will run a security check by using the logs to compute the current ACL for each document and then comparing it with the ACL actually stored with the document. A mismatch indicates a security breach. Your job is to write a program that, given an ACL log, computes the current ACL.

#### Input

The input consists of one or more ACL logs, each 3-79 characters long and on a line by itself, followed by a line containing only "#" that signals the end of the input. Logs will be in the format defined above and will not contain any whitespace.

#### Output

For each log, output a single line containing the log number (logs are numbered sequentially starting with one), then a colon, then the current ACL in the format shown below. Note that (1) spaces do not appear in the output; (2) entities are listed in alphabetical order; (3) the rights for an entity are listed in alphabetical order; (4) entities with no current rights are not listed (even if they appeared in a log entry), so it's possible that an ACL will be empty; and (5) if two or more consecutive entities have exactly the same rights, those rights are only output once, after the list of entities.

## Example

### Input :

```
MC-p, SC+c
YB=rde, B-dq, AYM+e
GQ+tju, GH-ju, AQ-z, Q=t, QG-t
JBL=fwa, H+wf, LD-fz, BJ-a, P=aw
#
```

### Output :

```
1:CSc
2:AeBerMeYder
3:
4:BHJfwLPaw
```

---

Added by: Nikola P Borisov

Date: 2008-10-25

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2007

## SPOJ Problem Set (classical)

### 3254. Guard

#### Problem code: GUARD

##### Guard Placement

The Bluewater Security Company provides guards for clients with valuable possessions. Bluewater has found that clients are interested in having guards posted where they can see everything that is valuable merely by turning their heads, and also like guards to be posted particularly close to particularly valuable items. A sample site layout is shown above. Ignore the three black dots for now. Various locations are labeled and assigned values. For instance location A at coordinates (0,8) is the position of an item with value 4. Locations showing a value 0, like G, do not have a valuable item. The straight lines indicate corridors. For simplicity, corridors are modeled as line segments with 0 width. A guard at an intersection point of several corridors can see and therefore guard the items on each of the corridors. If Bluewater were contracted to supply 3 guards, they might choose to post them at the positions indicated with the small black dots. The guard not at an already labeled position is at (15.5, 6). To model the desire for guards to be closer to items of higher value, Bluewater calculates the risk to a valuable item to be the value of the item times the minimum distance to a guard that can see the item. Even if a guard is close to an item that is around a corner, that guard does not affect the risk to the item, since the guard cannot see around a corner. In the diagram shown, the risks to the items are A:  $4 \times 5 = 20$ , C:  $4 \times 2.5 = 10$ , D:  $2 \times 0 = 0$ , .... The largest risks are for H:  $50 \times 7.5 = 375$  and I:  $50 \times 7.5 = 375$ , so the maximum risk to any one item is 375. With this site layout, no arrangement of 3 guards would provide a lower maximum risk, so this arrangement of 3 guards minimizes the maximum risk. Bluewater would like to be able to tell any client who requests a particular number of guards for a particular site layout, what the minimized maximum risk will be.

#### Input

The input will consist of one to sixteen data sets, followed by a line containing only 0. On each line the data will consist of blank separated tokens.

The first line of a dataset contains integers  $p$   $c$   $g$ , where  $p$  is the number of points specified,  $c$  is the number of corridors, and  $g$  is the number of guards to be placed. Constraints are  $1 < p < 12$ ;  $0 < c < 12$ ;  $0 < g < 5$ .

Next in the dataset are a total of  $p$  groups of four tokens, each consisting of a capital letter and three nonnegative integers  $L$   $x$   $y$   $v$  indicating the point  $(x, y)$  with label  $L$  contains an item with value  $v$ . If  $p$  is no greater than 6, these groups will all be on one line. If  $p$  is greater than 6, then the seventh and further groups will be on the next line. Labels will be consecutive letters starting from A. All the numbers are less than 1000. Each of the points is unique. A value of 0 for  $v$  means there is no item of value there. The number of locations with items of value will be at least as large as the number of guards.

The last line of a dataset contains  $c$  strings of letters, one for each corridor. For each corridor the letters are labels for points along the corridor, in order along the line segment from one end to the other, including both endpoints, all intersection points with other corridors, and all locations on the corridor with a valuable item. Each of the points given in the dataset will lie on at least one of the corridors.

## Output

There is one line of output for each data set. If there are not enough guards supplied to be able to see all the valuables, the line is "too few guards". Otherwise the line is an unsigned number  $r$  rounded to two places beyond the decimal point, where  $r$  is the minimum value over all placements of  $g$  guards of the maximum "risk" to the valuables.

The first example dataset matches the illustration above, and the next three examples only vary the number of guards.

## Example

### Input :

```
11 5 3
A 0 8 4 B 5 8 0 C 14 8 4 D 21 8 2 E 25 8 1 F 5 22 1
G 5 20 0 H 11 12 50 I 20 0 50 J 19 10 5 K 25 4 5
ABCDE AG FGB GHCI JDK
11 5 2
A 0 8 4 B 5 8 0 C 14 8 4 D 21 8 2 E 25 8 1 F 5 22 1
G 5 20 0 H 11 12 50 I 20 0 50 J 19 10 5 K 25 4 5
ABCDE AG FGB GHCI JDK
11 5 1
A 0 8 4 B 5 8 0 C 14 8 4 D 21 8 2 E 25 8 1 F 5 22 1
G 5 20 0 H 11 12 50 I 20 0 50 J 19 10 5 K 25 4 5
ABCDE AG FGB GHCI JDK
11 5 4
A 0 8 4 B 5 8 0 C 14 8 4 D 21 8 2 E 25 8 1 F 5 22 1
G 5 20 0 H 11 12 50 I 20 0 50 J 19 10 5 K 25 4 5
ABCDE AG FGB GHCI JDK
3 3 1
A 0 0 50 B 0 3 60 C 4 0 20
AB CB CA
0
```

### Output :

```
375.00
1250.00
too few guards
21.21
150.00
```

---

Added by: Nikola P Borisov

Date: 2008-10-25

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2007

## SPOJ Problem Set (classical)

### 3261. Race Against Time

#### Problem code: RACETIME

As another one of their crazy antics, the  $N$  ( $1 \leq N \leq 100,000$ ) cows want Farmer John to race against the clock to answer some of their pressing questions.

The cows are lined up in a row from 1 to  $N$ , and each one is holding a sign representing a number,  $A_i$  ( $1 \leq A_i \leq 1,000,000,000$ ). The cows need FJ to perform  $Q$  ( $1 \leq Q \leq 50,000$ ) operations, which can be either of the following:

- Modify cow  $i$ 's number to  $X$  ( $1 \leq X \leq 1,000,000,000$ ). This will be represented in the input as a line containing the letter M followed by the space-separated numbers  $i$  and  $X$ .
- Count how many cows in the range  $[P, Q]$  ( $1 \leq P \leq Q \leq N$ ) have  $A_i \leq X$  ( $0 \leq X \leq 1,000,000,000$ ). This will be represented in the input as a line containing the letter C followed by the space-separated numbers  $P$ ,  $Q$ , and  $X$ .

Of course, FJ would like your help.

#### Input

The first line gives the integers  $N$  and  $Q$ , and the next  $N$  lines give the initial values of  $A_i$ . Finally, the next  $Q$  lines each contain a query of the form "M  $i$   $X$ " or "C  $P$   $Q$   $X$ ".

#### Output

Print the answer to each 'C' query, one per line.

#### Example

##### Input :

```
4 6
3
4
1
7
C 2 4 4
M 4 1
C 2 4 4
C 1 4 5
M 2 10
C 1 3 9
```

##### Output :

```
2
3
4
2
```



FJ has 4 cows, whose initial numbers are 3, 4, 1, and 7. The cows then give him 6 operations; the first asks him to count the how many of the last three cows have a number at most 4, the second asks him to change the fourth cow's number to 1, etc.

**Warning: large input/output data.**

---

Added by: Neal Wu  
Date: 2008-10-25  
Time limit: 1s-8s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 3305. Roman Patrollers

#### Problem code: SA04C

In ancient times, patrollers were used to ensure that all the cities of the Roman Empire were under control. A patroller's job consisted in continuously visiting the cities of the empire, trying to minimise the interval between two visits to each city. The Military Society (MS) wants to simulate the behavior of one such patroller to see how effective they were.

Each cycle of the simulation corresponds to one time unit. The instantaneous city idleness (ICI) for a city X after T cycles of the simulation is the number of cycles elapsed since the last visit of the patroller to the city X (i.e. the number of time units the city X remained unvisited). All of the cities have initial instantaneous city idleness equal to zero at the start of the simulation. The instantaneous empire idleness (IEI) after each given cycle is the sum of the instantaneous city idleness of all cities after that given cycle. Finally, the empire idleness (EI) for an N-cycle simulation is the sum of the instantaneous empire idleness after each of the N cycles of simulation.

After visiting a city X, the patroller always chooses to visit the neighbour city Y with the highest instantaneous city idleness (if more than one city has the highest idleness, the one with the lowest identifier is chosen). Cities X and Y are neighbour if there is a road linking the two cities directly, without going through any intermediate city. In the beginning of the simulation, the patroller is located in one of the cities, and is given a map of the Roman Empire containing a description of all the roads in the empire, indicating the length (in kilometers) and which two cities each road connects. A road between cities X and Y can be used both to go from X to Y and from Y to X.

Assuming that a patroller travels one kilometer in one time unit (one simulation cycle) and that the time to visit a city is negligible (equal to zero), MS asks you to determine the empire idleness after an N-cycle simulation.

For clarity, consider the example of an empire which contains 3 cities (1, 2 and 3) and two roads of length 1 km. The first road connects cities 1 and 2, while the second road connects cities 2 and 3. Below you find a trace of a 3-cycle simulation for such a scenario, considering that the patroller starts at city 1.

Start of the simulation

Patroller at: 1

ICI1 = 0, ICI2 = 0, ICI3 = 0

IEI = 0

EI = 0

After cycle 1

Patroller at: 2

ICI1 = 1, ICI2 = 0, ICI3 = 1

IEI = 2

EI = 2

After cycle 2

Patroller at: 1

ICI1 = 0, ICI2 = 1, ICI3 = 2

IEI = 3

EI = 5

After cycle 3 Patroller at: 2

ICI1 = 1, ICI2 = 0, ICI3 = 3

IEI = 4

EI = 9

Therefore, for such a scenario, after 3 simulation cycles the empire idleness is 9.

## Input

The input consists of several test cases. The first line of a test case contains four integers C,R,N, and S, indicating respectively the quantity of cities in the empire ( $2 \leq C \leq 1000$ ), the number of roads ( $1 \leq R \leq C(C-1)/2$ ), the number of cycles to be simulated ( $1 \leq N \leq 1000$ ) and the identifier of the starting city of the patroller ( $1 \leq S \leq C$ ). Each city is identified by a distinct integer from 1 to C. Each of the following R lines contains three integers X, Y and D describing a road; X and Y represent cities ( $1 \leq X \neq Y \leq C$ ) and D represents the distance ( $1 \leq D \leq 1000$ ), in kilometers, of the road that connects X and Y directly, without passing through any other city. Each pair of cities X and Y will appear at most once in a road description. You can assume that it is always possible to travel from any city to any other city in the empire using the roads available. The end of input is indicated by  $C = R = N = S = 0$ .

## Output

For each test case in the input, your program must produce one line containing the empire idleness after the N-cycle simulation.

## Example

### Input :

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

### Output :

```
2
4
8
10
9
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-07

Time limit: 1s-3s

Source limit:50000B

Languages: All

Resource: ACM International Collegiate Programming Contest 2004 - Brazil Sub-Regional

## SPOJ Problem Set (classical)

### 3306. Very Special Boxes

#### Problem code: SA04D

Special Box Company (SBC) is a small family-owned and family-run business which produces decorated carton boxes for wrapping gifts. The boxes are hand-made, produced individually from fine materials. When accepting an order from a client, they always produce a few more boxes than needed, to keep a stock of boxes to be sold in the future, if needed. Over the years their stock has been growing, with boxes all over the place, and they decided they needed to organize it a bit more. They have therefore made a list registering the dimensions of every box in their stock.

SBC has just received an order from a client that must be delivered tomorrow, so there is no time to produce new boxes. The client wants a certain number  $N$  of boxes all of the same size; each box will be used to pack one item of dimensions  $X$ ,  $Y$  and  $Z$ . As the carton used in the boxes is very thin, you may assume that a box of size  $(X, Y, Z)$  would fit perfectly the item the client wants to wrap. If there are not at least  $N$  boxes that fit perfectly, the client wants  $N$  boxes that fit the items as tightly as possible. The box size that fits the items as tightly as possible is the one which minimizes the empty space when the item is put inside the box. An item can be rotated in any direction to be accommodated inside a box; therefore, a box of size  $(X, Y, Z)$  is as good as a box of size  $(Y, Z, X)$ , for example.

Can you help SBC finding whether they can fulfill the customer order?

#### Input

The input consists of several test cases. The first line of a test case contains two integers  $N$  and  $M$ , indicating respectively the number of boxes the client needs to buy ( $1 \leq N \leq 1500$ ) and the number of boxes in the stock list ( $1 \leq M \leq 1500$ ). The second line contains three integers  $X$ ,  $Y$  and  $Z$ , representing the dimensions of the item the client wants to wrap ( $0 < X, Y, Z \leq 50$ ).

Each of the next  $M$  lines contains three integers  $A$ ,  $B$  and  $C$  representing the dimensions of a box in the stock list ( $0 < A, B, C \leq 50$ ). A test case with  $N = 0$  indicates the end of the input.

The input must be read from standard input.

#### Output

For each test case in the input your program must produce one line, containing either:

-> The single word 'impossible', in case it is not possible to fulfill the client's order (because there are not at least  $N$  boxes of the same size in stock that can contain the item); or

-> one integer  $V$ , which specifies the volume of empty space left when one of the  $N$  items packed in one of the boxes chosen.

#### Example

**Input :**

```
1 1
2 4 3
2 3 4
2 6
3 1 3
7 4 7
10 8 2
```

```
2 8 10
6 2 9
7 7 4
6 2 9
1 1
3 3 3
1 1 1
0 0
```

**Output :**

```
0
99
impossible
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-07

Time limit: 1s-3s

Source limit:50000B

Languages: All

Resource: ACM International Collegiate Programming Contest 2004 - Brazil Sub-Regional

## SPOJ Problem Set (classical)

### 3307. Hex Tile Equations

#### Problem code: HEXTILE

An amusing puzzle consists of a collection of hexagonal tiles packed together with each tile showing a digit or '=' or an arithmetic operation '+', '-', '\*', or '/'. Consider continuous paths going through each tile exactly once, with each successive tile being an immediate neighbor of the previous tile. The object is to choose such a path so the sequence of characters on the tiles makes an acceptable equation, according to the restrictions listed below. A sequence is illustrated in each figure above. In Figure 1, if you follow the gray path from the top, the character sequence is "6/3=9-7". Similarly, in Figure 2, start from the bottom left 3 to get "3\*21+10=73".

There are a lot of potential paths through a moderate sized hex tile pattern. A puzzle player may get frustrated and want to see the answer. Your task is to automate the solution.

The arrangement of hex tiles and choices of characters in each puzzle satisfy these rules:

1. The hex pattern has an odd number of rows greater than 2. The odd numbered rows will all contain the same number of tiles. Even numbered rows will have one more hex tile than the odd numbered rows and these longer even numbered rows will stick out both to the left and the right of the odd numbered rows.
2. There is exactly one '=' in the hex pattern.
3. There are no more than two '\*' characters in the hex pattern.
4. There will be fewer than 14 total tiles in the hex pattern.
5. With the restrictions on allowed character sequences described below, there will be a unique acceptable solution in the hex pattern.

To have an acceptable solution from the characters in some path, the expressions on each side of the equal sign must be in acceptable form and evaluate to the same numeric value. The following rules define acceptable form of the expressions on each side of the equal sign and the method of expression evaluation:

6. The operators '+', '-', '\*', and '/' are only considered as binary operators, so no character sequences where '+' or '-' would be a unary operator are acceptable. For example "-2\*3=-6" and "1=5+-4" are not acceptable.
7. The usual precedence of operations is not used. Instead all operations have equal precedence and operations are carried out from left to right. For example "44-4/2=2+3\*4" is acceptable and "14=2+3\*4" is not acceptable.
8. If a division operation is included, the equation can only be acceptable if the division operation works out to an exact integer result. For example "10/5=12/6" and "7+3/5=3\*4/6" are acceptable. "5/2\*4=10" is not acceptable because the sides would only be equal with exact mathematical calculation including an intermediate fractional result. "5/2\*4=8" is not acceptable because the sides of the equation would only be equal if division were done with truncation.
9. At most two digits together are acceptable. For example, "123+1=124" is not acceptable.
10. A character sequences with a '0' directly followed by another digit is not acceptable. For example, "3\*05=15" is not acceptable.

With the assumptions above, an acceptable expression will never involve an intermediate or final arithmetic result with magnitude over three million.

## Input

The input will consist of one to fifteen data sets, followed by a line containing only 0.

The first line of a dataset contains blank separated integers  $rc$ , where  $r$  is the number of rows in the hex pattern and  $c$  is the number of entries in the odd numbered rows. The next  $r$  lines contain the characters on the hex tiles, one row per line. All hex tile characters for a row are blank separated. The lines for odd numbered rows also start with a blank, to better simulate the way the hexagons fit together. Properties 1-5 apply.

## Output

There is one line of output for each data set. It is the unique acceptable equation according to rules 6-10 above. The line includes no spaces.

## Example

### Input :

```
5 1
 6
/ 3
=
9 -
 7
3 3
 1 + 1
* 2 0 =
 3 3 7
5 2
 9 -
* 2 =
 3 4
+ 8 3
 4 /
0
```

### Output :

```
6/3=9-7
3*21+10=73
8/4+3*9-2=43
```

---

Added by: Nikola P Borisov

Date: 2008-11-07

Time limit: 20s

Source limit:50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2008

## SPOJ Problem Set (classical)

### 3308. The Bridges of San Mochti

#### Problem code: BRIDGES2

You work at a military training facility in the jungles of San Motchi. One of the training exercises is to cross a series of rope bridges set high in the trees. Every bridge has a maximum capacity, which is the number of people that the bridge can support without breaking. The goal is to cross the bridges as quickly as possible, subject to the following tactical requirements:

*One unit at a time!*

If two or more people can cross a bridge at the same time (because they do not exceed the capacity), they do so as a unit; they walk as close together as possible, and they all take a step at the same time. It is never acceptable to have two different units on the same bridge at the same time, even if they don't exceed the capacity. Having multiple units on a bridge is not tactically sound, and multiple units can cause oscillations in the rope that slow everyone down. This rule applies even if a unit contains only a single person.

*Keep moving!*

When a bridge is free, as many people as possible begin to cross it as a unit. Note that this strategy doesn't always lead to an optimal overall crossing time (it may be faster for a group to wait for people behind them to catch up so that more people can cross at once). But it is not tactically sound for a group to wait, because the people they're waiting for might not make it, and then they've not only wasted time but endangered themselves as well.

Periodically the bridges are reconfigured to give the trainees a different challenge. Given a bridge configuration, your job is to calculate the minimum amount of time it would take a group of people to cross all the bridges subject to these requirements.

For example, suppose you have nine people who must cross two bridges: the first has capacity 3 and takes 10 seconds to cross; the second has capacity 4 and takes 60 seconds to cross. The initial state can be represented as (900), meaning that 9 people are waiting to cross the first bridge, no one is waiting to cross the second bridge, and no one has crossed the last bridge. At 10 seconds the state is (630). At 20 seconds the state is (33/3:50/0), where /3:50/ means that a unit of three people is crossing the second bridge and has 50 seconds left. At 30 seconds the state is (06/3:40/0); at 70 seconds it's (063); at 130 seconds it's (027); and at 190 seconds it's (009). Thus the total minimum time is 190 seconds.

#### Input

The input consists of one or more bridge configurations, followed by a line containing two zeros that signals the end of the input. Each bridge configuration begins with a line containing a negative integer -B and a positive integer P, where B is the number of bridges and P is the total number of people that must cross the bridges. Both B and P will be at most 20. (The reason for putting -B in the input file is to make the first line of a configuration stand out from the remaining lines.) Following are B lines, one for each bridge, listed in order from the first bridge that must be crossed to the last. Each bridge is defined by two positive integers C and T, where C is the capacity of the bridge (the maximum number of people the bridge can hold), and T is the time it takes to cross the bridge (in seconds). C will be at most 5, and T will be at most 100. Only one unit, of size at most C, can cross a bridge at a time; the



time required is always  $T$ , regardless of the size of the unit (since they all move as one). The end of one bridge is always close to the beginning of the next, so the travel time between bridges is zero.

## Output

For each bridge configuration, output one line containing the minimum amount of time it will take (in seconds) for all of the people to cross all of the bridges while meeting both tactical requirements.

## Example

### Input :

```
-1 2
5 17
-1 8
3 25
-2 9
3 10
4 60
-3 10
2 10
3 30
2 15
-4 8
1 8
4 30
2 10
1 12
0 0
```

### Output :

```
17
75
190
145
162
```

---

Added by: Nikola P Borisov

Date: 2008-11-07

Time limit: 10s

Source limit: 50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2008

## SPOJ Problem Set (classical)

### 3309. Bulletin Board

#### Problem code: BULLETIN

The ACM Student Chapter has just been given custody of a number of school bulletin boards. Several members agreed to clear off the old posters. They found posters plastered many levels deep. They made a bet about how much area was left clear, what was the greatest depth of posters on top of each other, and how much of the area was covered to this greatest depth. To determine each bet's winner, they made very accurate measurements of all the poster positions as they removed them. Because of the large number of posters, they now need a program to do the calculations. That is your job.

A simple illustration is shown above: a bulletin board 45 units wide by 40 high, with three posters, one with corners at coordinates (10, 10) and (35, 20), another with corners at (20, 25) and (40, 35), and the last with corners at (25, 5) and (30, 30). The total area not covered by any poster is 1300. The maximum number of posters on top of each other is 2. The total area covered by exactly 2 posters is 75.

#### Input

The input will consist of one to twenty data sets, followed by a line containing only 0. On each line the data will consist of blank separated nonnegative integers.

The first line of a dataset contains integers  $n$   $w$   $h$ , where  $n$  is the number of posters on the bulletin board,  $w$  and  $h$  are the width and height of the bulletin board. Constraints are  $0 < n \leq 100$ ;  $0 < w \leq 50000$ ;  $0 < h \leq 40000$ .

The dataset ends with  $n$  lines, each describing the location of one poster. Each poster is rectangular and has horizontal and vertical sides. The  $x$  and  $y$  coordinates are measured from one corner of the bulletin board. Each line contains four numbers  $x_l$   $y_l$   $x_h$  and  $y_h$ , where  $x_l$  and  $y_l$  are the lowest values of the  $x$  and  $y$  coordinates in one corner of the poster and  $x_h$  and  $y_h$  are the highest values in the diagonally opposite corner. Each poster fits on the bulletin board, so  $0 \leq x_l < x_h \leq w$ , and  $0 \leq y_l < y_h \leq h$ .

#### Output

There is one line of output for each data set containing three integers, the total area of the bulletin board that is not covered by any poster, the maximum depth of posters on top of each other, and the total area covered this maximum number of times.

Caution: An approach examining every pair of integer coordinates might need to deal with 2 billion coordinate pairs.

## Example

### Input :

```
3 45 40
10 10 35 20
20 25 40 35
25 5 30 30
1 20 30
5 5 15 25
2 2000 1000
0 0 1000 1000
1000 0 2000 1000
3 10 10
0 0 10 10
0 0 10 10
0 0 10 10
0
```

### Output :

```
1300 2 75
400 1 200
0 1 2000000
0 3 100
```

---

Added by: Nikola P Borisov

Date: 2008-11-07

Time limit: 10s

Source limit:50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2008

## SPOJ Problem Set (classical)

### 3310. Serial Numbers

#### Problem code: SERIALN

A manufacturer keeps an ordered table of serial numbers by listing in each row of the table a range of serial numbers along with two corresponding pieces of information called the status code and the transfer code. A four-column table stores information about ranges of serial numbers in this order: starting serial number, ending serial number, status code, transfer code. Serial numbers as well as transfer codes are integers from 1 to  $2^{31}-1$  ( $2^{31}-1 = 2147483647$ ), and status codes are a single upper-case letter. The table is maintained in increasing order of serial numbers, serial number ranges are never allowed to overlap, and for any given serial number, the table must always accurately represent the most recent data (status code and transfer code) for that serial number.

Let's say that 100,000 serial numbers are created with a status of "A" and a transfer code of "1". An entry for those serial numbers might look like this:

```
1 100000 A 1
```

This is obviously far more efficient than storing 100,000 individual rows all with the same status and transfer codes. The challenge arises when serial numbers within already defined ranges need to be given different status or transfer codes. For example, if serial number 12345 needs to change to status B, the above table would need to become three separate entries:

```
1 12344 A 1
12345 12345 B 1
12346 100000 A 1
```

Now let's change the transfer code of all serial numbers in the range 12000 to 12999 to 2. This gets us:

```
1 11999 A 1
12000 12344 A 2
12345 12345 B 2
12346 12999 A 2
13000 100000 A 1
```

Now change all existing serial numbers from 10000 to 100000 to status C and transfer code 2:

```
1 9999 A 1
10000 100000 C 2
```

Once created a serial number will never be deleted, but it is possible to have ranges of undefined serial numbers between ranges of defined ones. To demonstrate, let's now set all serial numbers from 1000000 to 1999999 to status Z and transfer code 99:

```
1 9999 A 1
10000 100000 C 2
1000000 1999999 Z 99
```

Finally, the table is always maintained with a minimal number of rows, meaning specifically that there will never be two adjacent rows in the table where one would suffice. For example, consider the following serial number table:

```
1 10 A 1
11 20 A 1
21 30 B 1
```

The first two rows could actually be represented by a single row, meaning that the table above does not have a minimal number of rows. The same data represented by a minimal number of rows would look like this:

```
1 20 A 1
21 30 B 1
```

The following table, however, because the first two rows have non-matching transfer codes, already contains the minimal number of rows:

```
1 10 A 1
11 20 A 2
21 30 B 1
```

Similarly, the following table cannot be reduced further because the first two rows do not represent a continuous series of serial numbers:

```
1 10 A 1
12 20 A 1
21 30 B 1
```

## Input

Each input case begins with a single line that is a character string naming the test case. This string contains at most 80 characters. The name "END" marks the end of the input. Following this will be 1 to 100 lines of the form "A B S T", where A, B, and T are integers in the range 1 to  $2^{31}-1$ , S is an uppercase letter, and  $A \leq B$ . These lines are, in the order they are to be applied, the serial number transactions to be recorded, where A is the start of the serial number range, B is the end of the serial number range, S is the status code, and T is the transfer code. The list of serial number transactions is terminated by a line containing only a 0 (zero) character.

## Output

For each input case, echo the test case name to the output on a line by itself, followed by the resulting minimal-rows serial number table that results after all serial number transactions have been applied.

## Example

### Input :

```
First Example
1 100000 A 1
12345 12345 B 1
0
And Another
1 100000 A 1
12345 12345 B 1
12000 12999 A 2
```

```

12345 12345 B 2
0
Test Case Three
1 100000 A 1
12345 12345 B 1
12000 12999 A 2
12345 12345 B 2
10000 100000 C 2
0
Example Four
1 100000 A 1
12345 12345 B 1
12000 12999 A 2
12345 12345 B 2
10000 100000 C 2
1000000 1999999 Z 99
0
Example 5
1 10 A 1
21 30 B 1
11 20 A 1
0
Example 6
21 30 B 1
1 10 A 1
11 20 A 2
0
Example 7
12 20 A 1
21 30 B 1
1 10 A 1
0
END

```

**Output:**

```

First Example
1 12344 A 1
12345 12345 B 1
12346 100000 A 1
And Another
1 11999 A 1
12000 12344 A 2
12345 12345 B 2
12346 12999 A 2
13000 100000 A 1
Test Case Three
1 9999 A 1
10000 100000 C 2
Example Four
1 9999 A 1
10000 100000 C 2
1000000 1999999 Z 99
Example 5
1 20 A 1
21 30 B 1
Example 6
1 10 A 1
11 20 A 2
21 30 B 1

```

Example 7  
1 10 A 1  
12 20 A 1  
21 30 B 1

---

Added by: Nikola P Borisov  
Date: 2008-11-07  
Time limit: 10s  
Source limit: 50000B  
Languages: All  
Resource: Mid-Central Regional ACM-ICPC Contest 2008

## SPOJ Problem Set (classical)

### 3314. Umnozak

#### Problem code: UMNOZAK

The digit-product of a positive integer is the product of the number's decimal digits. For example, the digit-product of 2612 is  $2 \cdot 6 \cdot 1 \cdot 2 = 24$ .

The self-product of a number is the product of the number and its digit-product. For example, the self-product of 2612 is  $2612 \cdot 24 = 62688$ .

Write a program that, given two positive integers A and B ( $1 \leq A \leq B < 10^{18}$ ), calculates the number of positive integers whose self-product is between A and B, inclusive.

#### Input

The first line of input contains the integer T ( $1 \leq T \leq 20$ ). The next T lines each contain a pair of integers A and B.

#### Output

For each test case, print a line with the number of positive integers whose self-product is between A and B.

#### Example

**Input :**

```
3
20 30
145 192
2224222 2224222
```

**Output :**

```
2
4
1
```

For the second example, the self-products of the numbers 19, 24, 32, and 41 are 171, 192, 192 and 164, respectively.

---

Added by: Neal Wu

Date: 2008-11-08

Time limit: 10s

Source limit: 50000B

Languages: All

Resource: Croatian Olympiad in Informatics 2008



## SPOJ Problem Set (classical)

### 3322. Doubled Numbers

#### Problem code: DOUBLE

Some numbers have a curious property: when rotating the number to the right, the new number is the double of the original. Rotating the number to the right means choosing the last digit and moving it to the beginning of the number, as the leftmost digit. For example, the number 421052631578947368 when rotated to the right gives 842105263157894736, which is the double of the original. These numbers are expressed in the decimal system. In any numeral system such numbers exist, for example, in the binary (base 2) numeral system, numbers 01 and 0101 have this property. Note that leading zeros are required in this case.

Write a program that, for any given base  $B$  ( $2 \leq B \leq 250$ ), finds the smallest number in that numeral system which has this property. Try not to precompute the numbers, the solution is very easy and pretty.

#### Input

The input consists of several test cases. The first line contains an integer  $T$  ( $T \leq 20$ ), the number of test cases. The following  $T$  lines contain one number  $B$ , each.

#### Output

For each number  $B$ , output one or more numbers separated by a blank space that represent the digits in base  $B$  (written as decimal numbers) of the smallest number which has this property.

#### Example

**Input :**

3  
2  
10  
35

**Output :**

0 1  
0 5 2 6 3 1 5 7 8 9 4 7 3 6 8 4 2 1  
11 23

#### Output explanation

In example #1

The initial number (when converted to decimal system):

$$0 * 2^1 + 1 * 2^0 = 1$$

After applying the rotation:

$$1 * 2^1 + 0 * 2^0 = 2.$$

In example #3

The initial number (when converted to decimal system):  
 $11 * 35^1 + 23 * 35^0 = 408$   
After applying the rotation:  
 $23 * 35^1 + 11 * 35^0 = 816.$

---

Added by: Reinier César Mujica Hdez  
Date: 2008-11-10  
Time limit: 2s  
Source limit: 3072B  
Languages: All  
Resource: OCI Olimpiads Cuban in Informatics 2008 day 1

## SPOJ Problem Set (classical)

### 3347. Cestarine

#### Problem code: HIGHWAY

In a single day,  $N$  of Luka's trucks travel a specific highway. The highway has a number of exits and entrances. An exit with a particular number is in the same location as the entrance with that number.

Upon entering the highway, a truck driver receives a ticket which indicates the entrance he used. When exiting, the driver pays a toll equal to the absolute difference of the entrance and exit numbers. For example, if a ticket says he used entrance 30, then exiting at exit 12 will cost him 18.

Luka has figured out a way to save toll money that his company daily spends. Any two drivers can meet on the highway and exchange tickets, even if their routes don't overlap. Tickets can be exchanged an arbitrary number of times.

However, a driver cannot use an exit if his ticket says he used the same entrance, since that would be suspicious.

Write a program that calculates the least total amount of tolls that the drivers can achieve by exchanging tickets.

#### Input

On the first line of the input is the integer  $T$  ( $1 \leq T \leq 5$ ), the number of test cases.  $T$  cases follow, each beginning with the single integer  $N$  ( $2 \leq N \leq 100,000$ ). Each of the next  $N$  lines contains two integers between 1 and 1,000,000,000 inclusive, representing the entrance and exit numbers of a truck. Note that no two trucks will have the same entrance or exit numbers.

#### Output

For each test case, output the least total amount of tolls Luka's company must pay.

#### Example

**Input :**

```
2
3
3 65
45 10
60 25
3
5 5
6 7
8 8
```

**Output :**

```
32
5
```

In the first example, the first and third drivers will exchange tickets. After this, the second and third drivers exchange tickets. After this, the drivers will have the tickets 60, 3, 45, respectively. The total amount in tolls is  $|65 - 60| + |10 - 3| + |25 - 45| = 32$ .

**Warning: large input/output data.**

---

Added by: Neal Wu

Date: 2008-11-13

Time limit: 1s-8s

Source limit: 50000B

Languages: All

Resource: Croatian Open 07/08 - Contest 6

## SPOJ Problem Set (classical)

### 3359. Stack

#### Problem code: STACK

Alan loves to construct a stack of building bricks. His stack consists of many cuboids with square base. All cuboids have the same height 1. Alan puts the consecutive cuboids one over another.

Recently in math class, the concept of volume was introduced to Alan. Consequently, he wants to compute the volume of his stack now. The lengths of cuboids bases (from top to bottom) are constructed by Alan in the following way:

- Length of edge of the first square is one. i.e.  $a_1 = 1$ .
- Next, Alan fixes the length of the edge of the second square  $a_2$ .
- Next, Alan calculates the length  $a_n$  ( $n > 2$ ) by  $2*a_2*a_{n-1} - a_{n-2}$ . Do not ask why he chose such a formula; let us just say that he is a really peculiar young fellow.

For example, if Alan fixes  $a_2 = 2$ , then  $a_3 = 7$ . If Alan fixes  $a_2 = 1$ , then  $a_n = 1$  holds for all  $n$ .

Now Alan wonders if he can calculate the volume of stack of  $N$  consecutive building bricks. Help Alan and write the program that computes this volume. Since it can be quite large, it is enough to compute the answer modulo given natural number  $m$ .

#### Input

The input contains several test cases. The first line contains the number  $t$  ( $t \leq 100000$ ) denoting the number of test cases. Then  $t$  test cases follow. Each of them is given in a separate line containing three integers  $a_2$ ,  $N$ ,  $m$  ( $1 \leq a_2$ ,  $m \leq 10^9$ ,  $2 \leq N \leq 10^9$ ) separated by a single space.

#### Output

For each test case compute the volume of stack of  $N$  consecutive bricks constructed by Alan according to steps 1 to 3 and output its remainder modulo  $m$ .

#### Example

**Input :**

```
3
2 3 100
1 4 1000
3 3 1000000000
```

**Output :**

```
54
4
299
```

**Warning: large input/output data, be careful with certain languages**

**Warning: A naive algorithm won't terminate in even 2 minutes.**

---

Added by: Blue Mary

Date: 2008-11-15

Time limit: 43s

Source limit: 50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Wrocław 2008

## SPOJ Problem Set (classical)

### 3360. Digital Image Recognition

#### Problem code: IMGREC2

#### Description

*According to Wikipedia, image processing is any form of signal processing for which the input is an image, such as photographs or frames of video; the output of image processing can be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.*

The task you are facing here is a relatively easy one (compared to our general conception of image processing!). Given a black-and-white image of size  $R * C$  with some digits (and possibly other shapes) on it, your program needs to figure out the digits written on the image. Specifically, the digits drawn on the graph will adhere to the following rules:

1) Digits are drawn with a series of *strokes*. A **stroke** can be regarded as a **rectangle** of any size on the image, and its edges will always be parallel to either **x-axis** or **y-axis**. The number of strokes required to draw each digit will be exactly as follows:

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

Refer to the **figure below** if you are unclear about how the digits are drawn.

2) Although the **width** of strokes used to draw a digit might be **different**, the **outer shapes of digits** will strictly follow those specified in the **figure below**.

3) In order for a digit to be recognizable, **all** parts (**strokes** and **joints**) presented in the graph below must also be clearly **distinguishable** in the image.

*(Refer to the last sample test case if you are unsure about this requirement; in that test case, when the middle stroke of 2 is omitted, the number should not be considered as recognizable.)*

4) You may assume that the image is not rotated, and there is **no noise** in the input.

[IMAGE]

Please output the sum of digits recognizable in the graph. In the case that no characters is recognizable, please output 0 instead.

#### Input

There are multiple test cases in the input file.

Each test case starts with two integers, R and C ( $1 \leq R, C \leq 500$ ), specifying the number of rows / columns of the graph. Each of the following R lines contains consecutive C characters ("0" or "1"), describing the image to be processed.

Two successive test cases are separated by a blank line. A case with  $R = 0, C = 0$  indicates the end of the input file, and should not be processed by your program.

## Output

For each test case, please print a single integer, the sum of recognizable numbers. See the sample output for format details.

## Example

### Input :

```
5 12
001101011111
000101000011
000101001111
001101000011
000000000111

5 3
111
010
110
010
110

6 14
11111000011111
11001000000011
11111001000000
11111001001110
11001011001010
11111000001110

5 2
11
01
11
01
11

6 9
111100111
000100001
000100011
011100010
010000011
011110000

0 0
```

### Output :

```
Case #1: 4
```



Case #2: 0  
Case #3: 15  
Case #4: 3  
Case #5: 2

---

Added by: Blue Mary  
Date: 2008-11-15  
Time limit: 3s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: ACM/ICPC Asian Regional Contest, Hangzhou 2008

## SPOJ Problem Set (classical)

### 3363. Svada

#### Problem code: SVADA

The local zoo has acquired a large open garden in which animals may freely move as in their natural habitats and entertain visitors with their usual shenanigans.

The most popular animals are monkeys. With their climbing and jumping and other skills, they delight old and young visitors alike.

One species of monkey has specialized in climbing tall trees and picking off coconuts. Another species has specialized in breaking them open.

There are  $N$  monkeys of the first type (numbered 1 through  $N$ ) and  $M$  monkeys of the second type (numbered 1 through  $M$ ).

Monkey  $k$  of the first type takes  $A_k$  seconds to find a good spot on the tree, after which it picks off its first coconut. After that the monkey produces a new coconut every  $B_k$  seconds.

Monkey  $k$  of the second type takes  $C_k$  seconds to find a good tool for opening the coconuts, after which it opens its first coconut. After that the monkey opens another coconut every  $D_k$  seconds.

Unfortunately, the second type of monkey is extremely aggressive so the two types may not be in the garden at the same time. Therefore, zoo keepers will chase away the first type of monkeys as soon as they have picked off all the coconuts. Similarly, if monkeys of the same type stay too long after opening all the coconuts, fights will ensue. Because of that, zoo keepers will send them away as soon as they have opened all the coconuts.

The zoo keepers first arrive immediately after all coconuts have been picked, and again immediately after the monkeys open them all. The time needed for monkeys to enter or leave the garden is also negligibly small.

Tomislav especially likes the second type of monkey, but can never guess when to arrive in order to see them. Help him calculate the time when the second type arrives if he knows the total time that monkeys spent in the garden, but does not know the number of coconuts in the garden.

#### Input

The first line contains the integer  $T$  ( $1 \leq T \leq 1\,000\,000\,000$ ), the total time that monkeys spent in the garden, in seconds.

The next line contains the integer  $N$  ( $1 \leq N \leq 100$ ), the number of monkeys of the first type.

Each of the following  $N$  lines contains two integers  $A_k$  and  $B_k$  ( $1 \leq A_k, B_k \leq 1\,000\,000\,000$ ), how fast monkey  $k$  of the first type is.

The next line contains the integer  $M$  ( $1 \leq M \leq 100$ ), the number of monkeys of the second type.

Each of the following  $M$  lines contains two integers  $C_k$  and  $D_k$  ( $1 \leq C_k, D_k \leq 1\,000\,000\,000$ ), how fast monkey  $k$  of the second type is.

## Output

Output the number of seconds between the arrival of the first type of monkeys and the arrival of the second type.

## Example

**Input :**

```
20
2
3 2
1 3
3
3 1
4 1
5 1
```

**Output :**

```
13
```

---

Added by: Race with time  
Date: 2008-11-16  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: COCI 2008-2009

## SPOJ Problem Set (classical)

### 3372. Round Table

#### Problem code: ROUNDT

We have a round table with  $2 \cdot N$  seats ( $1 \leq N \leq 2000$ ). The seats are numbered with the numbers from 1 to  $2 \cdot N$  in order. This round table is in a round room with two doors. Door 1 is between seats 1 and  $2N$  on the table, and door 2 is between seats  $N$  and  $N+1$ . We have  $2N$  guests that we want to seat. Each guest has a id from 1 to  $2N$  and we want to seat him/her exactly at the seat corresponding to his id. All the guest are split into two groups of  $N$  and each group is waiting in front of a door in a line. This room unfortunately has the problem that if you let a person go from door 1 and he/she has to seep at position  $p$ , to get to his seat he has to make either all people seating on seats from 1 to  $p-1$  or all people seating on seats  $p+1$  to  $2N$  to get up to let him in. This presents you with the problem of how to let the guests in to cause minimum number of getting ups. The only thing you control is from which door to let the next guest. The guests that are waiting in front of door 1 can only get in from door 1 the same is true with door 2.

#### Input

On the first line there will one integer -  $N$ . Two more lines of input follow each with  $N$  integers in the range  $[1, 2N]$  - the guests waiting in front of door 1 and door 2 respectively. The first people in the list is the first to enter the room.

#### Output

Single integer the total min number of stand-ups that will happen if we choose the best sequence of letting guest in.

#### Example

**Input :**

```
3
4 5 3
6 2 1
```

**Output :**

```
3
```

---

Added by: Nikola P Borisov

Date: 2008-11-17

Time limit: 1s-10s

Source limit: 50000B

Languages: All

## **SPOJ Problem Set (classical)**

### **3373. Permutation Code**

**Problem code: PERMCODE**

As the owner of a computer forensics company, you have just been given the following note by a new client:

I, Albert Charles Montgomery, have just discovered the most amazing cypher for encrypting messages. Let me tell you about it.

To begin, you will need to decide on a set of symbols, call it S, perhaps with the letters RATE. The size of this set must be a power of 2 and the order of the symbols in S is important. You must note that R is at position 0, A at 1, T at 2, and E at 3. You will also need one permutation P of all those symbols, say TEAR. Finally you will need an integer, call it x. Together, these make up the key. Given a key, you are now ready to convert a plaintext message M of length n ( $M[0], M[1] \dots M[n-1]$ ), that has some but not necessarily all of the symbols in S, into a cyphertext string C, also of length n ( $C[0], C[1], \dots C[n-1]$ ), that has some but not necessarily all of the symbols in S.

The encrypting algorithm computes C as follows:

1. Calculate an integer d as the remainder after dividing the integer part of  $(n^{1.5} + x)$  by n. This can be expressed more succinctly as  $d = (\text{int})(n^{1.5} + x) \% n$ , where "%" is the remainder operator.
2. Set  $C[d]$  to be the symbol in S whose position is the same as the position of  $M[d]$  in P.
3. For each  $j \neq d$  in  $0..n-1$ , set  $C[j]$  to be the symbol in S whose position is the value obtained by xor-ing the position of  $M[j]$  in P with the position of  $M[(j+1) \% n]$  in S. Note that the bitwise xor operator is "^" in C, C++, and Java.

For example, consider this scenario where  $S=\text{RATE}$ ,  $P=\text{TEAR}$ ,  $x=102$ ,  $M=\text{TEETER}$ , and  $n=6$ . To compute d, first calculate  $6^{1.5} + 102 = 116.696938$ , then take the remainder after dividing by 6. So  $d = 116 \% 6 = 2$ . The following table shows the steps in filling in the cyphertext C. Note that the order of the steps is not important.

	0	1	2	3	4	5	
S =	R	A	T	E			
P =	T	E	A	R			
M =	T	E	E	T	E	R	
C =	E						$M[0]$ is T, T is at P[0]. $M[1]$ is E, E is at S[3]. $C[0] = S[0 \text{ xor } 3] = S[3]$
	E	T					$M[1]$ is E, E is at P[1]. $M[2]$ is E, E is at S[3]. $C[1] = S[1 \text{ xor } 3] = S[2]$
	E	T	A				2 is d. $M[2]$ is E, E is at P[1], so $C[2] = S[1]$
	E	T	A	E			$M[3]$ is T, T is at P[0]. $M[4]$ is E, E is at S[3]. $C[3] = S[0 \text{ xor } 3] = S[3]$
	E	T	A	E	A		$M[4]$ is E, E is at P[1]. $M[5]$ is R, R is at S[0]. $C[4] = S[1 \text{ xor } 0] = S[1]$
	E	T	A	E	A	A	$M[5]$ is R, R is at P[3]. $M[0]$ is T, T is at S[2]. $C[5] = S[3 \text{ xor } 2] = S[1]$

I have included additional examples of encrypted messages at the end of this note for you to experiment with. However, first, I need to tell you about the decryption algorithm.

Unfortunately, the next page of the note, with the decrypting algorithm, is completely unreadable because it is covered with huge, overlapping, messy ink blots. Given your considerable skill in unravelling puzzles, your task is to write the decoder based on your knowledge of the encoding algorithm.

## Input

The input for the decoder consists of one or more sets of {key, encrypted message} pairs. The key is on 3 separate lines. The first line contains the single integer  $x$ ,  $0 < x < 10,000$ ; the second line contains the string  $S$ ; and the third line contains the string  $P$ , which will be a permutation of  $S$ . The length of  $S$  (and therefore  $P$ ) will always be one of the following powers of two: 2, 4, 8, 16, or 32. Following the key is a line containing the encrypted message string  $C$ , which will contain at least one and at most sixty characters. The strings  $S$ ,  $P$ , and  $C$  will not contain whitespace, but may contain printable characters other than letters and digits. The end of the input is a line which contains the single integer 0.

## Output

For each input set print the decrypted string on a single line, as shown in the sample output.

## Example

### Input :

```
102
RATE
TEAR
ETAEAA
32
ABCDEFGHIJKLMNOPQRSTUVWXYZ._!?,;
;ABCDEFGHIJKLMNOPQRSTUVWXYZ._!?,
MOMCUKZ,ZPD
1956
ACEHINT_
ACTN_IHE
CIANCTNAAIECIA_TAI
0
```

### Output :

```
TEETER
HELLO_WORLD
THE_CAT_IN_THE_HAT
```

---

Added by: Nikola P Borisov

Date: 2008-11-17

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2004

## SPOJ Problem Set (classical)

### 3374. Scavenger Hunt

#### Problem code: SCAVHUNT

Bill has been the greatest boy scout in America and has become quite a superstar because he always organized the most wonderful scavenger hunts (you know, where the kids have to find a certain route following certain hints). Bill has retired now, but a nationwide election quickly found a successor for him, a guy called George. He does a poor job, though, and wants to learn from Bill's routes. Unfortunately Bill has left only a few notes for his successor. Bill never wrote his routes completely, he only left lots of little sheets on which he had written two consecutive steps of the routes. He then mixed these sheets and memorized his routes similarly to how some people learn for exams: practicing again and again, always reading the first step and trying to remember the following. This made much sense, since one step always required something from the previous step. George however would like to have a route written down as one long sequence of all the steps in the correct order. Please help him make the nation happy again by reconstructing the routes.

#### Input

The first line contains the number of scenarios. Each scenario describes one route and its first line tells you how many steps ( $3 \leq S \leq 333$ ) the route has. The next  $S - 1$  lines each contain one consecutive pair of the steps on the route separated by a single space. The name of each step is always a single string of letters.

#### Output

The output for every scenario begins with a line containing "Scenario #i:", where i is the number of the scenario starting at 1. Then print S lines containing the steps of the route in correct order. Terminate the output for the scenario with a blank line.

#### Example

**Input :**

```
2
4
SwimmingPool OldTree
BirdsNest Garage
Garage SwimmingPool
3
Toilet Hospital
VideoGame Toilet
```

**Output :**

```
Scenario #1:
BirdsNest
Garage
SwimmingPool
OldTree
```



Scenario #2:  
VideoGame  
Toilet  
Hospital

---

Added by: Daniel Gómez Didier  
Date: 2008-11-17  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: 2007 - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3375. Stamps

#### Problem code: STAMPS

Everybody hates Raymond. He's the largest stamp collector on planet earth and because of that he always makes fun of all the others at the stamp collector parties. Fortunately everybody loves Lucy, and she has a plan. She secretly asks her friends whether they could lend her some stamps, so that she can embarrass Raymond by showing an even larger collection than his. Raymond is so sure about his superiority that he always tells how many stamps he'll show. And since Lucy knows how many she owns, she knows how many more she needs. She also knows how many friends would lend her some stamps and how many each would lend. But she's like to borrow from as few friends as possible and if she needs too many then she'd rather not do it at all. Can you tell her the minimum number of friends she needs to borrow from?

#### Input

The first line contains the number of scenarios. Each scenario describes one collectors party and its first line tells you how many stamps (from 1 to 1000000) Lucy needs to borrow and how many friends (from 1 to 1000) offer her some stamps. In a second line you'll get the number of stamps (from 1 to 10000) each of her friends id offering.

#### Output

The output for every scenario begins with a line containing "Scenario #i:", where i is the number of the scenario starting at 1. Then print a single line with the minimum number of friends Lucy needs to borrow stamps from. If it's impossible even if she borrows everything from everybody, write impossible. Terminate the output for the scenario with a blank line.

#### Example

**Input :**

```
3
100 6
13 17 42 9 23 57
99 6
13 17 42 9 23 57
1000 3
314 159 265
```

**Output :**

```
Scenario #1:
3

Scenario #2:
2

Scenario #3:
impossible
```

---

Added by: Daniel Gómez Didier  
Date: 2008-11-17  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: 2007 - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3376. Parking Lot

#### Problem code: PARKINGL

At a certain college, a small parking lot is arranged in a rectangular shape, with 20 spaces numbered 1, 2, 3..... 19, 20. Traffic flow is one way in a counter- clockwise direction. The lot looks something like this:

[IMAGE]

Note that the first position encountered upon entering is 1 and the last is 20. Cars may exit or continue to drive in a counter-clockwise direction. The following assumptions apply to this problem:

- \* At the start, class is in session and the lot is full (all 20 spaces are occupied by parked cars).
- \* In addition to the (20) cars already parked in the lot, K autos are in the lot waiting for positions to become available ( $1 \leq K \leq 20$ ).
- \* Each waiting auto is positioned behind one of the occupied spaces. When a position empties, the space is filled either by the car waiting at that position or, if no car is waiting at that position, by the closest car, bearing in mind that the traffic flow is one way. (There is sufficient room at each position for the car parked in that position to leave and the car waiting at that position to then park.)
- \* When an auto advances N positions to a free spot, all other cars advance N positions. Since the lot is circular, advancing 4 positions from position 18 means advancing to position 2.
- \* None of the waiting cars exits.

#### Input

Write a program that reads data from standard input. Input consist of a line indicating the number of datasets, a blank line, and the datasets separated by a blank line. Each dataset is in two parts. The first part consists of integers, one per line beginning in column 1, representing initial positions of waiting autos. An integer 99 signals the end of this part of the data. The second part consists of integers, in the same format, representing positions vacated. Positions are vacated in the order in which their numbers appear in the second part of the data.

#### Output

The output of each dataset should consist a series of lines giving, for each initial (waiting) car position, the initial position and the final position of that car based on the description and assumptions stated above. The output lines must appear in the same order as the order of the initial positions given in the input. Print a blank line between datasets.

#### Example

Input :

1

6

19

17

13

1  
99  
1  
3  
20  
16

**Output :**

Original position 6 parked in 16  
Original position 19 parked in 3  
Original position 17 did not park  
Original position 13 parked in 20  
Original position 1 parked in 1

---

Added by: Daniel Gómez Didier

Date: 2008-11-17

Time limit: 3s

Source limit:50000B

Languages: All

Resource: 2007 PUJ - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3377. A Bug's Life

#### Problem code: BUGLIFE

Professor Hopper is researching the sexual behavior of a rare species of bugs. He assumes that they feature two different genders and that they only interact with bugs of the opposite gender. In his experiment, individual bugs and their interactions were easy to identify, because numbers were printed on their backs.

Given a list of bug interactions, decide whether the experiment supports his assumption of two genders with no homosexual bugs or if it contains some bug interactions that falsify it.

#### Input

The first line of the input contains the number of scenarios. Each scenario starts with one line giving the number of bugs (at least one, and up to 2000) and the number of interactions (up to 1000000) separated by a single space. In the following lines, each interaction is given in the form of two distinct bug numbers separated by a single space. Bugs are numbered consecutively starting from one.

#### Output

The output for every scenario is a line containing "Scenario #i:", where i is the number of the scenario starting at 1, followed by one line saying either "No suspicious bugs found!" if the experiment is consistent with his assumption about the bugs' sexual behavior, or "Suspicious bugs found!" if Professor Hopper's assumption is definitely wrong.

#### Example

**Input :**

```
2
3 3
1 2
2 3
1 3
4 2
1 2
3 4
```

**Output :**

```
Scenario #1:
Suspicious bugs found!
Scenario #2:
No suspicious bugs found!
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-17

Time limit: 1s-2s

Source limit:50000B

Languages: All

Resource: 2007 PUJ - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3378. Mirrored Pairs

#### Problem code: MIRRORRED

The letters b and d are mirror images of each other, as are p and q. No other pairs of letters are mirrors, except for letters like H that are mirrors of themselves, and what's the interest in a pair that's just two of the same letter? We refuse to count self-mirrors as mirrored pairs.

#### Input

Input is a list of lines with two characters on each line. Your program should end immediately when it encounters a line with two spaces.

#### Output

The first line of output should contain only Ready. For each pair of characters (prior to a pair of spaces), print the line Mirrored pair if the characters are mirrors, otherwise print the line Ordinary pair.

#### Example

**Input :**

```
Fr
qp
HH
db
```

```
pq
```

**Output :**

```
Ready
Ordinary pair
Mirrored pair
Ordinary pair
Mirrored pair
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-17

Time limit: 1s

Source limit:50000B

Languages: All

Resource: 2007 PUJ - Circuito de Maratones ACIS / REDIS



## SPOJ Problem Set (classical)

### 3379. String Shuffle

#### Problem code: SSHUFFLE

Given three strings consisting of just lowercase letters, count the number of ways that the third string can be constructed by combining two subsequences from the first two strings.

One derives a subsequence of the string by deleting zero or more characters from a string. For example, "", "a", "b", "c", "ab", "ac", "bc", and "abc" are all the subsequence strings of "abc". (Note that the empty string, "", is a subsequence of any string.)

The two subsequences are combined to make a third string by shuffling them together. That is, the relative order of the letters from the subsequence cannot be changed in the target string; but the two subsequences can be interleaved arbitrarily. For example, consider the two subsequences "abc" and "de". By combining them, one can get the following strings: "abcde", "abdce", "abdec", "adbce", "adbec", "adebc", "dabce", "dabec", "daeabc", and "deabc".

#### Input

The first line of the input contains a single integer  $t$  that indicates the number of test cases. Each test case contains 3 strings, each containing only lowercase characters. The length of each string is between 1 and 60, inclusive.

#### Output

For each test case, output a line with a single integer that denotes the number of ways that one can construct the third string from the first two strings as described above.

#### Example

**Input :**

```
3
abc abc abc
aa aa aa
abbcd bccde abcde
```

**Output :**

```
8
10
18
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: 2008 PUJ - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3380. Tourist

#### Problem code: TOURIST

A lazy tourist wants to visit as many interesting locations in a city as possible without going one step further than necessary. Starting from his hotel, located in the north-west corner of city, he intends to take a walk to the south-east corner of the city and then walk back. When walking to the south-east corner, he will only walk east or south, and when walking back to the north-west corner, he will only walk north or west. After studying the city map he realizes that the task is not so simple because some areas are blocked. Therefore he has kindly asked you to write a program to solve his problem. Given the city map (a 2D grid) where the interesting locations and blocked areas are marked, determine the maximum number of interesting locations he can visit. Locations visited twice are only counted once.

#### Input

The first line in the input contains the number of test cases (at most 20). Then follow the cases. Each case starts with a line containing two integers, W and H ( $2 \leq W$ ,  $H \leq 100$ ), the width and the height of the city map. Then follow H lines, each containing a string with W characters with the following meaning:

. Walkable area

\* Interesting location (also walkable area)

# Blocked area

You may assume that the upper-left corner (start and end point) and lower-right corner (turning point) are walkable, and that a walkable path of length  $H + W - 2$  exists between them.

#### Output

For each test case, output a line containing a single integer: the maximum number of interesting locations the lazy tourist can visit.

#### Example

**Input :**

```
2
9 7
* . . . . .
. . . . * * # .
. . * * . . # *
. . # # # # * # .
. * . # * . * # .
. . . # * * . . .
* . . . . . .
5 5
. * . * .
* # # # .
* . * . *
. # # # *
. * . * .
```

**Output :**

7

8

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 3s

Source limit:50000B

Languages: All

Resource: 2007 PUJ - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3381. Highways

#### Problem code: HIGHWAYS

A number of cities are connected by a network of highways. Each highway is bidirectional and connects two cities, with a given travel time. What is the shortest time to get from a given city to another given city?

#### Input

The first line of input contains the number of test cases.

Each test case starts with a line containing the number of cities  $n$  ( $2 \leq n \leq 100000$ ), the number of highways  $m$  ( $1 \leq m \leq 100000$ ), the starting city and the ending city. Cities are numbered from 1 to  $n$ .

Then  $m$  lines follow, each describing one highway. The description consists of the two distinct city numbers and the time in minutes to travel along the highway. The time will be between 1 and 1000.

#### Output

For each test case output a single line containing the minimum time it takes to get from the start to the destination. If no connection exists, output NONE.

#### Example

**Input :**

```
2
4 2 1 4
1 2 5
3 4 5
4 4 1 4
1 2 5
2 3 5
3 4 5
4 2 6
```

**Output :**

```
NONE
11
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3382. Monster Trap

#### Problem code: MONSTER

Once upon a time when people still believed in magic, there was a great wizard Aranyaka Gondlir. After twenty years of hard training in a deep forest, he had finally mastered ultimate magic, and decided to leave the forest for his home.

Arriving at his home village, Aranyaka was very surprised at the extraordinary desolation. A gloom had settled over the village. Even the whisper of the wind could scare villagers. It was a mere shadow of what it had been.

What had happened? Soon he recognized a sure sign of an evil monster that is immortal. Even the great wizard could not kill it, and so he resolved to seal it with magic. Aranyaka could cast a spell to create a monster trap: once he had drawn a line on the ground with his magic rod, the line would function as a barrier wall that any monster could not get over. Since he could only draw straight lines, he had to draw several lines to complete a monster trap, i.e., magic barrier walls enclosing the monster. If there was a gap between barrier walls, the monster could easily run away through the gap.

For instance, a complete monster trap without any gaps is built by the barrier walls in the left figure, where "M" indicates the position of the monster. In contrast, the barrier walls in the right figure have a loophole, even though it is almost complete.

[IMAGE]

Your mission is to write a program to tell whether or not the wizard has successfully sealed the monster.

#### Input

The input consists of multiple data sets, each in the following format.

[IMAGE]

The first line of a data set contains a positive integer  $n$ , which is the number of the line segments drawn by the wizard. Each of the following  $n$  input lines contains four integers  $x$ ,  $y$ ,  $x$ , and  $y$ , which represent the  $x$ - and  $y$ -coordinates of two points  $(x, y)$  and  $(x, y)$  connected by a line segment. You may assume that all line segments have non-zero lengths. You may also assume that  $n$  is less than or equal to 100 and that all coordinates are between -50 and 50, inclusive.

For your convenience, the coordinate system is arranged so that the monster is always on the origin (0, 0). The wizard never draws lines crossing (0, 0).

You may assume that any two line segments have at most one intersection point and that no three line segments share the same intersection point. You may also assume that the distance between any two intersection points is greater than  $10^{-5}$ .

An input line containing a zero indicates the end of the input.

## Output

For each data set, print "yes" or "no" in a line. If a monster trap is completed, print "yes". Otherwise, i.e., if there is a loophole, print "no".

## Example

### Input :

```
8
-7 9 6 9
-5 5 6 5
-10 -5 10 -5
-6 9 -9 -6
6 9 9 -6
-1 -2 -3 10
1 -2 3 10
-2 -3 2 -3
8
-7 9 5 7
-5 5 6 5
-10 -5 10 -5
-6 9 -9 -6
6 9 9 -6
-1 -2 -3 10
1 -2 3 10
-2 -3 2 -3
0
```

### Output :

```
yes
no
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 3s

Source limit:50000B

Languages: All

Resource: 2008 PUJ - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3385. Yoda Goes Palindromic !

#### Problem code: YODA

According to a very famous web site, which in this case we will trust, defines a palindrome as ‘a word, phrase, verse, or sentence that reads the same backward or forward’. For example, the phrase A man, a plan, a canal, Panama! is a palindrome. Actually, writing texts consisting of only palindromes is part of a literary technique called constrained writing.

Now imagine the wise Yoda, the master of all, whose proficiency putting words together in sentences is one of his well-known abilities. He is now interested in enriching his long-lasting, and maybe boring, inactivity periods by ‘composing’ palindromic sentences. That is, he has plans to use only palindromic sentences for his chats. For this matter, he needs to practice. The first task in his practice plan is to count all the palindromes that can be arranged out of a collection of characters.

Today, you will be Yoda’s assistant for this first task. Your only mission is to, given a sequence of characters, determine how many palindromes can be obtained with some of the characters in the sequence; you will only take into account uppercase or lowercase letters. Put in other way, you need to determine how many permutations of a given sequence of characters are palindromes. Your solution will help definitively master Yoda.

#### Input

The input consists of several test cases, one per line. For each test case, the input consists of a sequence of ASCII characters.

#### Output

For each test case you should print in a single line, and according to the order of the test cases, the total number of palindromes generated by the input sequence of ASCII characters. For your purpose, you should only consider uppercase or lowercase characters appearing in the input; any other character should be ignored in the calculations. Uppercase and lowercase characters are not considered different; for example, A and a should not be considered different. In any case, the total number of palindromes will not exceed the number  $e^{43}$ , where  $e$  is approximately 2.71828. Remember that the empty sequence is a palindrome itself.

#### Example

**Input :**

```
A man, a plan, a canal, Panama!  
arD,R!A  
B.a.C1/  
12[';. =1
```

**Output :**

```
15120  
2  
0  
1
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 4s

Source limit:50000B

Languages: All

Resource: 2007 U.Nacional - Circuito de Maratones ACIS / REDIS



## SPOJ Problem Set (classical)

### 3386. Contest System Quality Assurance Tester

#### Problem code: QUALITY

Write a program to score a small, three-problem programming contest. Each input line contains six space-separated integers representing raw score data. The first three integers are in the range 0 . . . 100000. They represent seconds taken to solve the first, second, and third problems, respectively. Zero seconds indicates that a problem has not been solved. The last three integers are in the range 0 . . . 100, representing the attempts taken to solve the first, second, and third problems, respectively. Every failed attempt is penalized with 20 minutes, but only for problems that are eventually solved. Each output line should begin with the string team, followed by a single space, the input line number, a colon, a single space, the number of solved problems, a comma, a single space, and the total number of seconds including penalties it took for the solved problems.

**Input :**

```
0 777 0 4 1 1
1 1 1 1 1 1
```

**Output :**

```
team 1: 1, 777
team 2: 3, 3
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: 2007 U.Nacional - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3387. Changing Maze

#### Problem code: CHMAZE

Luke Skywalker and his sister/love interest Leia are trying to get through a killer maze. And I mean killer! Every time step, the boundaries change. If our twins/lovebirds ever visit a square the same time a boundary appears, they're toast. There is no need to panic; the Force will guide them through the maze, and they will not die. However, the Force needs to know what advice to give and is therefore asking you for help.

Luke and Leia begin in the northwest corner of a maze. They want to make it to the southeast corner of the maze. At any given time step, Luke and Leia can move one square north, south, east, or west, or they can stay where they are. At every time step, the boundaries of the maze change: there is a finite list of patterns; if Luke and Leia are still in the maze when the list of patterns is exhausted, the maze cycles through again from the beginning of the list. You need to compute whether Luke and Leia can make it to the southeast corner of the maze, and, if so, the minimum number of time steps necessary for them to get there. Remember, the Force is counting on you! If you give the Force bad advice, we'll have to wait around for A Newer Hope and Force Knows how long that could take!

#### Input

The input consists of several test cases. Each case (but the last) will begin with a line containing three decimal integers. The first is the number of rows in the maze; the second is the number of columns in the maze; the third is the number of patterns in the list. The first two numbers will be inclusively between 1 and 20; the third will be inclusively between 1 and 10. The integers will be separated by exactly one space and will be followed by one . Immediately following this line will be a number of patterns, equal to the number specified on the first line. Each pattern will consist of  $r$  lines each containing  $c$  characters, where  $r$  is the number of rows and  $c$  is the number of columns indicated on the first line. Each character will be either 0 (indicating no boundary) or 1 (indicating a boundary). Each line will be terminated by , and an extra will follow each pattern. The northwest corner of the first pattern will always be zero, since Luke and Leia will be starting from there. The last case will be three zeros, separated by exactly one space and followed by exactly one . This case is not to be processed; it indicates the end of input.

#### Output

The output cases are to appear in the same order in which they appear in the input. Each output case should be of the form *Case c: Luke and Leia can escape in s steps.* or of the form *Case c: Luke and Leia cannot escape.*  $c$  and  $s$  are decimal integers.  $c$  is the number of the case being processed (starting with 1) and  $s$  is the minimum number of time steps Luke and Leia require to reach the southeast corner. Each line should be terminated by exactly one .

## Example

### Input :

```
5 5 1
00000
00000
00000
00000
00000
5 5 2
00000
00000
00000
00000
00000
01110
01110
11111
01110
01110
0 0 0
```

### Output :

```
Case 1: Luke and Leia can escape in 8 steps.
Case 2: Luke and Leia cannot escape.
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: 2007 U.Nacional - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3388. Double Near Palindromes

#### Problem code: DNPALIN

C-3PO is an expert in pretty much every language. His conversation with R2-D2 are always fun to observe un that R2-D2 speaks in Droid, C-3PO speak in English, and they understand each other perfectly! Anyway, humans and droids both enjoy playing word games. A palindrome is a word or sequence of one or more letters that reads the same forwards and backwards. A near palindrome is a word or sequence that can be changed to or kept a palindrome by changing exactly one letter to a different letter. For example. BAT is a near palindrome, since changing the T to a B woluld make the word a palindrome: BAB. PEEP is not a near palindrome: although PEEP is palindrome, changing any letter would remove its palindrome status. A double near palindrome is a word or sequence that consist of two near palindromes concatenated together. For example, BATMAN is a double near palindrome, since BAT and MAN are both near palindromes. Given a list of words, you are to determine wich words are double near palindromes and wich are not.

#### Input

The input consists of one or more words. All words (except the last) will be inclusively between 1 and 25 letters long and will consist of entirely of capital letters. The last word will be `*END*` and is not be processed; it simply indicates the end of the input. There may be any number of spaces and characters before, after, and between words.

#### Output

The output cases are to appear in the same order in wich they appear in the input. For each input case, you are to print either `w is a double near palindrome.` or `w is not a double near palindrome.` whichever is appropriate, where `w` is the input word. Exactly one should follow each output case (meaning there should be no blank lines in the output).

#### Example

**Input :**

```
BATMAN
CONSTANTINOPLE
*END*
```

**Output :**

```
BATMAN is a double near palindrome.
CONSTANTINOPLE is not a double near palindrome.
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 3s

Source limit:50000B

Languages: All

Resource: 2007 U.Nacional - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3389. The Knights of the Round Circle

#### Problem code: KNIGHTSR

A group of Jedi Knights is having a competition. One of the Knights at random stands within a circle. The other Knights, in a random order, challenge him. If a challenger defeats the Knight of the Round Circle, that Knight must leave the contest. The challenger then becomes the new Knight of the Round Circle and, as such, will face all subsequent challengers until he is defeated. If the current Knight of the Round Circle wins the challenge, he stays within the circle and the challenger must leave the competition. The Knight within the circle at the end of the competition is deemed the winner. You may assume that no two Knights have exactly the same skill and that a stronger Knight will always defeat a weaker Knight.

Suppose there are three Knights in the competition. If the strongest one happens to stand in the circle first, he will not be defeated, so no one will ever leave the circle. If the weakest one happens to be first in the circle, he will be kicked out after his first match. If the Knight that defeated him was the strongest, he will win the final challenge as well (so only one Knight will ever leave the circle), otherwise the strongest Knight will kick the middle Knight out of the circle during his challenge (so that two Knights leave the circle). If the middle Knight stands in the circle first, he will be the only one kicked out of the circle, no matter what order the other two come at him. All in all, an average of  $\frac{5}{6}$  or 0.83 Knight will leave the circle during the competition.

You are to compute the average number of Knights to leave the circle during a competition given the number of Knights in the competition.

#### Input

The input consists of several lines. Each line (but the last) will contain one positive decimal integer no larger than 10000. This integer is followed by exactly one space. These integers represent the number of Knights in the competition. The last line will contain one zero, followed by a space. This line is not to be processed; it merely signifies the end of the input.

#### Output

The output cases are to appear in the same order in which they appear in the input. For each case, you are to print "With c competitors, a Jedi Knight will be replaced approximately t times." c is the number of competitors in this case and should be a decimal integer. t is the average number of times a Jedi Knight leaves the circle and should be a floating point decimal number with exactly two digits following the decimal point. There should always be at least one digit before the decimal point (use 0.50 rather than .50, for example). The statement should be followed by two spaces, which is to say that a blank line should follow every output case.

#### Example

Input :

```
3
1000
0
```

**Output:**

With 3 competitors, a Jedi Knight will be replaced approximately 0.83 times.

With 1000 competitors, a Jedi Knight will be replaced approximately 6.49 times.

---

Added by: Daniel Gómez Didier

Date: 2008-11-18

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: 2007 U.Nacional - Circuito de Maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3390. Tribe Council

#### Problem code: TRIBE2

The Kazooba tribe contains  $N$  men, who want to gather for a tribe council. The men are all descendants of a single one, who is the chief of the tribe. Since the people of this tribe are quite long lived, every person's ancestors, including the chief, are alive and will be attending the council.

The men arrive at the council in some particular order and they are seated as they arrive. The men sit in a row of parallel tables. The first table is at the base of the Holy Mountain and the row extends indefinitely to the West (away from the Mountain). Unfortunately, each man doesn't get along with his father and his sons, so he doesn't want to sit at the same table with any of them. On the other hand, each man wants to be as close to divinity as possible, so, when he arrives at the council, he goes to the table closest to the Holy Mountain, where none of his children or father is already seated.

As usual, the Gods of the tribe have a certain inclination for grandeur. Therefore, they would like to command the men to arrive in such an order, as to maximize the number of tables that are occupied. Unfortunately, they do not have any inclination for programming, so they have ordered you to write a program for that.

Write a program that determines the maximum number of tables that can end up being occupied.

#### Input

The first line of the input file contains an integer  $N$ , representing the number of men in the tribe. All men are numbered from 1 to  $N$ ; the chief is number 1. Each of the following lines describe a father-son relation and contains two integers  $A$   $B$  separated by a blank, meaning that person number  $A$  is the father of the person number  $B$ . The relations described in the file are correct (for instance, there are no "cycles" and each person is a descendent of the chief).

#### Output

The output file should contain a single line with the maximum number of tables that can be occupied.

#### Example

Input:

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

Output:

```
3
```

Explanation:

If men arrive in the order 2 4 1 5 3, the following happens:

● 2 goes to the first table ● 4 goes to the first table ● 1 has a son (4) at the first table, so he goes to the second table ● 5 goes to the first table ● 3 has two sons at the first table (2 and 5) and his father (1) is at the second table, so he goes to the third table



## Constraints

- $1 < N \leq 100\,000$
- Any table has unlimited capacity.

**Note:** The problem statement and test data was updated on 22-11-2008. I'm sorry for the inconvenience.

---

Added by: Ajay Somani

Date: 2008-11-19

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: BOI 2003

## SPOJ Problem Set (classical)

### 3393. Knot or Not

#### Problem code: NOTOKNOT

Disentangling of string loops is a classical 3D- puzzle. A designer of one of these puzzles wants to know if two given string loops can be disentangled or not.

The designer says that a string loop configuration that can be disentangled is a Notknot. In fact, he says that knots are those string loops that can not be disentangled.

Your task is to write a program to help the puzzle designer deciding if some configurations can or cannot be disentangled. In the problems that you are going to solve, loops are defined by straight segments in the space between points with integer coordinates. Then, a loop is described with a list of  $p$  points with integral coordinates for some  $p \geq 3$ .

#### Input

Input consists of  $N$  test cases ( $1 \leq N \leq 1000$ ). The number  $N$  is given in the first line of the input. Each test case contains the description of two loops, each one in a line. A description for a  $p$  points loop ( $3 \leq p \leq 20$ ) is given in one input line with  $3p$  integer numbers separated by blanks:

$$x_1 \ y_1 \ z_1 \ x_2 \ y_2 \ z_2 \ \dots \ x_p \ y_p \ z_p$$

what represents the loop:

$$(x_1, y_1, z_1) - (x_2, y_2, z_2) - \dots - (x_p, y_p, z_p) - (x_1, y_1, z_1)$$

where there is a straight segment between adjacent coordinates.

#### Output

For each analyzed case, one line classifying the case: Notknot or Knot.

#### Example

**Input :**

```
3
10 0 0 0 0 -10 0 10 0 0 0 10
5 0 0 -10 -10 0 0 5 0 10 10 0
10 0 0 0 0 -10 0 10 0 0 0 10
15 0 0 -10 -10 0 0 5 0 10 10 0
1 0 0 0 1 0 0 0 1
10 10 0 0 10 0 0 0 10 10 0 0 25 5 0 3 3 0
```

**Output :**

```
Notknot
Knot
Notknot
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-19

Time limit: 4s

Source limit:50000B

Languages: All

Resource: 2008 U.Catolica & U.Central - Circuito de maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3394. Lagrange's Four-Square Theorem

#### Problem code: LAGRANGE

The fact that any positive integer has a representation as the sum of at most four positive squares (i.e. squares of positive integers) is known as Lagrange's Four-Square Theorem. The first published proof of the theorem was given by Joseph-Louis Lagrange in 1770. Your mission however is not to explain the original proof nor to discover a new proof but to show that the theorem holds for some specific numbers by counting how many such possible representations there are. For a given positive integer  $n$ , you should report the number of all representations of  $n$  as the sum of at most four positive squares. The order of addition does not matter, e.g. you should consider  $4^2 + 3^2$  and  $3^2 + 4^2$  are the same representation.

For example, let's check the case of 25. This integer has just three representations  $1^2 + 2^2 + 2^2 + 4^2$ ,  $3^2 + 4^2$ , and  $5^2$ . Thus you should report 3 in this case. Be careful not to count  $4^2 + 3^2$  and  $3^2 + 4^2$  separately.

#### Input

The input is composed of at most 255 lines, each containing a single positive integer less than  $2^{15}$ , followed by a line containing a single zero. The last line is not a part of the input data.

#### Output

The output should be composed of lines, each containing a single integer. No other characters should appear in the output. The output integer corresponding to the input integer  $n$  is the number of all representations of  $n$  as the sum of at most four positive squares.

#### Example

**Input :**

```
1
25
2003
211
20007
0
```

**Output :**

```
1
3
48
7
738
```

---

Added by: Daniel Gómez Didier

Date: 2008-11-19

Time limit: 2s

Source limit:50000B

Languages: All

Resource: 2008 U.Catolica & U.Central - Circuito de maratones ACIS / REDIS

## SPOJ Problem Set (classical)

### 3405. Almost Shortest Path

#### Problem code: SAMER08A

Finding the shortest path that goes from a starting point to a destination point given a set of points and route lengths connecting them is an already well known problem, and it's even part of our daily lives, as shortest path programs are widely available nowadays.

Most people usually like very much these applications as they make their lives easier. Well, maybe not that much easier.

Now that almost everyone can have access to GPS navigation devices able to calculate shortest paths, most routes that form the shortest path are getting slower because of heavy traffic. As most people try to follow the same path, it's not worth it anymore to follow these directions.

With this in his mind, your boss asks you to develop a new application that only he will have access to, thus saving him time whenever he has a meeting or any urgent event. He asks you that the program must answer not the shortest path, but the almost shortest path. He defines the almost shortest path as the shortest path that goes from a starting point to a destination point such that no route between two consecutive points belongs to any shortest path from the starting point to the destination.

For example, suppose the figure below represents the map given, with circles representing location points, and lines representing direct, one-way routes with lengths indicated. The starting point is marked as S and the destination point is marked as D. The bold lines belong to a shortest path (in this case there are two shortest paths, each with total length 4). Thus, the almost shortest path would be the one indicated by dashed lines (total length 5), as no route between two consecutive points belongs to any shortest path. Notice that there could exist more than one possible answer, for instance if the route with length 3 had length 1. There could exist no possible answer as well.

subir imagenes

#### Input

The input contains several test cases. The first line of a test case contains two integers  $N$  ( $2 \leq N \leq 500$ ) and  $M$  ( $1 \leq M \leq 10^4$ ), separated by a single space, indicating respectively the number of points in the map and the number of existing one-way routes connecting two points directly. Each point is identified by an integer between 0 and  $N - 1$ . The second line contains two integers  $S$  and  $D$ , separated by a single space, indicating respectively the starting and the destination points ( $S \neq D$ ;  $0 \leq S, D < N$ ).

Each one of the following  $M$  lines contains three integers  $U$ ,  $V$  and  $P$  ( $U \neq V$ ;  $0 \leq U, V < N$ ;  $1 \leq P \leq 10^3$ ), separated by single spaces, indicating the existence of a one-way route from  $U$  to  $V$  with distance  $P$ . There is at most one route from a given point  $U$  to a given point  $V$ , but notice that the existence of a route from  $U$  to  $V$  does not imply there is a route from  $V$  to  $U$ , and, if such road exists, it can have a different length. The end of input is indicated by a line containing only two zeros separated by a single space.

## Output

For each test case in the input, your program must print a single line, containing  $-1$  if it is not possible to match the requirements, or an integer representing the length of the almost shortest path found.

## Example

### Input :

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

### Output :

```
5
-1
6
```

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 2s

Source limit: 50000B

Languages: C C++ 4.0.0-8 PAS gpc PAS fpc JAVA

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3406. Bases

#### Problem code: SAMER08B

What do you get if you multiply 6 by 9? The answer, of course, is 42, but only if you do the calculations in base 13.

Given an integer  $B \geq 2$ , the *base B numbering system* is a manner of writing integers using only digits between 0 and  $B - 1$ , inclusive. In a number written in base  $B$ , the rightmost digit has its value multiplied by 1, the second rightmost digit has its value multiplied by  $B$ , the third rightmost digit has its value multiplied by  $B^2$ , and so on.

Some equations are true or false depending on the base they are considered in. The equation  $2+2=4$ , for instance, is true for any  $B \geq 5$  - it does not hold in base 4, for instance, since there is no digit '4' in base 4. On the other hand, an equation like  $2+2=5$  is never true.

Write a program that given an equation determines for which bases it holds.

#### Input

Each line of the input contains a test case; each test case is an equation of the form "EXPR=EXPR", where both "EXPR" are arithmetic expressions with at most 17 characters.

All expressions are valid, and contain only the characters '+', '\*', and the digits from '0' to '9'. No expressions contain leading plus signs, and no numbers in it have leading zeros.

The end of input is indicated by a line containing only "=".

#### Output

For each test case in the input your program should produce a single line in the output, indicating for which bases the given equation holds.

If the expression is true for infinitely many bases, print "B+", where  $B$  is the first base for which the equation holds.

If the expression is valid only for a finite set of bases, print them in ascending order, separated by single spaces.

If the expression is not true in any base, print the character '\*'.

#### Example

**Input :**

```
6*9=42
10000+3*5*334=3*5000+10+0
2+2=3
2+2=4
```



0\*0=0  
=

**Output :**

13  
6 10  
\*  
5+  
2+

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 1s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3407. Candy

#### Problem code: SAMER08C

Little Charlie is a nice boy addicted to candies. He is even a subscriber to All Candies Magazine and was selected to participate in the International Candy Picking Contest.

In this contest a random number of boxes containing candies are disposed in  $M$  rows with  $N$  columns each (so, there are a total of  $M \times N$  boxes). Each box has a number indicating how many candies it contains.

The contestant can pick a box (any one) and get all the candies it contains. But there is a catch (there is always a catch): when choosing a box, all the boxes from the rows immediately above and immediately below are emptied, as well as the box to the left and the box to the right of the chosen box. The contestant continues to pick a box until there are no candies left.

The figure bellow illustrates this, step by step. Each cell represents one box and the number of candies it contains. At each step, the chosen box is circled and the shaded cells represent the boxes that will be emptied. After eight steps the game is over and Charlie picked  $10+9+8+3+7+6+10+1 = 54$  candies.

subir imagenes

For small values of  $M$  and  $N$ , Charlie can easily find the maximum number of candies he can pick, but when the numbers are really large he gets completely lost. Can you help Charlie maximize the number of candies he can pick?

#### Input

The input contains several test cases. The first line of a test case contains two positive integers  $M$  and  $N$  ( $1 \leq M \times N \leq 10^5$ ), separated by a single space, indicating the number of rows and columns respectively. Each of the following  $M$  lines contains  $N$  integers separated by single spaces, each representing the initial number of candies in the corresponding box. Each box will have initially at least 1 and at most  $10^3$  candies.

The end of input is indicated by a line containing two zeroes separated by a single space.

#### Output

For each test case in the input, your program must print a single line, containing a single value, the integer indicating the maximum number of candies that Charlie can pick.

#### Example

Input :

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

```
1 2 10 3 10
8 4 7 9 1
7 1 3 1 6
4 4
10 1 1 10
1 1 1 1
1 1 1 1
10 1 1 10
2 4
9 10 2 7
5 1 1 5
0 0
```

**Output :**

```
54
40
17
```

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 2s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3408. DNA Sequences

#### Problem code: SAMER08D

Thomas, a computer scientist that works with DNA sequences, needs to compute longest common subsequences of given pairs of strings. Consider an alphabet  $S$  of letters and a word  $w = a_1 a_2 \dots a_r$ , where  $a_i \in S$ , for  $i = 1, 2, \dots, r$ . A *subsequence* of  $w$  is a word  $x = a_{i_1} a_{i_2} \dots a_{i_s}$  such that  $1 \leq i_1 < i_2 < \dots < i_s \leq r$ . Subsequence  $x$  is a *segment* of  $w$  if  $i_{j+1} = i_j + 1$ , for  $j = 1, 2, \dots, s-1$ . For example the word `ove` is a segment of the word `lovely`, whereas the word `loly` is a subsequence of `lovely`, but not a segment.

A word is a *common subsequence* of two words  $w_1$  and  $w_2$  if it is a subsequence of each of the two words. A *longest common subsequence* of  $w_1$  and  $w_2$  is a common subsequence of  $w_1$  and  $w_2$  having the largest possible length. For example, consider the words  $w_1 = \text{lovxxelyxxxxx}$  and  $w_2 = \text{xxxxxxlovely}$ . The words  $w_3 = \text{lovely}$  and  $w_4 = \text{xxxxxxx}$ , the latter of length 7, are both common subsequences of  $w_1$  and  $w_2$ . In fact,  $w_4$  is their longest common subsequence. Notice that the empty word, of length zero, is always a common subsequence, although not necessarily the longest.

In the case of Thomas, there is an extra requirement: the subsequence must be formed from common segments having length  $K$  or more. For example, if Thomas decides that  $K=3$ , then he considers `lovely` to be an acceptable common subsequence of `lovxxelyxxxxx` and `xxxxxxlovely`, whereas `xxxxxxx`, which has length 7 and is also a common subsequence, is not acceptable. Can you help Thomas?

#### Input

The input contains several test cases. The first line of a test case contains an integer  $K$  representing the minimum length of common segments, where  $1 \leq K \leq 100$ . The next two lines contain each a string on lowercase letters from the regular alphabet of 26 letters. The length  $l$  of each string satisfies the inequality  $1 \leq l \leq 10^3$ . There are no spaces on any line in the input. The end of the input is indicated by a line containing a zero.

#### Output

For each test case in the input, your program must print a single line, containing the length of the longest subsequence formed by consecutive segments of length at least  $K$  from both strings. If no such common subsequence of length greater than zero exists, then 0 must be printed.

## Example

### Input :

```
3
lovxxelyxxxxx
xxxxxxlovely
1
lovxxelyxxxxx
xxxxxxlovely
3
lovxxelxyxxxx
xxxlovelyxxxxxxx
4
lovxxelyxxx
xxxxxxlovely
0
```

### Output :

```
6
7
10
0
```

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 10s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3409. Electricity

#### Problem code: SAMER08E

Martin and Isa stopped playing crazy games and finally got married. It's good news! They're pursuing a new life of happiness for both and, moreover, they're moving to a new house in a remote place, bought with most of their savings.

Life is different in this new place. In particular, electricity is very expensive, and they want to keep everything under control. That's why Martin proposed to keep a daily record of how much electricity has been consumed in the house. They have an electricity meter, which displays a number with the amount of KWh (kilowatt-hour) that has been consumed since their arrival.

At the beginning of each day they consult the electricity meter, and write down the consumption. Some days Martin does it, and some days Isa does. That way, they will be able to look at the differences of consumption between consecutive days and know how much has been consumed.

But some days they simply forget to do it, so, after a long time, their register is now incomplete. They have a list of dates and consumptions, but not all of the dates are consecutive. They want to take into account only the days for which the consumption can be precisely determined, and they need help.

#### Input

The input contains several test cases. The first line of each test case contains one integer  $N$  indicating the number of measures that have been taken ( $2 \leq N \leq 10^3$ ). Each of the  $N$  following lines contains four integers  $D$ ,  $M$ ,  $Y$  and  $C$ , separated by single spaces, indicating respectively the day ( $1 \leq D \leq 31$ ), month ( $1 \leq M \leq 12$ ), year ( $1900 \leq Y \leq 2100$ ), and consumption ( $0 \leq C \leq 10^6$ ) read at the beginning of that day. These  $N$  lines are increasingly ordered by date, and may include leap years. The sequence of consumptions is strictly increasing (this is, no two different readings have the same number). You may assume that  $D$ ,  $M$  and  $Y$  represent a valid date.

Remember that a year is a leap year if it is divisible by 4 and not by 100, or well, if the year is divisible by 400.

The end of input is indicated by a line containing only one zero.

#### Output

For each test case in the input, your program must print a single line containing two integers separated by a single space: the number of days for which a consumption can be precisely determined, and the sum of the consumptions for those days.

## Example

### Input :

```
5
9 9 1979 440
29 10 1979 458
30 10 1979 470
1 11 1979 480
2 11 1979 483
3
5 5 2000 6780
6 5 2001 7795
7 5 2002 8201
8
28 2 1978 112
1 3 1978 113
28 2 1980 220
1 3 1980 221
5 11 1980 500
14 11 2008 600
15 11 2008 790
16 12 2008 810
0
```

### Output :

```
2 15
0 0
2 191
```

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 1s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3410. Feynman

#### Problem code: SAMER08F

Richard Phillips Feynman was a well known American physicist and a recipient of the Nobel Prize in Physics. He worked in theoretical physics and also pioneered the field of quantum computing. He visited South America for ten months, giving lectures and enjoying life in the tropics. He is also known for his books "Surely You're Joking, Mr. Feynman!" and "What Do You Care What Other People Think?", which include some of his adventures below the equator.

His life-long addiction was solving and making puzzles, locks, and cyphers. Recently, an old farmer in South America, who was a host to the young physicist in 1949, found some papers and notes that is believed to have belonged to Feynman. Among notes about mesons and electromagnetism, there was a napkin where he wrote a simple puzzle: "how many different squares are there in a grid of  $N \times N$  squares?".

In the same napkin there was a drawing which is reproduced below, showing that, for  $N=2$ , the answer is 5.

subir imagenes

#### Input

The input contains several test cases. Each test case is composed of a single line, containing only one integer  $N$ , representing the number of squares in each side of the grid ( $1 \leq N \leq 100$ ).

The end of input is indicated by a line containing only one zero.

#### Output

For each test case in the input, your program must print a single line, containing the number of different squares for the corresponding input.

#### Example

**Input :**

2  
1  
8  
0

**Output :**

5  
1  
204

---



Added by: Diego Satoba

Date: 2008-11-23

Time limit: 1s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3411. Pole Position

#### Problem code: SAMER08G

In car races, there is always a high pole next to the finish line of the track. Before the race starts, the pole is used to display the starting grid. The number of the first car in the grid is displayed at the top of the pole, the number of the car in second place is shown below that, and so on.

During the race, the pole is used to display the current position of each car: the car that is winning the race has its number displayed at the top of the pole, followed by the car that is in second place, and so on.

Besides showing the current position of a car, the pole is also used to display the number of positions the cars have won or lost, relative to the starting grid. This is done by showing, side by side to the car number, an integer number. A positive value  $v$  beside a car number in the pole means that car has won  $v$  positions relative to the starting grid. A negative value  $v$  means that car has lost  $v$  positions relative to the starting grid. A zero beside a car number in the pole means the car has neither won nor lost any positions relative to the starting grid (the car is in the same position it started).

subir imagenes

We are in the middle of the Swedish Grand Prix, the last race of the World Championship. The race director, Dr.Shoo Makra, is getting worried: there have been some complaints that the software that controls the pole position system is defective, showing information that does not reflect the true race order.

Dr.Shoo Makra devised a way to check whether the pole system is working properly. Given the information currently displayed in the pole, he wants to reconstruct the starting grid of the race. If it is possible to reconstruct a valid starting grid, he plans to check it against the real starting grid. On the other hand, if it is not possible to reconstruct a valid starting grid, the pole system is indeed defective.

Can you help Dr.Shoo Makra?

#### Input

The input contains several test cases. The first line of a test case contains one integer  $N$  indicating the number of cars in the race ( $2 \leq N \leq 10^3$ ). Each of the next  $N$  lines contains two integers  $C$  and  $P$ , separated by one space, representing respectively a car number ( $1 \leq C \leq 10^4$ ) and the number of positions that car has won or lost relative to the starting grid ( $-10^6 \leq P \leq 10^6$ ), according to the pole system. All cars in a race have different numbers.

The end of input is indicated by a line containing only one zero.

## Output

For each test case in the input, your program must print a single line, containing the reconstructed starting grid, with car numbers separated by single spaces. If it is not possible to reconstruct a valid starting grid, the line must contain only the value  $-1$ .

## Example

**Input :**

```
4
1 0
3 1
2 -1
4 0
4
22 1
9 1
13 0
21 -2
3
19 1
9 -345
17 0
7
2 2
8 0
5 -2
7 1
1 1
9 1
3 -3
0
```

**Output :**

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

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 1s

Source limit: 50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA C#

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3412. Higgs Boson

#### Problem code: SAMER08H

It's been 100 years since the detection of the first Higgs boson and now particle physics is a mainstream subject in all high schools. Obviously, kids love the fact that they can create tiny black holes using only their portable particle accelerators and show off to their friends and colleagues. Although the creation of big black holes that could swallow the whole planet is possible even with these portable particle accelerators, the devices are programmed to only throw particles when this undesirable side effect is impossible.

Your granddaughter is trying to create her own black holes with a portable accelerator kit, which is composed of two small particle accelerators that throw, each one, a boson-sized particle. Both particles are thrown at the same time, and a black hole appears when the particles collide. However, your granddaughter doesn't know how much time she'll have to wait before this happens. Fortunately, each accelerator can predict the particle's trajectory, showing four integer values into its display, called  $A$ ,  $B$ ,  $C$  and  $D$ . Each value can be replaced into the following equations:

$$r = At + B$$

$$\text{th} = Ct + D$$

in order to determine the trajectory of the particle, in polar coordinates. The radius ( $r$ ) is represented in distance units and the angle ( $\text{th}$ ) in degrees. The time ( $t$ ) is given in time units and it is always a rational value which can be represented by an irreducible fraction. Your granddaughter knows that in polar coordinates a point has infinite representations. In general, the point  $(r, \text{th})$  can be represented as  $(r, \text{th} + k \times 360^\circ)$  or  $(-r, \text{th} + (2k + 1) \times 180^\circ)$ , where  $k$  is any integer. Besides, the origin ( $r = 0$ ) can be represented as  $(0, \text{th})$  for any  $\text{th}$ .

Using these parameters informed by each particle accelerator, your granddaughter wants to determine whether the particles will eventually collide and, if they do, the time when they will collide. After the first collision it is impossible to predict the particle's trajectory, therefore, only the first possible collision should be considered.

Although your granddaughter is really intelligent and has a deep knowledge of particle physics, she does not know how to program computers and is looking for some notes in her grandfather's (or grandmother's) ICPC notebook (don't forget, she is *your* granddaughter!). Fortunately for you, there is a note on your notebook which says that you wrote that code during the 2008 ICPC South America Regional Contest (or, to be more specific, *this* contest).

### Input

The input consists of several test cases, one per line. Each test case contains eight integer numbers separated by single spaces,  $A_1, B_1, C_1, D_1, A_2, B_2, C_2, D_2$  ( $-10^4 \leq A_1, B_1, C_1, D_1, A_2, B_2, C_2, D_2 \leq 10^4$ ). The first four input values ( $A_1, B_1, C_1, D_1$ ) correspond to the four parameters displayed

by the first portable particle accelerator and the following input values ( $A_2, B_2, C_2, D_2$ ) correspond to the four parameters displayed by the second portable particle accelerator when both particles are thrown. The end of the input is represented by  $A_1 = B_1 = C_1 = D_1 = A_2 = B_2 = C_2 = D_2 = 0$ , which should not be processed as a test case, since these are the values displayed by the particle accelerators when a big black hole would be created if the particles were thrown. Although the end of input is represented by a line with eight zeroes, note that the number zero is a possible input value.

## Output

For each test case, your program must output a line containing two non-negative integers  $t_a$  and  $t_b$  separated by a single space. If there is no possibility of collision,  $t_a = t_b = 0$ , otherwise,  $t_a/t_b$  must be an irreducible fraction representing the earliest collision time. Even if the fraction results in an integer value, you still must output the number 1 as the denominator (see samples below).

## Example

### Input :

```
1 1 180 0 2 0 180 360
10 10 360 0 -24 18 180 72
5 5 180 0 -12 9 10 40
-9 5 5 180 2 5 5 180
0 0 0 0 0 0 0 0
```

### Output :

```
1 1
0 0
4 17
0 1
```

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 1s

Source limit: 50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc SCALA JAVA C#

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3413. Traveling Shoemaker Problem

#### Problem code: SAMER08I

Once upon a time there was a very peaceful country named Nlogonia. Back then, Poly the Shoemaker could come to the country and travel freely from city to city doing his job without any harassment. This task was very easy, as every city in Nlogonia had a direct road to every other city in the country. He could then easily travel the whole country visiting each city exactly once and fixing everybody's shoes.

But not anymore. The times have changed and war has come to Nlogonia. The age when people could travel freely is over.

Confederations identified by colors were formed among the cities all over the country, and now each city belongs to at least one and at most two confederations. When trying to enter a city, you must give to the border officer a ticket from one of the confederations this city belongs to. When leaving the city, you receive a ticket from the other confederation the city belongs to (i.e. different from the one you gave when entering) or from the same confederation if the city only belongs to one.

As Poly the Shoemaker is a long time friend of Nlogonia, he is allowed to choose a ticket and a city he wants to enter as the first city in the country, but after that he must obey the confederations rules. He wants to do the same routine he did before, visiting each city exactly once in Nlogonia, but now it's not easy for him to do this, even though he can choose where to start his journey.

For example, suppose there are four cities, labeled from 0 to 3. City 0 belongs to confederations *red* and *green*; city 1 belongs only to *red*; city 2 belongs to *green* and *yellow*; and city 3 belongs to *blue* and *red*. If Poly the Shoemaker chooses to start at city 0, he can enter it carrying either the *red* or the *green* ticket and leave receiving the other. Should he choose the *red* ticket, he will leave with a *green* ticket, and then there is only city 2 he can travel to. When leaving city 2 he receives the *yellow* ticket and now can't go anywhere else. If he had chosen the *green* ticket as the first he would receive the *red* one when leaving, and then he could travel to cities 1 or 3. If he chooses city 3, when leaving he will receive the *blue* ticket and again can't go anywhere else. If he chooses city 1, he receives the *red* ticket again when leaving (city 1 belongs only to the *red* confederation) and can only travel to city 3 and will never get to city 2. Thus, it is not possible to visit each city exactly once starting at city 0. It is possible, however, starting at city 2 with the *yellow* ticket, leaving the city with the *green* ticket, then visiting city 0, leaving with *red* ticket, then visiting city 1, leaving with *red* ticket again and, at last, visiting city 3.

As you can see, it got really difficult for Poly the Shoemaker to accomplish the task, so he asks you to help him. He wants to know if it's possible to choose a city to start such that he can travel all cities from Nlogonia exactly once.

Can you help Poly the Shoemaker?

## Input

The input contains several test cases. The first line of a test case contains two integers  $N$  and  $C$ , separated by one space, indicating respectively the number of cities ( $1 \leq N \leq 500$ ) and confederations ( $1 \leq C \leq 100$ ) in the country. Each of the next  $C$  lines describes a confederation. It starts with one integer  $K$  ( $0 \leq K \leq N$ ) and then  $K$  integers representing the cities which belong to this confederation. All integers are separated by single spaces and cities are numbered from 0 to  $N-1$ . Each city will appear at least once and at most twice and no city will be repeated on the same confederation.

The end of input is indicated by a line containing two zeroes separated by a single space.

## Output

For each test case in the input, your program must print a single line, containing the integer  $-1$  if it's not possible to match the requirements or one integer representing the city where Poly the Shoemaker can start his journey. If there are multiple correct answers, print the smallest one.

## Example

### Input :

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

### Output :

```
2
-1
1
```

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 1s

Source limit: 50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA C#

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3414. Bora Bora

#### Problem code: SAMER08J

Bora Bora is a simple card game for children, invented in the South Pacific Island of the same name. Two or more players can play, using a deck of standard cards. Cards have the usual ranks: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen and King. Each card has also one of four suits: Clubs, Diamonds, Hearts and Spades.

Players sit on a circle around the table and play by turns. The next player to play may be the one to the left (clockwise direction) or to the right (counter-clockwise direction) of the current player, depending on the cards played, as we will see. At the start, the direction of play is clockwise.

The deck is shuffled and each player is dealt a hand of cards. The remaining of the deck is placed, face down, on the table; this is called the *stock* pile. Then the first (topmost) card is removed from the stock and placed on the table, face up, starting another pile, called the *discard* pile.

The objective of the game is for a player to discard all his cards. At each turn, a player discards at most one card. A card can be discarded only if it has the same rank or the same suit as the topmost card on the discard pile. A player discards a card by placing it, face up, in the discard pile (this card becomes the topmost). If a player does not have a suitable card to discard on his turn, he must draw one card from the stock and add it to his hand; if he can discard that card, he does so, otherwise he does nothing else and his turn ends. A player always discards the highest valued card he possibly can. The *value* of a card is determined first by the card rank and then by the card suit. The rank order is the rank itself (Ace is the lowest, King is the highest), and the suit order is, from lowest to highest, Clubs, Diamonds, Hearts and Spades. Therefore, the highest valued card is the King of Spades and the lowest valued card is the Ace of Clubs. As an example, a Queen of Diamonds has a higher value than a Jack (any suit) but has a lower value than a Queen of Hearts.

Some of the discarded cards affect the play, as follows:

- when a Queen is discarded, the direction of play is reversed: if the direction is clockwise, it changes to counter-clockwise, and vice-versa;
- when a Seven is discarded, the next player to play must draw two cards from the stock (the number of cards in his hand increases by two), and misses his turn (does not discard any card);
- when an Ace is discarded, the next player to play must draw one card from the stock (the number of cards in his hand increases by one), and misses his turn (does not discard any card);
- when a Jack is discarded, the next player to play misses his turn (does not discard any card).

Notice that the penalty for the first card in the discard pile (the card draw from the stock at the beginning) is applied to the first player to play. For example, if the first player to play is  $p$  and the first card on the discard pile is an Ace, player  $p$  draws a card from the stock and does not discard any card on his first turn. Also notice that if the first card is a Queen, the direction of play is reversed to counter-clockwise, but the first player to play remains the same.



The winner is the player who first discards all his cards (the game ends after the winner discards his last card).

Given the description of the shuffled deck and the number of players, write a program to determine who will win the game.

## Input

The input contains several test cases. The first line of a test case contains three integers  $P$ ,  $M$  and  $N$ , separated by single spaces, indicating respectively the number of players ( $2 \leq P \leq 10$ ), the number of cards distributed to each of the players at the beginning of the game ( $1 \leq M \leq 11$ ) and the total number of cards in the shuffled deck ( $3 \leq N \leq 300$ ). Each of the next  $N$  lines contains the description of one card. A card is described by one integer  $X$  and one character  $S$ , separated by one space, representing respectively the card rank and the card suite. Card ranks are mapped to integers from 1 to 13 (Ace is 1, Jack is 11, Queen is 12 and King is 13). Card suits are designated by the suit's first letter: 'C' (Clubs), 'D' (Diamonds), 'H' (Hearts) or 'S' (Spades).

Players are identified by numbers from 1 to  $P$ , and sit on a circle, in clockwise direction, 1, 2 ... $P$ , 1. The first  $P \times M$  cards of the deck are dealt to the players: the first  $M$  cards to the first player (player 1), the next  $M$  to the second player (player 2), and so on. After dealing the cards to the players, the next card on the deck - the  $(P \times M + 1)$ -th card - is used to start the discard pile, and the remaining cards form the stock. The  $(P \times M + 2)$ -th card to appear on the input is the topmost card on the stock, and the last card to appear on the input (the  $N$ -th card) is the bottommost card of the stock (the last card that can be drawn). Player 1 is always the first to play (even when the card used to start the discard pile is a Queen). All test cases have one winner, and in all test cases the number of cards in the deck is sufficient for playing to the end of the game.

The end of input is indicated by a line containing only three zeros, separated by single spaces.

## Output

For each test case in the input, your program must print a single line, containing the number of the player who wins the game.

## Example

**Input :**

```
2 2 10
1 D
7 D
1 S
3 C
13 D
1 S
5 H
12 D
7 S
2 C
3 2 11
1 S
7 D
11 D
3 D
7 D
```

3 S  
11 C  
8 C  
9 H  
6 H  
9 S  
3 3 16  
1 H  
10 C  
13 D  
7 C  
10 H  
2 S  
2 C  
10 S  
8 S  
12 H  
11 C  
1 C  
1 C  
4 S  
5 D  
6 S  
0 0 0

**Output :**

1  
3  
2

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 1s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA C#

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3415. Shrinking Polygons

#### Problem code: SAMER08K

A polygon is said to be *inscribed* in a circle when all its vertices lie on that circle. In this problem you will be given a polygon inscribed in a circle, and you must determine the minimum number of vertices that should be removed to transform the given polygon into a *regular polygon*, i.e., a polygon that is equiangular (all angles are congruent) and equilateral (all edges have the same length).

When you remove a vertex  $v$  from a polygon you first remove the vertex and the edges connecting it to its adjacent vertices  $w_1$  and  $w_2$ , and then create a new edge connecting  $w_1$  and  $w_2$ . Figure (a) below illustrates a polygon inscribed in a circle, with ten vertices, and figure (b) shows a pentagon (regular polygon with five edges) formed by removing five vertices from the polygon in (a).

subir imagenes

In this problem, we consider that any polygon must have at least three edges.

#### Input

The input contains several test cases. The first line of a test case contains one integer  $N$  indicating the number of vertices of the inscribed polygon ( $3 \leq N \leq 10^4$ ). The second line contains  $N$  integers  $X_i$  separated by single spaces ( $1 \leq X_i \leq 10^3$ , for  $0 \leq i \leq N-1$ ). Each  $X_i$  represents the length of the arc defined in the inscribing circle, clockwise, by vertex  $i$  and vertex  $(i+1) \bmod N$ . Remember that an *arc* is a segment of the circumference of a circle; do not mistake it for a *chord*, which is a line segment whose endpoints both lie on a circle.

The end of input is indicated by a line containing only one zero.

#### Output

For each test case in the input, your program must print a single line, containing the minimum number of vertices that must be removed from the given polygon to form a regular polygon. If it is not possible to form a regular polygon, the line must contain only the value  $-1$ .

#### Example

**Input :**

```
3
1000 1000 1000
6
1 2 3 1 2 3
3
1 1 2
10
10 40 20 30 30 10 10 50 24 26
```

0

**Output :**

0

2

-1

5

---

Added by: Diego Satoba

Date: 2008-11-23

Time limit: 1s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA C#

Resource: South American Regional Contests 2008

## SPOJ Problem Set (classical)

### 3420. Falling Ice

#### Problem code: FALLINGI

Imagine disks of ice falling, one at a time, into a box, each ending up at the lowest point it can reach without overlapping or moving previous disks. Each disk then freezes into place, so it cannot be moved by later disks. Your job is to find the overall height of the final combination of disks.

So that the answer is unique, assume that any disk reaching the bottom of the box rolls as far to the left as possible. Also the data is chosen so there will be a unique lowest position for any disk that does not reach the bottom. The data is also such that there are no "perfect fits": each disk that lands will be in contact with only two other points, on previous circles or the sides of the box. The illustrations above show white filled disks labeled with the order in which they fall into their boxes. The gray circle in the fourth illustration is not intended to be a disk that fell in. The gray disk is included to demonstrate a point: the gray disk is the same size as disk 2, so there is space for disk 2 on the very bottom of its box, but disk 2 cannot reach that position by falling from the top. It gets caught on disk 1 and the side of the box.

One way to find the top intersection point of two intersecting circles is as follows. Suppose circle 1 has center  $(x_1, y_1)$  and radius  $r_1$ , and suppose circle 2 has center  $(x_2, y_2)$ , and radius  $r_2$ . Also assume that circle 1 is to the left of circle 2, i.e.,  $x_1 < x_2$ . Let

$$\begin{aligned}dx &= x_2 - x_1, \\dy &= y_2 - y_1, \\D &= \sqrt{dx^2 + dy^2}, \\E &= (r_1^2 - r_2^2 + D^2)/(2D), \\F &= \sqrt{r_1^2 - E^2};\end{aligned}$$

then the upper intersection point is  $(x_1 + (E \cdot dx - F \cdot dy)/D, y_1 + (F \cdot dx + E \cdot dy)/D)$ .

#### Input

The input consists of one or more data sets, followed by a line containing only 0 that signals the end of the input. Each data set is on a line by itself and contains a sequence of three or more blank-separated positive integers, in the format  $w, n, d_1, d_2, d_3, \dots, d_n$ , where  $w$  is the width of the box,  $n$  is the number of disks, and the remaining numbers are the diameters of the disks, in the order in which they fall into the box. You can assume that  $w < 100$ , that  $n < 10$ , and that each diameter is less than  $w$ .

#### Output

For each data set, output a single line containing the height of the pile of disks, rounded to two places beyond the decimal point.

The example data matches the illustrations above.

## Example

### Input :

```
10 3 5 2 3
8 2 5 5
11 3 10 2 4
9 3 4 4 6
10 6 5 4 6 3 5 2
0
```

### Output :

```
5.00
9.00
12.99
9.58
14.19
```

---

Added by: Nikola P Borisov

Date: 2008-11-24

Time limit: 60s

Source limit:50000B

Languages: All

Resource: Mid-Central Regional ACM-ICPC Contest 2006

## SPOJ Problem Set (classical)

### 3426. Ouroboros Snake

#### Problem code: OROSNAKE

Ouroboros is a mythical snake from ancient Egypt. It has its tail in its mouth and continuously devours itself.

The Ouroboros numbers are binary numbers of  $2^n$  bits that have the property of "generating" the whole set of numbers from 0 to  $2^n - 1$ . The generation works as follows: given an Ouroboros number, we place its  $2^n$  bits wrapped in a circle. Then, we can take  $2^n$  groups of  $n$  bits starting each time with the next bit in the circle. Such circles are called Ouroboros circles for the number  $n$ . We will work only with the smallest Ouroboros number for each  $n$ .

Example: for  $n = 2$ , there are only four Ouroboros numbers. These are 0011;0110;1100; and 1001. In this case, the smallest one is 0011. Here is the Ouroboros circle for 0011:

[IMAGE]

The table describes the function  $o(n;k)$  which calculates the  $k$ -th number in the Ouroboros circle of the smallest Ouroboros number of size  $n$ . This function is what your program should compute.

#### Input

The input consists of several test cases. For each test case, there will be a line containing two integers  $n$  and  $k$  ( $1 \leq n \leq 15$ ;  $0 \leq k < 2^n$ ). The end of the input file is indicated by a line containing two zeros. Don't process that line.

#### Output

For each test case, output  $o(n;k)$  on a line by itself.

#### Example

**Input :**

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

**Output :**

```
0
1
3
2
```

---

Added by: Daniel Gómez Didier  
Date: 2008-11-24  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: PUJ Internal Contest



## SPOJ Problem Set (main)

### 3436. Histogram

#### Problem code: HIST2

In statistics, a histogram is a graphical display of tabulated frequencies, shown as bars. It shows what proportion of cases fall into each of several categories. It is a polygon composed of a sequence of rectangles aligned at a common base line. In this problem all rectangles have a width of unit length. But their heights are distinct. Some permutation of the heights will give the maximum perimeter. Your task is to find the maximum perimeter of the histogram and the number of permutations that give the maximum perimeter.

[IMAGE]

In the image Figure (a) shows a histogram with heights {1,2,3,4} (1st sample testcase) and has a perimeter of 16 units. Figure (b) shows one of the permutations {3,1,2,4} having the maximum perimeter of 20 units.

#### Input

Input consists of multiple test cases. Each test case describes a histogram and starts with an integer  $N$ ,  $2 \leq N \leq 15$ , denoting the number of rectangles it is composed of. Next line consists of  $N$  space separated positive integers representing the heights of the rectangles. All heights are distinct and less than or equal to 100.  $N=0$  indicates the end of tests. There are atmost 50 test cases.

#### Output

For each test case output the maximum possible perimeter of the histogram and the number of permutations that give maximum perimeter in a single line, separated by a single space.

#### Example

**Input :**

```
4
1 2 3 4
3
2 6 5
0
```

**Output :**

```
20 8
24 2
```

---

Added by: u.swarnaprakash  
Date: 2008-11-29  
Time limit: 4s  
Source limit:50000B  
Languages: All  
Resource: Kurukshetra 09 OPC

## SPOJ Problem Set (classical)

### 3459. SkyScrapers

#### Problem code: CEPC08B

In a seaside village, there is an avenue of skyscrapers. Each skyscraper is 100m wide and has certain height. Due to very high price of parcels, any two consecutive skyscrapers are adjacent. The avenue lies close to the beach so the street is exactly at the sea level. Unfortunately, this year, due to the global warming, the sea level started to increase by one meter each day. If the skyscraper height is no greater than the current sea level, it is considered flooded. A region is a maximal set of non-flooded, adjacent skyscrapers. This term is of particular importance, as it is sufficient to deliver goods (like current, carrots or cabbages) to any single skyscraper in each region. Hence, the city major wants to know how many regions there will be in the hard days that come. An example of an avenue with 5 skyscrapers after 2 days is given below.

[IMAGE]

#### Input

The input contains several test cases. The first line contains an integer  $t$  ( $t \leq 15$ ) denoting the number of test cases. Then  $t$  test cases follow. Each of them begins with a line containing two numbers  $n$  and  $d$  ( $1 \leq n, d \leq 10^6$ ),  $n$  is the number of skyscrapers and  $d$  is the number of days which the major wants to query. Skyscrapers are numbered from left to right. The next line contains  $n$  integers  $h_1, h_2, \dots, h_n$  where  $1 \leq h_i \leq 10^9$  is the height of skyscraper  $i$ . The third line of a single test case contains  $d$  numbers  $t_j$  such that  $0 \leq t_1 < t_2 < \dots < t_{d-1} < t_d \leq 10^9$ .

#### Output

For each test case output  $d$  numbers  $r_1, r_2, \dots, r_d$ , where  $r_j$  is the number of regions on day  $t_j$ .

#### Example

**Input :**

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

**Output :**

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

---

Added by: Robert Rychcicki  
Date: 2008-12-06  
Time limit: 10s  
Source limit: 50000B  
Languages: All  
Resource: Central European Regional Contest 2008

## SPOJ Problem Set (classical)

### 3461. Song Contest

#### Problem code: SONG

Every year, the continent of Cacophonea organises the Cacophonean Song Contest, for which each of its nations presents an act by a national singer or group. Each Cacophonean inhabitant may televote for any act which is not from his nation, so a nation can never vote for its own act. In the end, each of the  $s$  Cacophonean nations will award points to  $r$  acts. The act which received most votes from a certain nation will get  $r$  points from this nation, the act with the second largest amount of votes will get  $r - 1$  points, etc., so the act with the  $r$ th largest amount of votes gets 1 point and less popular acts get no points from the voting nation. The final ranking of the song contest will then be decided by the total amount of points each nation received.

Music producer Dustin has been eagerly following the Cacophonean Song Contest for many years. Lately, he has observed that in certain nations, televotes are politically rather than artistically motivated:

(1) Politically voting nations prefer acts from neighbouring nations. More specifically, the Euclidean distance between their capital and another nation's capital is their popularity measure, irregardless of the artistic quality of the corresponding act. Hence, the nation with the closest capital will get most votes and the nation with the farthest capital will receive the least votes, which could yield no points at all if  $r < s - 1$ . It will never occur that two or more capitals will have the same distance to a certain capital.

(2) Nations that vote quality-motivated will, as the name suggests, award points to nations according to an indisputable act ranking based on each act's artistic quality. In this ranking, there will be no ties so each nation has its own unique rank.

However, Dustin has heard he can influence the voting behaviour of other nations: an artist can find favour of politically voting nations by giving them special attention during his act (e.g. by singing parts in their local dialects, waving their flags, etcetera). The more a politically voting nation will receive such attention in an act, the higher it will rank it. Of course this will be at the cost of the original act and might result in terribly campy results. Therefore, nations that vote according to artistic quality will punish such behaviour.

More specifically, Dustin can divide an act into exactly  $s - 1$  parts. Originally, all parts are dedicated to the nation of the performer (i.e. they reflect his original artistic ideas), but this can be changed:

(1) For each part in the act that will be dedicated to a certain politically voting nation, that nation will rank the performer's nation one place higher (unless the performer's nation is already ranked first). As each nation has a unique ranking position, the nation that originally was at that higher rank will then be ranked one place lower.

(2) Quality-motivated voting nations do not like these soft-soaping attempts at all. Therefore, for each part in the act that will be dedicated to a nation which is not the original performer's nation, quality-motivated nations will rank the original performer's nation one place lower (unless the performer's nation is already ranked lowest).

Only the fact that a certain amount of parts is dedicated to a certain nation will influence voting behaviour: the exact part dedication sequence in the total act is not of interest here.

Dustin wants to use this knowledge (which no other Cacophonean producer has) to produce a smashing act, yielding as much points in the overall results as possible. You are asked to determine what the largest possible overall point score is he can obtain for an act, when he optimally exploits the described act-changing practices.

## Input

The first line of input consists of the integer number **n**, the number of test cases;

Then, for each test case:

A line with an integer number **s** ( $1 < s \leq 100$ ), indicating the number of participating nations in the song contest;

Then, for each nation:

(1) A line containing:

(1.1) A string **c** (not containing any spaces) with the nation's name, followed by a space. Within a test case, there will not be multiple nations sharing the same name;

(1.2) A character indicating the nation's voting behaviour: *q* if the voting behaviour is quality-motivated and *p* if the behaviour is politically motivated.

(2) A line containing:

(2.1) The location of the nation's capital, expressed in an (x, y) integer coordinate ( $-10000 \leq x \leq 10000$ ,  $-10000 \leq y \leq 10000$ ). x and y are separated by a space. Furthermore, y is followed by a space;

(2.2) The actual artistic quality rank **q** of the nation's act. This is a unique number in the range 1...s.

After description of each nation:

A line with an integer number **r** ( $0 < r \leq s - 1$ ), indicating to how many nations each nation will attribute points;

A line with the name of the nation for which Dustin should produce a song, achieving as much points as possible.

## Output

For each test case, the output contains a single line with a single integer number: the maximal amount of points an act can obtain in the overall final score, if act-changing practices were performed in an optimal way.

## Example

### Input :

```
2
3
Aulatrias q
0 0 1
Binen q
5 0 2
Cahin q
0 -4 3
2
Cahin
3
Aulatrias p
0 0 1
Binen p
5 0 2
Cahin p
0 -4 3
2
Binen
```

### Output :

```
2
4
```

---

Added by: Blue Mary

Date: 2008-12-07

Time limit: 1s

Source limit:50000B

Languages: All except: C99 strict

Resource: Benelux Algorithm Programming Contest 2008

## SPOJ Problem Set (classical)

### 3462. The Skatepark's New Ramps

#### Problem code: RAMP

The local skating park has been given a financial incentive by the city to make the park interesting for skaters of all levels. The park wants to use the incentive to build a series of ramps, somewhat resembling a mountain range. When talking to some of the volunteers in the committee responsible for the project, you find out they're having difficulties deciding about the best configuration of the ramps. They know the number of ramps to be built, and for each ramp they agree on the range of the height for that ramp. They are still discussing exactly how high each ramp should be, since they can't afford to have them all at their highest, but they do want to spend all of the budget. This is the most important issue in the debate: they can't agree whether they want the differences between the ramps to be small, to give the full ride a more consistent feeling, or as big as possible, to create a more diverse set of challenges.

You also notice they don't really have a good idea what the possibilities are, leaving them stranded in 'what-if' discussions. You decide to help them out by showing them the options they have, both the ones where the difference between the highest and lowest ramp is kept as small as possible, as well as the one where that difference is as much as possible. Since the committee is mainly bickering over the allowable differences, you decide to start out by just presenting them the minimum and maximum difference between the highest and lowest ramp. Luckily, the park has a lot of space, so you won't need to take the placement of the ramps into account. All ramps have the same inclination, which is such that a ramp of height  $h$  will have a length  $4h$  (measured flat, not over the ramp).

#### Input

The first line of input consists of the integer number  $n$ , the number of test cases. For each test case:

A line with the integer number  $r$  ( $2 \leq r \leq 10000$ ), the number of ramps the park will place;

A line with the integer number  $m$  ( $0 \leq m \leq 200000000$ ), the number of cubic meters of concrete the park has money for;

$r$  lines with two numbers,  $l$  and  $t$  ( $0.00 \leq l \leq t \leq 100.00$ ), separated by one space, the minimum and maximum height in meters of the  $r$ -th ramp.

You may assume all ramps are made entirely of concrete, and shaped as 1 meter wide prisms, with a triangle with two equal sides as base. A series of ramps within the given constraints and using all concrete is guaranteed to exist.

#### Output

For each test case, the output contains one line with two numbers, separated by one space: the minimum difference between the highest and lowest ramp and the maximum difference between the highest and the lowest ramp. These numbers are rounded to two decimals.



## Example

**Input :**

```
1
3
36
1.00 4.00
1.00 4.00
1.00 4.00
```

**Output :**

```
0.00 3.00
```

---

Added by: Blue Mary

Date: 2008-12-07

Time limit: 1s

Source limit:50000B

Languages: All except: C99 strict

Resource: Benelux Algorithm Programming Contest 2008

## SPOJ Problem Set (classical)

### 3463. Robintron

#### Problem code: ROBIN

It is during the great war in the year 2240 that the Robinson family decides to leave the human empire, in search for more peaceful and quiet places. The Robinsons already have a planet in mind to which they wish to travel and want to get there as soon as possible. However, because all vehicles capable of spaceflight are being used for the war, the Robinson family has no way to escape to other planets by means of ordinary spaceflight. It is therefore that Joe Robinson, the father of the family, created the Robintron. The Robintron is a vehicle that is capable of travelling from one planet's surface to another by only using the forces of gravity.

It is the gravitational pull of a planet that keeps the Robintron on a planet's surface. This pull extends as far as the planet's gravity well, a circular area around the center of the planet, which is generated by the planet's mass. However, these gravity wells can also be used to assist the Robintron in leaving a planet by the way of planet hopping. Planet hopping can be performed when the Robintron is on the surface of a planet and comes within the area of another planet's gravity well. The Robintron uses the other planet's gravity well to gain enough momentum to escape into space, and to land on the other planet's surface. Leaving a planet and subsequently landing on another one takes no significant amount of time.

Planet hopping has some disadvantages. The Robintron must be within the gravity well of a planet other than the one it resides on, to be able to effectively use it for planet hopping. However, as the planets rotate around a star (which they all do in perfectly circular orbits), their position continuously changes according to their rotational speed. Thus, it can take up some time for the Robintron to enter the gravity well of a particular planet. Also, as soon as the Robintron chooses to enter the gravity well of a planet, it will move along with that planet around the star. Therefore, this could mean that another planet's gravity well may never come in reach of the Robintron.

Given a list of planets in a star system, a starting position and destination, write a program that determines how many days it will take (using the ceiling function, i.e.  $\text{ceiling}(2.3) = 3$ ) for the Robintron to travel to its destination, given that it travels via the fastest route possible.

Because in most star systems all planets are positioned around the star in a disc, only two dimensions have to be taken into account. Also, a planet is assumed to be a single point in space, and the Robintron's coordinates are equal to those of the planet it resides on.

#### Input

The first line of input consists of the integer number  $n$ , the number of test cases;

Then, for each test case:

A line containing the positive integer number  $m$  ( $0 < m < 1000$ ), the number of planets in the star system (excluding the star which always resides at position  $[0, 0]$ );

Per planet a line containing 4 floating-point numbers  $x$  ( $-1e10 \leq x \leq 1e10$ ) and  $y$  ( $-1e10 \leq y \leq 1e10$ ), the x-coordinate and y-coordinate of the planet relative to the star at the start of the Robintron's journey respectively;  $r$  ( $0 < r \leq 1e5$ ) the radius of the planet's gravity well and  $s$  ( $0 \leq s \leq 2 * \text{Pi}$ ) the speed, in radians per day, at which the planet rotates (counterclockwise) around the central star. The numbers are separated by a space.

The Robintron's journey always starts at the first listed planet and its destination is always the last listed planet, which is always reachable from the Robintron's starting position. The star (at position [0, 0]) is too hot for the Robintron and cannot be used for planet hopping.

## Output

For each test case, the output consists of a line with one integer number: the number of days (rounded up, or 0 if the Robintron can reach its destination immediately) that the Robintron must travel to reach its destination.

## Example

**Input :**

```
2
3
10.0 0.0 1.0 1.570796325
-13.0 0.0 3.1 3.14159265
17.0 0.0 4.1 0.0
5
10.0 0.0 1.1 1.0
12.0 0.0 1.1 2.0
13.0 0.0 1.1 1.0
0.0 11.0 1.1 3.14159265
14.0 0.0 1.1 1.0
```

**Output :**

```
3
7
```

---

Added by: Blue Mary

Date: 2008-12-07

Time limit: 1s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Benelux Algorithm Programming Contest 2008

## SPOJ Problem Set (classical)

### 3465. Drive through MegaCity

#### Problem code: DRIVE

MegaCity of the future is a rectangular grid of streets. Each intersection has integer Cartesian coordinates  $x$  and  $y$ . To get from intersection  $a$  with coordinates  $x_a, y_a$  to intersection  $b$  with coordinates  $x_b, y_b$  you need to drive exactly  $|x_a - x_b| + |y_a - y_b|$  blocks. Usually, it takes 10 time units to drive one block, so one can easily compute the time it takes to get from  $a$  to  $b$ . However, traffic jams that occur in MegaCity turn estimation of minimal driving time into a complex problem that you have to solve.

Traffic jams in MegaCity affect a rectangular area that is specified by coordinates of its bottom-left and top-right corners. The time to travel one block in the traffic jam is specified. All streets that are strictly inside the rectangular region are affected by the traffic jam. Sometimes, it is better to drive around the traffic jams to save time, but sometimes it is better to drive through some traffic jams as shown in the example - 17 blocks are driven outside of traffic jams, taking 10 time units per block, and 2 blocks in the light traffic jam with 11 time units per block.

[IMAGE]

#### Input

Multiple test cases. The number of them is given in the very first line. For each test case:

The first line contains four integer numbers  $x_a, y_a, x_b$  and  $y_b$ , coordinates of the start and finish intersections. The second line contains a single integer number  $n$  ( $0 \leq n \leq 1000$ ) which specifies the number of traffic jams. The following  $n$  lines describe traffic jams. Each traffic jam is described by five integer numbers  $x_{1,i}, y_{1,i}, x_{2,i}, y_{2,i}$  and  $t_i$ , where first four numbers are coordinates of the bottom-left and top-right corners of the jammed area ( $x_{1,i} < x_{2,i}, y_{1,i} < y_{2,i}$ ), and  $t_i$  ( $10 < t_i \leq 10^8$ ) is the time it takes to travel one block inside this traffic jam. All coordinates are from 0 to  $10^8$  inclusive. Areas of traffic jams neither intersect nor touch each other. Start and finish points are different and do not lie inside nor on the border of any traffic jam.

#### Output

For each test case:

A single integer - the minimal driving time from intersection  $a$  to intersection  $b$ .

#### Example

**Input :**

```
1
1 6 15 3
4
2 1 3 7 44
5 2 10 4 33
```

```
8 5 11 9 22
12 1 14 8 11
```

**Output :**  
192

**Warning: A naive algorithm may not run in time!**

Note: In Sphere Online Judge system, "Memory Limit Exceeded" will be shown as "Runtime Error(other)", with the 0.00 second run-time & 92-200k memory used, or "Runtime Error(SIGSEGV)" with 250M memory used.

---

Added by: Blue Mary  
Date: 2008-12-07  
Time limit: 60s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: ACM Northeastern European Regional Contest 2008

## SPOJ Problem Set (classical)

### 3476. Deposit

#### Problem code: DEPOSIT

Banks offer deposit schemes of various kinds to attract customers. In an  $r$ -year progressively reducing recurring deposit scheme (PRRDS) of a bank, a customer is required to deposit progressively reducing amounts every year for  $r$  years. Depending on the duration  $r$  of the scheme and the total amount  $T$  deposited in  $r$  years, the bank offers to return on maturity, i.e., after the expiry of  $r$  years, an amount  $R$ , which is equal to  $k$  times the amount deposited in the first year. The bank ensures that the return  $R$  looks attractive by making a suitable choice of  $k$ ;  $k$  being a natural number.

In a PRRDS, the amount to be deposited in each but the last two years is exactly equal to the sum of amounts to be deposited in the next two years. The amounts to be deposited in the last two years, say  $x$  in the last year and  $y$  in the last but one year, are progressively reducing ( $x, y > 0; y > x$ ) and are determined so that the total amount deposited in  $r$  years is exactly equal to the specified amount  $T$ . Assume that all deposits are in whole number of Rupees.

Write a program for the bank, so that given  $r$ ,  $k$  and  $T$ , the program computes  $x$  and  $y$  for which the return  $R$  is maximum. For example in a 4-year scheme with  $r = 4$ ,  $k = 3$  and  $T = 500$ , the progressively reducing recurring deposits 248, 126, 122 and 4, ensures the maximum return  $R = 744$  with  $x = 4$  and  $y = 122$ .

#### Input

The input may contain multiple test cases.

For each test case there is only one input line. The line gives values of  $r$ ,  $k$  and  $T$ . Assume that  $r$  is not greater than 20.

A line containing a zero '0' as the first character follows the last case.

#### Output

For each test case there is only one output line. The line gives the computed values of  $x$ ,  $y$  and  $R$ .

#### Example

##### Input

```
4 3 500
5 3 10000
6 4 8000
8 5 12000
0
```

##### Output

```
4 122 744
5 1425 12855
1 666 13332
1 363 23635
```

---

Added by: Walrus  
Date: 2008-12-09  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: ACM Kanpur 2007

## SPOJ Problem Set (classical)

### 3477. Baby

#### Problem code: BABY

A baby tries to solve the well-known eight-queen puzzle: the problem of placing eight chess queens on an 8×8 chessboard so that no two queens share the same row, column, or diagonal. The baby understands the concept of row and column quite well but diagonal is not very clear to her. As a result she succeeds placing eight queens on the board so that no two queens share the same row or column but there remains the possibility that some queens share the same diagonal.

Given baby's queens (a solution by the baby) and a valid eight-queen solution, it is possible to move baby's queens to positions of queens in the valid solution. Assume that in a single move, a queen can be moved one unit row-wise or column-wise into an unoccupied position.

Write a program to find the minimum number of moves required to move baby's queens to positions of queens in the valid solution. The program should be usable for a more general n -queen puzzle where n queens are placed on an n×n chessboard,  $4 \leq n \leq 16$ . Assume that rows and columns of the chessboard are numbered 1, 2,..., n .

#### Input

The input consists of multiple test cases.

Each case begins with a line containing the integer n .

Each of the next two lines contains a sequence of n integers. Integers in the first line represent column numbers of baby's queens appearing in rows 1, 2,..., n respectively. In the same way, the second line contains column numbers of queens in the given valid solution. A space separates two consecutive integers in the sequence.

A line containing a zero '0' as the first character follows the last case.

#### Output

For each test case, print the minimum number of moves required.

#### Example

##### Sample Input

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



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

**Sample Output**

```
6
2
0
8
```

---

Added by: Walrus  
Date: 2008-12-09  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: ACM Kanpur 2007

## SPOJ Problem Set (classical)

### 3483. Begin

#### Problem code: BEGIN

Begin a sequence of distinct natural numbers  $N_i$ ,  $i = 0, 1, 2, \dots$ , with the number  $B$  ( $= N_0$ ); generate numbers  $N_i$ ,  $i = 1, 2, \dots$ , recursively and end the sequence with the last generated number  $E$ . The characteristic of numbers and the process for generation are stated below:

\* Each number in the sequence contains an even number of decimal digits and is of the form  $f_1d_1f_2d_2f_k\dots d_k$  where  $d_1, d_2, \dots, d_k$ , are  $k$  distinct digits in increasing order and each  $f_j$  is a non-zero digit.

\* For  $i = 0, 1, 2, \dots$ , if  $N_i = f_1d_1f_2d_2\dots f_kd_k$  then  $N_{i+1} = F_1D_1F_2D_2\dots F_KD_K$ , where  $K \geq k$ ;  $D_1, D_2, \dots, D_K$ , are distinct digits that occur in  $N_i$  and appear in increasing order in  $N_{i+1}$ ; and  $F_J$  is the frequency of  $D_J$  in  $N_i$ , for  $J = 1, 2, \dots, K$ . For example if  $N_i = 102335$  then  $N_{i+1} = 1011122315$ .

Write a program to find for a given  $E$ , the longest sequence of numbers that ends with  $E$  and begins with the smallest  $B$ .

Again consider an example; if  $E = 1011122315$  then the required sequence of numbers is 303355 103325 1011122315.

#### Input

The input may contain multiple test cases.

Each test case contains only one input, viz.,  $E$ .

The input terminates when a line containing 0 appears as a test case.

#### Output

For each test case, print the longest sequence of numbers that ends with  $E$  and begins with the smallest  $B$ . Use space to separate two consecutive numbers in the sequence.

#### Example

##### Sample Input

```
1011122315
22
112213
0
```

##### Sample Output

```
303355 103325 1011122315
22
13 1113 3113 2123 112213
```

---

Added by: Walrus  
Date: 2008-12-09  
Time limit: 1s-10s  
Source limit:50000B  
Languages: All  
Resource: ACM Kanpur 2006

## SPOJ Problem Set (classical)

### 3484. Crossbits

#### Problem code: CROSSBIT

Crossbits are like Crosswords; instead of entering words you enter binary bits 01 in a Crossbit under certain given conditions, assuming that a solution exists. An empty Crossbit of size  $N$  is an empty grid of size  $N \times N$ .

Given a natural number  $N$ , consider entering  $N^2$  binary bits in an empty Crossbit, satisfying the following conditions:

- Each square in the grid contains either a 0-bit or a 1-bit with no 1-bit in two major diagonals.
- The total number of 1-bit in each row / column is exactly equal to  $K$ ,  $K$  being a given natural number less than  $N$ .
- A 0-bit has at least another adjacent 0-bit either in the same row or in the same column.
- The Crossbit represents the  $N^2$ -bit binary number  $B$  formed by placing bits in the 1st, the 2nd, ... the  $N$ th row from left to right.

You are required to write a program that enters bits in an empty Crossbit so that the Crossbit represents the least binary number  $B$  for given  $N$  and  $K$ .

As an illustration consider the case with  $N = 4$  and  $K = 1$ . The Crossbit shown below represents the least binary number  $B = 0010100000010100$  of 16 bits satisfying the specified conditions.

0	0	1	0
1	0	0	0
0	0	0	1
0	1	0	0

#### Input

The input may contain multiple test cases.

For each test case parameters  $N$  and  $K$  of the Crossbit are given in one line. Assume that  $N$  does not exceed 10.

The input terminates with a line containing 0 as input.

#### Output

For each test case, print the Crossbit in  $N$  rows; each row contains  $N$  bits with a space between two neighbouring bits. Keep a blank line after the last output line of each test case.

## Example

### Sample Input

```
4 1
6 2
0
```

### Sample Output

```
0 0 1 0
1 0 0 0
0 0 0 1
0 1 0 0

0 0 0 1 1 0
1 0 0 1 0 0
0 0 0 0 1 1
1 1 0 0 0 0
0 0 1 0 0 1
0 1 1 0 0 0
```

---

Added by: Walrus

Date: 2008-12-09

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM Kanpur 2006

## SPOJ Problem Set (classical)

### 3486. Elimination

#### Problem code: ELIM

Elimination of contestants from a live IQ contest on a TV channel is decided in phases.

Initially at phase 0,  $N$  contestants, where  $N = 2^n$ ,  $n < 10$ , are selected through a special online IQ contest in which a total of  $M$  ( $M > N$ ) contestants participate. The contestants are identified by distinct registration numbers  $1, 2, \dots, M$ . The selected contestants are ranked distinctly from 1 to  $N$  according to their performance in the online contest. They are qualified to participate in the live contest.

In the  $p^{\text{th}}$  phase,  $p = 1, 2, \dots, n$ ,  $K_p$  contestants participate in the live contest, where  $K_p = 2^{n-p+1}$ . On the basis of response to questions presented during the show,  $K_p/2$  of  $K_p$  contestants are ranked distinctly from 1 to  $K_p/2$ . These  $K_p/2$  contestants qualify to participate in the next phase. At the  $n^{\text{th}}$  phase there are only two contestants and the one selected at this phase is the winner of the contest.

You are required to write a program that identifies the winner of the contest, given the following information:

- INFO\_1: Registration numbers of  $N$  contestants who are selected through the online IQ contest, in order of the rank in the online IQ contest, and
- INFO\_2: A total of  $N - 1$  qualified contestants in different phases;  $K_2$  in phase 1,  $K_3$  in phase 2, ... , and  $K_{n+1}$  in phase  $n$ . Qualified contestants of different phases appear in order of phases, i.e., phase 1, phase 2, ... , phase  $n$ . Further, qualified contestants in a phase, say phase  $p$ , appear in the order of the rank in the phase, i.e., the rank in phase  $p$ . A qualified contestant of a phase, say phase  $p$ , is identified by his/her rank in the previous phase, i.e., in phase  $p - 1$ .

## Input

Input may contain multiple test cases. For each case there are two input lines.

The first line gives  $N$  integers representing INFO\_1 while the second line gives  $N - 1$  integers representing INFO\_2.

In each input line integers are separated by space. The input terminates with a line containing 0 as input.

## Output

For each test case there is only one output line. The line prints the registration number of the winner of the contest.

## Sample Input

```
23 18 6 20
4 2 2
29 57 4 33 5 12 16 18
7 1 5 3 2 1 1
0
```

## Sample Output

```
18
29
```

---

Added by: Walrus  
Date: 2008-12-09  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ACM Kanpur 2006

## SPOJ Problem Set (classical)

### 3488. The Top-Code

#### Problem code: TOPCODE

A word is a string of two or more letters while a code is a string of one or more distinct words in lexicographic order. Thus a string of letters may represent either a word or a code. An optimum code is a code that contains the maximum number of words.

For a given string of letters there may be one or more optimum codes. The optimum code of top priority is the optimum code that appears at the top when all optimum codes are arranged in lexicographic order.

Given a string of letters, you are required to write a program that finds the following:

- The total number of words,  $m$  in an optimum code,
- The total number of optimum codes,  $n$  represented by the string,
- The optimum code of top priority, the top-code.

## Input

Input consists of multiple test cases.

For each test case there is only one line of input. It contains a string of at most 100 letters.

A line consisting of a single letter terminates input.

## Output

For each test case, present output in two lines.

The first line gives the two integers  $m$  and  $n$  defined above. The next line gives the optimum code of top priority, the top-code.

## Sample Input

```
aaaaaa
words
lexicographic
a
```

## Sample Output

```
2 1
aa aaaa
```



1 1  
words  
3 2  
lexic og raphic

---

*Kanpur-Kolkata 2004-2005*

---

Added by: Walrus  
Date: 2008-12-09  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ACM Kanpur 2004

## SPOJ Problem Set (classical)

### 3490. Hidden Triangle

#### Problem code: HIDTRI

Assume that each '0' or '1' in the array represents a point on a plane and the distance between each pair of neighbouring points row wise or column wise is unity. Assume further that every neighbouring pair of 1's, row wise, column wise or diagonally is connected by a line segment. Two line segments emerging from a point, either join together to form a longer line segment or form an angle of  $45^\circ$ ,  $90^\circ$  or  $135^\circ$ , thus forming right-angled isosceles triangles. The existence of hidden right-angled isosceles triangles in an array is illustrated in the figure below.

`\epsfbox{p3258.eps}`

## Input

Input consists of multiple test cases.

For each test case the first line gives three integers: the case number  $k$ , the number of rows  $m$  and the number of columns  $n$  of the given array. A space appears between two neighbouring integers.

Each of the next  $m$  lines gives a string of 0's and 1's of length  $n$ ; the  $i$ -th line gives the  $i$ -th row of the array.

Input terminates with a value zero for case number  $k$ .

## Output

For each test case, display output in one line. The line contains the case number  $k$  and the area of the largest right-angled isosceles triangle hidden in the array. The area is a real number with one digit after the decimal point. If a triangle does not exist then output '0.0' as the area.

## Sample Input

```
1 3 3
101
100
101
2 4 6
001001
010101
111111
000001
0
```

# Sample Output

```
1 0.0
2 4.0
```

---

*Kanpur-Kolkata 2004-2005*

---

Added by: Walrus  
Date: 2008-12-09  
Time limit: 1s-3s  
Source limit:50000B  
Languages: All  
Resource: ACM Kanpur 2004

## SPOJ Problem Set (classical)

### 3492. Braille Transcription

#### Problem code: BRAILLE

Visually handicapped people use Braille system of codes for reading and writing. The basic Braille symbol (or cell) is composed of six dots arranged in two vertical columns, each column being three dots high. This pattern produces 64 one-cell symbols with character index  $\#(2^0 a_1 + 2^1 a_2 + 2^2 a_3 + 2^3 a_4 + 2^4 a_5 + 2^5 a_6)$ , where  $a_i = 1$ , if dot  $i$  is embossed up and zero otherwise. The positions of these dots are numbered as follows:

A cell without numbers    A cell with numbers

`\epsfbox{p3254.eps}`

Many Braille codes are in use; one such is the Simple Braille System (SBS). In SBS alphabets in lower case are default characters; letters 'a, b,..., z' have character indices '1, 2, ..., 26' respectively. The "letter sign" (dots 5-6) may be used optionally before a string of alphabets in lower case. Each numeric digit 0-9 requires one cell, with character index the digit itself. However the "number sign" (dots 3-4-5-6) is added before a string of numerals. In order to revert back to normal alphabets after a string of numerals, the "letter sign" is used. The blank cell is used as a space in alphabetic context and zero in numeric context. For example the numerals 1 - 10 are the same as the first ten letters of the alphabet, index of #a being 1 and #j being 10. SBS allows the contraction of 'th', by a single cell with dots 1-4-5-6. A two-cell contraction for 'tion' is allowed with dots 5-6 and dots 1-3-4-5.

There are no single-cell codes for capital letters in SBS. So a "capital sign" (dot 6) is inserted before a capital letter. Two "capital signs" are inserted to indicate that the string of alphabets that follows is capitalized. To revert back to normal alphabets (or numerals), the "letter sign" (or the "number sign") is used. SBS ignores punctuation marks altogether.

You are required to write a program for SBS transcription that converts an SBS code to English.

## Input

Input consists of multiple test cases.

In each test case there is an SBS code. It is given in three input lines containing a certain number of Braille cells. Each Braille cell is represented by a 3x2 array of 0's and 1's, appearing in an odd and the next even numbered column of the three input lines, where '1' is used for an embossed dot and '0' otherwise.

A line that is not a part of an SBS code, containing a single zero in column 1 terminates input.

# Output

For each test case, output the SBS code in English, in one line. In case the input does not conform to SBS rules stated above output simply the sign ‘?’.

# Sample Input

```
110010
011100
011110
110110
010100
011110
000011
000101
010110
00001110
00000100
01010110
0
```

# Sample Output

```
?
th5
Tion
THE
```

---

*Kanpur-Kolkata 2004-2005*

---

Added by: Walrus  
Date: 2008-12-09  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ACM Kanpur 2004

## SPOJ Problem Set (classical)

### 3495. The Nobel Thief

#### Problem code: NBLTHIEF

The Nobel Prize of Kabiguru Rabindranath Thagore was stolen from a museum of Viswa Bharati University in West Bengal. The Central Bureau of Investigation (CBI) has been assigned the job to investigate the crime and recover the prize. CBI has identified some suspects and linked each one of them to a distinct subset of a set of clues.

Let there be  $p$  suspects and  $q$  clues. Integers 1 to  $p$  identify suspects while  $q$  distinct letter-codes identify clues. The clues are of varying importance. The alphabetic order of letter-codes determines the priority order in the clues; letter-codes 'a' to 'z' vary from highest to lowest priority.

Let  $L_0$  be the set of all suspects. Based on a clue ' $\alpha$ ', a subset  $L$  of  $L_0$  may be split into two disjoint subsets  $L_+^\alpha$  and  $L_-^\alpha$ . The subset  $L_+^\alpha$  includes all elements of  $L$  that are linked to a subset of clues containing ' $\alpha$ ' and  $L_-^\alpha$  includes all other elements of  $L$ . Let  $n$ ,  $n_+^\alpha$ , and  $n_-^\alpha$  denote respectively the total number of elements in  $L$ ,  $L_+^\alpha$  and  $L_-^\alpha$ . The discriminatory power of a clue ' $\alpha$ ' to discriminate suspects in  $L$  is defined by  $\Delta_\alpha(L) = (n_+^\alpha - n_-^\alpha)$ .

Let  $L^*$  denote a set of disjoint subsets of  $L_0$ , each subset containing two or more elements. The discriminatory power  $\Delta_\alpha(L^*)$  of a clue ' $\alpha$ ' to discriminate suspects in subsets contained in  $L^*$  is defined to be the sum of all  $\Delta_\alpha(L)$ 's corresponding to each subset in  $L^*$ .

CBI wants to select a set  $D$  of dominant clues so that the presence or absence of some or all of these clues can identify each suspect uniquely. The selection is to be done in stages.

Let  $L^*$  contain only  $L_0$  initially. At each stage of selection a clue ' $\beta$ ' with highest discriminatory power  $\Delta_\beta(L^*)$  is selected. Selecting the clue ' $\beta$ ' with highest priority breaks tie, if any. After a selection of ' $\beta$ ' each  $L$  in  $L^*$  is split into disjoint subsets  $L_+^\beta$  and ' $L_-^\beta$ ' all resulting subsets with less than two elements are dropped from  $L^*$ . The process of selection continues until  $L^*$  becomes empty. All the clues thus selected form the set of dominant clues  $D$ .

You are required to write a program to find the set of dominant clues  $D$ .

## Input

Input may contain multiple test cases. For each test case input is given in one line. It contains an integer  $k$  representing the case number and a certain number of strings of clues. The  $i$ -th string represents the subset of clues to which the  $i$ -th suspect is linked. A space separates two consecutive fields in input.

Input terminates with an input 0 for the case number  $k$ .

## Output

For each test case, present output in one line. The line contains the case number  $k$  and a string of letters. The letters in the string correspond to the clues in  $D$  and appear in the order of their selection.

## Sample Input

```
1 cbx cpxb bc brc
2 bac adce cbd d
0
```

## Sample Output

```
1 xpr
2 ab
```

---

*Kanpur-Kolkata 2004-2005*

---

Added by: Walrus  
Date: 2008-12-09  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: ACM Kanpur 2004

## SPOJ Problem Set (classical)

### 3543. Matrica

#### Problem code: MATRICA

A matrix is a rectangular table of letters. A square matrix is a matrix with an equal number of rows and columns. A square matrix  $M$  is called symmetric if its letters are symmetric with respect to the main diagonal ( $M_{i,j} = M_{j,i}$  for all pairs of  $i$  and  $j$ ).

For example, the following two matrices are symmetric:

AAB	AAA
ACC	ABA
BCC	AAA

However, the following two are not:

ABCD	AAB
ABCD	ACA
ABCD	DAA
ABCD	

Given a collection of available letters, you are to output a subset of columns in the lexicographically smallest symmetric matrix which can be composed using all the letters. If no such matrix exists, output "IMPOSSIBLE".

To determine if matrix  $A$  is lexicographically smaller than matrix  $B$ , consider their elements in row-major order (as if you concatenated all rows to form a long string). If the first element in which the matrices differ is smaller in  $A$ , then  $A$  is lexicographically smaller than  $B$ .

#### Input

The first line of input contains two integers  $N$  ( $1 \leq N \leq 30000$ ) and  $K$  ( $1 \leq K \leq 26$ ).  $N$  is the dimension of the matrix, while  $K$  is the number of distinct letters that will appear.

Each of the following  $K$  lines contains an uppercase letter and a positive integer, separated by a space.

The integer denotes how many corresponding letters are to be used. For example, if a line says "A 3", then the letter A must appear three times in the output matrix.

The total number of letters will be exactly  $N^2$ . No letter will appear more than once in the input.

The next line contains an integer  $P$  ( $1 \leq P \leq 50$ ), the number of columns that must be output.

The last line contains  $P$  integers, the indices of columns that must be output. The indices will be between 1 and  $N$  inclusive, given in increasing order and without duplicates.



## Output

If it is possible to compose a symmetric matrix from the given collection of letters, output the required columns on N lines, each containing P character, without spaces. Otherwise, output "IMPOSSIBLE" (quotes for clarity).

## Example

**Input :**

```
3 3
A 3
B 2
C 4
3
1 2 3
```

**Output :**

```
AAB
ACC
BCC
```

**Input :**

```
4 5
E 4
A 3
B 3
C 3
D 3
2
2 4
```

**Output :**

```
AC
BE
DE
ED
```

**Input :**

```
4 6
F 1
E 3
A 3
B 3
C 3
D 3
4
1 2 3 4
```

**Output :**

```
IMPOSSIBLE
```

**Warning: large input/output data.**

Note: The test data for this problem consist of the official test cases from the contest, as well some cases of my own.

---

Added by: Neal Wu  
Date: 2008-12-17  
Time limit: 1s-1.5s  
Source limit:50000B  
Languages: All  
Resource: Croatian Open 08/09 - Contest 3

## SPOJ Problem Set (classical)

### 3544. Binary Search Tree

#### Problem code: BST

A binary search tree is a tree in which every node has at most two children nodes (a left and a right child). Each node has an integer written inside it. If the number  $X$  is written inside a node, then the numbers in its left subtree are less than  $X$  and the numbers in its right subtree are greater than  $X$ .

You will be given a sequence of integers between 1 and  $N$  (inclusive) such that each number appears in the sequence exactly once. You are to create a binary search tree from the sequence, putting the first number in the root node and inserting every other number in order. In other words, run `insert (X, root)` for every other number:

```
insert (number X, node N)
    increase the counter C by 1
    if X is less than the number in node N
        if N has no left child
            create a new node with the number X and set it to be the left child of node N
        else
            insert (X, left child of node N)
    else (X is greater than the number in node N)
        if N has no right child
            create a new node with the number X and set it to be the right child of node N
        else
            insert (X, right child of node N)
```

Write a program that calculates the value of the counter  $C$  after every number is inserted. The counter is initially 0.

#### Input

The first line contains the integer  $N$  ( $1 \leq N \leq 300\,000$ ), the length of the sequence.

The remaining  $N$  lines contain the numbers in the sequence, integers in the interval  $[1, N]$ . The numbers will be distinct.

#### Output

Output  $N$  integers, each on its own line, the values of the counter  $C$  after each number is inserted into the tree.

#### Example

**Input :**

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

**Output :**

0  
1  
2  
4  
7  
11  
13  
15

**Warning: large input/output data.**

**Warning: A naive algorithm may not run in time; do not simply implement the above algorithm.**

Note: The test data for this problem consist of the official test cases from the contest, as well some cases of my own.

---

Added by: Neal Wu

Date: 2008-12-17

Time limit: 1s-5s

Source limit:50000B

Languages: All

Resource: Croatian Open 08/09 - Contest 3

## SPOJ Problem Set (classical)

### 3545. Najkraci

#### Problem code: NAJKRACI

A road network in a country consists of  $N$  cities and  $M$  one-way roads. The cities are numbered 1 through  $N$ . For each road we know the origin and destination cities, as well as its length.

We say that the road  $F$  is a continuation of road  $E$  if the destination city of road  $E$  is the same as the origin city of road  $F$ . A path from city  $A$  to city  $B$  is a sequence of road such that origin of the first road is city  $A$ , each other road is a continuation of the one before it, and the destination of the last road is city  $B$ . The length of the path is the sum of lengths of all roads in it.

A path from  $A$  to  $B$  is a shortest path if there is no other path from  $A$  to  $B$  that is shorter in length.

Your task is to, for each road, output how many different shortest paths containing that road, modulo 1 000 000 007.

#### Input

The first line contains two integers  $N$  and  $M$  ( $1 \leq N \leq 1500$ ,  $1 \leq M \leq 5000$ ), the number of cities and roads.

Each of the following  $M$  lines contains three positive integers  $O$ ,  $D$  and  $L$ . These represent a one-way road from city  $O$  to city  $D$  of length  $L$ . The numbers  $O$  and  $D$  will be different and  $L$  will be at most 10000.

#### Output

Output  $M$  integers, each on its own line - for each road, the number of different shortest paths containing it, modulo 1 000 000 007. The order of these numbers should match the order of roads in the input.

#### Example

**Input :**

```
4 4
1 2 5
2 3 5
3 4 5
1 4 8
```

**Output :**

```
2
3
2
1
```

**Input :**

```
5 8
1 2 20
```

```
1 3 2
2 3 2
4 2 3
4 2 3
3 4 5
4 3 5
5 4 20
```

**Output :**

```
0
4
6
6
6
7
2
6
```

Note: The test data for this problem consist of the official test cases from the contest, as well some cases of my own.

---

Added by: Neal Wu  
Date: 2008-12-17  
Time limit: 1s-10s  
Source limit: 50000B  
Languages: All  
Resource: Croatian Open 08/09 - Contest 3

## SPOJ Problem Set (classical)

### 3576. Boy Scouts

#### Problem code: BOYSCOUT

Boy Scouts of New England organize Scout Olympics every year. They ask each team to perform certain tasks, sum up their points, announce winners, and then stay up all night by the fire playing guitar and singing scout songs. This year, Scouts decided to organize the Olympics in one of the most beautiful forests in Maine. There will be only one difficult task. A team picks one tree as a starting point, then goes to another tree in a straight line, then to another, etc. until they come back to the starting one. They win as many points as there are trees on their route. However, they are only allowed to move in a counter-clockwise manner, i.e. after reaching a tree, they can only rotate to the left by less than 180 degrees. Furthermore, when they reach the starting tree again, they should be able to repeat the same route, still going counter-clockwise. More specifically, their path should trace out the boundary of a convex polygon. As they don't bring laptops to the Olympics, the Boy Scouts wants you to compute the maximum possible score a team can achieve.

#### Input

The first line of the input contains a single integer  $N$  ( $3 \leq N \leq 100$ ), which is the number of trees in the forest. Each of the next  $N$  lines contain two real numbers  $x$  and  $y$  separated by a space character ( $-10^6 \leq x, y \leq 10^6$ ), that represent coordinates of one tree. Coordinates are given with at most two decimal digits. There are no three colinear trees.

#### Output

Output one integer, the maximum number of points a team can score, followed by a newline.

#### Example

**Input :**

```
5
0 0
1.5 -0.25
0 -1
-1 0.5
0.5 1
```

**Output :**

```
4
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-12-22

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: MIT Individual Contest 2008

## SPOJ Problem Set (main)

### 3577. Parity

#### Problem code: PARITY

You are given  $n$  binary strings  $s_1, \dots, s_n$ , each of the same length  $m$ . Along with each  $s_i$  you are given a bit  $b_i$ . You are also given some nonnegative integer  $k$  and want to know whether there exists a subset  $S$  of  $\{0, 1, \dots, m-1\}$  of size at most  $k$  such that for each  $i=1, 2, \dots, n$ , the bit  $b_i$  is the XOR of the bits of  $s_i$  at the indices in  $S$ . The  $s_i$  are 0-indexed strings. Recall that the XOR of a set of bits is 1 if the number of bits equal to 1 is odd, else the XOR is 0 (in particular, the XOR of an empty set of bits is 0). For example, if  $s_1 = 1010$  and  $S = \{0, 3\}$ , then  $b_1$  would be 1 (the first bit of  $s_1$ ) XOR'd with 0 (the last bit of  $s_1$ ), which is 1. Given  $n$ ,  $k$ , and the strings  $s_1, \dots, s_n$  and their corresponding  $b_i$ , find a set  $S$  of size at most  $k$  which produces the given  $b_i$ . You should also detect when no such  $S$  exists.

#### Input

The first line contains  $n$  and  $k$ , space-separated ( $1 \leq n \leq 64$ ,  $0 \leq k \leq 10$ ).  $n$  lines then follow, where the  $i$ th line contains  $s_i$ , followed by a space, then  $b_i$ . In a given test case all strings  $s_i$  are of the same length  $m$  ( $1 \leq m \leq 50$ ).  $k$  will not be bigger than  $m$ .

#### Output

If no set  $S$  of size at most  $k$  exists producing the given  $b_i$ , output -1 followed by a newline. Otherwise, on the first line output the size of a possible  $S$ . If the size of that  $S$  is not 0, on the second line, output a space-separated list of the indices in  $S$ , followed by a newline. If there exist multiple valid  $S$  to be output, you can output any one of your choosing.

#### Example

**Input :**

```
3 1
111 1
001 0
011 1
```

**Output :**

```
1
1
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-12-22

Time limit: 5s-30s

Source limit: 50000B

Languages: All

Resource: MIT Individual Contest 2008



## SPOJ Problem Set (main)

### 3578. Hashing

#### Problem code: HASH

Consider the hash function  $h(y) = a*y + b \pmod m$  which maps each integer to some integer between 0 and  $m-1$ . You are given  $x, n, c, d$  and are curious how many of the hash values  $h(x), h(x+1), \dots, h(x+n)$  land in the interval  $[c, d]$ .

#### Input

The first line contains a positive integer  $t$ , the number of test cases ( $1 \leq t \leq 10^5$ ).  $t$  lines then follow, where the  $i$ th line gives the values  $a, b, x, n, c, d, m$ , space-separated, for the  $i$ th test case. All given values are non-negative. Also,  $1 \leq m \leq 10^{15}$ ,  $c \leq d < m$ ,  $a, b < m$ ,  $x+n \leq 10^{15}$ , and  $a*(x+n) + b \leq 10^{15}$ .

#### Output

For each test case in order output the number of  $i$ ,  $0 \leq i \leq n$ , such that  $c \leq a*(x+i) + b \pmod m \leq d$  in that test case, followed by a newline.

#### Example

**Input :**

```
2
2 3 1 3 0 1 7
1 0 0 8 0 8 9
```

**Output :**

```
1
9
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-12-22

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: MIT Individual Contest 2008

## SPOJ Problem Set (main)

### 3579. Disjoint Paths

#### Problem code: DISJPATH

One of your classes has  $K$  students in it who really don't like each other. In fact, they dislike each other so much that they want to find routes to class that don't cross at any intersection so that they won't ever see each other outside of class. Can you find such routes?

#### Input

The input file will contain multiple cases. The first line of each case is  $K\ N$ , where  $K$  is the number of routes you need to find and  $N$  is the number of intersections in MIT's floor plan. The intersections are numbered  $1, \dots, N$ . This is followed by  $N$  lines, one for each intersection, containing the indices of the adjacent intersections, separated by spaces. (This means that if the line for intersection 2 contains a 3, then the line for intersection 3 will contain a 2.) Every intersection is adjacent to at least one other intersection. Each case is followed immediately by the next case. The end of the input is indicated by a line containing only "0 0". You may assume that  $1 \leq K \leq 100$  and  $2 \leq N \leq 5000$ . The students all start at intersection 1 and their class is at intersection 2.

#### Output

For each case, output the case number, in the format "Case #:", followed by a newline. If there are  $K$  non-intersecting routes from the start (1) to the end (2), then this must be followed  $K$  lines, each one giving a list of corners, in order, on one such route from 1 to 2. If not, then output one line with the word "Impossible". Output a blank line after each test case.

#### Example

##### Input :

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

##### Output :

```
Case 1:
1 3 2
1 4 2
```

1 5 2

Case 2:  
Impossible

---

Added by: Jelani Nelson (Minilek)  
Date: 2008-12-22  
Time limit: 30s  
Source limit: 50000B  
Languages: All  
Resource: MIT Individual Contest 2008

## SPOJ Problem Set (main)

### 3581. Tree Similarity

#### Problem code: TREESIM

You are given two labeled and ordered rooted trees  $T$  and  $T'$  and would like to calculate the *distance* from  $T$  to  $T'$ , which is the minimum number of operations you can perform on  $T$  to make it *equivalent* to  $T'$ . For each operation you can choose to do one of three things:

1. change the label of one node in  $T$
2. delete a non-root node in  $T$
3. insert a new node in  $T$  at a position somewhere below its root

Recall the trees  $T$  and  $T'$  are ordered, which means that if a non-leaf node has  $c$  children, its children are ordered from 1 to  $c$ . That is, there is a 1st child, a 2nd child, etc., all the way up to a  $c$ th child. When we say a tree  $X$  is equivalent to a tree  $Y$ , we mean the root of  $X$  should have the same label as the root of  $Y$ , their roots should have the same number of children (call it  $c$ ), and the subtree rooted at the  $i$ th child of the root of  $X$  should be equivalent to the subtree rooted at the  $i$ th child of the root of  $Y$  for  $i=1,2,\dots,c$ . We now describe what we mean by deletion and insertion of non-root nodes in  $T$ . When deleting a non-root node  $w$  with  $d$  children, let  $u$  be its parent and suppose  $w$  is  $u$ 's  $i$ th child. Then the first child of  $w$  becomes  $u$ 's  $i$ th child, the second child of  $w$  becomes  $u$ 's  $(i+1)$ st child, etc. For  $j < i$ , the  $j$ th child of  $u$  remains the same, but for all  $j > i$ , the child which was formerly the  $j$ th child of  $u$  now becomes its  $(j+d-1)$ st child (they get "shifted over" due to the insertion of  $w$ 's children into  $u$ 's child list). To insert a non-root node  $w$  into the tree, we can choose any node  $u$  to be its parent, and we can choose any contiguous subsequence (possibly empty) of  $u$ 's children to become  $w$ 's children, putting  $w$  in their place. When inserting a node, we can give it any label we want at the time of insertion. The root of  $T$  can never be deleted, and you can never insert a new node above the root to become the old root's parent. You can, however, change the label of the root.

[IMAGE]

#### Input

The first line contains  $n$  and  $m$  separated by a space, the sizes of the trees  $T$  and  $T'$ , respectively ( $1 \leq n, m \leq 60$ ). The next  $n$  lines describe  $T$ . On the  $i$ th line is a description of the  $i$ th node in the tree: its label, the number of children it has, then a list of its children in order from first to last, all space-separated. The next  $m$  lines similarly describe  $T'$ . Labels are nonnegative integers fitting in a 32-bit signed integer. The root of each tree is the node which is not the child of any other node in the tree.

#### Output

On a single line output the minimum number of operations that can be performed on  $T$  to make it equivalent to  $T'$ , followed by a newline.

## Example

**Input :**

```
3 2
6 0
1 2 0 2
4 0
2 1 1
4 0
```

**Output :**

```
2
```

---

Added by: Jelani Nelson (Minilek)

Date: 2008-12-22

Time limit: 2s

Source limit:50000B

Languages: All

Resource: MIT Individual Contest 2008

## SPOJ Problem Set (main)

### 3582. Restaurant Tab

#### Problem code: RSTAURNT

After eating dinner at a restaurant with some friends, you determine how much money each person owes. Each of you has some cash and some change, but very few of you have exact change. Can you make change for each other so that each person ends up paying the exact right amount?

#### Input

The input file will contain multiple cases. The first line of each case is  $N$ , the number of people at the table. This is followed by  $N$  lines, one for each  $i$  ( $i \in [1, N]$ ), containing

$x_i$     $c_{i,1}$     $c_{i,5}$     $c_{i,10}$     $c_{i,25}$     $c_{i,100}$     $c_{i,500}$     $c_{i,1000}$     $c_{i,2000}$     $c_{i,5000}$     $c_{i,10000}$

where  $x_i$  is the amount in cents that person  $i$  owes and  $c_{i,v}$  is the number of coins or bills worth  $v$  cents that person  $i$  starts out with. For example, person 1 has  $c_{1,1}$  pennies,  $c_{1,5}$  nickels, etc. Each case is followed immediately by the next case. The end of the input is indicated by a line containing only a zero. You may assume that no person owes more money than they have (i.e.  $x_i \leq \sum_j c_{i,j} \cdot v_j$ ) and that the total amount of money in cents that everyone starts with fits in a signed 32-bit integer. You may also assume that  $N \leq 100000$ .

#### Output

For each case, output the case number, in the format "Case #:" (where # is the case number, starting at 1), followed by a space, followed by "YES" if all of the money can be rearranged so that each person ends up paying the correct amount and "NO" if not.

#### Example

##### Input :

```
1
10 0 0 1 0 0 0 0 0 0 0
2
0 0 0 0 0 2 0 0 0 0 0
500 0 0 0 0 0 1 0 0 0 0
1
100 4 0 2 3 0 1 0 0 0 0
0
```

##### Output :

```
Case 1: YES
Case 2: YES
Case 3: NO
```

---

Added by: Jelani Nelson (Minilek)  
Date: 2008-12-22  
Time limit: 30s  
Source limit: 50000B  
Languages: All  
Resource: MIT Individual Contest 2008

## SPOJ Problem Set (classical)

### 3591. Patting Heads

#### Problem code: PATHEADS

It's Bessie's birthday and time for party games! Bessie has instructed the  $N$  ( $1 \leq N \leq 100,000$ ) cows conveniently numbered  $1..N$  to sit in a circle (so that cow  $i$  [except at the ends] sits next to cows  $i-1$  and  $i+1$ ; cow  $N$  sits next to cow  $1$ ). Meanwhile, Farmer John fills a barrel with one billion slips of paper, each containing some integer in the range  $1..1,000,000$ .

Each cow  $i$  then draws a number  $A_i$  ( $1 \leq A_i \leq 1,000,000$ ) (which is not necessarily unique, of course) from the giant barrel. Taking turns, each cow  $i$  then takes a walk around the circle and pats the heads of all other cows  $j$  such that her number  $A_i$  is exactly divisible by cow  $j$ 's number  $A_j$ ; she then sits again back in her original position.

The cows would like you to help them determine, for each cow, the number of other cows she should pat.

#### Input

- Line 1: A single integer:  $N$ .
- Lines  $2..N+1$ : Line  $i+1$  contains a single integer:  $A_i$ .

#### Output

- Lines  $1..N$ : On line  $i$ , print a single integer that is the number of other cows patted by cow  $i$ .

#### Example

Input :

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

Output :

```
2
0
2
1
3
```

The first cow pats the second and third cows; the second cow pats no cows; etc.

---



Added by: Neal Wu  
Date: 2008-12-26  
Time limit: 5s  
Source limit: 50000B  
Languages: All except: SCALA  
Resource: USACO Dec 2008

## SPOJ Problem Set (classical)

### 3678. Cattle Bruisers

#### Problem code: CATTLEB

Canmuu is out for revenge after being utterly defeated by Bessie in paintball and has challenged Bessie to a video game.

In this game, Bessie starts out at point  $(BX, BY)$  in the coordinate grid  $(-1,000 \leq BX \leq 1,000; -1,000 \leq BY \leq 1,000)$ , and tries to escape, starting at time 0. She moves continuously at a velocity of  $(BVX, BVY)$  units/second  $(-100 \leq BVX \leq 100; -100 \leq BVY \leq 100)$ . Thus, at time 1 she will be at point  $(BX + BVX, BY + BVY)$ ; at time 1.5 she will be at  $(BX + 1.5 \cdot BVX, BY + 1.5 \cdot BVY)$ .

Unfortunately, Canmuu has sent  $N$  ( $1 \leq N \leq 50,000$ ) cattle bruisers to pursue Bessie. At time  $t=0$ , cattle bruiser  $i$  is at position  $(X_i, Y_i)$   $(-1,000 \leq X_i \leq 1,000; -1,000 \leq Y_i \leq 1,000)$  with velocity  $(VX_i, VY_i)$  units/second  $(-1,000 \leq VX_i \leq 1,000; -1,000 \leq VY_i \leq 1,000)$ .

Each cattle bruiser carries a "proximity" weapon to fire at Bessie; the weapon can hurt Bessie when the cattle bruiser is no further than  $R$  ( $1 \leq R \leq 2,500$ ) units from her.

Bessie has a shield to protect herself from these attacks. However, she does not want to waste any of her shield's power, so she would like to know the maximum number of cattle bruisers within firing range for any (potentially non-integer) time  $t \geq 0$ .

In order to avoid precision errors with real numbers, it is guaranteed that the answer produced will be the same whether the attack range is decreased to  $R-0.0001$  or increased to  $R+0.0001$ .

#### Input

\* Line 1: Six space-separated integers:  $N$ ,  $R$ ,  $BX$ ,  $BY$ ,  $BVX$ , and  $BVY$  \* Lines 2.. $N+1$ : Line  $i+1$  contains four space-separated integers:  $X_i$ ,  $Y_i$ ,  $VX_i$ , and  $VY_i$

#### Output

\* Line 1: Print a single integer denoting the maximum number of cattle bruisers within attack range at any point in time.

#### Example

Input :

```
3 1 0 0 0 2
0 -3 0 4
1 2 -1 1
1 -2 2 -1
```

Input details:

Bessie starts at point  $(0, 0)$  and is moving at 2 units per second in the (positive) y-direction. There are 3 cattle bruisers, the first of which starts at point  $(0, -3)$  and travels 4 units per second in the y-direction. The maximum distance for a cattle bruiser to be in range of Bessie is 1 unit.

**Output :**

2

**Output details:**

At time 1.5, Bessie is at point  $(0, 3)$ , and the three bruisers are at points  $(0, 3)$ ,  $(-0.5, 3.5)$ , and  $(4, -3.5)$ . The first two cattle bruisers are within 1 unit of Bessie, while the third will never be within 1 unit of Bessie, so 2 is the most achievable.

---

Added by: Mir Wasi Ahmed

Date: 2009-01-07

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: USACO Holiday Special Contest 2009, Problemsetter - Neal Wu

## SPOJ Problem Set (classical)

### 3679. Moo University - Emergency Pizza Order

#### Problem code: MOOPIZZA

Moo U's cafeteria has run out of hay and so must order pizzas for the  $C$  ( $1 \leq C \leq 1,000$ ) calves attending Moo U. Conveniently, a large pizza from the local pizzeria, Pizza Farm, serves exactly one calf.

Pizza Farm is willing to make a pizza for each calf, but, due to the size of the order, has three constraints on the order:

- \* Although Pizza Farm has long list of  $T$  ( $1 \leq T \leq 30$ ) vegetarian toppings, each of the pizzas must have exactly  $K$  ( $1 \leq K \leq T$ ) toppings

- \* No topping on a pizza can be duplicated (a pizza cannot have onions and onions, for example).

- \* No two pizzas in the order can have the same set of toppings.

For example, if pizza 1 has onions, green peppers, pineapples, and wheat grass, then it can be the only pizza with that exact set of toppings, although pizza 2 might have onions, green peppers, pineapples, and also olives.

For ordering purposes, the toppings are numbered  $1..T$ .

The calves at Moo U are very picky when it comes to their pizza toppings. Some calves might not like all of the toppings available. A calf will eat a pizza only she likes every single one of the toppings on that pizza. Determine the maximum number of calves that can be fed.

#### Input

- \* Line 1: Three integers:  $C$ ,  $T$ , and  $K$ .
- \* Lines  $2..C+1$ : Each line of space-separated integers describes which toppings one of the calves likes. The first integer on a line is the number of topping the calf likes. The remaining integers on the line are the toppings that the calf likes.

#### Output

- \* Line 1: A single integer, the maximum number of calves that can be fed.

#### Example

Input :

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

Input details:

There are three calves. Pizza Farm has two toppings and each pizza must have exactly one topping. The first calf likes both of the toppings, the second calf likes only the first topping, and the third calf likes only the second topping.

**Output :**

2

**Output details:**

There are only two pizzas that can be made: a pizza with topping 1 and a pizza with topping 2. If the first pizza is given to the first calf (since she likes topping 1) and the second pizza to the third calf (since she likes topping 2), two calves will be fed. There is no way to feed all three calves.

---

Added by: Mir Wasi Ahmed

Date: 2009-01-07

Time limit: 1s

Source limit:50000B

Languages: All

Resource: USACO 2004 March Green Division, Problemsetter - Hal Burch

## SPOJ Problem Set (main)

### 3693. Maximum Sum

#### Problem code: KGSS

You are given a sequence  $A[1], A[2], \dots, A[N]$  ( $0 \leq A[i] \leq 10^8$ ,  $2 \leq N \leq 10^5$ ). There are two types of operations and they are defined as follows:

##### Update:

This will be indicated in the input by a 'U' followed by space and then two integers  $i$  and  $x$ .

**U i x**,  $1 \leq i \leq N$ , and  $x$ ,  $0 \leq x \leq 10^8$ .

This operation sets the value of  $A[i]$  to  $x$ .

##### Query:

This will be indicated in the input by a 'Q' followed by a single space and then two integers  $i$  and  $j$ .

**Q x y**,  $1 \leq x < y \leq N$ .

You must find  $i$  and  $j$  such that  $x \leq i, j \leq y$  and  $i \neq j$ , such that the sum  $A[i] + A[j]$  is maximized. Print the sum  $A[i] + A[j]$ .

### Input

The first line of input consists of an integer  $N$  representing the length of the sequence. Next line consists of  $N$  space separated integers  $A[i]$ . Next line contains an integer  $Q$ ,  $Q \leq 10^5$ , representing the number of operations. Next  $Q$  lines contain the operations.

### Output

Output the maximum sum mentioned above, in a separate line, for each Query.

### Example

#### Input :

```
5
1 2 3 4 5
6
Q 2 4
Q 2 5
U 1 6
Q 1 5
U 1 7
Q 1 5
```

#### Output :

7  
9  
11  
12

**Warning: large Input/Output data, be careful with certain languages**

---

Added by: u.swarnaprakash  
Date: 2009-01-10  
Time limit: 2s-4s  
Source limit:50000B  
Languages: All  
Resource: Kurukshetra 09 OPC

## SPOJ Problem Set (main)

### 3713. Primitive Root

#### Problem code: PROOT

In the field of Cryptography, prime numbers play an important role. We are interested in a scheme called "Diffie-Hellman" key exchange which allows two communicating parties to exchange a secret key. This method requires a prime number  $p$  and  $r$  which is a primitive root of  $p$  to be publicly known. For a prime number  $p$ ,  $r$  is a primitive root if and only if its exponents  $r, r^2, r^3, \dots, r^{p-1}$  are distinct (mod  $p$ ).

Cryptography Experts Group (CEG) is trying to develop such a system. They want to have a list of prime numbers and their primitive roots. You are going to write a program to help them. Given a prime number  $p$  and another integer  $r < p$ , you need to tell whether  $r$  is a primitive root of  $p$ .

#### Input

There will be multiple test cases. Each test case starts with two integers  $p$  ( $p < 2^{31}$ ) and  $n$  ( $1 \leq n \leq 100$ ) separated by a space on a single line.  $p$  is the prime number we want to use and  $n$  is the number of candidates we need to check. Then  $n$  lines follow each containing a single integer to check. An empty line follows each test case and the end of test cases is indicated by  $p=0$  and  $n=0$  and it should not be processed. The number of test cases is at most 60.

#### Output

For each test case print "YES" (quotes for clarity) if  $r$  is a primitive root of  $p$  and "NO" (again quotes for clarity) otherwise.

#### Example

**Input :**

```
5 2
3
4
```

```
7 2
3
4
```

```
0 0
```

**Output :**

```
YES
NO
YES
NO
```



## Explanation

In the first test case  $3^1$ ,  $3^2$ ,  $3^3$  and  $3^4$  are respectively 3, 4, 2 and 1 (mod 5). So, 3 is a primitive root of 5.

$4^1$ ,  $4^2$ ,  $4^3$  and  $4^4$  are respectively 4, 1, 4 and 1 respectively. So, 4 is not a primitive root of 5.

---

Added by: u.swarnaprakash

Date: 2009-01-14

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Kurukshetra 09 OPC

## SPOJ Problem Set (main)

### 3724. Rainbow Ride

#### Problem code: RAINBOW

Mr.Raju and his extended family are on vacation in Chennai. They visit MGM and see the Rainbow ride. They want to enjoy the ride. However, there are some problems.

Each person in the family likes some other people in the family. Each person insists that he or she will go on the ride only if all the people whom that person likes and all the people who like that person also go on the ride. If someone doesn't like anyone and no one likes him, he may come for the ride.

You have been roped in to solve this dilemma. Given the weight of the each person in the family, and the list of people they like, and the maximum weight that the Rainbow can bear safely, calculate the maximum number of people in the family who can go on the rainbow.

#### Input

There will be multiple test cases in the input. For our convenience the family members are numbered from 1 to n. Each test case begins with a line containing two integers **n** (  $1 \leq n \leq 1000$  ) and **C** (  $0 \leq C \leq 1000$  ), where n is the number of people in the family and C the maximum capacity of the ride in kilograms.

The next line contains n space separated integers with the **i**th integer giving the weight of the **i**th family member. These weights are positive and less than or equal to 200 kilograms. Then n lines follow. Each line contains a sequence of integers separated by spaces. The first integer **k<sub>i</sub>** gives the number of people in the family person **i** likes, followed by the persons **i** likes. An empty line separates each test case. The end of input is indicated by n=0 and C=0 and it should not be processed. There are at most 50 test cases.

#### Output

For each test case output on a separate line the maximum number of persons that can take the ride under the given conditions.

#### Example

**Input :**

```
5 200
50 50 50 50 50
1 2
1 3
0
1 5
1 4

3 200
100 100 100
1 2
1 3
```

1 1

0 0

**Output :**

3

0

---

Added by: u.swarnaprakash

Date: 2009-01-16

Time limit: 5s

Source limit:50000B

Languages: All

Resource: Kurukshetra 09 OPC

## SPOJ Problem Set (main)

### 3725. Taming a T-REX

#### Problem code: TREX

Although evolution theory suggests that mammals started to dominate this world only after the mass extinction of the dinosaurs, there are some people who say man and dinosaurs may have co-existed for some time. Some argue that man even tamed and used some of these animals like the Flintstones. Shankar is such a believer and Sunil is a skeptic.

One day Sunil asked Shankar, "If your argument is right how would you tame a T-REX and what would you use it for?". Shankar replied, "We can use it for cow transportation from one village to another and we can keep it calm by feeding it at constant intervals". Sunil argued that the T-REX would have a maximum capacity  $C$  to carry. Let us say the distance is  $d$  km. If it is long, the T-REX would eat all the cows before it reaches the other village. Shankar argued that he knew a method that takes the maximum possible number of cows  $M$  to the destination. Sunil replied, "Oh really? I will give a few conditions. The T-REX will eat 1 cow every km until it reaches the destination. It may do so at any time during a 1 km stretch. So, there can not be a situation where the T-REX has no cow to eat. If you drop cows in the middle, you can do so only at distances which are a multiple of 1 km. And, finally all the cows at the destination need to be alive i.e you can not cut a cow (fractions are not allowed)".

Shankar was stunned. He needs your help. Given  $I$  (the number of cows at the starting village),  $d$  and  $C$  find  $M$ , the maximum number of cows that can be taken to the destination subject to the mentioned constraints.

#### Input

There will be multiple test cases in the input. The input begins with a line containing a single integer  $n$ ,  $n \leq 300$ , which gives the number of test cases. Then  $n$  lines follow each containing the three integers  $I$ ,  $1 \leq I \leq 10^6$ ,  $d$ ,  $1 \leq d \leq 10^5$ , and  $C$ ,  $1 \leq C \leq 10^6$ , in that order separated by spaces.  $d$  is in kilometers.

#### Output

For each test case print on a separate line the maximum number of cows that can be transported to the destination village under the given conditions.

#### Example

**Input :**

```
2
3000 1000 1000
30 10 10
```

**Output :**

```
533
5
```

**Note:**

**A few test cases have been added and this problem has been rejudged  
on January 25th, 2009.**

---

**Added by:** u.swarnaprakash

**Date:** 2009-01-17

**Time limit:** 5s

**Source  
limit:** 50000B

**Languages:** All

**Resource:** Kurukshetra 09  
OPC

## SPOJ Problem Set (classical)

### 3749. Subset Sums

#### Problem code: SUBSUMS

Given a sequence of  $N$  ( $1 \leq N \leq 34$ ) numbers  $S_1, \dots, S_N$  ( $-20,000,000 \leq S_i \leq 20,000,000$ ), determine how many subsets of  $S$  (including the empty one) have a sum between  $A$  and  $B$  ( $-500,000,000 \leq A \leq B \leq 500,000,000$ ), inclusive.

#### Input

The first line of standard input contains the three integers  $N$ ,  $A$ , and  $B$ . The following  $N$  lines contain  $S_1$  through  $S_N$ , in order.

#### Output

Print a single integer to standard output representing the number of subsets satisfying the above property. Note that the answer may overflow a 32-bit integer.

#### Example

**Input :**

```
3 -1 2
1
-2
3
```

**Output :**

```
5
```

The following 5 subsets have a sum between -1 and 2:

- $0 = 0$  (the empty subset)
- $1 = 1$
- $1 + (-2) = -1$
- $-2 + 3 = 1$
- $1 + (-2) + 3 = 2$

---

Added by: Neal Wu

Date: 2009-01-19

Time limit: 1s-2s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 3763. George

#### Problem code: GEORGE

Last week Mister George visited Croatia. Since Mister George is a very important person, while he was in a street, the police **disallowed entry** to that street, but vehicles that entered the street before Mister George could continue driving.

While Mister George was visiting, Luka drove his truck around town. But because of some of the streets being closed off, he couldn't make his delivery in time and almost lost his job. Although it is late now, he is wondering how he could have planned his delivery better i.e. what would have been the least time needed to make his delivery while Mister George was visiting. He knows the route mister George took.

The city is modeled with intersections and two-way streets connecting them. For each street, Luka knows how much time he needs to traverse it (mister George needs the same amount of time).

For example, if Mister George starts traversing a street during minute 10 and needs 5 minutes to exit it, this street will be blocked during minutes 10, 11, 12, 13 and 14. Luka can enter the street during minutes 9 and earlier, or 15 and later.

Write a program that calculates the least amount of time Luka needs to make his delivery, if he starts driving  $K$  minutes after the arrival of Mister George.

#### Input

The first line contains two integers  $N$  and  $M$  ( $2 \leq N \leq 1000$ ,  $2 \leq M \leq 10\,000$ ), the number of intersections and the number of streets. The intersections are numbered 1 to  $N$ . The second line contains four integers  $A$ ,  $B$ ,  $K$  and  $G$  ( $1 \leq A, B \leq N$ ,  $0 \leq K \leq 1000$ ,  $0 \leq G \leq 1000$ ). These are, in order:

- The intersection where Luka starts;
- The intersection Luka must get to;
- The difference in starting times between mister George and Luka (Luka starts at intersection  $A$  exactly  $K$  minutes after mister George starts his route);
- The number of intersections on Mister George's route.

The third line contains  $G$  integers, the labels of intersections mister George will visit. Every pair of adjacent integers denotes a street he will traverse. That street will exist and Mister George will traverse every street at most once. Each of the following  $M$  lines contains three integers  $A$ ,  $B$  and  $L$ , meaning that there is a street between intersection  $A$  and  $B$ , and it takes  $L$  minutes to traverse.  $L$  will be between 1 and 1000.

## Output

Output the least amount of time (in minutes) Luka needs to make his delivery.

## Example

**Input :**

```
6 5
1 6 20 4
5 3 2 4
1 2 2
2 3 8
2 4 3
3 6 10
3 5 15
```

**Output :**

```
21
```

---

**Input :**

```
8 9
1 5 5 5
1 2 3 4 5
1 2 8
2 7 4
2 3 10
6 7 40
3 6 5
6 8 3
4 8 4
4 5 5
3 4 23
```

**Output :**

```
40
```

---

Croatian Open Competition in Informatics (COCI) - 2007/2008 Contest #6

---

Added by: Andrés Mejía-Posada

Date: 2009-01-25

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Croatian Open Competition in Informatics (COCI) - 2007/2008 Contest #6



## SPOJ Problem Set (classical)

### 3791. Street

#### Problem code: STREET

There are  $n$  lots on one side of a street (where  $n \leq 500$ ). We would like to erect at most  $k$  apartment buildings on these lots. Each building must occupy an interval of at most  $t$  consecutive lots. Moreover, each lot  $i$  has a height restriction  $r[i]$  (where  $r[i] \leq 100$ ). A building cannot exceed any of the height restriction of any lot on which it is built (that is, the maximal height of the building that can be erected on lot  $i$  to  $j$  is:

$$H = \min\{r[i], r[i + 1], \dots, r[j]\}$$

Hence, the maximum usable facade space of the building is:  $H \times (j - i + 1)$ . We would like to have a program to select at most  $k$  non-overlapping intervals to erect the buildings such that the total usable facade space is maximized.

#### Example 1

Consider a street of length 10. The height restriction of each lot is as follows:

7, 3, 12, 11, 13, 4, 8, 6, 6, 20

Suppose we would like to erect at most  $k = 2$  buildings and each building occupies at most  $t = 4$  lots. Then, to maximize the total usable facade space, we choose two intervals  $r[3..5] = (12, 11, 13)$  and  $r[7..10] = (8, 6, 6, 20)$  (see "Example 1" in the figure below). The maximum usable facade space is  $3 * \min\{12, 11, 13\} + 4 * \min\{8, 6, 6, 20\} = 57$ .

Example

#### Example 2

Suppose we would like to erect at most  $k = 3$  buildings on the same street with the same height restrictions as in Example 1, and each building occupies at most  $t = 4$  lots. Then, to maximize the total usable facade space, we choose three intervals  $r[3..5] = (12, 11, 13)$ ,  $r[7..9] = (8, 6, 6)$  and  $r[10..10] = (20)$  (see "Example 2" in the figure above). The maximum usable facade space is  $3 * \min\{12, 11, 13\} + 3 * \min\{8, 6, 6\} + 1 * 20 = 71$ .

#### Input

The input file is as follows: The first line contains three integers  $n$ ,  $k$ , and  $t$  separated by a space character, where  $1 \leq n \leq 500$ ,  $1 \leq k \leq n$ , and  $1 \leq t \leq n$ . The rest of the  $n$  lines contain  $n$  positive integers representing the height restriction for the  $n$  lots. For Example 1, the input file looks like:

```
10 2 4
7
3
12
11
13
4
8
6
6
20
```

The input should be read from the standard input, and your program will be run several times, each one with one of the test cases.

## Output

The output file contains an integer which is the maximum usable facade space. For the above example, the output file looks like:

```
57
```

---

National Olympiad in Informatics (NOI) - 2007

---

Added by: Andrés Mejía-Posada

Date: 2009-01-31

Time limit: 3s

Source limit:50000B

Languages: All

Resource: National Olympiad in Informatics (NOI) - 2007

## SPOJ Problem Set (classical)

### 3831. Lubenica

#### Problem code: LUBEN

Children in school are having fun instead of listening to the teacher. With their iPhone devices the children throw watermelons at each other on the Facebook social site.

The game started when Goran threw one watermelon at each of his friends during the first class that day. During subsequent classes, all children (including Goran) behaved like this:

- If they had been hit by an odd number of watermelons during the previous class, they threw exactly one watermelon at each of their friends;
- If they had been hit by an even number of watermelons (including zero), then they hit each of their friends with two watermelons.

The children are numbered 1 through N, Goran obviously being number 1. The friend relationships between the children are also known.

Write a program that will calculate the total number of watermelons thrown after H classes.

#### Input

The first line contains two integers N and H ( $1 \leq N \leq 20$ ,  $1 \leq H \leq 1\,000\,000\,000$ ), the number of kids and classes.

Each of the following N lines contains a string of N characters '0' or '1'. The character (A, B) in this matrix is '1' if children A and B are friends.

No child will be their own friend. The input matrix will be symmetric

#### Output

Output the number of watermelons after H classes.

#### Example

**Input :**

```
5 3
01000
10110
01000
01001
00010
```

**Output :**

```
26
```

---

Added by: Race with time

Date: 2009-02-08

Time limit: 1s

Source limit:50000B

Languages: All

Resource: COCI 2008/2009 - Contest #5, 7th February 2009

## SPOJ Problem Set (classical)

### 3832. Kruska

#### Problem code: KRUS

Aladdin has become bored of life at the palace. He has a steady job, his wife Jasmine, kids are on the way and life is becoming monotonous. Prompted by all this, he has decided to have one more adventure before settling down.

He has decided to find the Golden Pear, an extremely valuable legendary artifact that no one has been able to find.

The desert Aladdin is searching is can be modeled as an  $N \times N$  grid of cells. Rows and columns are numbered 1 through N top to bottom and left to right. Some of the cells in the desert contain wizards that help Aladdin's quest in an unusual way.

Aladdin starts his quest in the top left corner of the desert on a Monday facing right. His movement involves repeating these steps:

1. If the current cell contains a wizard that is awake, then Aladdin turns 90 degrees left or right, depending on what the wizard says.
2. If moving forward would take Aladdin out of desert, he turns 180 degrees.
3. Aladdin moves forward one cell and it takes him exactly one day.

For each wizard we know his location and his activity schedule for each day of the week. The schedule is a string of exactly seven letters 'L', 'R' or 'S', each character telling us what the wizard does on one day of the week (starting with Monday). The letter 'L' means that Aladdin will be told to turn left, 'R' that Aladdin will be told to turn right, while 'S' means the wizard sleeps that day.

An old prophecy says that after K changes in direction (in steps 1 and/or 2) Aladdin will find the Pear.

Write a program that calculates how many days the search will last, according to the ancient prophecy.

#### Input

The first line contains two integers N and K ( $2 \leq N \leq 200$ ,  $1 \leq K \leq 1\,000\,000\,000$ ), the size of the desert and the number of direction changes in the prophecy.

The second line contains an integer M ( $0 \leq M \leq 10\,000$ ), the number of wizards.

Each of the following M lines contains two integers R and C ( $1 \leq R, C \leq N$ ), and a string of seven letters 'L', 'R' or 'S'. The numbers represent the row and column where the wizard is located, while the string is his schedule.

No two wizards will share the same cell, nor will there be a wizard in cell (1, 1).

## Output

Output the length of the search in days.

## Example

**Input :**

```
5 2
2
1 3 RRSRRRR
1 5 RRRRLRR
```

**Output :**

```
4
```

---

Added by: Race with time

Date: 2009-02-08

Time limit: 1s

Source limit:50000B

Languages: All

Resource: COCI 2008/2009 - Contest #5, 7th February 2009

## SPOJ Problem Set (classical)

### 3833. Tresnja

#### Problem code: TRES

Lana lives in a small but merry village. There is a row of cherry trees next to the main street. Lana numbered the trees with consecutive integers starting with 1.

After much studying, Lana noticed that the number of the tree uniquely determines the amount of cherries the tree gives.

For one tree, consider consecutive groups of digits in the tree's number. For each group of digits, multiply the digit by the square of the length of the group. Adding these numbers for all groups gives the total number of cherries the tree gives.

For example, in tree number 77744007, the groups are 777, 44, 00 and 7. The amount of cherries will be  $7 \cdot 3^2 + 4 \cdot 2^2 + 0 \cdot 2^2 + 7 \cdot 1^2 = 86$  units.

The time has come to pick the cherry trees and the villagers have agreed to pick all trees numbered A through B (inclusive). Write a program that will calculate the total amount of cherries picked.

#### Input

Input consists of two integers A and B ( $1 \leq A \leq B \leq 10^{15}$ ), the first and last trees to be picked.

#### Output

Output a single integer, how many units of cherries will be picked.

#### Example

**Input :**  
100 111

**Output :**  
68

---

Added by: Race with time  
Date: 2009-02-08  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: COCI 2008/2009 - Contest #5, 7th February 2009

## SPOJ Problem Set (classical)

### 3863. Area of circles

#### Problem code: VCIRCLES

Given N circles. Calculate the total area that these N circles cover.

#### Input

First line: N ( $1 \leq n \leq 50$ )

- In the i-th line of the next n lines contains 3 integers  $X_i$ ,  $Y_i$  and  $R_i$ , separated by spaces. These are the coordinates of the center and the radius of the i-th circle  
( $-10000 \leq Y_i - R_i, Y_i + R_i, X_i - R_i, X_i + R_i \leq 10000$ )

#### Output

The total area that these N circles cover with 5 digits after decimal point

#### Example

**Input :**

```
2
5 6 3
5 5 5
```

**Output :**

```
78.53982
```

---

Added by: Phenomenal

Date: 2009-02-14

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: IOICAMP



## SPOJ Problem Set (classical)

### 3865. Reljef

#### Problem code: RELJEF

Two groups of cavemen got into a land dispute and decided to settle it the old fashion-way, by throwing sticks at each other. The fight was organized in a cave, high enough that the ceiling is of no concern, but mineral deposits on the ground get in the way of flying sticks.

The cave can be divided into  $R$  rows and  $C$  columns, so that the entire cave consists of  $R \times C$  cells. Each cell in the cave is either empty or contains a chunk of mineral. Two chunks of minerals are part of the same cluster if they are adjacent in one of the four main directions (up, down, left, right).

One group of cavemen is on the left side of the cave, the other on the right side. The groups alternate throwing sticks at the other group; first a group chooses the height at which the stick will fly and then (climbing on each others' shoulders as necessary) they throw it and the stick flies horizontally through the cave at the chosen height.

If the stick hits a chunk of mineral on the way, it destroys the chunk, the cell becomes empty and the stick stops its journey.

When a chunk is destroyed, it is possible that a cluster falls apart. If a newly created cluster would float in the air, then it falls down because of gravity. While falling, the cluster does not change shape i.e. all chunks in it fall together. As soon as some chunk in the falling cluster lands on a chunk from a different cluster or the ground, the entire cluster stops falling. Of course, if a cluster lands on another, they merge and become one.

Your program will be given the layout of minerals in the cave and the heights at which sticks were thrown. Determine the layout of minerals after the sticks are exchanged.

#### Input

The first line contains two integers  $R$  and  $C$  ( $1 \leq R, C \leq 100$ ), the dimensions of the cave.

Each of the following  $R$  lines will contain  $C$  characters. The character '.' represents an empty cell, while the letter 'x' represents a chunk of mineral.

The next line contains an integer  $N$  ( $1 \leq N \leq 100$ ), the number of sticks thrown.

The last line contains  $N$  integers separated by spaces, the heights at which sticks were thrown. All heights will be between 1 and  $R$  (inclusive), with height 1 being the bottom of the matrix and height  $R$  the top. The first tick is thrown left to right, the second right to left and so on.

No cluster will initially float in the air. Also, the input data will be such that at no point will two or more clusters fall simultaneously, so that there will be no ambiguous situations.

## Output

The output should consist of R lines, each containing C characters, the final layout of the cave, in the same format as in the input.

## Example

**Input :**

```
8 8
.....
.....
...x.xx.
...xxx..
..xxx...
..x.xxx.
..x...x.
.xxx..x.
5
6 6 4 3 1
```

**Output :**

```
.....
.....
.....
.....
.....x..
..xxxx..
..xxx.x.
..xxxxx.
```

---

Added by: Race with time

Date: 2009-02-15

Time limit: 1s

Source limit:50000B

Languages: All

Resource: COCI 2008/2009 - Croatian Regional

## SPOJ Problem Set (classical)

### 3866. Finding Palindromes

#### Problem code: VPALIN

A word is called a palindrome if we read from right to left is as same as we read from left to right. For example, "dad", "eye" and "racecar" are all palindromes, but "odd", "see" and "orange" are not palindromes.

Given  $n$  palindromes, you can generate  $n \times n$  pairs of them and concatenate the pairs into single words. The task is to count how many of the so generated words are palindromes.

#### Input

The first line of input file contains the number of strings  $n$ . The following  $n$  lines describe each string: The  $i+1$ -th line contains the length of the  $i$ -th string  $l_i$ , then a single space and a string of  $l_i$  small letters of English alphabet. You can assume that the total length of all strings will not exceed 2,000,000. Two strings in different line may be the same.

#### Output

Print out only one integer, the number of palindromes.

#### Example

**Input :**

```
3
1 a
2 bb
2 aa
```

**Output :**

```
5
The 5 palindromes are:
aa aaa aaa bbb aaaa
```

---

Added by: Phenomenal  
Date: 2009-02-15  
Time limit: 5s-7s  
Source limit: 50000B  
Languages: All  
Resource: POI 2006

## SPOJ Problem Set (classical)

### 3867. Who is The Boss

#### Problem code: VBOSS

Several surveys indicate that the taller you are, the higher you can climb the corporate ladder. At TALL Enterprises Inc. this "de facto standard" has been properly formalized: your boss is always at least as tall as you are. Furthermore, you can safely assume that your boss earns a bit more than you do. In fact, you can be absolutely sure that your immediate boss is the person who earns the least among all the employees that earn more than you and are at least as tall as you are. Furthermore, if you are the immediate boss of someone, that person is your subordinate, and all his subordinates are your subordinates as well. If you are nobody's boss, then you have no subordinates. As simple as these rules are, many people working for TALL are unsure of to whom they should be turning in their weekly progress report and how many subordinates they have. Write a program that will help in determining for any employee who the immediate boss of that employee is and how many subordinates they have. Quality Assurance at TALL have devised a series of tests to ensure that your program is correct. These test are described below.

#### Input

On the first line of the input is a single positive integer  $n$ , telling the number of test scenarios to follow. Each scenario begins with a line containing two positive integers  $m$  and  $q$ , where  $m$  (at most 30000) is the number of employees and  $q$  (at most 200) is the number of queries. The following  $m$  lines each list an employee by three integers on the same line: employee ID number (six decimal digits, the first one of which is not zero), yearly salary in Euros and finally height in mm (1 mm =  $10^{-6}$  meters - accuracy is important at TALL). The chairperson is the employee that earns more than anyone else and is also the tallest person in the company. Then there are  $q$  lines listing queries. Each query is a single legal employee ID.

The salary is a positive integer which is at most 10 000 000. No two employees have the same ID, and no two employees have the same salary. The height of an employee is at least 1 000 000 mm and at most 2 500 000 mm.

#### Output

For each employee ID  $x$  in a query output a single line with two integers  $y$   $k$ , separated by one space character, where  $y$  is the ID of  $x$ 's boss, and  $k$  is the number of subordinates of  $x$ . If the query is the ID of the chairperson, then you should output 0 as the ID of his or her boss (since the chairperson has no immediate boss except, possibly, God).

#### Example

Input :

```
2
3 3
123456 14323 1700000
123458 41412 1900000
123457 15221 1800000
```

```
123456
123458
123457
4 4
200002 12234 1832001
200003 15002 1745201
200004 18745 1883410
200001 24834 1921313
200004
200002
200003
200001
```

**Output :**

```
123457 0
0 2
123458 1
200001 2
200004 0
200004 0
0 3
```

---

Added by: Phenomenal  
Date: 2009-02-15  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: NWERC 2003

## SPOJ Problem Set (classical)

### 3870. Military Story

#### Problem code: VMILI

Military headquarters plan to develop a better protection for a spaceport. They suppose that the spaceport would be best protected if it is surrounded with as many fences as possible and each fence is patrolled by armed guards. The corresponding order was issued and military engineers started to develop a project.

Wishing to be promoted, sergeant Stupid sent soldiers to dig in fence poles before the project was actually ready. Without much thinking, the soldiers put a lot of poles at random. Help the sergeant to decide how to make barbwire fences using the poles so that the number of fences is maximal.

#### Input

The first line contains an integer  $3 \leq N \leq 4000$ , which is the number of the poles. Each of the following  $N$  lines contains two integers  $0 \leq x, y \leq 10000$ , which are the coordinates of a corresponding pole. No two poles have the same position.

#### Output

The output should contain a single integer number, which is the maximal possible number of nested fences that can be constructed. Each fence is a closed polygonal line without self-crossing whose vertices are poles. Different fences should not have common points.

#### Example

**Input :**

```
4
100 100
200 100
100 200
300 300
```

**Output :**

```
1
```

---

Added by: Phenomenal  
Date: 2009-02-16  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: acm.timus.ru

## SPOJ Problem Set (classical)

### 3871. GCD Extreme

#### Problem code: GCDEX

Given the value of N, you will have to find the value of G. The meaning of G is given in the following code

```
G=0;

for(k=i;k< N;k++)

for(j=i+1;j<=N;j++)

{

G+=gcd(k,j);

}

/*Here gcd() is a function that finds the greatest common divisor of the two input numbers*/
```

#### Input

The input file contains at most 20000 lines of inputs. Each line contains an integer N ( $1 < N < 1000001$ ). The meaning of N is given in the problem statement. Input is terminated by a line containing a single zero.

#### Output

For each line of input produce one line of output. This line contains the value of G for the corresponding N. The value of G will fit in a 64-bit signed integer.

#### Example

**Input :**

```
10
100
200000
0
```

**Output :**

```
67
13015
143295493160
```

Time limit has been changed. Some AC solutions get TLE

---

Added by: Phenomenal  
Date: 2009-02-16  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: ACM World Final Warm up 1 - 2008



## SPOJ Problem Set (classical)

### 3872. Party At School

#### Problem code: VPARTY

Today there is a party at school.  $N$  girls and  $M$  boys attend this party. The principal wants to give some presents to the girl and he decides to make the boy do that. Each boy has told the principal the name of the two girls that he wants to give the present to so the principal wants the form teacher to choose some boys to do that. However, he is short in cash now so he wants the number of boys selected is minimum but he also wants all the girls to have at least one present. If you select a boy, then he will give the presents to both of the girls he has chosen.

#### Input

The first line contains two integers  $N$  and  $M$  ( $2 \leq N \leq 1000$ ,  $1 \leq M \leq 1000$ ) which is the number of the girls and boys.

The  $i$ -th line of the following  $M$  lines contains two integers  $a_i$  and  $b_i$  ( $1 \leq a_i, b_i \leq N$ ) which are the two girls that the  $i$ -th boy wants to give present to

#### Output

One single integer number, which is the minimum boys the form teacher should choose.

#### Example

**Input :**

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

**Output :**

```
2
```

---

Added by: Phenomenal

Date: 2009-02-16

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: IOICAMP

## SPOJ Problem Set (classical)

### 3884. When (You Believe)

#### Problem code: WHEN

It's said: there can be miracles, when you believe. The following programming language shows the power of "when". It has a very simple (case insensitive) grammar, shown below:

```
PROGRAM := WHEN | PROGRAM WHEN
WHEN := 'when ' EXPRESSION <ENTER> STATEMENTS 'end when' <ENTER>
STATEMENTS := STATEMENT | STATEMENTS STATEMENT
STATEMENT := PRINT | SET
PRINT := 'print ' EXPRESSION_LIST <ENTER>
SET := 'set ' ASSIGNMENT_LIST <ENTER>
EXPRESSION_LIST := EXPRESSION | EXPRESSION_LIST ',' EXPRESSION
ASSIGNMENT_LIST := ASSIGNMENT | ASSIGNMENT_LIST ',' ASSIGNMENT
ASSIGNMENT := VARIABLE '=' EXPRESSION
EXPRESSION := '(' EXPRESSION OP EXPRESSION ')' | VARIABLE | NUMBER
OP := '<' | '+' | '-' | 'and' | 'or' | 'xor'
VARIABLE := '$' NOT_DOLLAR_STRING '$'
NUMBER := DIGIT | NUMBER DIGIT
DIGIT := '0' | .. | '9'
NOT_DOLLAR_STRING := any sequence of printable characters (including blanks)
                      that does not contain a $ symbol.
```

In the above, any string enclosed in single quotes are to be treated literally. <ENTER> is the end of line.

In words, Spaces are allowed before or after any literal except inside a number. Spaces are allowed in variable names, and each non-empty sequence of spaces is treated as a single underscore, so the following refer to the same variable:

```
$Remote Switch#1$
$Remote_Switch#1$
$Remote   switch#1$
```

All numbers appearing in the program will be integers between 0 and 1000000000, inclusive. All variable and literal values are integers between -1000000000 and 1000000000, inclusive. All variables are global and initially zero. The programs you will be tested on will never have an EXPRESSION that evaluates to a value outside of this range. The logical operators evaluate to 0 for false and 1 for true, and treat any nonzero value as true.

Running the program amounts to executing all the active when clauses until none are active. More specifically, the active list of when clauses is initially empty, then the following steps are repeated:

- In the order they appear in the program, the conditions of all when clauses that are not currently active are evaluated. If true, the clause is added to the end of the active list, with its first statement marked as "ready". Each active when clause has one "ready" statement.
- If the active list is empty after this step, the program terminates.
- The "ready" statement from the "current" when clause (initially the first clause in the active list) is executed.

- The statement marked as "ready" is advanced, removing the when clause from the active list if this is the last statement in the "current" when clause.
- The when clause marked as "current" is advanced, cycling to the beginning of the active list if the end is reached.

In other words, inactive when conditions are evaluated to determine if these clauses are added to the active list. Then one statement (set or print) is executed from the current active when clause. If this is the last statement in that clause, it is removed from the active list. One the next iteration, one statement is executed from the next active when clause, etc.

A set statement executes all the assignments concurrently, so that

```
set  $x$=$y$, $y$=$x$
```

swaps the values of \$x\$ and \$y\$. The same variable cannot appear twice on the left hand part of the same set statement (so set \$x\$=1,\$x\$=2 is illegal).

A print statement evaluates and prints the given expressions in the output, separated by commas and followed by a new line. So

```
print 1, (2+3)
```

results in the line

```
1,5
```

in the output.

## Input

The input consists of a single syntactically correct program. You may assume that the program will not execute more than 100000 set statements and 100000 print statements.

## Output

Print the output produced by executing the given program. Both the input and output file will not exceed 100KB.

## Example

### Input :

```
When ($Mr. Bill$<5)
  Set $mr._bill$=($mr. bill$+1), $Y$=($Y$+10)
End When
When ($mr. Bill$<10)
  Set $MR. BILL$=($mr. bill$+1)
  Print $mr. bill$, $Y$
End When
```

### Output :

```
3,20
6,40
```

7,40  
8,40  
9,40  
10,40

---

Added by: Blue Mary  
Date: 2009-02-17  
Time limit: 2s  
Source limit:6666B  
Languages: All except: C99 strict  
Resource: Whitney Houston: When You Believe

## SPOJ Problem Set (classical)

### 3894. Bouncing Balls

#### Problem code: BOBALLS

Consider a grid having  $N \times M$  squares. The top left square is (0,0) and the bottom right is (N-1,M-1). Each square in the grid is either occupied by a platform or has a number written on it. Two balls are released from the top of the grid (from locations (0,Y1) and (0,Y2),  $0 \leq Y1, Y2 < M$ ). Each ball falls down vertically, unless either it falls down the bottom row, or encounters a platform beneath. When the ball encounters a platform beneath, it rolls either to the left or to the right, each with an equal probability. The score obtained by a ball is the sum of the numbers on the squares that it passes (including the starting square). However, if both the balls pass over the same square, points corresponding to that square are obtained only once, and not twice. Your goal is to choose Y1 and Y2 such that the expected score obtained by the two balls is maximized. For example, consider the grid below : (P represents a platform)

```
N = 6, M = 6
112214
211243
30PPP2
423378
1P9753
220102
```

Here, dropping a ball from position (0,3) could result in one of the following three scores :

- 1)  $2 + 2 + 1 + 1 + 0 + 2 + 4 + 1 + 2 = 15$
- 2)  $2 + 2 + 1 + 1 + 0 + 2 + 3 + 9 + 0 = 20$
- 3)  $2 + 2 + 4 + 3 + 2 + 8 + 3 + 2 = 26$

The expected score is (considering only 1 ball) :

$$1/2 * (1/2 * (15) + 1/2 * (20)) + 1/2 * (26)$$

#### Input

The first line contains the number of test cases.

The first line for each test case consists of N and M.

Lines 2..N+1 for each test case consist of M characters each. Each character is either a digit from 0 to 9, or the letter 'P'.

#### Output

The maximum expected score accurate upto 4 decimal places.

## Example

### Input :

```
4
5 5
53214
53214
53214
54214
53214
5 5
00000
0P0P0
00000
01P20
00000
5 5
09090
0P0P0
00000
01P20
00000
6 6
112214
211243
30PPP2
423378
1P9753
220102
```

### Output :

```
45.0000
2.2500
19.3125
35.5000
```

## Constraints

Dataset 1:  $1 \leq \text{number of test cases} \leq 100$

$3 \leq N, M \leq 100$

All possible paths from the top will eventually lead to the ball falling from the bottom. There will be no "rebounds" possible. If there is a 'P' on square (x,y), there will not be a 'P' on squares (x-1,y-1) or (x-1,y+1) or (x+1,y-1) or (x+1,y+1). Also, platforms will not occur on the boundaries of the grid. Thus, the X coordinate of a platform will never be 0 or N-1, and the Y coordinate will never be 0 or M-1. The test case was generated to guarantee that any answer with absolute error in  $1e-9$  will get accepted. Time limit: 7s

---

Added by: Race with time

Date: 2009-02-19

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: Code Craft 09

## SPOJ Problem Set (classical)

### 3920. Lucius Dungeon

#### Problem code: BYTESE1

LUCIUS' DUNGEON (5 points) There are a set of rooms in a dungeon, arranged in an  $M \times N$  rectangular grid. In one of the rooms, evil Lucius Malfoy has imprisoned Hermione, owing to his hatred towards the mudbloods. The noble Harry potter is on his way to rescue Hermione. Harry potter starts in the room at the top left corner of the grid, which is labeled (1,1). Each room contains some guards. It takes some time for Harry potter to kill all the guards in the room he is in. The time taken to kill the guards varies from room to room. Once he has killed all the guards in a room, he can move on to any one of its neighbors by going left, right, up or down, provided, of course, that there is a neighboring room in the corresponding direction. He cannot move diagonally.

>Lucius Malfoy, knowing that Harry Potter is on his way, has set a time bomb that will kill Hermione after T seconds. You will be given the position of Hermione, the time left for the bomb to go off and the time it takes for Harry to kill the guards in each of the rooms in the dungeon. Your task is to determine if it is possible for Harry to reach Hermione and save her by defusing the bomb before the T seconds expire. For example, suppose the dungeon is described by the following grid of numbers where the numbers start from (1,1):

> 2 3 2

> 2 5 1

> 5 3 1

> 3 1 1

> The number at position (i,j) indicates the time taken for Harry Potter to overpower the guards in room (i,j). Suppose Hermione is in the room at position (4,2). If T = 10. There is no way Harry Potter can reach Hermione in time. However, if M = 15, Harry Potter can reach Hermione with 4 seconds to spare, as follows. Starting from (1,1), he moves right to (1,2) and then (1,3), comes down all the way to (4,3) and then moves to (4,2). This takes 11 seconds (note that he must also overpower the guard in the room where Hermione is incarcerated). You can check that he cannot reach Hermione with more than 4 seconds to spare by any route.

>Note: If Harry reaches Hermione at exactly 'T' seconds from the start then the answer is "YES" with 0 seconds to spare.

#### Input

The first line consists of the number of test cases K ( $1 \leq K \leq 20$ ). In each test case, the first line contains two integers M and N indicating the number of rows and columns in the rectangular dungeon ( $1 \leq M, N \leq 100$ ). Next M lines contain N integers (single digits only). The jth integer on ith line is the time taken to overpower the guards at room (i,j). The last line in each test case, contains three integers a, b and T, where (a,b) is the position of the cell where Hermione is held and T is the amount of time before the bomb goes off.

## Output

For each of the test case, if it is not possible for Harry Potter to save Hermione then print NO. Otherwise, print two lines. The first line should say YES. The second line should contain a single integer indicating the maximum possible time to spare when Harry Potter rescues the Hermione.

## Example

**Input :**

```
2
4 3
2 3 2
2 5 1
5 3 1
3 1 1
4 2 15
2 2
1 2
1 1
2 2 2
```

**Output :**

```
YES
4
NO
```

---

**Added by:** Paritosh Aggarwal  
**Date:** 2009-02-21  
**Time limit:** 1s-8s  
**Source limit:** 50000B  
**Languages:** All



## SPOJ Problem Set (classical)

### 3921. The Great Ball

#### Problem code: BYTESE2

The Great Ball (5 points) Hogwarts has organized The Great Ball to welcome the schools participating in the Triwizard Tournament. The ball is being held in the Great Hall and The Weird Sisters have been called to play the band. The students drift in to dance and then go out when they get tired. Hagrid is stationed at the gate and is noting down the time at which people enter and leave the hall. At the end of the day, he wonders what the maximum number of dancers was during the course of the ball. For convenience, he writes down for each person entering, the number of minutes from the start of the ball at which the person entered and left. The door of the hall is narrow, so at any time, either one person can enter or one person can exit, but not both. For example, suppose the observations noted down by Hagrid are the following:

Serial No	Enters at	Leaves at
1	1	7
2	2	4
3	6	9
4	3	8
5	5	10

Each line denotes the entry time and exit time of one person. (The identity of the person is not important - the same person may enter and leave many times. For instance, in the example, it might well be that the entries and exits recorded at serial no. 2 & 5 refer to the same person). In this example, the maximum size of the dancers during the ball was 4. This was achieved between time 6 & 7. Hagrid is not good at Math so he requires your help. Your task is to read the list of entry and exit times and compute the maximum number of dancers during the ball.

#### Input

The first line is a single integer,  $T$  ( $1 \leq T \leq 100$ ), which is the number of test cases. For each of the test case, the first line contains a single integer  $N$ , ( $1 \leq N \leq 100$ ), the number of entries and exits recorded. This is followed by  $N$  lines. Each of these lines consists of two integers, separated by a space, describing the entry and exit time of that person. The entry and exit times are guaranteed to be distinct, and the entry time will be less than the exit time. The constraint on entry and exit times is 10000000.

#### Output

A total of  $T$  lines each of them containing a single integer, denoting the maximum number of dancers during the ball.

## Example

**Input :**

```
1
5
1 7
2 4
6 9
3 8
5 10
```

**Output :**

```
4
```

---

Added by: Paritosh Aggarwal

Date: 2009-02-21

Time limit: 1s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 3922. Mystical River

#### Problem code: BYTESM1

Harry Potter was punished for his impudence by Snape and was sent to the forbidden forest for detention. He has now lost his way amidst the forest. He has come across 3 mystical rivers flowing in his way to the school but he is not sure which river does he have to cross. Alongside each mystical river are stones after every meter with a number written on them. The numbers start with 1, 3 and 9 respectively for the three rivers. The number on a stone is equal to the no. on the previous stone plus the sum of its digits. For example, if one no. is 403 then the next no. is  $403+4+0+3=410$ , the next no. is  $410+4+1+0=415$  and so on. Harry calls this a 'stone river'. Harry knows that he has to cross at the stone number which is part of the stone river of the number he remembers. He has to now find the point of intersection of the stone river generated by the no. 'N' that he remembers, with the rivers of 1 or 3 or 9. Your task is to find which mystical river intersects the stone river generated by Harry's number. Also find the point of intersection at which Harry can cross the mystical river. For example, if Harry remembers that he has to cross at the stone number which is part of the stone river of 29 then he has to cross at the stone number 107 which is also in the river of number 1. Stone river of 29: 29,40,44,52,59,73,83,94,107,.... River of 1: 1,2,4,8,16,23,28,38,49,62,70,77,91,101,103,107,.... Both the rivers meet at 107 and hence Harry has to cross at stone number 107. It is possible that the stone river might intersect with more than one of the mystical rivers. In that case, output the least intersection number.

#### Input

The first line consists of a single integer 'T' ( $1 \leq T \leq 50$ ) which is the total number of test cases. Each of the next T lines consist of a single integer 'N' ( $1 \leq N \leq 999999999$ ) which is the number that Harry remembers.

#### Output

A total of T lines, where each line consists of two integers separated by a space. The first integer represents the river out of 1, 3 and 9 which intersects with the stone river of 'N'. The second integer represents the stone number at which Harry can cross.

#### Example

**Input :**

2  
29  
42

**Output :**

1 107  
3 111

---

Added by: Paritosh Aggarwal  
Date: 2009-02-21  
Time limit: 6s  
Source limit: 50000B  
Languages: All  
Resource: British Informatics Olympiad, 1999

## SPOJ Problem Set (classical)

### 3923. Philosophers Stone

#### Problem code: BYTESM2

One of the secret chambers in Hogwarts is full of philosopher's stones. The floor of the chamber is covered by  $h \times w$  square tiles, where there are  $h$  rows of tiles from front (first row) to back (last row) and  $w$  columns of tiles from left to right. Each tile has 1 to 100 stones on it. Harry has to grab as many philosopher's stones as possible, subject to the following restrictions:

- He starts by choosing any tile in the first row, and collects the philosopher's stones on that tile. Then, he moves to a tile in the next row, collects the philosopher's stones on the tile, and so on until he reaches the last row.
- When he moves from one tile to a tile in the next row, he can only move to the tile just below it or diagonally to the left or right.

Given the values of  $h$  and  $w$ , and the number of philosopher's stones on each tile, write a program to compute the maximum possible number of philosopher's stones Harry can grab in one single trip from the first row to the last row.

#### Input

The first line consists of a single integer  $T$ , the number of test cases. In each of the test cases, the first line has two integers. The first integer  $h$  ( $1 \leq h \leq 100$ ) is the number of rows of tiles on the floor. The second integer  $w$  ( $1 \leq w \leq 100$ ) is the number of columns of tiles on the floor. Next, there are  $h$  lines of inputs. The  $i$ th line of these, specifies the number of philosopher's stones in each tile of the  $i$ th row from the front. Each line has  $w$  integers, where each integer  $m$  ( $0 \leq m \leq 100$ ) is the number of philosopher's stones on that tile. The integers are separated by a space character.

#### Output

The output should consist of  $T$  lines, ( $1 \leq T \leq 100$ ), one for each test case. Each line consists of a single integer, which is the maximum possible number of philosopher's stones Harry can grab, in one single trip from the first row to the last row for the corresponding test case.

#### Example

**Input :**

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

**Output :**

32

//7+1+8+5+4+7=32

---

Added by: Paritosh Aggarwal

Date: 2009-02-21

Time limit: 1s-3s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 3924. Filchs Dilemma

#### Problem code: BYTESH1

Filch's Dilemma (15 points) Argus Filch, the caretaker of Hogwarts, has been given the task to carpet the way to Hogwarts through the grounds. The way is 2 units wide and 'N' units long. He has only two types of carpets available, one is 1 unit wide and 2 units long and the other one is L shaped, having 3 square units. Here are their pictures:

> [IMAGE] /www.dccetech.com/events/troika/bytes/images/tiles1.jpg" align="center"/>

> Filch can rotate the carpets when he lays them and has an infinite supply of both types of carpets. As Filch is a squib he cannot magically arrange the carpets and has to resort to logic to find out all possible ways of carpeting the way. He wishes to calculate the number of different ways of carpeting the way.

> For instance, a 2x3 way can be carpeted in 5 different ways as follows:

>

> [IMAGE]

> Notice that both types of carpets can be used simultaneously. Consider, for instance the following way of carpeting a 2x4 way:

>

> [IMAGE] /www.dccetech.com/events/troika/bytes/images/tiles3.jpg" align="center"/>

> Given N, you have to help Filch determine the number of ways to carpet the way of size 2xN. Since this number may be very large, it is sufficient to report the last four digits of the answer. For instance the number of ways to carpet a 2x13 way is 13465. Your program should just print 3465. If the answer is in 4 digits or less it should print the entire answer. For example, if N=3 you should print 5.

>

#### Input

The first line of the input consists of a single integer T ( $1 \leq T \leq 100$ ). Each of the next T lines consists of a single integer N ( $1 \leq N \leq 1000000$ ), indicating the size of the way.

#### Output

For each test case, output the last four digits of the number of ways of carpeting the 2xN way. If the answer involves fewer than 4 digits, print the entire number.

> **Important Update - If the output of last four digits has leading zeros, print the output without the leading zeros**

#### Example

**Input :**

2  
3  
13

**Output :**

5  
3465

---

**Added by:** Paritosh  
**Aggarwal**  
**Date:** 2009-02-21  
**Time limit:** 2s  
**Source**  
**limit:** 50000B  
**Languages:** All



## SPOJ Problem Set (classical)

### 3999. FROGGER

#### Problem code: FROGGER

"Frogger" was one of the first really popular arcade games after it was introduced by SEGA in 1981. The game consists of helping a frog cross a multi-lane motorway without getting run over by a car. You are given a view of an  $n$ -lane motorway where each lane consists of  $m$  different spaces that can either be empty or be occupied by a car. On each side of the motorway is a curb on which the frog can move freely. In the traffic lanes the frog can only move on the spaces not occupied by cars. The motorway is constructed in such a way that the direction in which the cars travel alternates between the lanes, with cars in the first lane (the one closest to the starting point of the frog) moving to the right. The cars never switch lanes and only move one step forward in each turn. To ensure a steady supply of traffic, a car that reaches the boundary of its lane is reentered at the opposite end of its lane. In one turn of the game all the cars move one step in their assigned direction while the frog can either move one step to the right or to the left, or one step up or down (between lanes or between the curb and the adjoining lane), or it can stand still. Contrary to the cars the frog cannot "wrap-around" i.e. move in one step between the first and last position of a lane or a curb. The frog and the cars move simultaneously. Thus the frog can move to a space given that there will be no car on it in the next round. If the frog is on the same space at the same time as a car it is run over and dies. Note that the frog can jump over an adjacent approaching car in the same lane as itself. Your job is to write a computer program that will calculate the minimum number of turns needed for the frog to get from its starting position on the curb to its final position on the curb on the other side of the road or to determine that this is not possible within a given number of rounds.

#### Input

First there will be a line containing the number of scenarios you are asked to help the frog in. For each scenario there will first be a line containing a positive integer  $x \leq 10^5$  giving the maximum number of rounds that can be used. The next line contains the number of lanes  $n$ ,  $1 \leq n \leq 20$ , and the length of each lane  $m$ ,  $1 \leq m \leq 50$ . Each of the next  $n + 2$  lines will contain a string of  $m$  characters. The character X indicates a car, the character O (letter O) indicates a free space, the character F gives the starting position of the frog, and the character G gives the final destination of the frog. The first line indicates the destination curb, consisting of O's and exactly one G while the last line gives the starting curb consisting of O's and exactly one F, while the intermediate lines each represent one lane of the motorway.

#### Output

The output will be one line per scenario, either giving the minimum number of turns needed before the frog can get from its starting position to the final position without getting run over by a car or a statement indicating that this was not possible within the maximum number of allowed turns.

## Example

### Input :

```
2
10
4 4
OOGO
XXOO
XOOX
XXOO
XXOO
OOF0
2
2 2
OG
XX
OO
FO
```

### Output :

```
The minimum number of turns is 9.
The problem has no solution.
```

---

Added by: Fabio Avellaneda

Date: 2009-03-01

Time limit: 60s

Source limit:50000B

Languages: All

Resource: I maratón interuniversitaria del circuito Redis - Acis. Sedes: Politécnico - Javeriana

## SPOJ Problem Set (classical)

### 4000. GALLUP

#### Problem code: GALLUP

Often, we see results of gallups, like this: Prefer red: 3.5% Prefer green: 4.5% Prefer yellow: 22.0% Prefer blue: 70.0% and you begin to wonder: how many people did they really ask? If the numbers are simple, like 20%, 40%, and 40%, you know that they asked 5 people (or 10, or 15, or more, but we are interested in the minimum number of people). Your task is to write a program that reads sets of percentages and calculates the smallest number of people that could produce the given percentages. We know that this number is always less than 10 000.

#### Input

The input is a set of percentages. Each set is on a line of its own. Every line starts with an integer  $n$  ( $0 \leq n \leq 20$ ) giving the number of percentages in the set. If  $n > 0$ , the percentages follow as  $n$  numbers; these numbers may have 0-5 decimals, and all percentages in a set have the same number of decimals. (If there are no decimals, there is no decimal point.) The percentages always add up to about 100% as there may be small rounding errors. Numbers are rounded when digits are removed; they are rounded upwards if the first removed digit is 5 or more. Thus, 4.472 is rounded to 4.47, 4.5, or 4, depending on how many digits you want.

#### Output

For each set of data, print a line starting with "Case  $i$  :", where " $i$ " is the data set's number. Then follows a space and an integer giving the computed number of people. If no legal answer in the range 1-9999 exists, print "error" instead of the number.

#### Example

##### Input :

```
3 20 40 40
3 33.3 33.3 33.3
2 33 67
1 100.0000
4 3.75 4.25 22.00 70.00
2 49 51
2 50 51
2 49 50
0
```

##### Output :

```
Case 1: 5
Case 2: 3
Case 3: 3
Case 4: 1
Case 5: 400
Case 6: 35
Case 7: 200
Case 8: error
```

---

Added by: Fabio Avellaneda

Date: 2009-03-01

Time limit: 60s

Source limit:50000B

Languages: All

Resource: I maratón interuniversitaria del circuito Redis - Acis. Sedes: Politécnico - Javeriana

## SPOJ Problem Set (classical)

### 4003. Subway planning

#### Problem code: SUBWAYPL

The government in a foreign country is looking into the possibility of establishing a subway system in its capital. Because of practical reasons, they would like each subway line to start at the central station and then go in a straight line in some angle as far as necessary. You have been hired to investigate whether such an approach is feasible. Given the coordinates of important places in the city as well as the maximum distance these places can be from a subway station (possibly the central station, which is already built), your job is to calculate the minimum number of subway lines needed. You may assume that any number of subway stations can be built along a subway line.

Figure 1: The figure above corresponds to the first data set in the example input.  
subway example

#### Input

The first line in the input file contains an integer  $N$ , the number of data sets to follow. Each set starts with two integers,  $n$  and  $d$  ( $1 \leq n \leq 500$ ,  $0 \leq d < 150$ ).  $n$  is the number of important places in the city that must have a subway station nearby, and  $d$  is the maximum distance allowed between an important place and a subway station. Then comes  $n$  lines, each line containing two integers  $x$  and  $y$  ( $-100 \leq x, y \leq 100$ ), the coordinates of an important place in the capital. The central station will always have coordinates  $0, 0$ . All pairs of coordinates within a data set will be distinct (and none will be  $0, 0$ ).

#### Output

For each data set, output a single integer on a line by itself: the minimum number of subway lines needed to make sure all important places in the city is at a distance of at most  $d$  from a subway station.

#### Example

##### Input :

```
2
7 1
-1 -4
-3 1
-3 -1
2 3
2 4
2 -2
6 -2
4 0
0 4
-12 18
0 27
-34 51
```

##### Output :

```
4
2
```

---

Added by: Fabio Avellaneda

Date: 2009-03-01

Time limit: 60s

Source limit:50000B

Languages: All

Resource: I maratón interuniversitaria del circuito Redis - Acis. Sedes: Politécnico - Javeriana

## SPOJ Problem Set (classical)

### 4004. Exploding CPU

#### Problem code: CPU

The well known hardware manufacturing company Processors for Professors is about to release a highly specialized CPU with exceptional functionality in, amongst other areas, number theory. It has, for example, an instruction PFACT that takes one parameter and returns all prime factors of that parameter, with an outstanding execution speed. It has, however, one considerable problem. The scientists at the testing lab has just found out that the PFACT instruction for some special input values freaks out and makes the entire processor explode. Even though this could be an amusing effect, it is not the way it was intended to work. The skilled mathematicians have, by trial and error, found that the explosive numbers all share the same interesting number theoretic properties, which might be of help when troubleshooting. An explosive number is a number  $x = p_0 p_1 p_2 \dots p_n$  where all  $p_i$ s are distinct prime numbers such that  $p_i = A p_{i-1} + B$  for  $i = 1, 2, \dots, n$ .  $n \geq 3$ ,  $p_0 = 1$ .  $A$  and  $B$  are always integers, and might be different for different explosive numbers. For example, the processor will explode when factorizing the number 4505, because  $4505 = 1 \cdot 5 \cdot 17 \cdot 53$  and  $5 = 3 \cdot 1 + 2$ ,  $17 = 3 \cdot 5 + 2$  and  $53 = 3 \cdot 17 + 2$  and the numbers 5, 17 and 53 are all prime numbers. In this case  $A = 3$  and  $B = 2$ . You are kindly asked to write a computer program that will aid this company in estimating the impact of the errors, by calculating the amount of explosive numbers that exists within a given range of integers.

#### Input

The input starts with a row containing the number  $0 \leq N \leq 100$  of test cases that will follow. For each test case, there will be one row containing two integers,  $x_L$  and  $x_H$  separated by a single space. These numbers are such that  $0 \leq x_L \leq x_H \leq 2,000,000,000$ .

#### Output

For each test case, output the number of explosive numbers that exist in the range  $x_L \leq x \leq x_H$ .

#### Example

**Input :**

```
2
4505 4505
0 5000
```

**Output :**

```
1
5
```

---

Added by: Fabio Avellaneda

Date: 2009-03-01

Time limit: 60s

Source limit:50000B

Languages: All

Resource: I maratón interuniversitaria del circuito Redis - Acis. Sedes: Politécnico - Javeriana



## SPOJ Problem Set (classical)

### 4033. Phone List

#### Problem code: PHONELST

Phone List Given a list of phone numbers, determine if it is consistent in the sense that no number is the prefix of another. Let's say the phone catalogue listed these numbers:

\* Emergency 911

\* Alice 97 625 999

\* Bob 91 12 54 26

In this case, it's not possible to call Bob, because the central would direct your call to the emergency line as soon as you had dialled the first three digits of Bob's phone number. So this list would not be consistent.

#### Input

The first line of input gives a single integer,  $1 \leq t \leq 40$ , the number of test cases. Each test case starts with  $n$ , the number of phone numbers, on a separate line,  $1 \leq n \leq 10000$ . Then follows  $n$  lines with one unique phone number on each line. A phone number is a sequence of at most ten digits.

#### Output

For each test case, output "YES" if the list is consistent, or "NO" otherwise.

#### Example

**Input :**

```
2
3
911
97625999
91125426
5
113
12340
123440
12345
98346
```

**Output :**

```
NO
YES
```

---

Added by: Andres Galvis  
Date: 2009-03-08  
Time limit: 1s-3s  
Source limit:50000B  
Languages: All  
Resource: Nordic Collegiate Programming Contest 2007

## SPOJ Problem Set (classical)

### 4036. Cuckoo Hashing

#### Problem code: CUCKOO

One of the most fundamental data structure problems is the dictionary problem: given a set  $D$  of words you want to be able to quickly determine if any given query string  $q$  is present in the dictionary  $D$  or not. Hashing is a well-known solution for the problem. The idea is to create a function  $h : S^* \rightarrow [0..n - 1]$  from all strings to the integer range  $0, 1, \dots, n - 1$ , i.e. you describe a fast deterministic program which takes a string as input and outputs an integer between 0 and  $n-1$ . Next you allocate an empty hash table  $T$  of size  $n$  and for each word  $w$  in  $D$ , you set  $T[h(w)] = w$ . Thus, given a query string  $q$ , you only need to calculate  $h(q)$  and see if  $T[h(q)]$  equals  $q$ , to determine if  $q$  is in the dictionary. Seems simple enough, but aren't we forgetting something? Of course, what if two words in  $D$  map to the same location in the table? This phenomenon, called collision, happens fairly often (remember the Birthday paradox: in a class of 24 pupils there is more than 50% chance that two of them share birthday). On average you will only be able to put roughly  $\sqrt{n}$ -sized dictionaries into the table without getting collisions, quite poor space usage!

A stronger variant is Cuckoo Hashing. The idea is to use two hash functions  $h_1$  and  $h_2$ . Thus each string maps to two positions in the table. A query string  $q$  is now handled as follows: you compute both  $h_1(q)$  and  $h_2(q)$ , and if  $T[h_1(q)] = q$ , or  $T[h_2(q)] = q$ , you conclude that  $q$  is in  $D$ . The name "Cuckoo Hashing" stems from the process of creating the table. Initially you have an empty table. You iterate over the words  $d$  in  $D$ , and insert them one by one. If  $T[h_1(d)]$  is free, you set  $T[h_1(d)] = d$ . Otherwise if  $T[h_2(d)]$  is free, you set  $T[h_2(d)] = d$ . If both are occupied however, just like the cuckoo with other birds' eggs, you evict the word  $r$  in  $T[h_1(d)]$  and set  $T[h_1(d)] = d$ . Next you put  $r$  back into the table in its alternative place (and if that entry was already occupied you evict that word and move it to its alternative place, and so on). Of course, we may end up in an infinite loop here, in which case we need to rebuild the table with other choices of hash functions. The good news is that this will not happen with great probability even if  $D$  contains up to  $n/2$  words

#### Input

On the first line of input is a single positive integer  $1 \leq t \leq 50$  specifying the number of test cases to follow. Each test case begins with two positive integers  $1 \leq m \leq n \leq 10000$  on a line of itself,  $m$  telling the number of words in the dictionary and  $n$  the size of the hash table in the test case. Next follow  $m$  lines of which the  $i$ :th describes the  $i$ :th word  $d_i$  in the dictionary  $D$  by two non-negative integers  $h_1(d_i)$  and  $h_2(d_i)$  less than  $n$  giving the two hash function values of the word  $d_i$ . The two values may be identical.

#### Output

For each test case there should be exactly one line of output either containing the string "successful hashing" if it is possible to insert all words in the given order into the table, or the string "rehash necessary" if it is impossible.

## Example

### Input :

```
2
3 3
0 1
1 2
2 0
5 6
2 3
3 1
1 2
5 1
2 5
```

### Output :

```
successful hashing
rehash necessary
```

---

Added by: Andres Galvis

Date: 2009-03-09

Time limit: 1s-3s

Source limit:50000B

Languages: All

Resource: Nordic Collegiate Programming Contest 2007

## SPOJ Problem Set (classical)

### 4060. A game with probability

#### Problem code: KPGAME

Alice and Bob play the following game. First, they collect  $N$  small stones and put them together in one pile. After that, they throw a coin one by one. Alice starts first. If a player throws heads then he takes exactly one stone from the pile. In case of tails he don't do anything. The one who takes the last stone wins. For each player, his skill of throwing a coin is known (to everyone, including himself and his opponent). More precisely, if Alice wants to throw some specific side of the coin, she always succeeds with probability  $P$ . The same probability for Bob is  $Q$ . You are to find probability that Alice will win the game if both guys play optimally.

#### Input

Input starts with a line containing one integer  $T$  - a number of test cases ( $1 \leq T \leq 50$ ). Then  $T$  test cases follow. Each of them is one line with three numbers  $N$ ,  $P$ , and  $Q$  separated with a space ( $1 \leq N \leq 99999999$ ,  $0.5 \leq P$ ,  $Q \leq 0.99999999$ ).  $P$  and  $Q$  have not more than 8 digits after decimal point.

#### Output

For each test case output one line with a probability that Alice will win the game. Your answer must be precise up to  $10^{-6}$ .

#### Example

**Input :**

```
1
1 0.5 0.5
```

**Output :**

```
0.666666667
```

---

Added by: Pavel Kuznetsov

Date: 2009-03-16

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Vologda 2009

## SPOJ Problem Set (classical)

### 4069. Morphing is Fun

#### Problem code: MORPH

Morphic is a tree that grows very rapidly, bringing happiness to its owner. It has a single trunk consisting of a number of cells stacked one on top of another. Each cell has one of  $n$  possible colors which determine the way it mutates during the night, while nobody can see it. Florists denote these colors by the first  $n$  small letters of the English alphabet and know exactly into how many cells, and of what colors, a cell of each color divides. In fact, they have wrote their knowledge down simply with  $n$  nonempty words, each word representing the resulting sequence of colors.

A seed of a Morhic has a single cell of color  $a$  and is rooted firmly in the ground. As long as the Morhic is still alive, each night all its cells simultaneously morph according to the aforementioned rules, possibly causing an exponential growth because each new cell is of the same size as the original one. For example, if rules say that  $a$  becomes  $ab$ , and  $b$  becomes  $ca$ , then after two nights a seed will evolve to a trunk consisting of 4 cells:  $abca$ .

Therefore the top of a Morhic is usually hidden in clouds. The only way to tell if it is still alive is to check if visible part of the trunk is changing colors. In order to do so, one can build enormously high (yet still of constant height) tower, and watch from its top a fixed fragment of the trunk.

As you can easily see, it is either sufficient to observe first  $k$  cells from the bottom for some fixed  $k$ , or no matter how high the tower is, you will not be able to tell for sure if a Morhic died. The latter happens when for every  $k$ , rules cause the  $k$ -th cell to eventually stop changing colors, even though the tree is still alive and mutating.

To prevent waste of money on building such enormous towers, you are to write a program that determines if it is possible to monitor health of a Morhic.

#### Input

The input contains several Morphics descriptions. The first line contains the number of descriptions  $t$  ( $t \leq 10000$ ) that follow. Each of them begins with the number of colors  $n$  ( $1 \leq n \leq 26$ ). Next  $n$  lines contain the rules by which the Morhic grows. The  $i$ -th one describes the sequence of colors in bottom-up order obtained from a single cell of  $i$ -th color. Each line contains at most 100 lowercase English letters.

#### Output

For each test case output one line containing YES if building of a tower is pointless (as in: YES, we can save money!). Otherwise output NO.

## Example

**Input :**

```
4
2
ab
a
3
ba
c
c
3
ba
c
b
3
bbbbbbbbbbbbbbbb
cccccccccccccccc
c
```

**Output :**

```
YES
YES
NO
YES
```

**Warning: enormous input/output data, be careful with certain languages**

---

Added by: Blue Mary

Date: 2009-03-17

Time limit: 13s

Source limit:50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Wrocław 2008

## SPOJ Problem Set (classical)

### 4070. Two Professors

#### Problem code: TWOPROF

There are two professors at the great Academy of X that really do not get along with each other. In order not to reveal their names, we will call them 1 and 2. The Academy employs exactly  $n$  professors, each of them has to give exactly one lecture. As their schedules are rather tight (they are professors, remember?), the starting and the ending time of each lecture is already fixed. However, it is not yet fixed where each lecture will take place. Obviously, it is impossible to schedule two lectures in the same room if their durations overlap; on the other hand, it is possible if one of them starts exactly at the same time that the other one ends. Your task is to find the minimal number of rooms allowing to arrange all the lectures. But know that professors 1 and 2 hate each other so much that they will never give their lectures in the same room.

#### Input

The input contains several test cases. The first line contains the number of test cases  $t$  ( $t \leq 250$ ). Each test begins with a line containing the number of professors  $n$  ( $2 \leq n \leq 100000$ ). Next  $n$  lines follow,  $i$ -th of which contains two integers  $start_i$  and  $end_i$  ( $0 \leq start_i < end_i \leq 1000000000$ ), the starting and the ending time of the lecture that the  $i$ -th professor gives, respectively.

#### Output

For each test case output the minimal number of rooms necessary to schedule all the lectures.

#### Example

**Input :**

```
4
2
0 10
10 20
3
0 10
10 20
10 20
5
4 14
3 13
2 12
1 11
0 10
4
0 10
10 20
20 30
30 40
```

**Output :**



2  
2  
5  
2

**Warning: enormous input/output data, be careful with certain languages**

**Note: The input is too large, so we have 4 input files and the total time limit is 17 seconds.**

---

Added by: Blue Mary

Date: 2009-03-17

Time limit: 17s

Source limit: 50000B

Languages: All except: C99 strict

Resource: ACM Central European Programming Contest, Wrocław 2008

## SPOJ Problem Set (classical)

### 4103. Extend to Palindrome

#### Problem code: EPALIN

Your task is, given an integer  $N$ , to make a palindrome (word that reads the same when you reverse it) of length at least  $N$  ( $1 \leq N \leq 100,000$ ). Any palindrome will do.

Easy, isn't it? That's what you thought before you passed it on to your inexperienced team-mate. When the contest is almost over, you find out that that problem still isn't solved. The problem with the code is that the strings generated are often not palindromic. There's not enough time to start again from scratch or to debug his messy code.

Seeing that the situation is desperate, you decide to simply write some additional code that takes the output and adds just enough extra characters to it to make it a palindrome and hope for the best. Your solution should take as its input a string and produce the smallest palindrome that can be formed by adding zero or more characters at its end. The input string will consist of only upper and lower case letters.

#### Example

##### Input :

```
aaaa
abba
amanaplanacanal
xyz
```

##### Output :

```
aaaa
abba
amanaplanacanalpanama
xyzzyx
```

*Note: 1. All palindromes are considered case-sensitive (i.e. 'Aa' is not a palindrome). 2. Large I/O. Be careful in certain languages.*

---

Added by: Muntasir Azam Khan

Date: 2009-03-22

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Own problem, used in Next Generation Contest 5

## SPOJ Problem Set (classical)

### 4110. Fast Maximum Flow

#### Problem code: FASTFLOW

Given a graph with  $N$  ( $2 \leq N \leq 5,000$ ) vertices numbered 1 to  $N$  and  $M$  ( $1 \leq M \leq 30,000$ ) undirected, weighted edges, compute the maximum flow / minimum cut from vertex 1 to vertex  $N$ .

#### Input

The first line contains the two integers  $N$  and  $M$ . The next  $M$  lines each contain three integers  $A$ ,  $B$ , and  $C$ , denoting that there is an edge of capacity  $C$  ( $1 \leq C \leq 10^9$ ) between nodes  $A$  and  $B$  ( $1 \leq A, B \leq N$ ). Note that it is possible for there to be duplicate edges, as well as an edge from a node to itself.

#### Output

Print a single integer (which may not fit into a 32-bit integer) denoting the maximum flow / minimum cut between 1 and  $N$ .

#### Example

**Input :**

```
4 6
1 2 3
2 3 4
3 1 2
2 2 5
3 4 3
4 3 3
```

**Output :**

```
5
```

Viewing the problem as max-flow, we may send 3 units of flow through the path 1 - 2 - 3 - 4 and 2 units of flow through the path 1 - 3 - 4. Viewing the problem as min-cut, we may cut the first and third edges. Either way the total is 5.

Note: see also <http://www.spoj.pl/problems/MATCHING/>.

---

Added by: Neal Wu

Date: 2009-03-25

Time limit: 5s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 4142. Ellipse

#### Problem code: ELLIPSE

Given 5 points on a ellipse, calculate the area of the ellipse. We accept solutions with **absolute error less than  $10^{-6}$**  or **relative error less than  $10^{-9}$** .

#### Input

Many test cases. Each contains a line with 10 integers with absolute value less than 1000 - the X and Y coordinates of the 5 points, respectively.

Input terminates by EOF. Note that there can be extra spaces in a single line.

#### Output

Each line contains a single float-point number - the area of the corresponding ellipse, or "IMPOSSIBLE" if the ellipse doesn't exist or can't be unique determined.

#### Example

**Input :**

```
6 1 3 2 -2 -3 -3 -2 1 6
7 -3 2 7 6 3 5 5 -2 -9
```

**Output :**

```
IMPOSSIBLE
157.079633
```

**Note: You can click on "Wrong Answer" to get further information.**

**Note: Judge is slightly modified to avoid some precision problems.**

---

Added by: [Trichromatic] XilinX

Date: 2009-03-27

Time limit: 10s

Source limit:50000B

Languages: All except: C99 strict ERL TECS JS

Resource: Classical Problem, description by Blue Mary

## SPOJ Problem Set (first)

### 4164. A conjecture of Paul Erdős

#### Problem code: HS08PAUL

In number theory there is a very deep unsolved conjecture of the Hungarian Paul Erdős (1913-1996), that there exist infinitely many primes of the form  $x^2+1$ , where  $x$  is an integer. However, a weaker form of this conjecture has been proved: there are infinitely many primes of the form  $x^2+y^4$ . You don't need to prove this, it is only your task to find the number of (positive) primes not larger than  $n$  which are of the form  $x^2+y^4$  (where  $x$  and  $y$  are integers).

#### Input

An integer  $T$ , denoting the number of testcases ( $T \leq 10000$ ). Each of the  $T$  following lines contains a positive integer  $n$ , where  $n < 10000000$ .

#### Output

Output the answer for each  $n$ .

#### Example

**Input :**

```
4
1
2
10
9999999
```

**Output :**

```
0
1
2
13175
```

---

Added by: Robert Gerbicz

Date: 2009-04-05

Time limit: 5s

Source limit: 4096B

Languages: All

Resource: High School Programming League 2008/09

## SPOJ Problem Set (classical)

### 4166. Four colors

#### Problem code: HS08FOUR

Let there be given  $n$  points:  $P_1, P_2, \dots, P_n$  arranged in this order on a line. We would like to color them using four colors: white, black, red, and blue, in such a way that for every three consecutive points it is true that either

1. the colors of these three points are pairwise distinct, or
2. the color of some point is white.

#### Input

An integer  $T$ , denoting the number of testcases ( $T < 100000$ ). In each line you are given one positive integer ( $n < 1000000000$ ). There are 5 input sets.

#### Output

Find the number of possible colorings of the  $n$  points. Since the answer can be very big, output only the answer modulo 1000000007.

#### Example

**Input :** 41231000**Output :** 41643283570349

**Warning: large input/output data, be careful with certain languages**

**Warning: A naive algorithm will probably solve only the first input set.**

---

Added by: Robert Gerbicz

Date: 2009-04-05

Time limit: 1s

Source limit: 4096B

Languages: All

Resource: High School Programming League 2008/09

## SPOJ Problem Set (classical)

### 4168. Square-free integers

#### Problem code: SQFREE

In number theory we call an integer square-free if it is not divisible by a perfect square, except 1. You have to count them!

#### Input

First line contains an integer  $T$ , the number of test cases ( $T \leq 100$ ). The following  $T$  lines each contains one positive integer:  $n$ , where  $n \leq 10^{14}$

#### Output

$T$  lines, on each line output the number of (positive) square-free integers not larger than  $n$ .

#### Example

**Input :**

```
3
1
1000
1000000000000000
```

**Output :**

```
1
608
60792710185947
```

**Warning: A naive algorithm probably not works.**

---

Added by: Robert Gerbicz  
Date: 2009-04-06  
Time limit: 20s  
Source limit: 2009B  
Languages: All  
Resource: classic, own input

## SPOJ Problem Set (classical)

### 4172. Multiplicative digital root

#### Problem code: DROOT

For an integer find the multiplicative digital root of it! Multiple all nonzero digits of that number and repeat this process until it is only a single digit. We call that digit the multiplicative digital root of the number. For example the multiplicative digital root of  $n=2009$  is 8, because the first iteration is:  $2*9=18$ , the second is  $1*8=8$ , and we stop here.

#### Input

The first line of the input file contains one integer  $T$ , the number of test cases. The following  $T$  lines each contains a big positive integer:  $n$ , where  $n < 10^{10000}$

#### Output

Output the multiplicative digital root for each  $n$ .

#### Example

**Input :**

```
4
6
2009
555555555
847938630482747410708417738635300464477112059683336648877683
```

**Output :**

```
6
8
5
2
```

**Warning: large input data, be careful with certain languages**

**Warning: not every languages are available for this task**

---

Added by: Robert Gerbicz

Date: 2009-04-06

Time limit: 2s

Source limit: 2048B

Languages: C C++ PAS gpc PAS fpc

Resource: classic, own input



## SPOJ Problem Set (classical)

### 4176. A Knightly Pursuit

#### Problem code: KPURSUIT

In chess, game pieces move about an chessboard in a fashion defined by their type. The object of the game is to capture opposing pieces by landing on their squares, and eventually trapping the king piece. In our version of the game, we shall use a variable sized board with only 2 pieces on it: A white pawn which moves relentlessly towards the top row of the chessboard one square at a time per move; and a black knight which can move from its current location in any of up to eight ways: two squares up or down and one square left or right, or one square up or down and two squares left or right. The knight must remain on the board at all times; any move that would take it off the board is therefore disallowed. In the diagram below, the knight's position is labelled K and its possible moves are labelled 1 to 8.

```
.....  
.. 8 . 1 ..  
. 7 ... 2 .  
... K ...  
. 6 ... 3 .  
.. 5 . 4 ..  
.....
```

The pawn moves first; then the knight and pawn alternate moves. The knight tries to land either on the square occupied by the pawn (a win) or on the square immediately above the pawn (a stalemate). If the pawn reaches the top row of the board the game ends immediately and the knight loses (a loss).

#### Input

The first line of input contains a positive integer, n, the number of games to analyze. For each game there are six lines on input:

r, the number of rows in the chessboard.

c, the number of columns in the chessboard.

pr, the row of the starting position of the pawn.

pc, the column of the starting position of the pawn.

kr, the row of the starting position of the knight.

kc, the column of the starting position of the knight.

All numbers in the input don't exceed 100. (Thanks to Blue Mary for pointing that out).

The pawn and the knight will have different starting positions. Row 1 is at the bottom of the board and Row r is at the top of the board. Column 1 is at the left and column c is at the right.

#### Output

If the knight can win and, output the minimum number of moves it must make to do so. If the knight cannot win, your program should determine if it can cause a stalemate and, if it can, the minimum number of moves it must make to do so. Finally if the knight cannot win or cause a stalemate, your program should compute the number of moves the knight makes before the pawn wins.

## Example

### Input :

```
3
99
99
33
33
33
35
3
3
1
1
2
3
99
99
96
23
99
1
```

### Output :

```
Win in 1 knight move(s).
Stalemate in 1 knight move(s).
Loss in 2 knight move(s).
```

---

Added by: Analysis Mode (Elspeth, Knight-Errant)

Date: 2009-04-07

Time limit: 1s

Source limit:50000B

Languages: All except: C99 strict

Resource: Canadian Computing Competition 1999 Senior Question 4

## SPOJ Problem Set (classical)

### 4177. Herding

#### Problem code: HERDING

Oh no! A number of stray cats have been let loose in the city, and as the City Cat Catcher, you have been assigned the vital task of retrieving all of the cats. This is an ideal opportunity to test your latest invention, a cat trap which is guaranteed to retrieve every cat which walks into a square-shaped subsection of the city.

Fortunately, you have the assistance of one of the world's foremost cat psychologists, who has the amazing ability of predicting, given a square subsection of the city, exactly which of the four cardinal directions (north, east, south or west) the cat will head. While this information is handy, you still don't know where all the cats currently are.

In order to prove the cost-effectiveness of your method to the City it would, of course, be important to minimize the number of traps used.

#### Input

The input will begin with a line consisting of two numbers  $n$  and  $m$ , separated by a space ( $1 \leq n, m \leq 1000$ ). The city will be an  $n \times m$  grid of square subsections. The next  $n$  lines will each consist of a string of length  $m$ , consisting of the letters 'N', 'E', 'S', or 'W', representing north, east, south and west, respectively. (The first character of the first line will be the northwesternmost point.) The direction in the square is the direction which cats will head if they are in that square. The cat psychologist assures you that cats have no interest in leaving the city.

#### Output

Output the minimum number of traps needed.

#### Example

**Input :**

```
3 4
SWWW
SEWN
EEEN
```

**Output :**

```
2
```

---

Added by: Analysis Mode (Elspeth, Knight-Errant)  
Date: 2009-04-07  
Time limit: 1s-3s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Canadian Computing Competition 2008 Stage 2 Day 2 Problem D

## SPOJ Problem Set (classical)

### 4178. Distance on a square lattice

#### Problem code: LATTICE

Let  $L$  to be an  $n \times n$  square lattice, you can consider its points as  $(x, y)$ , where  $x$  and  $y$  are integers from the  $[1, n]$  interval. And let  $f(n)$  to be the expected distance between two not necessarily distinct points on the lattice. For example  $f(1)=0$  and  $f(2)=(2 + \sqrt{2})/4$ .

#### Input

There is no input.

#### Output

5000 lines, on the  $n$ -th line give the value of  $f(n)$  by 2 digits after the decimal point.

#### Example

**Input :**

No input.

**Output :**

0.00  
0.85  
1.45  
2.01  
2.55  
.  
.  
.  
2607.03

---

Added by: Robert Gerbicz

Date: 2009-04-07

Time limit: 1s

Source limit: 50000B

Languages: TEXT

Resource: own resource

## SPOJ Problem Set (classical)

### 4179. Temptation Island

#### Problem code: TEMPTISL

On Monday, the number of frosh were reduced in half. To further reduce the number of engineers to a manageable number, the following challenge was devised for the second day. Each of the students would have to take this challenge individually.

Each student would be placed at a vertex of perimeter fence of Waterloo (oh yeah, some background: to keep UofT's engineering Lady Godiva band out of Waterloo, a fence was erected surrounding the university. The fence just happens to be an N-gon). At some other vertex along the fence would be located a temptation so seductive that no Waterloo student could resist - an extra-credit assignment. The challenge of each student is to go from his starting vertex to the vertex with the prize. There are however 3 rules:

- The student can only travel from vertex to vertex (backwards or forwards) along the polygonal fence.
- The student has to make contact with exactly K vertices (the vertex he starts at doesn't count unless he returns to it). The K vertices need not be unique. The final vertex has to be the one with the prize.
- If the student cannot reach the prize and make contact with exactly K vertices, he fails the test and is kicked out of the university.

Of course, no Waterloo student is satisfied with only 1 solution to any problem. Therefore, inevitably, each student determines all ways that he/she can win. Note that there may be no solution to the problem (the astute student has figured out that this will result in a class size of 0 - this is entirely allowable as the variable used to quantify enrollment was incorrectly defined as a whole number instead of a natural number).

#### Input

N K (N, K ≤ 50)

A B (A = the starting vertex number, B = destination vertex number)

-1 -1 terminates input

#### Output

The total number of ways of reaching the destination from the starting point by following the above rules. The total number of ways will be less than  $2^{63} - 1$ . Output 0 if there are no solution.

#### Example

**Input :**

8 5  
1 4  
-1 -1

**Output :**

6

---

Added by: Analysis Mode (Elspeth, Knight-Errant)  
Date: 2009-04-08  
Time limit: 0.5s-1s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Woburn Challenge 2001

## SPOJ Problem Set (classical)

### 4182. Candy (Again)

#### Problem code: FCANDY

You and a friend have a big bag of candy. You want to keep slim and trim, and so you would like to equalize the candy which you are sharing with your friend in terms of calorie count. That is, your task is to divide the candies into two groups such that the number of calories in each group is as close together as possible.

#### Input

The first line of input contains the number of different kinds of candy you have in your bag of candy  $N$  ( $1 \leq N \leq 100$ ). On the following  $N$  lines, there are pairs of numbers describing each type of candy. The candy description is of the form  $k_i \ c_i$  where  $k_i$  is the number of that particular type of candy contained in the bag and  $c_i$  is the calorie count for each piece of that type of candy. You may assume that  $1 \leq k_i \leq 500$  and  $1 \leq c_i \leq 200$ .

#### Output

Your output is one integer which is the minimum difference of calories between friends

#### Example

**Input :**

```
4
3 5
3 3
1 2
3 100
```

**Output :**

```
74
```

---

Added by: Analysis Mode (Elspeth, Knight-Errant)

Date: 2009-04-08

Time limit: 0.5s-9s

Source limit:50000B

Languages: All except: C99 strict

Resource: Canadian Computing Competition 2008 Stage 2 Question E



## SPOJ Problem Set (classical)

### 4186. Break a New RSA system

#### Problem code: HS08CODE

Today, Gerrob's RSA company has featured a New RSA cryptosystem: its public key is  $n$ , the secret keys are three distinct primes  $p$ ,  $q$  and  $r$ , where  $n=p*q*r$ . Note that the ordinary RSA uses only 2 primes! Unfortunately some hackers have stolen a DVD from the company. It does not store the secret keys, only some information about the system, namely, the values of:

$\phi(n)$  - Euler's totient function and

$s(n)$  - the sum of the divisors.

Obviously you know also  $n$ , because that's public.

Now, Gerrob's RSA employees are trying to determine if hackers will be able to break the system. Could you help them to answer this question?

#### Input

The first line contains a single integer  $T$ , the number of test cases, where  $T \leq 20000$ . The following  $T$  lines each contains three numbers  $n$ ,  $\phi(n)$  and  $s(n)$  in this order. There are 5 input sets.

#### Output

Output  $T$  lines, the values of  $p$ ,  $q$  and  $r$  in increasing order. It is guaranteed that  $p, q, r < 10^6$ .

#### Example

**Input :**

4

30 8 72

61321 54912 68040

451464315257 451286179344 451642497600

91896729624994213 91896040105364880 91897419147616160

**Output :**

2 3 5

13 53 89

6397 8039 8779

231859 574261 690187

**Warning: large input/output data, be careful with certain languages**

**Warning: A naive algorithm will probably solve only the first input set.**

---

Added by: Robert Gerbicz  
Date: 2009-04-08  
Time limit: 0.400s-1s  
Source limit:50000B  
Languages: All  
Resource: High School Programming League 2008/09

## SPOJ Problem Set (classical)

### 4188. Amazing equality

#### Problem code: HS08EQ

The definition of a perfect number is about 2300 years old. A perfect number is defined as a positive integer which is the sum of its proper positive divisors, that is, the sum of the positive divisors excluding the number itself. What can we get if, in the sum, we replace each divisor by its square? You can prove that there is no such number. But there are many numbers for which the sum of some divisors' squares is equal to  $n$ , so  $n = d_1^2 + d_2^2 + \dots + d_k^2$ , where  $d_1, d_2, \dots, d_k$  are distinct (positive) divisors of  $n$ . You have to count how many times this happens. For example: the divisors of  $n=120$  are 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120. And there are exactly two amazing equalities:

$$120 = 2^2 + 4^2 + 10^2$$

$$120 = 2^2 + 4^2 + 6^2 + 8^2$$

#### Input

The first number is  $T$ , denoting the number of test cases ( $T < 1000$ ).  $T$  lines follow, each of which contains one positive integer ( $n < 10^{10}$ ).

#### Output

Output  $T$  lines, the answer for each  $n$ .

#### Example

**Input :**

```
6
120
720
1000
1200
92070
123618780
```

**Output :**

```
2
13
0
10
6448
292
```

---

Added by: Robert Gerbicz

Date: 2009-04-09

Time limit: 12s

Source limit: 4096B

Languages: All

Resource: High School Programming League 2008/09

## SPOJ Problem Set (classical)

### 4198. Lego

#### Problem code: LEGO

It's Christmas morning, and you've got what you wanted: a box of Lego(TM)! (Okay, maybe not, but better than nothing)

Lego is pretty fun to tinker with, and you've decided to build some sort of shape.

(For the sake of this problem, let's say your shape is basically 2-dimensional - it'll be a slab)

But once you pick it up, you discover that you didn't plan it properly, and your wonderful shape just falls apart.

Now, you're planning to build something big, and so you're going to use the computer to help you.

Write a program, that given the layout of a Lego design, outputs the number of pieces it would break into if picked up.

(Assume that the bricks bind together perfectly)

The Legos will be built on a x-y coordinate plane, with (0,0) being the bottom left corner.

The blocks are flat on your carpet, so a block will never 'fall down'.

(If you haven't seen a Lego brick before: A Lego brick has grooves on its top that match with notches on the bottom.

If a groove and a notch bind, the bricks will stay together. See the diagram.

A brick will bind with another brick securely even if just a single notch touches another groove.

#### Input:

The first line contains  $N$  (the number of Lego pieces),  $1 \leq N \leq 100000$ .

$N$  lines follow, each with 4 integers  $x_1, y_1, x_2, y_2$  ( $0 \leq x_1 < x_2 \leq 2 \times 10^9$ ,  $0 \leq y_1 < y_2 \leq 2 \times 10^9$ )

This means that there is a brick with bottom left corner  $(x_1, y_1)$  and top right corner  $(x_2, y_2)$ .  $x$  denotes the horizontal coordinate and  $y$  the vertical coordinate. Two bricks will bind if one's bottom  $y$ -coordinate coincides with the other's top  $y$ -coordinate and the union of the two intervals (the bottom of one and the top of the other) has nonzero length.

No bricks will overlap.

#### Output:

A single line containing the number of separate pieces that these blocks form.

#### Sample Input:

```
4
0 0 2 2
1 2 3 4
2 0 4 2
4 0 6 2
```

## Sample Output:

2

## Explanation

Blocks #1,2,3 are joined securely.  
However, #4 is just hanging around.

---

Added by: Brian

Date: 2009-04-10

Time limit: 1s-3s

Source limit:50000B

Languages: All except: TECS

Resource: Hanson Wang

## SPOJ Problem Set (classical)

### 4202. Brackets Parade

#### Problem code: BRPAR

Count the number of different correct bracket sequences consisting of  $k_1$  pairs of brackets of the 1st type,  $k_2$  pairs of brackets of the 2nd type, ...,  $k_m$  pairs of brackets of the  $m$ -th type. The bracket sequence is considered correct in the following cases:

- empty sequence is correct;
- if A is correct and B is correct then AB is correct;
- if A is correct then  $(_i A)_i$  is correct where  $(_i$  and  $)_i$  are opening and closing brackets of the same type.

#### Input

The first line of input is the number  $0 < n \leq 1000$  of test cases. Each of the following  $n$  lines describe a test case. Each line starts with number  $0 < m \leq 100$  the amount of different bracket types. Then  $m$  positive numbers  $k_1, k_2, \dots, k_m$  follow each separated with a space. Number  $k_i$  is the amount of pairs of brackets of  $i$ -th type. The total amount of pairs of brackets is not greater than 1000.

#### Output

For each test case output a line containing single integer - the answer to the problem modulo 1000000007.

#### Example

**Input :**

```
3
1 4
2 2 2
3 1 2 3
```

**Output :**

```
14
84
7920
```

---

Added by: Spooky

Date: 2009-04-11

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Open All-Ukrainian Collegiate Contest Semi-Final, 2009

## SPOJ Problem Set (classical)

### 4206. Fast Maximum Matching

#### Problem code: MATCHING

FJ has  $N$  ( $1 \leq N \leq 50,000$ ) cows and  $M$  ( $1 \leq M \leq 50,000$ ) bulls. Given a list of  $P$  ( $1 \leq P \leq 150,000$ ) potential matches between a cow and a bull, compute the greatest number of pairs that can be matched. Of course, a cow can be matched to at most one bull, and vice versa.

#### Input

The first line contains three integers,  $N$ ,  $M$ , and  $P$ . Each of the next  $P$  lines contains two integers  $A$  ( $1 \leq A \leq N$ ) and  $B$  ( $1 \leq B \leq M$ ), denoting that cow  $A$  can be matched with bull  $B$ .

#### Output

Print a single integer that is the maximum number of pairs that can be obtained.

#### Example

**Input :**

```
5 4 6
5 2
1 2
4 3
3 1
2 2
4 4
```

**Output :**

```
3
```

Cow 1 can be matched to bull 2, cow 3 to bull 1, and cow 4 to bull 3.

Note: see also <http://www.spoj.pl/problems/FASTFLOW/>.

---

Added by: Neal Wu

Date: 2009-04-12

Time limit: 3s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 4235. Wandering Queen

#### Problem code: QUEEN

There is a checkmates board with **n** rows and **m** columns. Some of the cells of the board are occupied. There is a queen standing on a certain cell. It wants to move to another cell of this board. Help it do this making the least possible moves. The queen can go any number of cells in any of eight directions in a single move, but it can't pass through or stand on the occupied cells and leave the board.

#### Input

The first line of the input contains number **t** - the amount of tests. Then **t** test descriptions follow. The first line of each test consists of two numbers **n** and **m** separated with a space. Then **n** lines follow each containing **m** characters describing the board. Character '.' means a free cell, character 'X' - an occupied cell, character 'S' - the starting cell of the queen, character 'F' - the cell where the queen wants to go. It is guaranteed that there will be exactly one character 'S' and one character 'F' on each board.

#### Constraints

$1 \leq t \leq 30$   
 $2 \leq n, m \leq 1000$

#### Output

For each test case print the minimum number of moves the queen has to do to reach the desired cell. Print '-1' if the queen can't reach the cell.

#### Example

##### Input :

```
3
3 3
S..
...
..F
3 3
S..
XX.
F..
3 3
S..
XXX
..F
```

##### Output :

```
1
3
-1
```

---



Added by: Spooky  
Date: 2009-04-16  
Time limit: 5s  
Source limit: 50000B  
Languages: All  
Resource: Advancement Spring 2009, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 4273. Train TimeTable

#### Problem code: TTTABLE

A train line has two stations on it, A and B. Trains can take trips from A to B or from B to A multiple times during a day. When a train arrives at B from A (or arrives at A from B), it needs a certain amount of time before it is ready to take the return journey - this is the turnaround time. For example, if a train arrives at 12:00 and the turnaround time is 0 minutes, it can leave immediately, at 12:00.

A train timetable specifies departure and arrival time of all trips between A and B. The train company needs to know how many trains have to start the day at A and B in order to make the timetable work: whenever a train is supposed to leave A or B, there must actually be one there ready to go. There are passing sections on the track, so trains don't necessarily arrive in the same order that they leave. Trains may not travel on trips that do not appear on the schedule.

#### Input

The first line of input gives the number of cases,  $N$  ( $1 \leq N \leq 100$ ).  $N$  test cases follow.

Each case contains a number of lines. The first line is the turnaround time,  $T$  ( $0 \leq T \leq 60$ ), in minutes. The next line has two numbers on it,  $NA$  and  $NB$ .  $NA$  is the number of trips from A to B, and  $NB$  is the number of trips from B to A ( $0 \leq NA, NB \leq 100$ ). Then there are  $NA$  lines giving the details of the trips from A to B.

Each line contains two fields, giving the HH:MM departure and arrival time for that trip. The departure time for each trip will be earlier than the arrival time. All arrivals and departures occur on the same day. The trips may appear in any order - they are not necessarily sorted by time. The hour and minute values are both two digits, zero-padded, and are on a 24-hour clock (00:00 through 23:59). After these  $NA$  lines, there are  $NB$  lines giving the departure and arrival times for the trips from B to A.

#### Output

For each test case, output one line containing "Case #x: " followed by the number of trains that must start at A and the number of trains that must start at B.

#### Example

**Input :**

```
2
5
3 2
09:00 12:00
10:00 13:00
11:00 12:30
12:02 15:00
09:00 10:30
2
2 0
09:00 09:01
12:00 12:02
```

**Output :**

Case #1: 2 2

Case #2: 2 0

---

Added by: abhijith reddy d

Date: 2009-04-27

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Google Codejam 2008

## SPOJ Problem Set (classical)

### 4324. The fate of the pineapple

#### Problem code: EVERLAST

In order to help terraform Mars, astronauts have brought (among other things)  $N$  ( $0 \leq N < 5$ ) young, healthy pineapple plants.

This particular type of pineapple reproduces asexually in the following way:

1. A single pineapple plant produces  $K$  ( $0 \leq K < 15$ ) new pineapple in one growing season.
2. At the end of the growing season, the new pineapples are adults, and the old ones are dead.
3. Increased levels of radiation have a  $P$  ( $0 \leq P \leq 1$ ) chance of sterilizing any new pineapple that develops on Mars. This probability is independent for each pineapple.

What is the probability that the pineapple population will never die out?

#### Input

The first line is the number of test cases (no more than  $10^5$ ). Each of the following lines describes a test case. The integers  $N$  and  $K$  and the decimal number  $P$  are separated by single spaces.

#### Output

There will be one line for each test case. Each line will have the probability of eventual survival in percent, to two decimals, followed by the percent sign.

#### Example

**Input :**

```
5
1 3 0.6666666666666666
1 3 0.65
1 1 0
1 0 1
3 4 0.7101634622811129
```

**Output :**

```
0.00%
13.83%
100.00%
0.00%
70.94%
```

---

Added by: Paul Draper  
Date: 2009-05-05  
Time limit: 1s-4.5s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 4343. Empty Boxes

#### Problem code: EBOXES

$N$  large empty boxes (assume they are of type:1) are initially placed on a table. An unknown number of boxes (type:1) are selected and in each of them  $K$  smaller boxes (type:2) are placed. Again an unknown number of type:2 boxes are selected and  $K$  boxes of type:3 are placed inside. This process is repeated  $T$  times. Now a box is assumed to be empty when it has no smaller boxes inside it. Finally after all the processes are complete let there be  $F$  empty boxes in total.

#### LIMITS

$1 < N, K, T, F < 1000000$

#### Input

First line of the input file contains the number of test cases. Then each line contains 4 integers  $N, K, T, F$  as described above.

#### Output

Each line should contain the total number of boxes on the table.

#### Example

**Input :**

1

11 8 2 102

**Output :**

115

---

Added by: abhijith reddy d

Date: 2009-05-07

Time limit: 5s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (main)

### 4407. Counting Arborescence

#### Problem code: DAGCNT

*"In graph theory, an arborescence is a directed graph in which, for a vertex  $v$  called the root and any other vertex  $u$ , there is exactly one directed path from  $v$  to  $u$ . In other words, an arborescence is a directed, rooted tree in which all edges point away from the root. Every arborescence is a directed acyclic graph."*

-- from Wikipedia, the free encyclopedia

You are given a directed graph with  $N$  vertices, and your task is to count the number of different arborescences of size  $N$  that can be found in the given graph.

Two arborescences are considered different when they consist of different edges.

#### Input

Input consists of multiple test cases.

For each test case, the first line contains one integer  $N$  described as above.

$N$  lines follows, each consists of  $N$  characters, either '0' or '1', representing the adjacency matrix of the graph.

The directed graph contains edge  $(i,j)$  if and only if the  $j$ th character of the  $i$ th line of the matrix is '1'.

The graph consists of no more than 8 vertices.

End of input is indicated by a line consisting of a single 0.

#### Output

For each test case, output one line consisting of one single integer, the number of arborescences.

#### Example

**Input :**

```
2
00
00
2
01
10
0
```

**Output :**

```
0
2
```

---

Added by: Blue Mary  
Date: 2009-05-23  
Time limit: 11s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Fudan University Local Contest #1

## SPOJ Problem Set (classical)

### 4408. Build a Fence

#### Problem code: FENCE1

There is a wall in your backyard. It is so long that you can't see its endpoints. You want to build a fence of length  $L$  such that the area enclosed between the wall and the fence is maximized. The fence can be of arbitrary shape, but only its two endpoints may touch the wall.

#### Input

The input consists of several test cases.

For every test case, there is only one integer  $L$  ( $1 \leq L \leq 100$ ), indicating the length of the fence.

The input ends with  $L=0$ .

#### Output

For each test case, output one line containing the largest area. Your answer should be rounded to 2 digits after the decimal point.

#### Example

**Input :**

1  
0

**Output :**

0.16

---

Added by: Blue Mary

Date: 2009-05-23

Time limit: 1s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Fudan University Local Contest #1, practise session



## SPOJ Problem Set (classical)

### 4409. Circle vs Triangle

#### Problem code: AREA1

You are given a triangle and a circle in a plane. You can arbitrarily rotate or move them. What's the maximum possible area of their overlapping region?

#### Input

Input consists of one or more lines. For each line, there are four integers describing one test case: the lengths of three sides of a triangle  $a, b, c$ ; and the radius of a circle  $r$ ; where  $1 \leq a \leq b \leq c \leq 100$ ,  $1 \leq r \leq 100$ ,  $a+b > c$ .

End of input is indicated by a line consisting four zeros.

#### Output

For each test case, output a single line showing the largest overlapping area of the circle and the triangle. We accept solutions with absolute error less than  $10^{-2}$ .

#### Example

**Input :**

```
3 4 5 1
5 5 8 4
0 0 0 0
```

**Output :**

```
3.14
12.00
```

**Judge is modified on Feb 23,2010. Now you can click on "Wrong Answer" for further information.**

---

Added by: [Trichromatic] XilinX

Date: 2009-05-23

Time limit: 11s

Source limit:50000B

Languages: All except: C99 strict ERL TECS JS

Resource: Fudan University Local Contest #1

## SPOJ Problem Set (main)

### 4410. Repair the Door

#### Problem code: REPAIR1

Once upon a time, there was a famous university called Famous University. As thousands of students studied and lived in FU, a gigantic residential building was built, which is called 'B37'. All students lived in B37 happily.

After decades, FU is still as famous as it had been in the past; however, the students living in it are now unhappy, because B37 is too old. Although the door of the building looks fine, it can be easily broken when being opened by some careless student too forcefully.

So, Blue Mary, the accommodation officer of B37, is facing an extremely serious problem.

With some mysterious methods, Blue Mary has predicted that exactly  $N$  students will enter or exit B37 during the next term. Unfortunately she doesn't know who the careless ones are, so she assumes that every student opening the door has a probability of  $P$  percent to be a careless one. When the door is broken by some careless guy, Blue Mary may repair it immediately or after some time, with a cost of  $A$  yuan. Unfortunately when a student goes through the door and finds it already broken and not repaired, she will report it to the headmaster, and Blue Mary will be subject to a fine of  $B$  yuan. The door is in good condition before the term begins, and will be repaired by the university after the term ends, so Blue Mary can leave the door unrepaired at the end of the term.

Being good at mathematics, Blue Mary has made a strategy, to decide when to and when not to repair the door, in order to minimize her expense.

Please write a program to calculate the expectation of her expense.

#### Input

The input consists of multiple test cases, the number of them is about 200000.

For each test case, there is one line containing four non-negative integers  $N$ ,  $P$ ,  $A$ ,  $B$  described as above, with  $0 \leq N \leq 100000$ ,  $0 \leq P \leq 100$ ,  $0 \leq A \leq 100$ ,  $0 \leq B \leq 100$ .

End of input is indicated by a line consisting of four zeros.

#### Output

For each test case, output one line containing the expectation of Blue Mary's minimal expense. We accept solutions with absolute error less than  $10^{-4}$ .

## Example

### Input :

```
10 100 0 1
10 100 1 0
2 50 2 1
0 0 0 0
```

### Output :

```
0.0000
0.0000
0.5000
```

## Hint

In the first sample, the door will be broken every time it is opened, but repairing is free, so just repair it every time.

In the second sample, nothing will be fined, so just leave the door unrepaired.

In the last sample, if the door is broken by the first student, Blue Mary will be fined 1 yuan, otherwise she doesn't need to pay anything.

---

Added by: Blue Mary

Date: 2009-05-23

Time limit: 11s

Source limit:50000B

Languages: All except: C99 strict

Resource: Fudan University Local Contest #1

## SPOJ Problem Set (main)

### 4411. Counting Expressions

#### Problem code: EXPR3

Count the number of distinct expressions involving  $n$  different operands **a**, **b**, **c**, etc. Only operators +, -, \*, / and parentheses are permitted.

Two expressions are distinct if for some valid input values (i.e. You won't divide some number by zero) **a**, **b**, **c**, ... , the two expressions lead to different results. For example,  $a/b/c$  and  $a/(b*c)$  are the same expressions, but  $a/b+c$  and  $a/(b+c)$  are not.

#### Input

Multiply test cases. For each test case:

A single line -  $n$ . ( $1 \leq n \leq 50$ ).

Input terminates by a single zero.

#### Output

For each test case:

The number of different expressions, modulo 4999999999999993.

#### Example

**Input :**

3  
0

**Output :**

68

---

Added by: Blue Mary  
Date: 2009-05-23  
Time limit: 30s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: Fudan University Local Contest #1

## SPOJ Problem Set (classical)

# 4412. Factorization, Factorization, Factorization

## Problem code: FACTOR1

Factorize  $x^n - 1$  into several irreducible polynomials over the integers.

### Input

Multiply test cases. For each test case:

A single line -  $n$ . ( $2 \leq n \leq 1200$ ).

Input terminates by a single zero.

### Output

For each test case, output the factorization of the given polynomial.

There are multiple ways to express the factorization of a polynomial. To make it unique, we sort the irreducible polynomials according to the following rules:

Lower order polynomials are always lexicographically smaller than higher order polynomials. Same order polynomials should be sorted by their coefficients. We compare the coefficients from high degree terms to low degree terms, including the omitted terms, which the coefficients are regard as 0. Coefficients are being compared first by absolute value then by sign. Smaller absolute values are lexicographically smaller. For the same absolute value, negative coefficients are lexicographically smaller than positive coefficients.

See example for more output format details.

### Example

**Input :**

12  
0

**Output :**

$(x-1) (x+1) (x^2+1) (x^2-x+1) (x^2+x+1) (x^4-x^2+1)$

### Hint

There should **not** be a "\*" between digit and x, i.e.  $-2x^2$  should be printed as  $-2x^2$ .

---

Added by: Blue Mary  
Date: 2009-05-23  
Time limit: 11s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Fudan University Local Contest #1

## SPOJ Problem Set (main)

### 4413. Gem

#### Problem code: GEM

You are given a board with 8\*8 squares. In each square, there can be either a colored gem or no gem at all. Gems with different colors are represented by different integers. It is guaranteed that there are no more than two consecutive gems with the same color either in a row or in a column.

```
.....
.....
.....
.....
.....
..43366.
..121556
44212335
```

For two neighboring (up, down, left or right, we don't consider diagonal neighbors) squares, you can exchange the gems.

```
.....
.....
.....
.....
.....
..43366.
..111556
44222335
```

You can also exchange a gem with a space. After that, if there are more than two consecutive gems with the same color in a row or in a column after exchange, these gems will be taken away simultaneously. Note that a gem could be counted both in its row and in its column; refer to the sample test cases for details.

```
.....
.....
.....
.....
.....
..43366.
.....556
44...335
```

If there is no gem under a gem, the gem will fall to the square below.

```
.....
.....
.....
.....
.....
.....66.
.....556
44433335
```

After all the squares falling down to the floor or another gem square, repeat the procedure until there's no gem can be taken away: if there are more than two gems with the same color in a row or in a column, these gems will be taken away simultaneously. Then some gems will fall to the squares below, if there are no gems under those gems.

```
.....
.....
.....
.....
.....
.....66.
.....556
.....5
```

```
.....
.....
.....
.....
.....
.....666
.....555
```

```
.....
.....
.....
.....
.....
.....
.....
.....
```

Given a board with 8\*8 squares. This board is stable and you can't take away any gems in the original board. Your task is to determine whether all gems can be taken away by a single exchange or not.

## Input

The input consists of several test cases. Each test case will be eight lines, and each line contains eight characters. If in a square there is no gem, '.' is used to identify it, otherwise an integer  $k$  is used to identify the gem's color,  $1 \leq k \leq 9$ .

There is a blank line between two consecutive test cases.

End of input is indicated by a line consisting of 0.

## Output

For each test case, output a single line. If all gems can be taken away by a single exchange, output **Yes**; otherwise output **No**.

## Example

Input :

```
.....
.....
.....
.....
```



.....  
..43366.  
..121556  
44212335

.....  
.....  
.....  
.2.....  
.2.22...  
.1.11...  
.2.22...  
.2.22...

12121212  
21212121  
12121212  
21212121  
12121212  
21212121  
12121212  
21212121

.....  
.....  
.....  
.....  
.....  
...96...  
...96...  
.996966.

0

**Output:**

Yes  
Yes  
No  
Yes

---

Added by: Blue Mary  
Date: 2009-05-23  
Time limit: 1s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: Fudan University Local Contest #1

## SPOJ Problem Set (classical)

### 4414. Highway

#### Problem code: HIGHWAY1

As we all know, every day, there are hundreds of trucks passing through the highway. As some of the trucks might carry several tons of goods, the highway will be damaged unless it is frequently repaired. The administration of highway is worried about this, so it invented repairing cars to ensure that the cars can pass through the highway.

The highway has an initial durability. If a truck with  $x$  tons' goods pass the highway, its durability will be decreased by  $x$ . Once the highway's durability is less or equal to zero, it will be broken and can never be repaired. The trucks can't pass through the broken ones.

There are two kinds of repairing cars: T1 can increase the highway's durability by  $r$ , T2 can increase the highway's durability to  $p$ , if the highway's durability is less than  $p$ . Although the repairing cars can pass through the broken parts, the broken parts can't be repaired.

#### Input

The input consists of several test cases.

For every test case, there are three integers  $N$  ( $1 \leq N \leq 100000$ ),  $M$  ( $1 \leq M \leq 100000$ ),  $I$  ( $1 \leq I \leq 1000$ ) in the first line, indicating the highway's length, the numbers of cars and the initial durability of the highway.

Each of the next  $M$  lines described the information of cars in the following format:

1 s t d-- There is a truck with  $d$  tons' goods wanted to pass the interval  $[s, t]$ . You should check whether the truck can pass it. Notice that if the truck can't pass the whole interval, it will give up the whole passing; otherwise it can pass the highway freely, even if the highway will be broken after the truck's passing.

2 s t r-- A T1 car will pass the interval  $[s, t]$  and increase its durability by  $r$ .

3 s t p-- A T2 car will pass the interval  $[s, t]$  and increase its durability to  $p$ .

You can assume that  $1 \leq s \leq t \leq N$ ,  $1 \leq d, p, r \leq 1000$

The input ends with  $N=M=I=0$ .

#### Output

For each case, you should return how many trucks can successfully pass the interval.

#### Example

Input :

```
5 5 5
1 1 3 3
2 2 3 10
1 1 3 3
```

```
1 1 3 1
1 2 3 1
5 3 10
1 1 2 5
1 2 3 5
1 1 3 5
0 0 0
```

**Output :**

```
3
2
```

## Hint

In the second test case, the third truck can't pass the road, because although the durability of interval  $[1, 2)$  and  $(2, 3]$  is larger than 0, in position 2, the durability is 0.

---

Added by: [Trichromatic] XilinX

Date: 2009-05-23

Time limit: 11s

Source limit:50000B

Languages: All except: C99 strict ERL TECS JS

Resource: Fudan University Local Contest #1

## SPOJ Problem Set (main)

### 4415. Power of Integer

#### Problem code: INTEGER1

For a given positive integer  $y$  ( $y > 1$ ), if we can find a largest integer  $k$  and a smallest positive integer  $x$ , such that  $x^k = y$ , then the power of  $y$  is regarded as  $k$ .

Calculate the sum of the power of the integers from  $a$  to  $b$ . ( $2 \leq a \leq b \leq 10^{18}$ )

#### Input

The input consists of multiple test cases.

For each test case, there is one line containing two integers  $a$  and  $b$ .

End of input is indicated by a line containing two zeros.

#### Output

For each test case, output the sum of the power of the integers from  $a$  to  $b$ .

#### Example

**Input :**

```
2 10
248832 248832
0 0
```

**Output :**

```
13
5
```

---

Added by: Blue Mary  
Date: 2009-05-23  
Time limit: 11s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: Fudan University Local Contest #1

## SPOJ Problem Set (main)

### 4416. Jumping Hands

#### Problem code: JUMP1

In Shanghai, there are some famous clock towers built more than 100 years ago, such as the office building of Shanghai Customs, Xujiahui Church, etc. Every clock tower's clock-face consists of three hands: an hour hand, a minute hand, and a second hand. The hands are not move smoothly as time passing. When a second passes, the hands jump to the next place clockwise: the second hand moves  $1/60$  ring, the minute hand moves  $1/3600$  ring and the hour hand moves  $1/43200$  ring.

We assume that every hand's mass is evenly distributed, and its thickness can be ignored. In other words, every hand's centre of gravity is at the middle position of the respective hand. Suppose  $p_1$ ,  $p_2$  and  $p_3$  are, respectively, the position of the centre of gravity of the hour hand, that of the minute hand, and that of the second hand. The position of all three hands' centre of gravity,  $P$ , is the average of  $p_1$ ,  $p_2$  and  $p_3$  weighted by the hands' mass.

Suppose  $P_1$  and  $P_2$  are the positions of the three hands' centre of gravity at the start time and at the end time, respectively. Your task is to calculate the length of the path from  $P_1$  to  $P_2$ . That is, if  $P_3$  is the position of the three hands' centre of gravity on the clock-face at a point of time between start time and end time,  $X$  is the length of the path from  $P_1$  to  $P_3$ , and  $Y$  is the length of the path from  $P_3$  to  $P_2$ , the length of the path from  $P_1$  to  $P_2$  is  $X+Y$ .

#### Input

Input consists of one or more lines, each line describing one data set. Each line begins with 6 integers:  $L_1, L_2, L_3, M_1, M_2, M_3$ , followed by start time and end time.  $L_1, L_2$  and  $L_3$  indicate the lengths of hour hand, minute hand and second hand respectively, where  $1 \leq L_1 < L_2 < L_3 \leq 100$ .  $M_1, M_2$  and  $M_3$  indicate the weights of hour hand, minute hand and second hand respectively, where  $1 \leq M_1, M_2, M_3 \leq 100$ . The format of start time and end time is  $hh:mm:ss$ , where  $0 \leq hh \leq 23$ ,  $0 \leq mm \leq 59$ , and  $0 \leq ss \leq 59$ . Start time and end time should be in the same day.

End of input is indicated by a line consisting of -1.

#### Output

For each data set, output a single line. Each line should give the length of the path for the positions of three hands' centre of gravity at the start time and at the end time. We accept solutions with absolute error less than  $10^{-2}$ .

#### Example

Input :

```
1 2 3 1 2 3 00:00:00 00:00:01
3 4 5 1 1 1 09:00:00 18:00:00
-1
```

**Output :**

0.08  
2826.27

---

Added by: Blue Mary

Date: 2009-05-23

Time limit: 11s

Source limit:50000B

Languages: All except: C99 strict

Resource: Fudan University Local Contest #1

## SPOJ Problem Set (classical)

### 4420. Counting Graphs

#### Problem code: KPGRAPHS

In this problem your task is to count the amount of graphs of different types. We only consider undirected graphs without self-loops. Every pair of vertices can be connected with at most one edge. Graphs are labeled, i.e. if a graph has  $N$  vertices, then each of them has a unique label from 1 to  $N$ .

We will be interested in three types of graphs - connected, eulerian and bipartite. A graph is connected, if and only if there is at least one path between any pair of vertices. A graph is eulerian, if and only if it's connected and there is a cycle that goes through every edge exactly once. A graph is bipartite, if and only if we can split all of its vertices into two subsets  $A$  and  $B$ , such that every edge has one endpoint in  $A$  and another in  $B$ .

#### Input

The first line of the input contains one integer number  $T$  ( $1 \leq T \leq 1000$ ) - the number of test cases.

Next  $T$  lines contain different test cases. Each test case contains one integer number  $N$  ( $1 \leq N \leq 1000$ ) - the number of vertices in a graph.

#### Output

For each test case, output the number of connected graphs, the number of eulerian graphs and the number of bipartite graphs - all modulo 1000000007. See examples for the required format. Output one additional empty line after each test case.

#### Example

**Input:** 212**Output:** Connected: 1Eulerian: 1Bipartite: 1Connected: 1Eulerian: 0Bipartite: 2

---

Added by: Pavel Kuznetsov

Date: 2009-05-25

Time limit: 5s

Source limit: 7000B

Languages: All

## SPOJ Problem Set (classical)

### 4421. Irreducible polynomials over GF2

#### Problem code: GF2

Find the number of degree  $n$  irreducible polynomials over  $GF(2)$ . For example: for  $n=1$  there are two such polynoms:  $x$  and  $x+1$ . For  $n=2$  there is only one:  $x^2+x+1$ . Note that in  $R[x]$  the polynom  $x^2+1$  is irreducible, but not over  $GF(2)$ , because  $x^2+1=(x+1)*(x+1)$

#### Input

A single positive integer  $n$ , where  $n < 500000$

#### Output

Output the answer for  $n$ .

#### Example

Input: 201 Output: 15989433276208858463104100421305100522608250813995004946218 Input: 1 Output: 2 Input: 2 Output: 1 Input: 3 Output: 2

---

Added by: Robert Gerbicz

Date: 2009-05-25

Time limit: 0.5s-6s

Source limit: 4096B

Languages: All

Resource: classic problem, own input



## SPOJ Problem Set (classical)

### 4429. Spelling Lists

#### Problem code: MIB

J, of the Men In Black, has been learning an alien language and has a spelling test tomorrow. J, however, is bored of studying the nonsensical (and often unpronounceable) words.

Instead, he is seeing how many ways he can reorder his spelling list. After making all possible permutations of word on his list, he sorts the rearranged lists lexicographically (by the first word, then the second...). After the sort, in what position, with the lexicographically first list being in position 1, is his original spelling list?

#### Input

The first line is the number of spelling lists (no more than 10).

For each spelling list, a line with the number of words (no more than 1000) is given, followed by the original list on the next line.

All words within a spelling list are unique. Each word is composed of the letters a-z, is fewer than 100 characters, and is followed by a single space.

#### Output

On separate lines, give the positions of the original lists.

#### Example

**Input:**44a b c d 4d c b a 1mrsmith 6a aaaaaa aaaaa aaaa b bb **Output:**124155

---

Added by: Paul Draper

Date: 2009-05-28

Time limit: 1s-2s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 4452. Simple Arithmetics II

#### Problem code: ARITH2

While browsing aimlessly, Peter stumbled upon an old riddle he used to solve on his calculator when he was still young. It was the kind of a riddle where you punch in a bunch of numbers and operators into a simple pocket calculator and then turn it upside down to get the answer:

*These come in many different sizes but they are always exactly one foot long. Answer:  $103 * 103 * 5$ .*

*What are made of ice to keep people warm? Answer:  $50 * 40 * 250 + 791$ .*

After a few minutes he found a large amount of such riddles and full of excitement he went to solve them. He turned his computer screen upside down...

... only to find out that he does not have a reasonable calculator program installed on his computer.

#### Problem specification

You are given multiple sequences of button presses of a simple pocket calculator that consist of digits and arithmetic operators. For each such sequence find the number it would produce on a pocket calculator's display.

Note that the pocket calculator evaluates the operators in the order in which they are given. (i.e., there is no operator precedence.) Assume that the display of the calculator is large enough to show the result, and that its memory is sufficient to store all intermediate results.

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case represents one sequence of button presses for a pocket calculator. The sequence consists of non-negative integers and arithmetic operators and ends with an equal sign. It may also contain spaces to improve readability.

The operator  $/$  represents integer division, rounded down. You may assume that no test case contains division by zero and that in all test cases all intermediate results are non-negative.

*Tip: `long long int` in C/C++, `long` in Java or `int64` in Pascal is enough for this problem.*

#### Output specification

For each sequence from the input file output the number that would be displayed on the calculator.

## Example

**Input :**

4

1 + 1 \* 2 =

29 / 5 =

103 \* 103 \* 5 =

50 \* 40 \* 250 + 791 =

**Output :**

4

5

53045

500791

## Hint

The first test case shows that there is no operator precedence.

The second one shows that integer division always rounds down.

The last two outputs are the answers to the two riddles in the problem statement: "shoes" (53045 upside down), and "igloos"(500791 upside down).

---

Added by: Blue Mary

Date: 2009-05-31

Time limit: 3s

Source limit:50000B

Languages: All except: C99 strict

Resource: IPSC 2009

## SPOJ Problem Set (classical)

### 4453. Bouncing Balls II

#### Problem code: BOBALLS2

"Behold, my queen", said the jester, "the great Bouncing Ball Bowl!" The queen boredly waved her hand and sarcastically replied: "Let the fun begin!". And the fun begun! The jester spoke a magic word and all the colorful balls in his bowl started to roll and bounce, creating interesting pictures.

The queen watched vividly for a few minutes, but then she started to be bored again. "Just wait a moment, Your Majesty, in a minute they'll..." started the jester, but the queen interrupted: "I'm a queen! I don't want to wait! Can't you just fast forward it or something?"

#### Problem specification

The jester's box is an  $X * Y$  ( $1 \leq X, Y \leq 5000$ ) rectangle. The rectangle contains  $N$  ( $N \leq 3001$ ) small balls. At any moment, each ball is travelling at the same speed in one of the four diagonal directions.

The movement of the balls is continuous and for the purpose of this problem we may consider them to be points. When two or more balls meet, they bounce in a way described below.

Your task is to determine the state of the box at given moments in time.

#### Bouncing specification

Bouncing does not change the speed of the balls. Following images show how the balls bounce off each other, and also off walls. Each image can be rotated arbitrarily. For example, the first image shows that whenever two balls meet at a right angle, they bounce and depart at a right angle again. One particularly tricky case is shown in the third image.

#### Input specification

The input starts with a line containing the dimensions  $X$  and  $Y$  of the box. We will use a coordinate system with axes parallel to the sides of the box,  $(0,0)$  at one of the corners and  $(X,Y)$  at the opposite corner.

The second line contains the number of balls  $N$ .

Each of the next  $N$  lines contains four integers  $x, y, v_x, v_y$ , where  $(x, y)$  are the coordinates of one ball at time 0 and  $(v_x, v_y)$  is its current velocity vector. (Each ball will be strictly inside the box and for each ball both the absolute values of  $v_x$  and  $v_y$  will be equal to 1. No two balls will start at the same place.)

The following line contains the number of queen's requests  $M$ . ( $1 \leq M \leq 20$ )

On the last line there are  $M$  numbers  $t_1, \dots, t_M$  - the points in time the queen wants to see. These numbers will be less than  $10^{12}$ .

## Output specification

As a solution to this problem, we expect a file with  $M$  blocks, with the  $i$ -th block describing the situation at time  $t_i$ .

Each block must contain  $N$  lines, and each line must contain the  $x$  and  $y$  coordinates of one ball. The balls in each block must be sorted - primarily by to their first, secondarily by their second coordinate at that point in time.

You may output an empty line between the blocks.

## Example

### Input :

```
6 4
4
1 2 1 1
5 2 1 1
2 1 1 -1
3 1 -1 -1
1
4
```

### Output :

```
1 3
3 2
5 2
6 3
```

Note that the balls that start at (2,1) and (3,1) bounce off each other at a non-integer point in time.

---

Added by: Blue Mary  
Date: 2009-05-31  
Time limit: 3s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: IPSC 2009

## SPOJ Problem Set (classical)

### 4454. Brackets II

#### Problem code: BRCKTS2

Peter is preparing slides for his lecture on parsing arithmetic expressions. In the first part of the lecture he wants to focus just on parsing brackets. He invented an interesting geometric representation of a correct bracket sequence for his students, because one image is better than a thousand words:

Formally, the definition of the geometric representation looks as follows. The simplest correct bracket sequence  $()$  is represented by a  $1 * 1$  square. If  $A$  is a correct bracket sequence and  $g(A)$  its representation, then the representation for  $(A)$  is  $g(A)$  surrounded by a rectangle two units wider than  $g(A)$  and one unit taller than the highest point of  $g(A)$ . If  $A$  and  $B$  are two correct bracket sequences and  $g(A)$  and  $g(B)$  are their representations, then we get  $g(AB)$  by placing  $g(B)$  one unit to the right of  $g(A)$ .

After he finished his slides, Peter started to play with the images he prepared. He painted the bounded areas of the images alternately black and white, in such a way that the outer-most areas are all painted black. For the example above this coloring looks as follows:

#### Problem specification

You are given a correct bracket sequence. Calculate the area that is colored black.

#### Input specification

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case consists of one line with a correct bracket sequence with length less than 350000. Every line will only contain characters  $($  and  $)$ .

#### Output specification

For each test case output one line with one integer - the area of the black part of the corresponding geometric representation.

#### Example

**Input :**

2

$((()))$

$((()))((()))$

**Output :**

10

20

---

Added by: Blue Mary  
Date: 2009-05-31  
Time limit: 1s-7s  
Source limit:50000B  
Languages: All except: C99 strict  
Resource: IPSC 2009

## **SPOJ Problem Set (classical)**

### **4455. Going to the Movies**

#### **Problem code: MOVIE**

$N$  ( $N \leq 120$ ) friends decided to go to the local cinema together. They all bought tickets to the same row. As there was still some time left, each of them took her ticket and went shopping until the movie starts.

They all arrived back late, the movie already started. The usher standing at the door agreed to let them in one by one. Each of the girls was supposed to find her place and sit down.

However, the machine that printed their tickets was broken. Instead of consecutive numbers, each girl received a random seat number between 1 and  $K$ , where  $K$  is the number of seats in their row. The seat numbers they received were not necessarily distinct.

When a girl tries to sit down, she enters the row at the end where seat number 1 is, and walks until she reaches the number on her ticket. If her desired seat is free, she just sits down. If it is already taken, she continues to walk in the same direction until she finds the first free seat, and sits there.

Of course, it is possible that some unfortunate girl will reach the end of the row without finding a place to sit. In that case, the usher comes and throws her out.

#### **Problem specification**

You are given the numbers  $N$  and  $K$ . ( $1 \leq K \leq 200$ )

Assume that each girl's ticket had a number between 1 and  $K$ , inclusive. Each number was drawn uniformly at random, and draws were independent.

Also assume that the entire row was empty when the first girl started to look for her seat.

Compute the probability that at least one girl suffered the sad fate of being thrown out by the usher.

#### **Input specification**

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case consists of a single line containing two integers  $N$  and  $K$ .

#### **Output specification**

For each test case output a single line with the probability as a simplest fraction. (Do not output any spaces before or after the / sign.)



## Example

**Input :**

3

1 10

2 3

3 3

**Output :**

0/1

1/9

11/27

In the third case there are  $3^3 = 27$  possibilities. Out of these, in 11 some girl is thrown out. These 11 sequences are: 133, 222, 223, 232, 233, 313, 322, 323, 331, 332, and 333.

For example, if the sequence of numbers were 322, the first girl sits at seat #3, the second one at #2, and then the third one tries to sit at #2, but finds both seat #2 and seat #3 occupied, and she's thrown out.

---

Added by: Blue Mary

Date: 2009-05-31

Time limit: 1s-7s

Source limit:50000B

Languages: All except: C99 strict

Resource: IPSC 2009

## **SPOJ Problem Set (classical)**

### **4456. Jumbo Airlines**

#### **Problem code: AIRLINES**

The new catchphrase of Jumbo Airlines is "No annoying neighbors, each flight a unique experience!"

And as in most cases, the advertisement was produced by the marketing department, without ever consulting the engineers. They only learned about it after the boss asked them to "handle it ASAP".

There are  $M$  seats in each row, and there are  $N$  rows of seats in the airplane. Hence the seats form an  $M * N$  grid. (For the purpose of this problem we will ignore the presence of aisles.) The airline sells exactly  $K$  tickets for each flight.

To make sure that the "no annoying neighbors" part of the motto is satisfied, the seating must obey the following rule: Whenever a seat is occupied, the seats immediately in front of it and behind it, as well as the seats immediately to the left and to the right must remain free.

An allowed arrangement is a set of  $K$  occupied seats that obeys the rule above.

The "unique experience" part of the motto is then satisfied by using a different arrangement of occupied seats for each flight. (Two seating arrangements are different if there is at least one seat which is occupied in one arrangement and free in the other.)

#### **Problem specification**

You are given the numbers  $M$ ,  $N$  and  $K$ . Find the number of different allowed seating arrangements.

As this number can be very large, we're only interested in its value modulo 420047.

#### **Input specification**

Multiple test cases, separated by blank lines.

Each test case consists of a single line containing three integers  $M$ ,  $N$  and  $K$ . ( $M \leq N$ )

There are two kinds of input:

The input of the first kind satisfies that  $1 \leq M \leq 15$ ,  $1 \leq N \leq 50$ ,  $3 \leq K \leq 50$ .

The input of the second kind satisfies that  $1 \leq M \leq 4$ ,  $1 \leq N \leq 10^9$ ,  $3 \leq K \leq 5$ .

Input terminates by EOF.

## Output specification

For each test case output a single line with the number of allowed arrangements modulo 420047.

## Example

**Input :**

2 4 4

**Output :**

2

## Hint

The input file can be downloaded [here](#). You may submit a TEXT file - the corresponding output file.

---

Added by: Blue Mary

Date: 2009-05-31

Time limit: 1s

Source limit: 50000B

Languages: TEXT

Resource: IPSC 2009

## **SPOJ Problem Set (classical)**

### **4457. Shopping II**

#### **Problem code: SHOP2**

Karl is going to spend his holiday in Nothingland. Since there is nothing there, he has to buy all supplies now. At the moment, he is waiting at the checkout counter with a shopping cart full of stuff.

Of course, he has a sufficient amount of money in his wallet. However, he prefers to use alternate means of payment if possible: luncheon vouchers, gift certificates, different types of coupons, etc. What makes the matter complicated is that the use of these items is often limited: e.g., luncheon vouchers can only be used to buy food, and gift certificates are often limited to a certain type of gifts.

#### **Problem specification**

You are given the number  $N$  ( $1 \leq N \leq 2000$ ) of items in Karl's shopping cart and their prices. You are also given the number  $M$  ( $1 \leq M \leq 2000$ ) of vouchers in his wallet, together with the information on their allowed use.

When paying for his shopping, Karl may use vouchers for a larger sum than the cost of the things he is buying. It is also possible to split an item's cost between multiple vouchers and use a voucher to pay for more than one item.

Compute the minimum amount of additional cash money Karl needs to pay for his shopping.

#### **Input specification**

The first line of input file contains an integer  $T$  specifying the number of test cases.  $T$  blocks follows, each block describes one test case. Each block is preceded by a blank line.

Each block starts with line containing two positive integers  $N$  (the number of items) and  $M$  (the number of vouchers). The second line contains  $N$  numbers (each no more than 10000), the  $i$ -th of them being the price of the  $i$ -th item in Karl's shopping cart. The third line contains  $M$  numbers, the  $i$ -th of them being the cash value of the  $i$ -th voucher Karl has in his wallet.  $M$  lines follow. Each line consists of a number  $K_i$  (the count of items such that you can pay for them using the  $i$ -th voucher, no more than 100) followed by  $K_i$  numbers (the numbers of those items; items are numbered from 1 to  $N$ ).

#### **Output specification**

For each test case output a single number specifying how much cash money Karl needs to pay for his shopping.

## Example

**Input :**

```
1
3 2
15 20 10
20 30
3 1 2 3
1 3
```

**Output :**

```
15
```

---

Added by: Blue Mary

Date: 2009-05-31

Time limit: 7s

Source limit:50000B

Languages: All except: C99 strict

Resource: IPSC 2009

## SPOJ Problem Set (classical)

### 4465. The Ant

#### Problem code: ANTTT

There are **n** sticks lying on the ground. The Ant can move only along the sticks. It can go from one stick to another only if the sticks intersect or touch each other. Help the Ant find out if it can reach the stick **y** from the stick **x**.

#### Input

The first line of the input contains number **t** - the amount of tests. Then **t** test descriptions follow. The first line of each test contains two integers **n** and **m** - the number of stick and the number of queries. Next **n** lines contain four integers **Ax, Ay, Bx, By** - the coordinates of the endpoints of a stick. You may consider stick to be straight segment on a plane. The next **m** lines contain two integers each **x** and **y** which are the queries.

#### Constraints

$1 \leq t \leq 100$   
 $1 \leq n, m \leq 1000$   
 $-10000 \leq Ax, Ay, Bx, By \leq 10000$   
 $1 \leq x, y \leq n$

#### Output

For each query print "YES" if the Ant can reach the stick number **y** from the stick number **x**, otherwise print "NO".

#### Example

Input : 23 31 3 4 33 4 3 13 1 5 11 21 32 23 31 1 3 12 1 3 13 2 4 11 21 32 3

Output : YESYESYESYESNONO

---

Added by: Spooky

Date: 2009-06-02

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: Advancement Spring 2009, <http://sevolymp.uuuq.com/>  
author: elmariachi1414

## SPOJ Problem Set (classical)

### 4476. Playfair Cracker

#### Problem code: PLAYFAIR

In this problem, you will crack Playfair cyphers or decide a multiple solutions exist, or decide no solution exist.

Rules:

- 1) Convert all letters in the text to uppercase and omit all non-alphabetic characters.
- 2) Replace all letters 'J' by 'I'.
- 3) Form digraphs, but avoid having twice the same letter in a digraph. Insert an extra 'X' between the identical letters if necessary. If the repeated letter is an 'X', insert a 'Q' instead.
- 4) If the last digraph would be incomplete, append an extra 'X' to the text (or a 'Q' if the last letter in the text is an 'X').

Consider the following message: "Programming in C and Pascal is easy; I will learn Java next year."  
The digraph representation would be:

PR OG RA MX MI NG IN CA ND PA SC AL IS EA SY IW IL LX LE AR NI AV AN EX TY EA  
RX

Note the extra 'X' between the two 'M's of 'programming'. There is no extra 'X' between the two 'L's of 'will', because they are in different digraphs, but there is one between 'will' and 'learn'. There is also an extra 'X' at the end of the message. The 'J' in 'Java' is replaced by an 'I'.

To illustrate the exceptions for the letter 'X' in the original text, consider the message "I am an ex-xenophobe, attempting to relax!". This becomes:

IA MA NE XQ XE NO PH OB EA TX TE MP TI NG TO RE LA XQ

The next stage is the replacement of each digraph by an other digraph according to the following rules:

The uppercase letters, 'J' excluded, are placed in a 5X5 square in some predetermined order. This is the key for the encryption.

If the two letters of the digraph are in the same row of the square, replace them by the letters occurring at the immediate right of each one. If one of the letters is in the rightmost column, replace it by the letter in the first column of the same row (wrap around).

If the two letters of the digraph are in the same column of the square, replace them by the letters occurring immediately below each one. Wrap around to the same column in the top row if one of them is in the bottom row.

If the letters are neither in the same row nor the same column, replace the first letter by the letter in the same row as the first letter and the same column as the second letter. Replace the second letter by the letter in the same row as the second letter and the same column as the first letter.

The resulting digraphs form the encrypted code.

## Input

The input contains several cases, the number of which is on the first line. Every case has three parts. The first part is the plaintext and consists of one or more lines of ordinary text. The second part is the code that is the result of encrypting the first part. The third part is code for the text you are to decrypt. The parts are terminated by a hashmark ('#') on a line by itself. Code parts are printed as uppercase digraphs, 20 digraphs on a line, separated by one space. The last line of a code part can contain fewer than 100 digraphs. No code part will contain more than 5000 digraphs.

## Output

For each case, first output a line "Case x:" where x is the case number (starting from 1). Then output the decrypted code represented as digraphs in the same format as the code parts in the input. If more than one solution exist, output the following on a single line.

MULTIPLE SOLUTIONS

If no solutions exist output in one line:

NO SOLUTIONS

Separate the cases by an empty line.

## Example

---

Added by: Chen Xiaohong

Date: 2009-06-05

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Enhanced Version of Regional Warmup Contest 2005



## SPOJ Problem Set (classical)

### 4478. Counting Expressions II

#### Problem code: EXPR4

Count the number of distinct expressions involving  $n$  different operands **a**, **b**, **c**, etc. Only operators +, -, \*, / and parentheses are permitted.

Two expressions are distinct if for some valid input values (i.e. You won't divide some number by zero) **a**, **b**, **c**, ... , the two expressions leads to different results. For example,  $a/b/c$  and  $a/(b*c)$  are the same expressions, but  $a/b+c$  and  $a/(b+c)$  are not.

#### Input

Multiply test cases. For each test case:

A single line -  $n$ . ( $1 \leq n \leq 2000$ ).

Input terminates by a single zero.

#### Output

For each test case:

The number of different expressions, modulo 1000000007.

#### Example

**Input :**

3  
0

**Output :**

68

---

Added by: Blue Mary  
Date: 2009-06-06  
Time limit: 30s  
Source limit: 50000B  
Languages: All except: C99 strict  
Resource: Tomek Czajka

## SPOJ Problem Set (classical)

### 4487. Can you answer these queries VI

#### Problem code: GSS6

Given a sequence A of N ( $N \leq 100000$ ) integers, you have to apply Q ( $Q \leq 100000$ ) operations: Insert, delete, replace an element, find the maximum contiguous (non empty) sum in a given interval.

#### Input

The first line of the input contains an integer N.

The following line contains N integers, representing the starting sequence  $A_1..A_N$ , ( $|A_i| \leq 10000$ ).

The third line contains an integer Q. The next Q lines contains the operations in following form:

**I x y**: insert element y at position x (*between x - 1 and x*).

**D x**: delete the element at position x.

**R x y**: replace element at position x with y.

**Q x y**: print  $\max\{A_i + A_{i+1} + \dots + A_j \mid x \leq i \leq j \leq y\}$ .

All given positions are valid, and given values are between -10000 and +10000.

The sequence will never be empty.

#### Output

For each "Q" operation, print an integer (one per line) as described above.

#### Example

**Input:** 53 -4 3 -1 6 10 I 6 2 Q 3 5 R 5 -4 Q 3 5 D 2 Q 1 5 I 2 -10 Q 1 6 R 2 -1 Q 1 6 **Output:** 83635

---

Added by: Alfonso2 Peterssen

Date: 2009-06-08

Time limit: 2s-3s

Source limit: 50000B

Languages: All

Resource: my own

## SPOJ Problem Set (classical)

### 4491. Primes in GCD Table

#### Problem code: PGCD

Johnny has created a table which encodes the results of some operation -- a function of two arguments. But instead of a boring multiplication table of the sort you learn by heart at prep-school, he has created a GCD (greatest common divisor) table! So he now has a table (of height  $a$  and width  $b$ ), indexed from  $(1,1)$  to  $(a,b)$ , and with the value of field  $(i,j)$  equal to  $\gcd(i,j)$ . He wants to know how many times he has used prime numbers when writing the table.

#### Input

First,  $t \leq 10$ , the number of test cases. Each test case consists of two integers,  $1 \leq a, b < 10^7$ .

#### Output

For each test case write one number - the number of prime numbers Johnny wrote in that test case.

#### Example

**Input :** 210 10100 100

**Output :**

302791

---

Added by: Yash  
Date: 2009-06-12  
Time limit: 10s  
Source limit: 11111B  
Languages: All  
Resource: Codechef

## SPOJ Problem Set (classical)

### 4523. Binomial Coefficients

#### Problem code: UCI2009B

We all got too excited when we learned  $(A + B)^2 = A^2 + 2AB + B^2$ . After solving this problem, maybe you could get even more excited because you will have to calculate  $(A + B)^N$ , where  $(0 \leq N \leq 1000)$ .

Follow the rules below when giving the answer:

1. Consecutive terms must be separated by a '+' character.
2. At the  $i$ -th term,  $A$  must be raised to  $N - i$  and  $B$  must be raised to  $i$  ( $0 \leq i \leq N$ ).
3. Binomial coefficients must not be printed, print their prime factorization instead.
4. Use '^' for exponentiation and 'x' for multiplication in step 3.
5. Avoid the use of number 1 when possible.

See sample output for clarification.

#### Input

Input starts with an integer  $T$ , representing the number of test cases ( $1 \leq T \leq 15$ ).  $T$  lines follow, each one consisting of an integer  $N$ , ( $0 \leq N \leq 1000$ ).

#### Output

For each test case, print  $(A + B)^N$ , on a single line.

#### Example

**Input:** 6012345**Output:** 1A+BA^2+2xAB+B^2A^3+3xA^2B+3xAB^2+B^3A^4+2^2xA^3B+2x3xA^2B^2+2^2xAB^3+B^4A^5+5xA^4B+2x5xA^3B^2+2x5xA^2B^3+5xAB^4+B^5**Warning: Large output. Be careful with certain languages.**

---

Added by: yandry p  rez clemente

Date: 2009-06-23

Time limit: 3s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 4525. Digger Octaves

#### Problem code: UCI2009D

After many years spent playing Digger, little Ivan realized he was not taking advantage of the octaves. Oops, sorry! Most of you were not born when Digger came to light!

Digger is a Canadian computer game, originally designed for the IBM personal computer, back in 1983. The aim of the game is to collect precious gold and emeralds buried deep in subterranean levels of an old abandoned mine.

We Digger gurus call a set of eight consecutive emeralds an octave. Notice that, by consecutive we mean that we can collect them one after another. Your Digger Mobile is able to move in the four directions: North, South, West and East.

In a simplified Digger version, consisting only of emeralds and empty spaces, you will have to count how many octaves are present for a given map.

#### Input

Input starts with an integer  $T$ , representing the number of test cases ( $1 \leq T \leq 20$ ). Each test case consists of a map, described as follows:

An integer  $N$  ( $1 \leq N \leq 8$ ), representing the side length of the square-shaped map.  $N$  lines follow,  $N$  characters each. A 'X' character represents an emerald, and a '.' represents an empty space.

#### Output

For each test case print the number of octaves on a single line.

#### Example

**Input :** 23XXXX.XXXX3XXXXXXXXXX**Output :**  
15

---

Added by: yandry p  rez clemente  
Date: 2009-06-23  
Time limit: 1s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 4528. Frog Wrestling

#### Problem code: FROGS

Billy Jean loves collecting frogs. Recently, she developed the sport of frog wrestling. Now she wants to rank her frogs by their wrestling prowess.

Billy Jean has made a algorithm for sorting her frogs.

1. She arranges  $N$  cages, numbered  $1, 2, \dots, N$ , each with one frog.
2. For each pair of cages in a specified, pre-determined list of  $K$  pairs of cages,
  1. she removes the frogs from the two cages,
  2. has the frogs wrestle,
  3. puts the winner in the higher-numbered cage, and
  4. puts the loser in the lower-numbered cage.

When she is finished, she hopes to have all her frogs sorted from worst to best in the cages 1 to  $N$ . Will her algorithm work regardless of the initial order of the frogs?

Note:

- Assume that a strict ordering by wrestling ability is possible.
- Billy Jean isn't the sharpest tool in the shed. Sometimes she has written the same two numbers for a pair. In this case, that frog is simply taken out and then put back.

#### Constraints

$1 \leq N \leq 20$

$1 \leq K \leq 1000$

#### Input

The first line is the number of test cases. Each test cases is preceded by a blank line.

The first line of each test case is  $N$ . The next line is  $K$ . The next  $K$  lines are the pairs, separated by a single space.

#### Output

On separate lines, output whether Billy Jean's algorithm is correct. Output "YES" (without quotes) if it is or "NO" (without quotes) if it is not.

## Example

**Input :** 4 2 1 2 1 2 1 1 1 1 1 4 5 1 2 3 4 1 3 2 4 2 3 **Output :**  
YES NO YES YES

---

Added by: Paul Draper

Date: 2009-06-24

Time limit: 1s-7s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 4533. Determinant of Banded Matrices

#### Problem code: BANDMATR

Computing the determinant of a matrix using Gaussian elimination takes  $O(n^3)$ . On the other hand, computing the determinant of tridiagonal matrix is  $O(n)$  using a recurrence. In this problem you will compute the determinant of banded matrices. A band matrix is a sparse matrix, whose non-zero entries are confined to a diagonal band, comprising the main diagonal and zero or more diagonals on either side. In this problem, given a banded  $N \times N$  square integer matrix with  $M$  bands on each side of the diagonal, we ask you to compute the determinant of this matrix. For example a tridiagonal matrix has exactly 1 band on each side, and the 8x8 Matrix in the sample input has 2 bands on each side. For a good discussion of banded matrices, see Thorson's paper at:

[http://sepwww.stanford.edu/oldreports/sep20/20\\_11\\_abs.html](http://sepwww.stanford.edu/oldreports/sep20/20_11_abs.html)

#### Input

A total of <10 inputs. For each input,

First line has dimension,  $N$  ( $1 < N < 501$ ), of the matrix, followed by  $N$  lines with  $N$  integers, each less than **10001**, and greater than **-10001**. It is guaranteed that the number of bands on each side of the diagonal,  $M < 51$ . That is there are at most **101** bands in total including the diagonal. Use scanf IO, and avoid stl IO.

#### Output

For each input matrix, output its determinant **modulo**  $10^9+7$ .

*Hint:* Use Montgomery multiplication for fast computation, i.e., see:  
<http://everything2.com/title/Montgomery%2520multiplication>

#### Example

Input: 22 00 221 00 181 0 -1 0 0 0 0 0 -1 1 0 -1 0 0 0 0 -1 0 -1 1 -1 0 0 00 -1 0 -1 0 -1 0 00 0 -1 0 1 0 -1 00 0 0 -1 -1 1 0 -10 0 0 0 -1 0 -1 10 0 0 0 0 -1 0 -1Output: 4136

---

Added by: Chen Xiaohong

Date: 2009-06-26

Time limit: 0.5s

Source limit: 20000B

Languages: All

Resource: classical numerical analysis



## SPOJ Problem Set (classical)

### 4546. Tobo or not Tobo

#### Problem code: ANARC08A

The game of Tobo is played on a plastic board designed into a 3X3 grid with cells numbered from 1 to 9 as shown in figure (a). The grid has four dials (labeled 'A' to 'D' in the figure.) Each dial can be rotated in 90 degrees increment in either direction. Rotating a dial causes the four cells currently adjacent to it to rotate along. For example, figure (b) shows the Tobo after rotating dial 'A' once in a clockwise direction. Figure (c) shows the Tobo in figure (b) after rotating dial 'D' once in a counterclockwise direction.

Kids love to challenge each other playing the Tobo. Starting with the arrangement shown in figure (a), (which we'll call the standard arrangement,) one kid would randomly rotate the dials, X number of times, in order to shuffle the board. Another kid then tries to bring the board back to its standard arrangement, taking no more than X rotations to do so. The less rotations are needed to restore it, the better. This is where you see a business opportunity. You would like to sell these kids a program to advise them on the minimum number of steps needed to bring a Tobo back to its standard arrangement.

#### Input

Your program will be tested on one or more test cases. Each test case is specified on a line by itself. Each line is made of 10 decimal digits. Let's call the first digit Y. The remaining 9 digits are non-zeros and describe the current arrangement of the Tobo in a row-major top-down, left-to-right ordering. The first sample case corresponds to figure (c).

The last line of the input file is a sequence of 10 zeros.

#### Output

For each test case, print the result using the following format:

k. R

where k is the test case number (starting at 1,) is a single space, and R is the minimum number of rotations needed to bring the Tobo back to its standard arrangement. If this can't be done in Y dials or less, then R = -1.

#### Example

**Input:** 341356972811654327890000000000**Output:** 1. 22. -1

---

Added by: Ahmed Aly

Date: 2009-07-02

Time limit: 5s

Source limit: 50000B

Languages: All except: JS

Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4549. Adding Sevens

#### Problem code: ANARC08B

A seven segment display, similar to the one shown on the right, is composed of seven light-emitting elements. Individually on or off, they can be combined to produce 127 different combinations, including the ten Arabic numerals. The figure below illustrates how the ten numerals are displayed. 7-seg displays (as they're often abbreviated) are widely used in digital clocks, electronic meters, and calculators.

A 7-seg has seven connectors, one for each element, (plus few more connectors for other electrical purposes.) Each element can be turned on by sending an electric current through its pin. Each of the seven pins is viewed by programmers as a single bit in a 7-bit number, as they are more comfortable dealing with bits rather than electrical signals. The figure below shows the bit assignment for a typical 7-seg, bit 0 being the right-most bit.

For example, in order to display the digit 1, the programmer knows that only bits 1 and 3 need to be on, i.e. the 7-bit binary number to display digit 1 is "0001010", or 10 in decimal. Let's call the decimal number for displaying a digit, its display code, or just code for short. Since a 7-seg displays 127 different configurations, display codes are normally written using 3 decimal places with leading zeros if necessary, i.e. the display code for digit 1 is written as 010.

In a 9-digit calculator, 9 7-seg displays are stacked next to each other, and are all controlled by a single controller. The controller is sent a sequence of 3n digits, representing n display codes, where  $0 < n < 10$ . If  $n < 9$ , the number is right justified and leading zeros are automatically displayed. For example, the display code for 13 is 010079 while for 144 it is 010106106

Write a program that reads the display codes of two numbers, and prints the display code of their sum.

#### Input

Your program will be tested on one or more test cases. Each test case is specified on a single line in the form of  $A+B=$  where both A and B are display codes for decimal numbers a and b respectively where  $0 < a, b < a + b < 1,000,000,000$ . The last line of the input file is the word "BYE" (without the double quotes.)

#### Output

For each test case, print  $A+B=C$  where C is the display code for  $a + b$ .

#### Example

**Input :**

```
010079010+010079=
106010+010=
BYE
```

**Output :**

```
010079010+010079=010106106
106010+010=106093
```

---

Added by: Ahmed Aly  
Date: 2009-07-03  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4551. Match Maker

#### Problem code: ANARC08C

In Computer Science, pattern matching is the act of checking if a certain sequence conforms (matches) a given pattern. Patterns are usually specified using a language based on regular expression. In this problem, we'll use a simple regular expression to express patterns on sequences of decimal digits. A pattern is a sequence of one or more decimal digits '0' ... '9', asterisks '\*', and hash signs '#'. A '\*' denotes a sequence of an even number of digits, whereas a '#' denotes a sequence of an odd number of digits. For example, the pattern "129" only matches the sequence 129. The pattern "1\*3" matches all sequences beginning with 1, ending with 3, and having an even number of decimal digits between the first and last digits. As another example, the pattern "#55" matches the sequences 155, 12355, 1234555, but none of the sequences 55, 1255, 123455. Your task is to write a program to find if a given sequence matches a given pattern.

#### Input

Your program will be tested on one or more data sets. Each data set contains a single pattern and one or more sequences to match. The first line of each data set specifies the pattern, and the remaining lines specify the sequences to match against that pattern. The end of a data set (except the last) is identified by the word "END" (without the double quotes.) The end of the last data set is identified by the word "QUIT". All lines are 100,000 characters long or shorter.

#### Output

k.s. result

Where k is the test case number (starting at one,) and s is the sequence number (starting at one within each test case,) and result is either the word "match" if the given string matches the pattern, or the word "not" if it doesn't.

#### Example

**Input :**

```
129
1299
129
1129
END
1*3
123
1223
END
#55
155
12355
55
1255
QUIT
```

**Output :**

1.1. not  
1.2. match  
1.3. not  
2.1. not  
2.2. match  
3.1. match  
3.2. match  
3.3. not  
3.4. not

---

Added by: Ahmed Aly

Date: 2009-07-03

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4552. Adding up Triangles

#### Problem code: ANARC08D

Take a look at the triangle on the left of the figure below. It is made of 9 (unit) triangles arranged in three rows ( $N = 3$ ). Needless to say, a unit triangle is a triangle with  $N = 1$ .

If you study the figure for few seconds, you'll realize that you can find 13 different triangles (which we'll call sub-triangles.) Of these 13 sub-triangles we have: Nine unit triangle; three with  $N = 2$ , and one with  $N = 3$ . The following table lists the number of sub-triangles in arrangements with  $N < 5$ .

# of Rows:	$N = 1$	$N = 2$	$N = 3$	$N = 4$
# of Sub-triangles:	1	5	13	27

Let's define the value of a unit triangle to be the integer value written in that triangle. In general, the value of a triangle is the sum of values in all its unit triangles. The triangle on the right is the same as the other one but with the sub-triangle having the largest value being highlighted. Write a program to determine the sub-triangle with the largest value.

#### Input

Your program will be tested on one or more test cases. Each test case is specified in a single line made of integers (separated by spaces.) The first integer is the number of rows in the test case, and the remaining integers are the values of the unit triangles specified in a top-down, left-to-right order. (the first test case in the example below is the same as the one in the figure.) The last line of the input file contains the number 0 (which is not part of the test cases.)

The maximum number of rows is 400. The absolute value of a unit triangle is less than 1000.

#### Output

For each test case, print the result using the following format:

k. V

where k is the test case number (starting at 1,) is a single space, and V is the maximum value of a sub-triangle in that test case.

#### Example

```
Input: 3 6 -24 0 12 -10 12 40 -4 6
4 1 1 -1 1 1 -1 1 -1 1 1 -1 1 -1 1 -1 1
0
Output: 1. 54
2. 4
```

---

Added by: Ahmed Aly  
Date: 2009-07-03  
Time limit: 5s  
Source limit:50000B  
Languages: All except: JS  
Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4554. Relax! It is just a game

#### Problem code: ANARC08E

You: What's the score? Did I miss much?

Me: It's 2-1 for elAhli and the second half just started. The first half was quite boring.

You: Who scored first? elAhli or ezZamalek?

Me: What difference does it make?

You: Big difference! I can predict the outcome of the match if I knew the order of which goals were scored in the first half.

Me: What do you mean?

You: It's 2-1 for elAhli, right? One of three things could have happened: elAhli scored two goals then ezZamalek scored; Or, elAhli scored its first goal, then ezZamalek, then elAhli again; Or, ezZamalek scored first, then elAhli scored its two goals.

Me: So?!! I still don't understand what difference does that make? It's still 2-1 for elAhli! Why don't you just relax and let us continue watching the game in peace.

You: You don't understand!! I believe the probability of who'll win depends on the order of how goals were scored. Now I have to predict the outcome for 3 possibilities.

Me: And what if the score was 3-2? What would you have done then?

You: I would have to work for 5 different possibilities. No?

Me: Of course not! The number of possibilities isn't always equal to the sum.

You: Can you tell me when will it be equal to the sum?

Me: You're a programmer, why don't you write a program that counts the number of possibilities and compare it to the sum?

You: I don't have the time, I want to watch the match. Besides, I have nine other problems to worry about.

Me: I'll give you a hint. The possibilities will be equal to the sum only if one of the teams scored a certain number of goals.

#### Input

Your program will be tested on one or more test cases. Each test case specifies two natural numbers (A and B ) (separated by one or more spaces) representing the score of the first half. No team will be able to score more than 10 goals. The last line of the input file contains two -1's (which is not part of the test cases.)

#### Output

Format For each test case where the number of possibilities is equal to the sum, print:

$A+B=C$

Where A and B are as above and C is their sum. If the number of possibilities is not equal to the sum, replace the '=' sign with '!=' (without the quotes.)



## Example

**Input :**

2 1  
1 0  
-1 -1

**Output :**

2+1=3  
1+0=1

---

Added by: Ahmed Aly

Date: 2009-07-04

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4555. Einbahnstrasse

**Problem code: ANARC08F**

Einbahnstrasse (German for a one-way street) is a street on which vehicles should only move in one direction. One reason for having one-way streets is to facilitate a smoother flow of traffic through crowded areas. This is useful in city centers, especially old cities like Cairo and Damascus. Careful planning guarantees that you can get to any location starting from any point. Nevertheless, drivers must carefully plan their route in order to avoid prolonging their trip due to one-way streets. Experienced drivers know that there are multiple paths to travel between any two locations. Not only that, there might be multiple roads between the same two locations. Knowing the shortest way between any two locations is a must! This is even more important when driving vehicles that are hard to maneuver (garbage trucks, towing trucks, etc.)

You just started a new job at a car-towing company. The company has a number of towing trucks parked at the company's garage. A tow-truck lifts the front or back wheels of a broken car in order to pull it straight back to the company's garage. You receive calls from various parts of the city about broken cars that need to be towed. The cars have to be towed in the same order as you receive the calls. Your job is to advise the tow-truck drivers regarding the shortest way in order to collect all broken cars back in to the company's garage. At the end of the day, you have to report to the management the total distance traveled by the trucks.

### Input

Your program will be tested on one or more test cases. The first line of each test case specifies three numbers (  $N$  ,  $C$  , and  $R$  ) separated by one or more spaces. The city has  $N$  locations with distinct names, including the company's garage.  $C$  is the number of broken cars.  $R$  is the number of roads in the city. Note that  $0 < N < 100$  ,  $0 \leq C < 1000$  , and  $R < 10000$  . The second line is made of  $C + 1$  words, the first being the location of the company's garage, and the rest being the locations of the broken cars. A location is a word made of 10 letters or less. Letter case is significant. After the second line, there will be exactly  $R$  lines, each describing a road. A road is described using one of these three formats:

$A \text{ --}v\text{--} B$

$A \text{ <}v\text{--} B$

$A \text{ <}v\text{--} B$

$A$  and  $B$  are names of two different locations, while  $v$  is a positive integer (not exceeding 1000) denoting the length of the road. The first format specifies a one-way street from location  $A$  to  $B$  , the second specifies a one-way street from  $B$  to  $A$  , while the last specifies a two-way street between them.  $A$  , "the arrow", and  $B$  are separated by one or more spaces. The end of the test cases is specified with a line having three zeros (for  $N$  ,  $C$  , and  $R$  .)

The test case in the example below is the same as the one in the figure.

[IMAGE]

## Output

For each test case, print the total distance traveled using the following format:

k. V

Where k is test case number (starting at 1,) is a space, and V is the result.

## Example

### Input :

```
4 2 5
NewTroy Midvale Metrodale
NewTroy    <-20-> Midvale
Midvale    --50-> Bakerline
NewTroy     <-5-- Bakerline
Metrodale  <-30-> NewTroy
Metrodale  --5-> Bakerline
0 0 0
```

### Output :

```
1. 80
```

---

Added by: Ahmed Aly

Date: 2009-07-04

Time limit: 1s

Source limit:50000B

Languages: All except: JS

Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4556. Think I will Buy Me a Football Team

**Problem code: ANARC08G**

Falling Stocks. Bankrupted companies. Banks with no Cash. Seems like the best time to invest: "Think I'll buy me a football team!"

No seriously, I think I have the solution to at least the problem of cash in banks. Banks nowadays are all owing each other great amounts of money and no bank has enough cash to pay other banks' debts even though, on paper at least, they should have enough money to do so. Take for example the inter-bank loans shown in figure (a). The graph shows the amounts owed between four banks (A ...D). For example, A owes B 50M while, at the same time, B owes A 150M. (It is quite common for two banks to owe each other at the same time.) A total amount of 380M in cash is needed to settle all debts between the banks.

[IMAGE]

In an attempt to decrease the need for cash, and after studying the example carefully, I concluded that there's a lot of cash being transferred unnecessarily. Take a look:

1. C owes D the same amount as D owes A, so we can say that C owes A an amount of 30M and get D out of the picture.
2. But since A already owes C 100M, we can say that A owes C an amount of 70M.
3. Similarly, B owes A 100M only, (since A already owes B 50M.) This reduces the above graph to the one shown in figure (b) which reduces the needed cash amount to 190M (A reduction of 200M, or 53%.)
4. I can still do better. Rather than B paying A 100M and A paying 70M to C, B can pay 70M (out of A's 100M) directly to C. This reduces the graph to the one shown in figure (c). Banks can settle all their debts with only 120M in cash. A total reduction of 260M or 68%. Amazing!

I have data about inter-bank debts but I can't seem to be able to process it to obtain the minimum amount of cash needed to settle all the debts. Could you please write a program to do that?

### Input

Your program will be tested on one or more test cases. Each test case is specified on  $N + 1$  lines where  $N < 1,000$  is the number of banks and is specified on the first line. The remaining  $N$  lines specifies the inter-bank debts using an  $N \times N$  adjacency matrix (with zero diagonal) specified in row-major order. The  $i$ th row specifies the amounts owed by the  $i$ th bank. Amounts are separated by one or more spaces. All amounts are less than 1000. The last line of the input file has a single 0.

### Output

For each test case, print the result using the following format:

k. B A

where  $k$  is the test case number (starting at 1,) is a space character,  $B$  is the amount of cash needed before reduction and  $A$  is the amount of cash after reduction.

## Example

**Input :**

```
4
  0  50 100  0
150  0  20  0
  0  0  0  30
 30  0  0  0
0
```

**Output :**

```
1. 380 120
```

---

Added by: Ahmed Aly

Date: 2009-07-04

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4557. Musical Chairs

#### Problem code: ANARC08H

In the traditional game of Musical Chairs,  $N + 1$  children run around  $N$  chairs (placed in a circle) as long as music is playing. The moment the music stops, children run and try to sit on an available chair. The child still standing leaves the game, a chair is removed, and the game continues with  $N$  children. The last child to sit is the winner.

In an attempt to create a similar game on these days' game consoles, you modify the game in the following manner:  $N$  Children are seated on  $N$  chairs arranged around a circle. The chairs are numbered from 1 to  $N$ . Your program pre-selects a positive number  $D$ . The program starts going in circles counting the children starting with the first chair. Once the count reaches  $D$ , that child leaves the game, removing his/her chair. The program starts counting again, beginning with the next chair in the circle. The last child remaining in the circle is the winner.

[IMAGE]

For example, consider the game illustrated in the figure above for  $N = 5$  and  $D = 3$ . In the figure, the dot indicates where counting starts and  $\times$  indicates the child leaving. Starting off, child #3 leaves the game, and counting restarts with child #4. Child #1 is the second child to leave and counting restart with child #2 resulting in child #5 leaving. Child #2 is the last to leave, and child #4 is the winner. Write a program to determine the winning child given both  $N$  and  $D$ .

#### Input

Your program will be tested on one or more test cases. Each test case specifies two positive integers  $N$  and  $D$  on a single line, separated by one or more spaces, where  $N, D < 1,000,000$ . The last line of the input file contains two 0's and is not part of the test cases.

#### Output

For each test case, write the winner using the following format:

$N \ D \ W$

Where  $N$  and  $D$  are as above, is a space character, and  $W$  is the winner of that game.

#### Example

**Input :**

```
5 3
7 4
0 0
```

**Output :**

```
5 3 4
7 4 2
```

---

Added by: Ahmed Aly  
Date: 2009-07-04  
Time limit: 15s  
Source limit:50000B  
Languages: All  
Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4558. I Speak Whales

#### Problem code: ANARC08I

According to Wikipedia, a Walsh matrix is a specific square matrix, with dimensions equal to a power of 2, the entries of which are +1 or -1, and the property that the dot product of any two distinct rows (or columns) is zero. Below are the first three Walsh Matrices. (The gray lines are imaginary lines for illustration purpose only.)

[IMAGE]

A Walsh Matrix of size  $2^{(N+1)}$  can be constructed as the "union" of 4 Walsh Matrices of size  $2^N$  arranged such that the lower right matrix is inverted whereas the other 3 matrices are not, i.e.:

[IMAGE]

Let's number the rows of a given Walsh Matrix from the top starting with row 0. Similarly, let's number the columns of the matrix from the left starting with column 0. Given the four integers  $N$ ,  $R$ ,  $S$ , and  $E$ , write a program that will construct a Walsh Matrix of size  $2^N$  and will print the sum of all the numbers in row  $R$  between columns  $S$  and  $E$  (inclusive.)

#### Input

Your program will be tested on one or more test cases. Each test case is specified using a single line listing four integers in the following order:  $N$ ,  $R$ ,  $S$ , and  $E$ , where  $0 \leq N \leq 60$ ,  $0 \leq R < 2^N$ ,  $0 \leq S \leq E < 2N$ , and  $E - S \leq 10,000$ . The last line of the input file has four -1's and is not part of the test cases.

#### Output

For each test case, print the output on a single line.

#### Example

**Input :**

```
2 1 0 1
48 0 0 47
-1 -1 -1 -1
```

**Output :**

```
0
48
```

---



Added by: Ahmed Aly  
Date: 2009-07-04  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4559. A Day at the Races

#### Problem code: ANARC08J

Formula One is the highest class of car racing sports. A typical Formula One season consists of a series of races called "Grands Prix" which constructors like Ferrari, Renault, etc. and others participate with one or more cars driven by the best drivers in the world. During the season, teams compete in two parallel championships: the drivers championship and the teams championship.

In the drivers championship, drivers compete to achieve the maximum total number of points by the end of the season, the rules of the competition states that the top eight drivers at each Grand Prix receive 10,8,6,5,4,3,2,1 points respectively. In case of points tie, the driver with the highest number of first places leads. If still tied, then the highest second places, and so on till the highest 8th places. If still tied, then drivers are sorted lexicographically by their last and then by their first names.

After each race, the points received by each driver are added to his team's pocket, and at the end of the season the team with the highest number of points wins the teams championship. To add excitement to the season, team sponsors are allowed to buy drivers from other teams even within the same season. In case of points tie between teams, teams are sorted lexicographically by their names. In this problem, you are given data of a formula one season and you're asked to process these data according to the rules above to determine both the drivers and teams standings.

#### Input

Your program will be tested on one or more data-sets, each representing a Formula One season. All input lines are 255 characters or less. Studying the sample I/O you'll discover that the first line of each season has an integer  $N$ , where  $0 < N < 32$  and representing the number of Grands Prix in that season. For each Grand Prix, the name of the Grand Prix appears on a line by itself (maximum length is 64 characters) followed by a table of the first name, last name and team name of the top eight drivers, from 1 to 8, in that Grand Prix. Each of the first and last names is a sequence of printable ASCII characters, no longer than 12 characters, and contains no spaces. Each team name is a sequence of printable ASCII characters, no longer than 18 characters, and may contain spaces (but no leading or trailing spaces.) Each team name is followed by a single period '.' which is not part of the name. Trailing white space may follow. A line of three '-'s follows the listing of each Grand Prix. The last line of the input file contains a single zero.

#### Output

For each data set in the input you must print "Season k :" where k is the data-set number (starting from 1.) The next line must state "Drivers Standing:". On subsequent lines list the drivers standing for that season. For each driver, print their first and last names separated by exactly one space and left justified in a field of width 25, followed by a single space, followed by the total number of points achieved by the driver during the season. The drivers standing should be followed by a blank line.

The next line must state "Teams Standing:" On subsequent lines list the teams standing for the that season. For each team, print the team name left justified in a field of width 25, followed by a single space, followed by the total number of points the team has scored during the season. The teams standing should be followed by a blank line.

## Example

### Input :

```
2
FORMULA 1 Gran Premio Telefonica de Espana 2006
Pos  Driver                      Team
1    Fernando Alonso             Renault.
2    Michael Schumacher          Ferrari.
3    Giancarlo Fisichella        Renault.
4    Felipe Massa                Ferrari.
5    Kimi Raikkonen              McLaren-Mercedes.
6    Jenson Button               Honda.
7    Rubens Barrichello          Honda.
8    Nick Heidfeld               Sauber-BMW.
---
FORMULA 1 Grand Prix de Monaco 2006
Pos  Driver                      Team
1    Fernando Alonso             Renault.
2    Jaun-Pablo Montoya          McLaren-Mercedes.
3    David Coulthard             RBR-Ferrari.
4    Rubens Barrichello          Honda.
5    Michael Schumacher          Ferrari.
6    Giancarlo Fisichella        Renault.
7    Nick Heidfeld               Sauber-BMW.
8    Ralf Schumacher             Toyota.
---
0
```

### Output :

```
Season 1:
Drivers Standing:
Fernando Alonso      20
Michael Schumacher   12
Giancarlo Fisichella 9
Jaun-Pablo Montoya   8
Rubens Barrichello   7
David Coulthard      6
Felipe Massa         5
Kimi Raikkonen       4
Jenson Button        3
Nick Heidfeld        3
Ralf Schumacher      1

Teams Standing:
Renault              29
Ferrari              17
McLaren-Mercedes     12
Honda                10
RBR-Ferrari          6
Sauber-BMW           3
Toyota               1
```

---

Added by: Ahmed Aly  
Date: 2009-07-04  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: ANARC 2008

## SPOJ Problem Set (classical)

### 4574. Riding in cycles

#### Problem code: CYCLERUN

There are  $N$  cities, numbered from 1 to  $N$ , in the country you are living. **Each pair** of the cities is connected with exactly one road. However, **each road is a one-way road**, so it is either possible to go directly from  $A$  to  $B$  or from  $B$  to  $A$  for each pair of cities  $(A, B)$ .

You are living in city #1 and you are practicing for upcoming cycling marathon, so you want to construct the following training plan:

First day you have to ride over 3 roads starting from and finishing in city #1.

Second day you have to ride over 4 roads in the same manner.

Third day you have to ride over 5 roads.

...

The last,  $(N-2)$ -th, day you have to ride over  $N$  roads starting from and finishing in city #1.

You don't like to visit the same city more than once per day, so you have to find a training route for each day that passes through **each city at most once**. City #1 should appear only at the start and at the end of each route.

Write the program that, given the layout of the network, outputs training route for each day, or writes "impossible" if such training plan is not achievable.

#### Input

The first line of input contains the integer  $N$  ( $3 \leq N \leq 1000$ ), number of cities.

Each of the next  $N$  lines contains exactly  $N$  characters that describes network layout.  $j$ -th character in  $i$ -th of these lines is '1' if it is possible to ride from city number  $i$  to city number  $j$ , or '0' otherwise.

#### Output

You should output training route for each day in a separate line. Training route consists of space separated integers - numbers of the cities in order they should be visited. Each training route starts and ends with 1.

If there is no achievable training plan, output word 'impossible' in a single line, instead.

## Example

### Input :

```
5
01000
00011
11001
10100
10010
```

### Output :

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

---

Added by: Luka Kalinovic

Date: 2009-07-07

Time limit: 1s

Source limit:50000B

Languages: All

Resource: own problem

## SPOJ Problem Set (classical)

### 4580. ABCDEF

#### Problem code: ABCDEF

You are given a set  $S$  of integers between  $-30000$  and  $30000$  (inclusive).

Find the total number of sextuples that satisfy:

#### Input

The first line contains integer  $N$  ( $1 \leq N \leq 100$ ), the size of a set  $S$ .

Elements of  $S$  are given in the next  $N$  lines, one integer per line. Given numbers will be distinct.

#### Output

Output the total number of plausible sextuples.

#### Examples

<b>Input :</b>	<b>Input :</b>	<b>Input :</b>	<b>Input :</b>
1	2	2	3
1	2	-1	5
	3	1	7
<b>Output :</b>			10
1	<b>Output :</b>	<b>Output :</b>	<b>Output :</b>
	4	24	10

---

Added by: Luka Kalinovic

Date: 2009-07-13

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: own problem

## SPOJ Problem Set (classical)

### 4585. Star Wars

#### Problem code: GCJ08C

Near the planet Mars, in a faraway galaxy eerily similar to our own, there is a fight to the death between the imperial forces and the rebels. The rebel army has  $N$  ships which we will consider as points  $(x_i, y_i, z_i)$ . Each ship has a receiver with power  $p_i$ . The rebel army needs to be able to send messages from the central cruiser to all the ships, but they are tight on finances, so they cannot afford a strong transmitter.

If the cruiser is placed at  $(x, y, z)$ , and one of the other ships is at  $(x_i, y_i, z_i)$  and has a receiver of power  $p_i$ , then the power of the cruiser's transmitter needs to be at least:

$$(|x_i - x| + |y_i - y| + |z_i - z|) / p_i$$

Your task is to find the position for the cruiser that minimizes the power required for its transmitter, and to output that power.

#### Input

The first line of input gives the number of cases,  $T$ .  $T$  test cases follow.

Each test case contains on the first line the integer  $N$ , the number of ships in the test case.

$N$  lines follow, each line containing four integer numbers  $x_i, y_i, z_i$  and  $p_i$ , separated by single spaces. These are the coordinates of the  $i$ -th ship, and the power of its receiver. There may be more than one ship at the same coordinates.

$$1 \leq T \leq 20$$

$$0 \leq x_i, y_i, z_i \leq 10^6$$

$$1 \leq p_i \leq 10^6$$

$$1 \leq N \leq 1000$$

#### Output

For each input case, you should output:

Case #X: Y

where  $X$  is the number of the test case and  $Y$  is the minimal power that is enough to reach all the fleet's ships. Answers with a relative or absolute error of at most  $10^{-6}$  will be considered correct.

#### Example

Input :

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

3 2 3 2

**Output :**

Case #1: 3.500000

Case #2: 0.000000

Case #3: 2.333333

---

Added by: Ahmed Aly

Date: 2009-07-15

Time limit: 3s

Source limit:50000B

Languages: All

Resource: Google Code Jam 2008



## SPOJ Problem Set (classical)

### 4586. Texas Trip

#### Problem code: WLOO0707

After a day trip with his friend Dick, Harry noticed a strange pattern of tiny holes in the door of his SUV. The local American Tire store sells fiberglass patching material only in square sheets. What is the smallest patch that Harry needs to fix his door?

Assume that the holes are points on the integer lattice in the plane. Your job is to find the area of the smallest square that will cover all the holes.

#### Input

The first line of input contains a single integer  $T$  expressed in decimal with no leading zeroes, denoting the number of test cases to follow. The subsequent lines of input describe the test cases.

Each test case begins with a single line, containing a single integer  $n$  expressed in decimal with no leading zeroes, the number of points to follow; each of the following  $n$  lines contains two integers  $x$  and  $y$ , both expressed in decimal with no leading zeroes, giving the coordinates of one of your points.

You are guaranteed that  $T \leq 30$  and that no data set contains more than 30 points. All points in each data set will be no more than 500 units away from  $(0,0)$ .

#### Output

Print, on a single line with two decimal places of precision, the area of the smallest square containing all of your points. An answer will be accepted if it lies within 0.01 of the correct answer.

#### Example

**Input :**

```
2
4
-1 -1
1 -1
1 1
-1 1
4
10 1
10 -1
-10 1
-10 -1
```

**Output :**

```
4.00
242.00
```

---

Added by: Ahmed Aly  
Date: 2009-07-15  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: 14 July, 2007 - Waterloo local contest

## SPOJ Problem Set (classical)

### 4587. Electric Fences

#### Problem code: FENCE3

Farmer John has decided to construct electric fences. He has fenced his fields into a number of bizarre shapes and now must find the optimal place to locate the electrical supply to each of the fences.

A single wire must run from some point on each and every fence to the source of electricity. Wires can run through other fences or across other wires. Wires can run at any angle. Wires can run from any point on a fence (i.e., the ends or anywhere in between) to the electrical supply.

Given the locations of all  $F$  ( $1 \leq F \leq 150$ ) fences (fences are always parallel to a grid axis and run from one integer gridpoint to another,  $0 \leq X, Y \leq 100$ ), your program must calculate both the total length of wire required to connect every fence to the central source of electricity and also the optimal location for the electrical source.

The optimal location for the electrical source might be anywhere in Farmer John's field, not necessarily on a grid point.

#### Input

The first line contains  $F$ , the number of fences.

$F$  subsequent lines each contain two  $X, Y$  pairs each of which denotes the endpoints of a fence.

#### Output

On a single line, print three space-separated floating point numbers, each with a single decimal place. Presume that your computer's output library will round the number correctly.

The three numbers are:

- \* the  $X$  value of the optimal location for the electricity,
- \* the  $Y$  value for the optimal location for the electricity, and
- \* the total (minimum) length of the wire required.

#### Example

**Input :**

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

**Output :**

```
1.0 1.6 3.7
```

---

Added by: Ahmed Aly  
Date: 2009-07-15  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: USACO

## SPOJ Problem Set (classical)

### 4588. SETI

#### Problem code: NWERC04H

For some years, quite a lot of work has been put into listening to electromagnetic radio signals received from space, in order to understand what civilizations in distant galaxies might be trying to tell us. One signal source that has been of particular interest to the scientists at Université de Technologie Spatiale is the Nebula Stupidicus.

Recently, it was discovered that if each message is assumed to be transmitted as a sequence of integers  $a_0, a_1, \dots, a_{n-1}$  the function  $f(k) = [a_k \cdot p] \pmod{p}$  always evaluates to values  $0 \leq f(k) \leq 26$  for  $1 \leq k \leq n$ , provided that the correct value of  $p$  is used.  $n$  is of course the length of the transmitted message, and the  $a_i$  denote integers such that  $0 \leq a_i < p$ .  $p$  is a prime number that is guaranteed to be larger than  $n$  as well as larger than 26. It is, however, known to never exceed 30 000.

These relationships altogether have been considered too peculiar for being pure coincidences, which calls for further investigation.

The linguists at the faculty of Langues et Cultures Extraterrestres transcribe these messages to strings in the English alphabet to make the messages easier to handle while trying to interpret their meanings. The transcription procedure simply assigns the letters a..z to the values 1..26 that  $f(k)$  might evaluate to, such that  $1 = a$ ,  $2 = b$  etc. The value 0 is transcribed to '\*' (an asterisk). While transcribing messages, the linguists simply loop from  $k = 1$  to  $n$ , and append the character corresponding to the value of  $f(k)$  at the end of the string.

The backward transcription procedure, has however, turned out to be too complex for the linguists to handle by themselves. You are therefore assigned the task of writing a program that converts a set of strings to their corresponding Extra Terrestrial number sequences.

#### Input

On the first line of the input there is a single positive integer  $N$ , telling the number of test cases to follow. Each case consists of one line containing the value of  $p$  to use during the transcription of the string, followed by the actual string to be transcribed. The only allowed characters in the string are the lower case letters 'a'..'z' and '\*' (asterisk). No string will be longer than 70 characters.

#### Output

For each transcribed string, output a line with the corresponding list of integers, separated by space, with each integer given in the order of ascending values of  $i$ .

#### Example

Input :

```
3
31 aaa
37 abc
29 hello*earth
```

**Output :**

```
1 0 0
0 1 0
8 13 9 13 4 27 18 10 12 24 15
```

---

Added by: Ahmed Aly

Date: 2009-07-15

Time limit: 2s

Source limit:50000B

Languages: All

Resource: NWERC 2004

## SPOJ Problem Set (classical)

### 4644. Proving Equivalences

#### Problem code: PMATRIX

Consider the following exercise, found in a generic linear algebra textbook. Let  $A$  be an  $n \times n$  matrix. Prove that the following statements are equivalent:

- (a)  $A$  is invertible.
- (b)  $Ax = b$  has exactly one solution for every  $n \times 1$  matrix  $b$ .
- (c)  $Ax = b$  is consistent for every  $n \times 1$  matrix  $b$ .
- (d)  $Ax = 0$  has only the trivial solution  $x = 0$ .

The typical way to solve such an exercise is to show a series of implications. For instance, one can proceed by showing that (a) implies (b), that (b) implies (c), that (c) implies (d), and finally that (d) implies (a). These four implications show that the four statements are equivalent. Another way would be to show that (a) is equivalent to (b) (by proving that (a) implies (b) and that (b) implies (a)), that (b) is equivalent to (c), and that (c) is equivalent to (d).

However, this way requires proving six implications, which is clearly a lot more work than just proving four implications! I have been given some similar tasks, and have already started proving some implications. Now I wonder, how many more implications do I have to prove? Can you help me determine this?

#### Input

On the first line one positive number: the number of testcases, at most 100. After that per testcase:

- One line containing two integers  $n$  ( $1 \leq n \leq 20\,000$ ) and  $m$  ( $0 \leq m \leq 50\,000$ ): the number of statements and the number of implications that have already been proved.
- $m$  lines with two integers  $s_1$  and  $s_2$  ( $1 \leq s_1, s_2 \leq n$  and  $s_1 \neq s_2$ ) each, indicating that it has been proved that statement  $s_1$  implies statement  $s_2$ .

#### Output

Per testcase:

One line with the minimum number of additional implications that need to be proved in order to prove that all statements are equivalent.

#### Example

**Input :** 24 03 21 21 3 **Output :** 42

---

Added by: Hemant Verma

Date: 2009-07-25

Time limit: 3s

Source limit:50000B

Languages: All except: C++ 4.3.2 TCL SCALA PYTH 2.6.2 ERL JS

Resource: NWERC 2008



## SPOJ Problem Set (classical)

### 4656. Cross Mountain Climb

#### Problem code: CCROSS

Somewhere in the neighborhood we have a very nice mountain that gives a splendid view over the surrounding area. There is one problem though: climbing this mountain is very difficult, because of rather large height differences. To make more people able to climb the mountain and enjoy the view, we would like to make the climb easier. To do so, we will model the mountain as follows: the mountain consists of  $n$  adjacent stacks of stones, and each of the stacks is  $h_i$  high. The successive height differences are therefore  $h_{i+1} - h_i$  (for  $1 \leq i \leq n - 1$ ). We would like all absolute values of these height differences to be smaller than or equal to some number  $d$ .

We can do this by increasing or decreasing the height of some of the stacks. The first stack (the starting point) and the last stack (the ending point) should remain at the same height as they are initially. Since adding and removing stones requires a lot of effort, we would like to minimize the total number of added stones plus the total number of removed stones. What is this minimum number?

#### Input

On the first line one positive number: the number of testcases, at most 100. After that per testcase:

- One line with two integers  $n$  ( $2 \leq n \leq 100$ ) and  $d$  ( $0 \leq d \leq 10^9$ ): the number of stacks of stones and the maximum allowed height difference.
- One line with  $n$  integers  $h_i$  ( $0 \leq h_i \leq 10^9$ ): the heights of the stacks.

#### Output

Per testcase:

One line with the minimum number of stones that have to be added or removed or "impossible" if it is impossible to achieve the goal.

#### Example

**Input:** 3 10 24 5 10 6 6 9 4 7 9 83 16 4 04 23 0 6 3 **Output:** 6 impossible 4

Problem text...

Problem text...

---

Added by: ???? [FameofLight]  
Date: 2009-07-27  
Time limit: 15s  
Source limit: 50000B  
Languages: All  
Resource: NWERC 2008 Regionals

## SPOJ Problem Set (classical)

### 4657. Gas Wars

#### Problem code: GASWARS

As the result of the gas wars the following agreement was made. The transit of the gas was allowed under the following conditions. There are **n** transit nodes and **m** pipes connecting those nodes. There **k** nodes where the gas enters and **l** nodes where it should be moved. Each pipe has a carrying capacity of **c<sub>i</sub>** cubic meters of gas per day. Gas can go through the pipes in either direction. It is needed to move **g** cubic meters of gas in total through the pipeline every day. The cost of the transit is defined as **maxC**\*100 thousand dollars, where **maxC** - maximum of carrying capacities of the used in the transit pipes (even those which are not fully used). You are to find the minimum possible cost of transit for the given pipeline.

#### Input

The first line of the input file contains **t** - the amount of test cases. The description of each test case follows. The first line of each test case contains five integers separated by spaces - **n, m, k, l, g**. Then **m** lines containing three integers **a, b, c** follow. Each lines means that nodes with numbers **a** and **b** are connected by the pipe with the carrying capacity of **c**. Next line contains **k** integers - the numbers of nodes where the gas should enter the pipeline. The last line of the test case contains **l** integers - the numbers of nodes where the gas should be moved. The gas can enter the pipeline in any of the **k** entrance nodes and can be moved to any of the **l** exit nodes. The nodes are numbered from 1 to **n**.

#### Constraints

$1 \leq t \leq 20$   
 $2 \leq n \leq 100$   
 $1 \leq m \leq n*(n-1)/2$   
 $1 \leq k, l \leq n/2$   
 $1 \leq g, c \leq 1000000$

#### Output

For each test case output a single integer on a separate line - the minimum cost of transit in thousands of dollars. If the transit of the needed volume is impossible, then output -1.

#### Example

Input :

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

5 6 1  
1  
6

**Output :**  
200

---

Added by: Spooky  
Date: 2009-07-28  
Time limit: 4s  
Source limit:50000B  
Languages: All  
Resource: Advancement Spring 2009, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 4658. Help Hemant Verma

#### Problem code: HHEMANT

Steganography is a method of cryptography where a message or entire document can be hidden inside of another file or image which shows no evidence that there is data hidden in it. Typically, the message or document to be sent is first encrypted and compressed, and then combined with an existing file in the bits that are less significant.

Hemant Verma is a secret agent who wants to send some classified information to his head office, the amount of data is very large, he needs your help to encode the message into image. You will be given an "image" and you will encode a given message into it and return the new image. The returned image should be in the same format as the original image.

The image will be in the format of a string of various lines where each three digits represent a number from 0 to 255, inclusive (leading zeros will be added as necessary), which is a pixel value in the image. You will also be given a message which contains the message you would like to encode into the image.

You will first encode the message into numbers representing the characters in the message - spaces will be 0, 'A'-'Z' will be 1-26, 'a'-'z' will be 27-52, '0'-'9' will be 53-62, and 63 will be used for any space after the message. All these numbers can be represented in binary with 6 digits. You will put each pair of bits (representing a number between 0 and 3) into the lowest two bits of the values in the image. For each character, you will put in the lowest two bits, then the middle two, then the highest two, and then continue to the next character. You will put them in the lowest two bits of the first pixel on the first row, then the second pixel on the first row, and so on until you get to the end of the first row, then the first pixel on the second row, and so on. Once you are out of characters, continue substituting the lowest two bits of each pixel value as if the current character were represented by number 63.

#### Input

First line contain T representing number of test case, for each test case first line contain message then follow N the number of lines for image then following N line contain image.

$$0 < \text{Length}(\text{message}) < 1000$$
$$0 < T, N < 10000$$

#### Output

For each test case output the image in same format as input.

#### Example

**Input:** 2hi1255123212001201222hi2255123212001201222**Output:** 254120214003200222254120214003200222

---

Added by: ???? [FameofLight]  
Date: 2009-07-28  
Time limit: 0.5s  
Source limit: 50000B  
Languages: All  
Resource: Modified Topcoder Problem

## SPOJ Problem Set (classical)

### 4667. Gremlins

#### Problem code: GREMLINS

Gremlins are small funny furry creatures. Once they were considered to be evil but that time has past and most gremlins live a decent family life now. There are  $N$  distinct types of gremlins.

Their origin is rather mysterious. Legend says that  $T$  years ago,  $N$  gremlins, one of each type, were born in a lab accident.

Their reproduction method is, however, well studied. No mating ritual is required for gremlins to multiply. All they need is a few drops of water and the magic happens.

Once a *type  $i$*  gremlin starts its reproduction process,  $K_i$  small furry balls are created. For each furry ball we know what is the type of gremlin that will hatch from the furry ball and how long will it take for that to happen. Unfortunately, the original gremlin dies in the process. A *type  $i$*  gremlin will start its reproduction process exactly  $Y_i$  years after it is **born**(ie. hatched from the furry ball).

Knowledge about the ancestors of a gremlin is passed on genetically, so each gremlin knows a list of his ancestors as soon as it is born.

Write a program that will find the length of the longest list of ancestors among all gremlins that ever lived (gremlins that still live are included, but unhatched furry balls are not), given the information about reproduction process and time elapsed since the lab accident that created initial gremlins, assuming **all gremlins that were supposed to hatch this year have already hatched**.

#### Input

The first line contains two integers  $N$  and  $T$  ( $1 \leq N \leq 100$ ,  $1 \leq T \leq 10^{15}$ ), the number of gremlin types and the number of year that has passed since the lab accident.

The next  $3 \cdot N$  lines give reproduction details for each gremlin type.

The first line of  $i$ -th block contains two integers  $K_i$  and  $Y_i$  ( $1 \leq Y_i \leq 1000$ ,  $1 \leq K_i \leq 1000$ ).

The second line contains  $K_i$  integers representing gremlin type for each furry ball.

The third line contains  $K_i$  integers between 1 and 1000 representing hatching time for each furry ball, in years.

#### Output

Output the length of the longest list of ancestors among all gremlins that ever lived in a single line.

## Examples

<b>Input :</b>	<b>Input :</b>	<b>Input :</b>
1 42	2 42	3 8
1 10	1 10	4 5
1	1	1 2 3 2
5	5	1 2 1 3
	1 5	1 1
	1	3
	5	1
		2 1
		1 2
		2 1
<b>Output :</b>	<b>Output :</b>	<b>Output :</b>
2	3	4

---

Added by: Luka Kalinovic

Date: 2009-08-06

Time limit: 5s

Source limit:50000B

Languages: All except: ERL TECS JS

Resource: own problem



## SPOJ Problem Set (classical)

### 4669. Cross Mountain Climb Extreme

#### Problem code: CCROSSX

Somewhere in the neighborhood we have a very nice mountain that gives a splendid view over the surrounding area. There is one problem though: climbing this mountain is very difficult, because of rather large height differences. To make more people able to climb the mountain and enjoy the view, we would like to make the climb easier. To do so, we will model the mountain as follows: the mountain consists of  $n$  adjacent stacks of stones, and each of the stacks is  $h_i$  high. The successive height differences are therefore  $h_{i+1} - h_i$  (for  $1 \leq i \leq n-1$ ). We would like all absolute values of these height differences to be smaller than or equal to some number  $d$ .

We can do this by increasing or decreasing the height of some of the stacks. The first stack (the starting point) and the last stack (the ending point) should remain at the same height as they are initially. Since adding and removing stones requires a lot of effort, we would like to minimize the total number of added stones plus the total number of removed stones. What is this minimum number?

#### Input

On the first line one positive number: the number of test cases, at most 50. After that, for each test case:

- One line with two integers  $n$  ( $2 \leq n \leq 10000$ ) and  $d$  ( $0 \leq d \leq 10^9$ ): the number of stacks of stones and the maximum allowed height difference.
- One line with  $n$  integers  $h_i$  ( $0 \leq h_i \leq 10^9$ ): the heights of the stacks.

#### Output

For each test case, output one line with the minimum number of stones that have to be added or removed, or "impossible" if it is impossible to achieve the goal.

#### Example

**Input:** 3 10 24 5 10 6 6 9 4 7 9 83 16 4 04 23 0 6 3 **Output:** 6 impossible 4

---

Added by: Lovro Puzar

Date: 2009-08-08

Time limit: 20s

Source limit: 50000B

Languages: All

Resource: Problem CCROSS with larger limits (originally from NWERC 2008)

## SPOJ Problem Set (classical)

### 4672. Yanu in Movie theatre

#### Problem code: FUNPROB

Yanu is a great fan of Harry Potter. So on the day of the movie release, Yanu rushes to the movie theatre to watch the movie. On the release of the 6th movie, on reaching the theatre she found a long queue for tickets already. As the distribution was about to start, the ticket counter did not have any change to start with. There are  $N+M$  people in queue, where  $N$  have Rs 10.00 and  $M$  have Rs 5.00. The ticket costs Rs 5.00.

Now Yanu is math geek too, now she wonders What is the probability that the theatre can always provide change.

#### Input

Each line contain  $N$  and  $M$ , separated by a space, End of Input is marked by 0 0 which should not be processed. Both  $N$  and  $M$  fits in integer range.

#### Output

For each input, output the respective probability upto 6 decimal digits.

#### Example

**Input:** 1 00 141 410 00 **Output:** 0.0000001.0000000.023810

---

Added by: Hemant Verma [FameofLight]

Date: 2009-08-15

Time limit: 1s

Source limit: 1024B

Languages: All

Resource: A Classical Probability Problem

## SPOJ Problem Set (classical)

### 4681. Twice

#### Problem code: TWICE

Given a string S, find the longest substring that appears at least twice in S (occurrences may overlap).

#### Input

The first line contains an integer L ( $1 \leq L \leq 200000$ ), the length of S.

The second line contains the string S, consisting of exactly L lowercase letters ('a'-'z').

#### Output

Output the length of the longest substring that appears at least twice in S. If there is no such substring, output 0.

#### Example

**Input:** 11sabcabcabc**Output:** 3**Input:** 18trutrutiktiktappop**Output:** 4

---

Added by: Lovro Puzar

Date: 2009-08-21

Time limit: 1s-5s

Source limit: 50000B

Languages: All

Resource: Own problem

## SPOJ Problem Set (classical)

### 4717. Grid Points in a Triangle

#### Problem code: GPINTRI

How many points  $(x, y)$  with non-negative integer coordinates satisfy  $y \leq ax / b$  and  $x \leq n$ ?

#### Input

The first line contains an integer  $T$  ( $T \leq 100000$ ).  $T$  lines follow, each contains three positive integers  $n, a, b$ , where  $n, a, b \leq 10^9$  and  $a \leq b$ .

#### Output

$T$  lines, each contains a single integer denoting to the number of points according to the description.

#### Example

**Input:** 58 2 108 4 47 1 5713241932 127894722 957823358759096725 496666160 980149020 **Output:** 13451133963383064794976145994569610845896

**Warning: enormous input/output data, be careful with certain languages**

---

Added by: Lordxfastx  
Date: 2009-08-26  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Own problem

## SPOJ Problem Set (classical)

### 4828. ZSequence

#### Problem code: ZSEQ

You will be given a sequence  $A$  containing  $N$  positive integers,  $a_1, a_2, \dots, a_N$ .

Let  $S(i, j) = a_i + a_{i+1} + \dots + a_j$ , if  $i \leq j$ .

You should find  $K - 1$  indexes,  $m_1 < m_2 < \dots < m_{K-1}$  such that  $lb_1 \leq S(1, m_1) \leq ub_1, \dots, lb_i \leq S(m_{i-1} + 1, m_i) \leq ub_i$  and  $lb_K \leq S(m_{K-1} + 1, N) \leq ub_K$ .

If the case of multiple solution, print the first lexicographically.

#### Input

The first line of the standard input contains two space-separated integers  $N$  ( $2 \leq N \leq 5\,000$ ) and  $K$  ( $1 \leq K - 1 \leq N - 1$ ). Next  $N$  lines contain integers  $a_1, a_2, \dots, a_N$ , respectively,  $1 \leq a_i \leq 10^5$ .

$i$ -th of the next  $K$  lines contain integers  $lb_i$  and  $ub_i$ ,  $1 \leq lb_i \leq ub_i \leq 10^9$ .

#### Output

On the first line of the standard output you should print space-separated  $K - 1$  indices of the solution as already explained. If such solution does not exist, you should print only one integer  $-1$ .

#### Note:

Memory limit is 16MBs.

#### Example

**Input:** 4 3 12341 32 43 10 **Output:**

1 2 **Input:** 4 3 12341 32 43 4 **Output:** 2 3 **Input:** 4 3 12341 32 43 3 **Output:** -1

---

Added by: Slobodan

Date: 2009-09-19

Time limit: 0.5s-0.600s

Source limit: 50000B

Languages: All except: TCL SCALA

Resource: Z-Trening, own problem

## SPOJ Problem Set (classical)

### 4871. Bridge

#### Problem code: BRI

Find a place to build a bridge over the river, so as to minimize total cost of the route between two cities A and B, located on opposite sides of the river.

#### Input

There is a single positive integer  $T$  on the first line of input (equal to about 100000). It stands for the number of test cases to follow. Each test case is exactly one line, containing six integers  $a, b, c, h, s_1$  and  $s_2$  ( $0 < a, b, c, h, s_1, s_2 < 100$ ), separated by spaces.  $a$  - the distance from city A to the river (the length of segment AE in the figure),  $b$  - the distance from city B to the river (the length of segment FG in the figure),  $c$  - the distance between A and B along the axis parallel to the river (the length of segment BF in the figure) and  $h$  - the width of the river (EG in the figure).  $s_1$  and  $s_2$  are the costs of unit of road and bridge respectively.

#### Output

For each test case your program should write a single number to the standard output, equal to the minimal total cost of the route between A and B, accurate up to two digits after the decimal dot.

#### Example

**Input:** 11 1 1 1 1 1 **Output:** 3.16

---

Added by: Ruslan Sennov

Date: 2009-09-27

Time limit: 7s

Source limit: 50000B

Languages: All except: SCALA

Resource: Based on HSPL09BRI

## SPOJ Problem Set (classical)

### 4881. Words on graphs

**Problem code: AMBIG**

#### Input

The input is a directed (multi)graph.

The first line gives the number of edges  $M$  and the number of nodes  $N$  ( $\geq 2$ ). Then each edge is described by a line of the form "FROM TO LABEL". Nodes (FROM, TO) are numbers in the range  $0..N-1$  and labels are also numbers.

All numbers in the input are nonnegative integers  $< 2000$ .

#### Output

Print "YES" if there are two distinct walks with the same labelling from node 0 to node 1, otherwise print "NO".

#### Example 1

**Input:** 4 40 2 00 3 02 1 13 1 2 **Output:** NO

#### Example 2

**Input:** 10 90 2 02 1 02 3 03 4 04 2 02 5 05 6 06 7 07 8 08 2 0 **Output:** YES

In this case the shortest labelling that appears on two walks is 0 repeated 10 times.

drawing of example 2 input

---

Added by: Radu Grigore  
Date: 2009-09-29  
Time limit: 1s-5s  
Source limit: 50000B  
Languages: All except: SCALA

## SPOJ Problem Set (classical)

### 4882. Counting in a DAG

#### Problem code: DAGCNT2

You are given a weighted DAG. For each vertex, calculate the sum of the weights of the vertices within its reach (including itself).

#### Input

The first line contains an integer  $T$ , denoting the number of test cases.

For each test case, the first line contains two positive integers  $n$  and  $m$ , denoting the number of vertices and the number of edges in the DAG.

The second line contains  $n$  positive integers  $w_1..w_n$ , denoting the weights of vertices.

The next  $m$  lines contain two positive integers  $u,v$ , denoting an edge from  $u$  to  $v$ .

#### Output

For each test case, print a line consisting of  $n$  numbers, denoting the sum for each vertex.

#### Example

**Input:** 24 3510 713 383 990 4 14 22 14 4450 379 230 520 3 42 42 32 4 **Output:** 510 1223 383 2213450 1129 750 520

#### Constraints

Input Set 1: numberOfTestCases  $\leq 40$ ,  $n \leq 100$ ,  $m \leq 10000$

Input Set 2: numberOfTestCases  $\leq 2$ ,  $n \leq 1000$ ,  $m \leq 500000$

Input Set 3: numberOfTestCases  $\leq 2$ ,  $n \leq 20000$ ,  $m \leq 500000$

The weights are no more than 1000

---

Added by: Lordxfastx  
Date: 2009-09-30  
Time limit: 1s-26s  
Source limit: 50000B  
Languages: All except: SCALA  
Resource: Own problem



## SPOJ Problem Set (classical)

### 4908. Run-Length Mathematics

#### Problem code: RLM

Run-length encoding of a number replaces a run of digits (that is, a sequence of consecutive equivalent digits) with the number of digits followed by the digit itself. For example, 44455 would become 3425 (three fours, two fives). Note that run-length encoding does not necessarily shorten the length of the data: 11 becomes 21, and 42 becomes 1412. If a number has more than nine consecutive digits of the same type, the encoding is done greedily: each run grabs as many digits as it can, so 111111111111111 is encoded as 9161.

Implement an integer arithmetic calculator that takes operands and gives results in run-length format. You should support addition, subtraction, multiplication, and division. You won't have to divide by zero or deal with negative numbers.

#### Input/Output

The input will consist of several test cases, one per line. For each test case, compute the run-length mathematics expression and output the original expression and the result, as shown in the examples. The (decimal) representation of all operands and results will fit in signed 64-bit integers.

#### Example

**Input :**

```
11 + 11
988726 - 978625
12 * 41
1124 / 1112
13 * 33
15 / 16
```

**Output :**

```
11 + 11 = 12
988726 - 978625 = 919111
12 * 41 = 42
1124 / 1112 = 1112
13 * 33 = 39
15 / 16 = 10
```

---

Added by: Miorel Palii

Date: 2009-10-04

Time limit: 2s

Source limit: 4096B

Languages: All

Resource: University of Florida Local Contest - April 13, 2009

## SPOJ Problem Set (classical)

### 4941. Integer Factorization (20 digits)

#### Problem code: FACT1

This is a problem to test the robustness of your Integer Factorization algorithm.

Given some integers, you need to factor them into product of prime numbers.

The largest integer given in the input file has 20 digits. FACT2 is a harder version of this problem (the numbers are larger).

You may need to use a general factorization algorithm since no special numbers (e.g. Fermat numbers) are considered when designing the input data.

#### Input

There are several numbers given, each one in a line.

The input ends with a number 0.

The number of test cases is about 10.

#### Output

For each number, print in a line the factorization of it. See examples below for the output format.

#### Example

**Input :**

```
3111989
13091989
2432902008176640000
77145199750673
0
```

**Output :**

```
317^1 9817^1
17^2 89^1 509^1
2^18 3^8 5^4 7^2 11^1 13^1 17^1 19^1
328439^1 234884407^1
```

---

Added by: Ngô Minh Đu+'c

Date: 2009-10-08

Time limit: 20s

Source limit: 50000B

Languages: All except: SCALA

## SPOJ Problem Set (classical)

### 4942. Integer Factorization (15 digits)

#### Problem code: FACT0

This is a problem to test the robustness of your Integer Factorization algorithm.

Given some integers, you need to factor them into product of prime numbers.

The largest integer given in the input file has 15 digits. FACT1 is a harder version of this problem (the numbers are larger).

You may need to use a general factorization algorithm since no special numbers (e.g. Fermat numbers) are considered when designing the input data.

#### Input

There are several numbers given, each one in a line.

The input ends with a number 0.

The number of test cases is about 10.

#### Output

For each number, print in a line the factorization of it. See examples below for the output format.

#### Example

**Input :**

```
3111989
13091989
77145199750673
0
```

**Output :**

```
317^1 9817^1
17^2 89^1 509^1
328439^1 234884407^1
```

---

Added by: Ngô Minh Đu+'c

Date: 2009-10-08

Time limit: 5s

Source limit: 50000B

Languages: All except: SCALA

## SPOJ Problem Set (classical)

### 4948. Integer Factorization (29 digits)

#### Problem code: FACT2

This is a problem to test the robustness of your Integer Factorization algorithm.

Given some integers, you need to factor them into product of prime numbers.

The largest integer given in the input file has 29 digits.

You may need to use a general factorization algorithm since no special numbers (e.g. Fermat numbers) are considered when designing the input data.

#### Input

There are several numbers given, each one in a line.

The input ends with a number 0.

The number of test cases is about 10.

#### Output

For each number, print in a line the factorization of it. See examples below for the output format.

#### Example

**Input :**

```
3111989
13091989
2432902008176640000
77145199750673
0
```

**Output :**

```
317^1 9817^1
17^2 89^1 509^1
2^18 3^8 5^4 7^2 11^1 13^1 17^1 19^1
328439^1 234884407^1
```

---

Added by: Ngô Minh Đu+’c

Date: 2009-10-08

Time limit: 20s

Source limit: 50000B

Languages: All except: SCALA

## SPOJ Problem Set (classical)

### 4951. Bridges! More bridges!

#### Problem code: BR11

Problem BRIDGE has shown that you are able to build the cheap bridge through the river very quickly. Now you will not have problems with time limit. You will have problems with number of bridges.

#### Input

There is a single positive integer  $T$  on the first line of input. It stands for the number of test cases to follow. Each test case is exactly five lines, containing description of the route between two cities A and B, located on opposite sides of the rivers.

$n$   
 $a_0 a_1 a_2 \dots a_n$   
 $h_1 h_2 \dots h_n$   
 $c$   
 $s_0 s_1 s_2 \dots s_n$

Here  $n$  is the number of the rivers which are parallel to each other,  $a_i$  - the distances between rivers or between rivers and cities,  $h_i$  - the widths of the rivers,  $c$  - the distance between A and B along the axis parallel to the river,  $s_i$  - the costs of the unit of the bridge through  $i_{th}$  river and  $s_0$  - the cost of the unit of the road. Example for  $n=2$  you can see on the picture.

All integers in input are positive and less than 50, except  $c$  - it is less than 2000.

#### Output

For each test case your program should write a single number to the standard output, equal to the minimal total cost of the route between A and B, accurate up to two digits after the decimal dot.

#### Example

**Input :**

1  
2  
1 1 1  
1 1  
1  
1 1 1

**Output :**

5.10

---

Added by: Ruslan Sennov  
Date: 2009-10-08  
Time limit: 7s  
Source limit: 50000B  
Languages: All except: SCALA  
Resource: BRIDGE

## SPOJ Problem Set (classical)

### 4987. Goal for Raúl

**Problem code: GOALFR**

## Goal for Raúl

What would a Madrid programming contest be without some task about Real Madrid? It's a team with a marvellous history of records. For example, the team's topscorer Raúl González has scored 318 goals so far (in 704 games). In this task you are going to help Raúl shoot his 319th.

Consider a game between Real Madrid and FC Barcelona. The match is in a critical situation: 10 seconds before the end, the score is 3:3 and Raúl has the opportunity of a direct free kick. The question you have to answer is: Is it possible for Raúl to score a goal by kicking the ball in a straight line?

To model a soccer game, think of the pitch as a rectangle in a coordinate grid, aligned to the axes. The pitch is centred at (0, 0). It is 105m long and 68m wide, thus  $x \in [-52.5, +52.5]$  and  $y \in [-34, +34]$ . The goal is 7.32m long and centred on the short side of the field. The coordinates of the four goal posts are thus  $(\pm 52.5, \pm 3.66)$ . Real Madrid is on the left side and has to shoot the ball into the right goal (where  $x > 0$ ).

To simplify things a bit, we think of the ball and the goal posts as points in space without any volume. Players, on the other hand, have an action radius, i.e. the maximum distance from their position where they can still reach the ball.

## Input

The input consists of several test cases. The first line of the input file contains one integer  $N$ , the number of cases that follow.

Each test case starts with a blank line. Then follow the  $x$  and  $y$  coordinates of the ball. The third line contains the  $x$  coordinate,  $y$  coordinate and action radius of the FC Barcelona Goalkeeper.

Have a look at the images and the corresponding sample input given:

### Sample input 1

Sample input 1: Goal!

Goal

### Sample input 2

Sample input 2: no Goal

No Goal

## Output

For each test case, print a line containing one of the following words:

"Goal!" if it is possible to shoot the ball in a straight line into the goal, without the goalkeeper intercepting it.

"No goal..." if it is not possible to do so.

## Example

**Input:** 215.0 -20.042.5 2.0 5.020.0 11.034.0 6.0 5.0**Output:** Goal!No goal...

---

Added by: Jonas Wagner

Date: 2009-10-14

Time limit: 1s

Source limit: 50000B

Languages: All except: ERL



## SPOJ Problem Set (classical)

### 4988. Madrids One Way Streets

#### Problem code: MOWS

As you know, PolyProg wants to send EPFL's best coders to Madrid. Now an important question that arises is where they should stay. Apart from being a cheap place, it should also be close to the contest location and the main tourist spots.

Now the problem is that there are mostly one-way streets in Madrid (actually there aren't, but this problem is so nice that we wanted to include it in this contest nevertheless). We would like to get to the contest and back to the hotel without breaking any traffic rules... can you help finding a hotel that allows to do so?

To be precise, we'd like to find a hotel that allows us to go to each place of interest and back again. If that's not possible, we'd like a hotel that allows us to travel to and from as many places of interest as possible. If the same number of places can be accessed from several hotels, you should choose the hotel with the smallest id.

#### Input

The first line of the input contains  $1 \leq N \leq 10$ , the number of test cases. Then follow three numbers  $1 \leq H \leq 1000$ ,  $1 \leq P \leq 100'000$  and  $1 \leq S \leq 1'000'000$  denoting the number of hotels, places of interest and streets, respectively.

In order to simplify things, we just represent hotels and places of interests as numbers: Hotels are numbered from 1 to  $H$ , whereas places are numbered from 1001 to  $1000+P$ .

Each of the following  $S$  lines contains two numbers  $A_s$  and  $B_s$ , indicating that there is a one-way street from object  $A_s$  to  $B_s$ .

A blank line precedes each test case.

The sample input corresponds to the following graph:

Graph for sample input

#### Output

For each testcase, print the id of the best hotel followed by the number of places of interest accessible from this hotel (and vice versa) on a line.

#### Example

**Input :** 12 4 101 10012 10012 10022 10032 10041001 10021002 11002 10031004 21004 1001**Output :** 1 2

---

Added by: Jonas Wagner  
Date: 2009-10-14  
Time limit: 10s  
Source limit: 50000B  
Languages: All except: ERL

## SPOJ Problem Set (classical)

### 4993. Traveling Salesman

#### Problem code: FAKETSP

According to Wikipedia, "The Traveling Salesman Problem (TSP) is a problem in combinatorial optimization studied in operations research and theoretical computer science. Given a list of cities and their pairwise distances, the task is to find a shortest possible tour that visits each city exactly once. The problem was first formulated as a mathematical problem in 1930 and is one of the most intensively studied problems in optimization. It is used as a benchmark for many optimization methods. Even though the problem is computationally difficult, a large number of heuristics and exact methods are known, so that some instances with tens of thousands of cities can be solved."

Fortunately, you won't have to solve TSP. You're working for a very clever traveling salesman who has already figured out the path he is going to take. All he needs from you is a quick way to figure out how far he traveled after every segment of his tour.

#### Input

The salesman kept detailed records of his travels. You'll be getting a series of lines of the form "Some text (X, Y)." indicating that the salesman has been at the point X kilometers east and Y kilometers north of the origin of a Cartesian plane.

#### Output

For each segment of the trip, output the total distance traveled up to that point as a line in the format "The salesman has traveled a total of D kilometers." Show three digits after the decimal point when printing D. Note that the salesman only travels in straight lines (even after a couple of drinks).

#### Example

**Input :**

```
I started out at (0, 5).
Then I traveled to (3.7, 5).
After a couple of drinks I wobbled to (2.7, 4).
The next morning I woke up near (4, 3).
I finished my journey in (-.2, 8).
```

**Output :**

```
The salesman has traveled a total of 3.700 kilometers.
The salesman has traveled a total of 5.114 kilometers.
The salesman has traveled a total of 6.754 kilometers.
The salesman has traveled a total of 13.284 kilometers.
```

---

Added by: Miorel Palii  
Date: 2009-10-15  
Time limit: 2s  
Source limit:4096B  
Languages: All except: ERL  
Resource: University of Florida Team Practice 2009

## SPOJ Problem Set (classical)

### 5010. Lost in Madrid

**Problem code: LIM**

#### Lost in Madrid

Programming contests can be very exhausting. After five hours of intensive programming, you want to get some well-deserved rest and make yourself on the way to your hotel. Unfortunately, you don't quite remember the way to get there... but that doesn't matter: In good spirits (due to a successful contest?) you set out.

As you don't know the exact way, you decide to walk around in the following fashion: Start at the contest site (denoted by id0) and choose a street at random. Follow the street to the next intersection, and choose another street at random. Every street at an intersection has the same probability of being chosen. You might even decide to take the street back where you came from. As you're on foot, you can use the streets in both directions, unlike in "Madrid's One Way Streets".

Your walk stops once you encounter your hotel (id=300) or one of the tourist information booths (id>290) where you can ask for the way. You can assume there is at least one path connecting you to either type of object.

Because you don't speak a lot of spanish (apart from some verbs that you can conjugate thanks to problem "Spanish Verbs"), you'd like to know the probability that you arrive at your hotel directly, without first arriving at a tourist information booth.

#### Input

The input consists of several testcases, separated by an empty line.

Each testcase starts with  $S$ , the number of streets. The following  $S$  lines contain two numbers  $0 \leq A, B \leq 300$  each. This means that there is a street connecting intersection  $A$  to intersection  $B$ . The same street will not appear multiple times in the input.

The input ends with  $S=0$ . This testcase should not be processed.

#### Output

For each testcase, print the probability to arrive directly at the hotel, rounded to three decimal places.

#### Example

**Input:** 30 2910 2920 30020 300291 30020 291291 30070 2920 880 140 300292 8888 30014 30000**Output:** 0.3331.0000.0000.579

---

Added by: Jonas Wagner  
Date: 2009-10-16  
Time limit: 10s  
Source limit: 50000B  
Languages: All except: ERL

## SPOJ Problem Set (classical)

### 5011. Library for Madrid

**Problem code: LFM**

## Library for Madrid

Good preparation is essential for winning programming contests. Thus, if you read this document, you're on the right track ;) Knowing your algorithms and the programming language you use is of prime importance. However, you don't have to learn everything by heart; each team is allowed to bring 25 pages of documentation to the contest.

Now the difficult question is: What should you put on those 25 pages? You know that you can fit 10 paragraphs of text on a page, but your stock of useful code snippets and handy texts is much larger than that. To make things more complicated, some topics depend on each other. You cannot include the line-circle intersection formula if you do not also include the code for lines, circles and points.

As a programmer, you decide to let your computer do the hard work for you. Given a set of topics, their space requirements and dependencies, write a program that prints the maximum number of topics that fit into the library.

## Input

The input consists of several testcases. Each problem description starts with the numbers  $1 \leq M \leq 100$  and  $0 \leq D \leq 10$ , the number of topics and the number of dependencies. The following  $M$  lines contain the name of a topic (one word) and the number  $L_i$  of paragraphs ( $1 \leq L_i \leq 1000$ ) of the topic, separated by a space. The next  $D$  lines each contain two topic names separated by space, indicating that the first topic depends on the second.

The input file ends with a testcase having  $M=0$ , which should not be processed.

## Output

For each test case, print a single line containing the maximum number of topics that you can fit in the library, followed by the number of free paragraphs that remain. If several solutions yield the same number of topics, choose the one that leaves as much empty space as possible.

## Example

**Input:** 5 4Dijkstra 50Intersections 30Lines 70Circles 120Points 40Intersections LinesIntersections CirclesLines PointsCircles Points0 **Output:** 3 90

## Notes

The sample output corresponds to choosing Dijkstra's algorithm, lines and points.

---

Added by: Jonas Wagner  
Date: 2009-10-17  
Time limit: 10s  
Source limit:50000B  
Languages: All except: ERL



## SPOJ Problem Set (classical)

### 5084. Discrete Math Problem

#### Problem code: GCD3

Given  $N$ ,  $M$  and  $K$  ( $1 \leq N, M \leq 100^{200}$  and  $1 \leq K \leq 16$ ) which

$$N = a + b$$

$$M = a^2 + b^2 - (2^K - 2) * a * b$$

with  $a > 0$ ,  $b > 0$  and  $\gcd(a, b) = 1$ .

Your task is to find  $\gcd(N, M)$ .

#### Input

The input file consists of several data sets. The first line contains the number of data sets  $T$  ( $1 \leq T \leq 10000$ ). The following  $T$  lines describe the data sets, one triple  $(N, M, K)$  for each.

#### Output

For each data test in the input write the  $\gcd(N, M)$ .

#### Example

---

**Input:** 2648570884104668119354133 420644191708310845403065233058235585438328857465 108017723549 59173349743176010825 **Output:** 113Note: For the first trio  $a = 648570884104668119354126$  and  $b = 7$ . For the second  $a = 8016478423$  and  $b = 1245126$ .

---

Added by: Frank Rafael Arteaga

Date: 2009-10-24

Time limit: 0.100s-0.300s

Source limit: 1000B

Languages: All except: JAVA PYTH 2.6.2 PYTH 2.5 RUBY PIKE PHP LISP sbcl LISP clisp HASK

Resource: Discrete Math

## SPOJ Problem Set (classical)

### 5091. Feline Olympics - Mouseball

#### Problem code: MBALL

A popular event at the feline Olympics is watching and wagering on the outcome of the house cats playing Mouseball [which has the same scoring rules as American football] but is played with a catnip mouse. Wagers often involved predicting the score and, of course, some scores are more likely to occur than others. Multiples of 7 are good bets, because teams typically go for touchdowns (6 points) then attempt to kick the football between the uprights for an extra point. A score of 4 is unlikely because safeties (2 points each) are rare.

A score of exactly 1 is nearly (though not) impossible to achieve: suppose Team A has just scored a touchdown; during the extra point attempt, Team A fumbles the ball; it is recovered by a player from Team B, who returns it almost the entire length of the field, but fumbles right before reaching the endzone; the ball is recovered by a player from Team A, who voluntarily enters his own endzone, where he is tackled by Team B; this counts as a safety, but because it was scored during an extra point attempt, Team B will only be awarded 1 point.

Not surprisingly, such a scenario is not known to have ever occurred in the history of the game. So for simplicity, we will ignore this possibility altogether and consider only the following ways of scoring points:

- a safety: 2 points, always
- a field goal: 3 points
- a touchdown: 6 points

Additionally, after scoring a touchdown, a team attempts a "try." This may be either an extra point or a two-point conversion and will give, if successful, 1 or 2 points, respectively.

Write a program that, given a score, outputs the number of ways that score can be achieved. As an example, a team could score 10 points in exactly 5 ways:

- 5 safeties
- 2 field goals and 2 safeties
- a touchdown, extra point good, and a field goal
- a touchdown, a two-point conversion, and a safety
- a touchdown with a failed try and 2 safeties

Note that order is not important: a touchdown followed by a field goal is considered equivalent to a field goal followed by a touchdown.

#### Input

The first line of input will contain an integer  $N \leq 100$ , indicating the number of test cases. Each of the next  $N$  lines will contain an integer  $S$ , the number of points scored by a team in a game.  $S$  will be between 0 and 100000 inclusive. (Hey, the orange & blue [Flame-point Siamese] team could make it happen.)

## Output

For each test case, output one line containing a single integer: the number of ways a team can score exactly S points.

## Example

**Input :**

2  
10  
6

**Output :**

5  
3

---

Added by: Miorel Paliu

Date: 2009-10-26

Time limit: 1s

Source limit: 4096B

Languages: All

Resource: University of Florida Local Contest - September 27, 2009

## SPOJ Problem Set (classical)

### 5102. Mystic Craft

#### Problem code: MYSTIC

In the Ancient Clash of Mystic Pandas (ACM Pandas) game, the player plays the role of a Panda Knight who needs to defend Panda Land by defeating evil Panda Wizards. As the wizards have special magical powers, they need to be defeated using specific types of Mystic Sticks (regular bamboo sticks are ineffective against them). To obtain a Mystic Stick, Panda Knight needs to craft it by infusing his regular bamboo stick with several different kinds of magic shards according to the known recipe for that particular type of Mystic Stick.

Normally, all kinds of shards can be purchased for 1 gold/piece from the Panda Magic Store (therefore Panda Knight will have no problem of acquiring the shards, as long as he has enough gold to buy them all from the Store). However due to the recent invasion, to conceal the shards from the incoming Panda Wizards, Panda Magic Store has packaged all the shards into inconspicuous Mystery Boxes. A Mystery Box contains a random piece of magic shard which type can't be determined prior to buying and opening the box, which Panda Knight can also buy for the same price (1 gold/box).

As his Panda Knight character is not rich, Mr. Wah is concerned about the possibility that he's unable to buy all the necessary shards due to not getting the required amount of a specific type of shard. He needs your help! Your task as Mr. Wah's best programmer friend is to compute the probability that he will be able to get all the shards and craft the Mystic Stick, so that he can plan his playing strategy accordingly. You can safely assume that all the required shards are available on the store via the Mystery Boxes, that the boxes will only contain the needed types of shard, and that each type of shard has equal probability of being contained inside any particular Mystery Box.

#### Input

The first line of input contains an integer  $T$  ( $1 \leq T \leq 100$ ), the number of test cases follow. Each test case begins with two integers  $G$  and  $N$  ( $1 \leq N \leq G \leq 32$ ) in one line, denoting the amount of Panda Knight's gold and the number of needed magic shard types respectively. The next line contains  $N$  integers, denoting how many magic shards of each type ( $1 \leq M_1 \dots M_N \leq 32$ ,  $M_1 + \dots + M_N \leq G$ ) are needed to craft the Mystic Stick.

#### Output

For each of the test cases, print the test case number followed by the probability (in percentage, correct to 6 decimal places - Mr. Wah is paranoid about this game) that Panda Knight will be able to craft the Mystic Stick, with the format as shown by the sample output.

##### Sample Input

```
5
3 2
1 1
8 3
3 2 2
10 3
1 2 3
```

```
7 7
1 1 1 1 1 1 1
32 8
1 1 1 1 1 1 1 1
```

**Output for Sample Input**

```
Case #1: 75.000000
Case #2: 23.472032
Case #3: 58.934106
Case #4: 0.611990
Case #5: 89.127753
```

Explanation for 1st sample test case: There are  $2^3 = 8$  possible combinations of shard types that Knight Panda can get by purchasing 3 Mystery Boxes with his available gold:

1. Type 1, Type 1, Type 1 2. Type 1, Type 1, Type 2 3. Type 1, Type 2, Type 1 4. Type 1, Type 2, Type 2 5. Type 2, Type 1, Type 1 6. Type 2, Type 1, Type 2 7. Type 2, Type 2, Type 1 8. Type 2, Type 2, Type 2

Since there are 6 out of 8 combinations that gives required amount of shards (at least one Type 1 shard and one Type 2 shard), the probability that Panda Knight will be able to craft the Mystic Stick is  $6/8 = 75\%$ .

---

Added by: VOJ problem setters  
Date: 2009-10-28  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: ACM ICPC - Jakarta 2009

## SPOJ Problem Set (classical)

### 5103. Top 10

#### Problem code: TOP10

Given a dictionary containing less than  $N = 20000$  words labeled from 1 to  $N$ . Each word consists of lowercase characters (from 'a' to 'z') with arbitrary length. The total number of characters in the dictionary is at most 100,000. Your task is to answer at most  $Q = 100000$  queries. Each query  $q_i$  is also a word (as defined above). For each query, you have to print the "Top 10" words in the dictionary with the following rules:

All the words in the "Top 10" have to contain the substring  $q_i$ .

All the words in the "Top 10" have to be sorted in this order:

1. The words with shorter length come first, if they have equal length then
2. The lexicographically smaller words come first, otherwise
3. The words with smaller label come first.

If the number of words in the dictionary that contains the substring  $q_i$  is less than 10 then print all the words otherwise, print only the top-10 words (note: the words are printed using their labels).

If there is no word in the dictionary that contains the substring  $q_i$  then print "-1" (without the quotes).

#### Input

The first line contains the number  $N$ . The next  $N$  lines contains the  $N$  words in the dictionary (the  $i$ th line is the word with label  $i$ ). The next line contains the number  $Q$  followed by the  $Q$  lines containing the queries.

#### Output

For each query, print one line containing the labels of the "Top 10" words (separated by a space) in the dictionary using the rules defined above.

#### Sample Input

```
17
acm
icpc
regional
asia
jakarta
two
thousand
and
nine
arranged
by
universitas
bina
nusantara
especially
for
you
5
a
an
```

win  
b  
z

### **Output for Sample Input**

1 8 4 13 5 10 3 7 14 15  
8 10 7 14  
-1  
11 13  
-1

---

Added by: VOJ problem setters  
Date: 2009-10-28  
Time limit: 6s  
Source limit: 50000B  
Languages: All except: C++ 4.3.2 TECS  
Resource: Problem Setter: Felix Halim  
>ACM ICPC - Jakarta 2009<td>

## SPOJ Problem Set (classical)

### 5104. Spam Detection

#### Problem code: SPAMD

It is well-known that the number of occurrences of the term "free" can distinguish spam and non-spam emails.

Your task is to build a spam detection module, based on the number of term "free" in an email.

The core of this detection module is a spam classifier, which is represented by two variables: Low and High.

An email that contains  $X$  "free" words is classified by this module as a spam if  $Low \leq X \leq High$ , otherwise it is not.

To measure the goodness of a classifier, we introduce several information-retrieval terminologies:

Actual

Spam Non-Spam

Predicted Spam TP FP

Non-Spam FN TN

TP (true positive) is the number of emails which are truly predicted as spam; FN (false negative) is the number of emails which are wrongly predicted as non-spam, and so on.

The portion of emails that are correctly identified as spam is denoted as precision ( $P$ ), which is formulated as  $P = TP / (TP + FP)$ .

The portion of spam emails that are successfully identified is denoted as recall ( $R$ ), which is formulated as  $R = TP / (TP + FN)$ .

To balance between precision and recall, we use the F-measure which is formulated as  $F = 2 \times P \times R / (P + R)$ .

For example, when  $TP = 5$ ,  $FP = 3$ ,  $FN = 2$ ,  $TN = 4$ , we have  $R = 5/7$ ,  $P = 5/8$ , and  $F = 2/3$ .

When there is no spam, we can report all emails as non-spam with  $F = 1.0$  (perfect classifier).

Our data mining team has manually analyzed several emails and labeled them as spam or non-spam.

Your task is to find the values of Low and High that yield the best classifier, i.e., the one that maximizes the F-measure.

#### Input

The input consists of several test cases, where each case contains of two lines:

$N$  : The maximum number of term "free" in any emails ( $1 \leq N \leq 2 \times 10^6$ )

$a0 \ A \ B \ M$  : parameters of random number generator. ( $2 \leq M \leq 10$ ;  $0 \leq a0, A, B < M$ )

This random number generator generates a sequence of number:

$a_i = (A * a_{i-1} + B) \text{ MOD } M$  for  $i \geq 1$

Specifying:

$pos_i = a_{2i}$  ( $0 \leq i \leq N$ ) : the number of spam emails with  $i$  number of term "free".

$neg_i = a_{2i+1}$  ( $0 \leq i \leq N$ ) : the number of non-spam emails with  $i$  number of term "free". The input is terminated by EOF.

#### Output

For each simulation print the F-measure of the best classifier (accurate to 6 decimal places).

#### Sample Input

3

1 1 1 3

5



2 3 4 5

### Output for Sample Input

0.666667

0.923077

Explanation for the 1st case: This random number generator generates a sequence of 1, 2, 0, 1, 2, ...  
The number of spam emails is:  $\text{posi} = \{1, 0, 2, 1\}$ , and the number of non-spam emails is  $\text{negi} = \{2, 1, 0, 2\}$ .

The optimal classifier treats emails with number of term "free" between 2 and 3 as spam, with  $R = 3/4$  and  $P = 3/5$ , resulting  $F = 2/3$ . Another way of producing optimal classifier is to consider emails with number of term "free" equals to 2 as spam.

---

Added by: VOJ problem setters

Date: 2009-10-28

Time limit: 3s

Source limit: 50000B

Languages: All except: C++ 4.3.2 TECS

Resource: Problem Setter: ardiankp  
>ACM ICPC - Jakarta 2009<td>

## SPOJ Problem Set (classical)

### 5105. Hero Adventure

#### Problem code: HEROADV

There is a game production company that is going to develop a new adventure game. You're very interested and join the recruitment phase. You're being tested to solve this simulation:

For each simulation there will be an  $R \times C$  map with the following characters:

- o '#' represents wall, hero can't move here.
- o 'S' represents starting point of the hero.
- o 'F' represents finish point, the game ends.
- o Number '1' to '9' represents the life point to be reduced if the hero moves here.
- o 'E' represents enemy that the hero need to fight if the hero want to move here.
- o 'I' represents item that will add 100 points to the hero's life force, become '0' after taken (no life force will be reduce to come back to this point).

The hero has life force (Lf), Experience (Exp), Defend power (Def) and Strength (Str).

The hero will be given extra 1 (one) point for the strength and defend power for each 25 (twenty five) experience point gained by the hero.

Hero will die if  $Lf \leq 0$ .

Rules of the fight with enemy:

- o Each enemy will have Strength, Life force and Experience.
- o The hero and the enemy will be given one chance to attack the other each turn start with the hero, until either the hero or the enemy die (life force  $\leq 0$ ).
- o If the hero attacks the enemy, the enemy's life force will be decreased by the hero's strength.
- o If the enemy attacks the hero, the hero's life force will be decreased by the enemy's strength reduced by the hero's defend power.
- o The hero will be given the enemy's experience if the hero defeats the enemy.
- o After the enemy defeated, the place will become '0' (no life force will be reduce to come back to this point).

For each simulation, you're asked to print three paths, Lf and Exp to the finish point that give:

1. The highest Lf.
2. The highest Exp. If there's more than one highest Exp, choose the highest Lf.
3. The shortest way. If there's more than one shortest way, choose the highest Lf.

If there is multiple path, choose the lexicographically smallest one.

#### Input

Input consists of several cases.

Each case begins with four integers in a line: Str ( $3 \leq Str \leq 10$ ), Def ( $0 \leq Def \leq 5$ ), Exp ( $0 \leq Exp \leq 20$ ) and Lf ( $10 \leq Lf \leq 1000$ ).

Denoting the strength, defend, experience and life force of the hero respectively.

The next line contains C ( $3 \leq C \leq 20$ ) and R ( $3 \leq R \leq 20$ ) denoting the columns and rows of the map respectively.

The next R lines contain the map as described above.

The next lines contain the description of the enemy, eStr ( $0 \leq eStr \leq 10$ ), eLf ( $10 \leq eLf \leq 100$ ) and eExp ( $1 \leq eExp \leq 25$ ) denoting the enemy's strength, life force and experience to be gained if it dies respectively.

Each enemy data corresponds to each 'e' which appear first in the map.

#### Output

For each simulation print "Simulation #n" without double quote("") and #n replace by the simulation number start with 1.

The next three lines each contain path, life force and experience. Use 'L' (left), 'R' (right), 'D' (down), 'U' (up) to describe the path that should be taken by the hero.

If it's not possible to reach the finish point then print "No solution." without double quote (") instead of the three lines.

Print blank line between simulation.

### **Sample Input**

10 5 20 1000

3 3

### SEF ###

10 50 15

10 0 0 100

7 4

#####

S12E#2#

#IE456F

#####

3 10 5

10 100 20

10 0 0 10

3 3

###

SEF

###

10 50 15

### **Output for Sample Input**

Simulation 1

RR 980 35

RR 980 35

RR 980 35

Simulation 2

RDURRDRRR 181 5

RDRRUDRRR 90 25

RDRRRRR 94 20

Simulation 3

No solution.

---

Added by: VOJ problem setters

Date: 2009-10-28

Time limit: 5s

Source limit:50000B

Languages: All except: C++ 4.3.2 TECS

Resource: ACM ICPC - Jakarta 2009

## SPOJ Problem Set (classical)

### 5107. Playing with Marbles

#### Problem code: TUTMRBL

Playing with marbles is one of the king's favorite pastimes. He especially enjoys a game which was taught to him by Eratosthenes, a visiting mathematician from Greece. The rules are very complicated but it all boils down to arranging marbles in a (filled) rectangular shape to score points. If playing with 24 marbles, for example, King Tut could make a 4 by 6 rectangle, or a 3 by 8 rectangle, or a 2 by 12 rectangle. Even the boring 1 by 24 rectangle is allowed. Other numbers of marbles, however, such as 23, make things difficult for the king. Try as he might, the only rectangle he can make is 1 by 23. (Note that rectangles are equivalent under rotation, so a 23 by 1 rectangle would not be a new shape.)

King Tut has decided to call numbers  $n$  which can form only the unexciting 1 by  $n$  rectangle "non-rectangular." Conversely, numbers like 24, which allow for the formation of more than one rectangle, shall henceforth be referred to as "rectangular." Playing with a single marble is not very interesting at all, so the number 1 will by definition be considered neither rectangular nor non-rectangular.

After playing for some time, the king started to notice that every integer greater than 1 could be written as a product of non-rectangular numbers. Were he a mathematician, he would try to prove this claim (which, incidentally, is true). However, the king is more of the engineer type, so he's going to make you verify the claim using brute force! While you're at it, also tell the king how many rectangles can be constructed given a certain number of marbles.

#### Input

There will be several test cases, one per line, each consisting of a single integer between 2 and  $10^7$  inclusive. An input of zero will be used to tell your program to stop processing.

#### Output

For each test case, print out two lines! The first should show the given number of marbles written as a product of non-rectangular numbers, following the example of the sample output. Factors must be written in non-decreasing order and separated by multiplication signs. Also print out spaces around the equals and multiplication signs to improve readability. The second line of output for each test case should be in the format: "With X marbles, Y different rectangles can be constructed." Again, don't forget to replace X and Y with the proper values.

#### Example

Input :

24  
23  
0

Output :

$24 = 2 * 2 * 2 * 3$   
With 24 marbles, 4 different rectangles can be constructed.  
 $23 = 23$   
With 23 marbles, 1 different rectangles can be constructed.

---

Added by: Miorel Palii  
Date: 2009-10-28  
Time limit: 5s  
Source limit:4096B  
Languages: All  
Resource: University of Florida Local Contest - September 9, 2007

## SPOJ Problem Set (classical)

### 5115. Two "Ways"

#### Problem code: SPHIWAY

There are  $N$  places and  $M$  bidirectional way. No two places have more than one direct way. Ana wants to walk from  $S$  to  $T$  and return to  $S$  by a itinerary that satisfy:

- No way can be go twice.
- Length of itinerary is the minimum.

#### Input

Line 1: 4 integers:  $N, M, S, T$  ( $N \leq 10^4$ ;  $M \leq 10^5$ )

Next  $M$  line: Line  $i$  include 3 integers  $u_i, v_i, c_i$ : distance of two places  $u_i$  and  $v_i$  is  $c_i$ . ( $c_i \leq 2000000000$ ).

#### Output

Length of the itinerary if it exists. Else print -1.

#### Example

**Input :** 5 7 1 51 2 31 4 82 3 52 4 43 5 54 3 84 5 3**Output :** 24

---

Added by: HNUE

Date: 2009-10-30

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Mr. Le Minh Hoang - HNUE

## SPOJ Problem Set (classical)

### 5117. Wine trading in Gergovia

#### Problem code: GERGOVIA

Gergovia consists of one street, and every inhabitant of the city is a wine salesman. Everyone buys wine from other inhabitants of the city. Every day each inhabitant decides how much wine he wants to buy or sell. Interestingly, demand and supply is always the same, so that each inhabitant gets what he wants.

There is one problem, however: Transporting wine from one house to another results in work. Since all wines are equally good, the inhabitants of Gergovia don't care which persons they are doing trade with, they are only interested in selling or buying a specific amount of wine.

In this problem you are asked to reconstruct the trading during one day in Gergovia. For simplicity we will assume that the houses are built along a straight line with equal distance between adjacent houses. Transporting one bottle of wine from one house to an adjacent house results in one unit of work.

#### Input

The input consists of several test cases.

Each test case starts with the number of inhabitants  $N$  ( $2 \leq N \leq 100000$ ).

The following line contains  $n$  integers  $a_i$  ( $-1000 \leq a_i \leq 1000$ ).

If  $a_i \geq 0$ , it means that the inhabitant living in the  $i^{\text{th}}$  house wants to buy  $a_i$  bottles of wine. If  $a_i < 0$ , he wants to sell  $-a_i$  bottles of wine.

You may assume that the numbers  $a_i$  sum up to 0.

The last test case is followed by a line containing 0.

#### Output

For each test case print the minimum amount of work units needed so that every inhabitant has his demand fulfilled.

#### Example

**Input**55 -4 1 -3 16-1000 -1000 -1000 1000 1000 100000**Output**:99000

---

Added by: HNUE  
Date: 2009-10-30  
Time limit: 0.300s  
Source limit:50000B  
Languages: All  
Resource: UVA



## SPOJ Problem Set (classical)

### 5120. Minimal Possible String

#### Problem code: MINSEQ

Given two strings A and B, your are to find the lexicographically smallest string after inserting B into A.

For example, string A is "369", and string B is "4799". There are 4 ways that I can insert B into A, and I'll get 4 different results: 4799369, 3479969, 3647999, 3694799. Thus, 3479969 is the lexicographically smallest one.

#### Input

Input contains several cases. Each case has 2 strings A and B with length no longer than 100000 in 2 lines. Process the input until EOF. The strings consist of only digit 1-9.

#### Output

For each case, output the minimal possible result.

#### Example

**Input :** 369479966612345**Output :** 347996912345666

---

Added by: 3xian

Date: 2009-10-30

Time limit: 1s-12s

Source limit:50000B

Languages: All except: PERL 6

Resource: GDUT Monthly

## SPOJ Problem Set (classical)

### 5128. Bomb the Bridge

#### Problem code: BOMB

You want to destroy a bridge with bombs. The lower-left corner of the bridge is at  $(0,0)$  and the upper-right corner is at  $(w,l)$ . There are already  $b$  bombs exploded, the  $i$ -th bomb created a hole of radius  $r_i$  centering at  $(x_i,y_i)$ . You want to throw exactly one more bomb so that the bridge is split into two connected parts(though the two parts can share a finite number of points), so that no one can go through the bridge from  $y = 0$  to  $y = l$ . Your task is to find the minimal radius of the last bomb to split the bridge, assuming that the last bomb can explode precisely at the position you want (possibly at non-integer coordinates). Note that you are only allowed to use bombs with integer radius. That is, even if a bomb with radius 1.01 is sufficient, you have to use a bomb with radius 2, since you only have bombs with integer radius.

#### Input

The first line contains  $t$  ( $1 \leq t \leq 10$ ), the number of test cases followed. Each test case begins with three integers  $w, l, b$  ( $1 \leq w, l \leq 100$ ,  $0 \leq b \leq 10$ ). Each of the following  $b$  lines contains three integers  $x_i, y_i, r_i$  ( $0 \leq x \leq w$ ,  $0 \leq y \leq l$ ,  $0 \leq r \leq 100$ ). The bridge is guaranteed to be connected before the last bomb.

#### Output

For each test case, print the minimal radius of the last bomb.

#### Example

**Input :**

```
3 100 100 2 15 50 20 90 50 30 100 100 150 50 40 100 100 110 50 10
```

**Output :**

```
135040
```

---

Added by: 3xian

Date: 2009-10-31

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Zhuhai Contest 2008

## SPOJ Problem Set (classical)

### 5132. Hello Kitty

#### Problem code: HELLOKIT

Kitty sends a kind of original email messages to her friend Garf. To write a message, she chooses a word  $W$  and a number  $n$  and replicates  $W$   $n$  times horizontally. Then she repeats this string in the next line, but rotating the characters once to the left. And she repeats this 'rotate-and-output' process until the word  $W$  appears displayed as the first column of the rectangular pattern that she produces.

As an example, when she chooses the word Hello and the number 3, she gets the pattern:

```
HelloHelloHello
elloHelloHelloH
lloHelloHelloHe
loHelloHelloHel
oHelloHelloHell
```

Kitty has been sending such emails during the last three years. Recently, Garf told her that perhaps her work may be automatized with a software to produce Kitty's patterns. Could you help her?

#### Input

The input file contains several test cases, each one of them in a separate line. Each test case has a word and a positive integer that should generate the corresponding rectangular pattern. The word is a string of alphabetic characters (a..z). The number is less than 10.

A line whose contents is a single period character means the end of the input (this last line is not to be processed).

#### Output

Output texts for each input case are presented in the same order that input is read. For each test case the answer must be a left aligned Kitty pattern corresponding to the input.

#### Example

**Input:** Love 1Kitty 2.**Output:** LoveoveLveLoeLovKittyKittyittyKittyKttyKittyKityKittyKittyKittyKitt

---

Added by: Daniel Gómez Didier  
Date: 2009-10-31  
Time limit: 1s  
Source limit: 50000B  
Languages: All

## **SPOJ Problem Set (classical)**

### **5142. A Pair of Graphs**

#### **Problem code: PAIRGRPH**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem A in the PDF. Remember that you must use stdin/stdout at SPOJ.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 3s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Hangzhou 2008

## **SPOJ Problem Set (classical)**

### **5143. Binary Integer**

#### **Problem code: BNYINT**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem B in the PDF. Remember that you must use stdin/stdout at SPOJ.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 60s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Hangzhou 2008

## **SPOJ Problem Set (classical)**

### **5144. Cryptography Reloaded (Act I)**

#### **Problem code: CRYPTO6**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem C in the PDF. Remember that you must use stdin/stdout at SPOJ.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 3s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Hangzhou 2008

## **SPOJ Problem Set (classical)**

### **5145. Déja vu**

#### **Problem code: DEJAVU**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem D in the PDF. Remember that you must use stdin/stdout at SPOJ.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 35s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Hangzhou 2008

## **SPOJ Problem Set (classical)**

### **5146. Experiment on a ... Cable**

#### **Problem code: CABLEXPR**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem E in the PDF. Remember that you must use stdin/stdout at SPOJ.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 2s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Hangzhou 2008



## **SPOJ Problem Set (classical)**

### **5147. Fire-Control System**

#### **Problem code: FCSYS**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem F in the PDF. Remember that you must use stdin/stdout at SPOJ.

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Added by: Xilinx

Date: 2009-11-01

Time limit: 13s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Hangzhou 2008

## **SPOJ Problem Set (classical)**

### **5148. Get-Together at Stockholm**

**Problem code: STCKHOLM**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem G in the PDF. Remember that you must use stdin/stdout at SPOJ.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 3s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Hangzhou 2008

## **SPOJ Problem Set (classical)**

### **5150. Junk-Mail Filter**

#### **Problem code: JMFILTER**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem J in the PDF. Remember that you must use stdin/stdout at SPOJ.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 7s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Hangzhou 2008

## **SPOJ Problem Set (classical)**

### **5151. Alice's Cube**

#### **Problem code: ALICECUB**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem A in the PDF.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 3s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009

## **SPOJ Problem Set (classical)**

### **5152. Brute-force Algorithm EXTREME**

#### **Problem code: BFALG**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem B in the PDF. But the data limits is slightly modified:  $1 \leq P \leq 1000000$  in the original description, but in this EXTREME version,  $1 \leq P \leq 1000000000$ .

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 3s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009

## **SPOJ Problem Set (classical)**

### **5153. Compressed String**

**Problem code: COMPRESS**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem C in the PDF.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 3s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009

## **SPOJ Problem Set (classical)**

### **5154. Cryptography Reloaded (Act II)**

**Problem code: CRYPTO7**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem D in the PDF.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 21s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009

## **SPOJ Problem Set (classical)**

### **5155. Exciting Time**

#### **Problem code: TETRIS2D**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem E in the PDF.

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Added by: Xilinx

Date: 2009-11-01

Time limit: 25s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009



## **SPOJ Problem Set (classical)**

### **5156. Flowers Placement**

#### **Problem code: FLOWERS2**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem F in the PDF.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 13s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009

## **SPOJ Problem Set (classical)**

### **5158. Heroes Arrangement**

**Problem code: HEROARR**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem H in the PDF.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 35s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009

## **SPOJ Problem Set (classical)**

### **5159. Island Explorer**

**Problem code: IEXPOLRE**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem I in the PDF.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 17s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009

## **SPOJ Problem Set (classical)**

### **5160. Jinyuetuan Puzzle**

#### **Problem code: O2JAM**

Please click [here](#) to download a PDF version of the contest problems. The problem is problem J in the PDF.

---

Added by: Xilinx

Date: 2009-11-01

Time limit: 60s

Source limit: 50000B

Languages: All except: C99 strict

Resource: Blue Mary's gifts of her retirement - ACM/ICPC Regional Contest, Shanghai 2009

## SPOJ Problem Set (classical)

### 5161. Factorial vs Power

#### Problem code: FACVSPOW

Consider two integer sequences  $f(n) = n!$  and  $g(n) = a^n$ , where  $n$  is a positive integer. For any integer  $a > 1$  the second sequence is greater than the first for a finite number of values. But starting from some integer  $k$ ,  $f(n)$  is greater than  $g(n)$  for all  $n \geq k$ . You are to find the least positive value of  $n$  for which  $f(n) > g(n)$ , for a given positive integer  $a > 1$ .

#### Input

The first line of the input contains number  $t$  - the amount of tests. Then  $t$  test descriptions follow. Each test consist of a single number  $a$ .

#### Constraints

$1 \leq t \leq 100000$   
 $2 \leq a \leq 10^6$

#### Output

For each test print the least positive value of  $n$  for which  $f(n) > g(n)$ .

#### Example

**Input :**

3  
2  
3  
4

**Output :**

4  
7  
9

---

Added by: Spooky

Date: 2009-11-01

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Advancement Autumn 2009, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 5163. Tower of Vientiane

#### Problem code: VIENTIAN

The Tower of Hanoi is a mathematical game or puzzle. It consists of three rods, and a number of disks of different sizes which can slide onto any rod. The puzzle starts with the disks neatly stacked in order of size on one rod, the smallest at the top, thus making a conical shape. The objective of the puzzle is to move the entire stack to another rod, obeying the following rules:

- Only one disk may be moved at a time.
- Each move consists of taking the upper disk from one of the rods and sliding it onto another rod, on top of the other disks that may already be present on that rod.
- No disk may be placed on top of a smaller disk.

It is known that the puzzle can be solved in  $2^n - 1$  steps for  $n$  disks.

Now consider the puzzle called The Tower of Vientiane. The rules are almost the same as for The Tower of Hanoi. But additionally there are limitations on the allowed moves. Let the initial rod be numbered 1, the target rod - 3, and the auxiliary rod - 2. The matrix of allowed moves is given. For example it can be allowed to move disks from rod 1 to rod 2 only, from rod 2 to rod 3 and from rod 3 to rod 1. You are to find out the minimal number of moves in which the puzzle can be solved given some limitations on the allowed moves.

#### Input

The first line of the input contains number  $t$  - the amount of tests. Then  $t$  test descriptions follow. The test starts with a  $3 \times 3$  matrix, consisting of **1s** and **0s**. The **1** in  $i$ -th row and  $j$ -th column of the matrix means that the move from rod  $i$  to rod  $j$  is allowed, otherwise it is not allowed. The next line of each test contains the number  $n$  - the amount of disks for the corresponding testcase.

#### Constraints

$1 \leq t \leq 10000$

$2 \leq n \leq 39$

#### Output

For each test print the minimal number of moves in which the puzzle can be solved or "Epic Fail..." if it's impossible to solve the puzzle under such limitations.

#### Example

**Input :**

```
3
011
101
110
```

5  
010  
101  
010  
5  
010  
001  
010  
5

**Output :**

31  
242  
Epic Fail...

---

Added by: Spooky  
Date: 2009-11-02  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: Advancement Autumn 2009, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 5196. Monotonous numbers

#### Problem code: MONONUM

Some integers possess interesting quality: each of their digits is not greater than the digit to the right. Let us define such integers as increasing integers. And let's call integers for which each digit is not lesser than the digit to the right decreasing integers. For example 24558 is increasing, 888410 is decreasing and 5 - is both increasing and decreasing. Given  $n$  calculate the ratio of the decreasing  $n$ -digit integers to the increasing  $n$ -digit integers. We consider only positive integers. Leading zeros are not allowed.

#### Input

The first line of the input contains number  $t$  - the amount of tests. Then  $t$  test descriptions follow. Each test consists of the single integer  $n$

#### Constraints

$1 \leq t \leq 10000$

$1 \leq n \leq 10^6$

#### Output

For each test print the needed ratio with six digits in the fractional part.

#### Example

**Input :**

2  
1  
2

**Output :**

1.000000  
1.200000

---

Added by: Spooky

Date: 2009-11-03

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Advancement Autumn 2009, <http://sevolymp.uuuq.com/>, author: Alexey Shchepin



## SPOJ Problem Set (classical)

### 5197. Differential Diagnosis

#### Problem code: DIFFDIAG

Daniel enjoys watching TV series. One of his favorite is "Doctor Chaos". In this series the medical genius is saving people by making difficult diagnosis. In his work he employs the differential diagnosis method. Doctor Chaos writes all the symptoms the patient have on the white board and his team tries to find out the disease which explains those symptoms best. Sometimes some symptoms are not caused by the disease itself. Sometimes some symptoms are not revealed yet and are not written on the board. Anyhow the team chooses some candidate-diseases and then runs the tests to identify the right one. Help Doctor Chaos by making a program which find out the diseases that are explaining the set of symptoms the best way. We'll say that the disease explains the set of symptoms the best way if it explains the most symptoms from the set among all known diseases.

#### Input

The first line of the input file contains number **n** - the amount of diseases known to Chaos and his team. Then **n** lines follow describing each disease. The description of the disease starts with the name of the disease. Then number **k** follows, that is the amount of different symptoms caused by the disease. Then there go the names of the symptoms separated by spaces. After the description of all the diseases there is number **t** - the amount of cases to diagnose. After that **t** lines follow each containing a set of symptoms. Each set starts with the number **q** - the amount of different symptoms. Then **q** names of the symptoms follow separated by spaces. The names of all diseases and symptoms consist of only small latin letters and don't exceed 20 characters. Each symptom in each set is explained by at least one disease.

#### Constraints

$1 \leq n \leq 1000$

$1 \leq k \leq 10$

$1 \leq t \leq 10000$

$1 \leq q \leq 10$

There are no more than 1000 different symptoms.

#### Output

For each case to diagnose first print the line "Diagnosis #x:" where **x** is the case number starting from one. Then list all the diseases which explains the corresponding set of symptoms best. The diseases should be listed one in line and in the same order in which they were given in the input file.

#### Example

**Input :**

```
3
migraine 2 headache nausea
poisoning 3 nausea stomachache fever
flu 3 fever cough headache
```

4  
1 fever  
2 nausea headache  
2 nausea cough  
4 fever nausea cough headache

**Output :**

Diagnosis #1:  
poisoning  
flu  
Diagnosis #2:  
migraine  
Diagnosis #3:  
migraine  
poisoning  
flu  
Diagnosis #4:  
flu

---

Added by: Spooky  
Date: 2009-11-03  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: Advancement Autumn 2009, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 5240. Area of a Garden

#### Problem code: GARDENAR

One rich person decided to make himself a great garden. The garden should have a form of equilateral triangle. There should be a gazebo inside the garden. The gazebo will be connected with the triangle vertexes by roads. The lengths of all three roads are known. Those numbers are sacred for this rich man. The expense of building such a garden will depend on the area of the garden. Help the rich man by calculating what will be the area of his garden.

#### Input

The first line of the input contains number **t** - the amount of tests. Then **t** test descriptions follow. Each test consists of three integers **a**, **b**, **c** - the lengths of the roads. It is guaranteed that it's possible to build such a garden.

#### Constraints

$1 \leq t \leq 1000$   
 $1 \leq a, b, c \leq 1000$

#### Output

For each test print the area of the garden with two digits in the fractional part.

#### Example

**Input :**

1  
3 4 5

**Output :**

19.83

---

Added by: Spooky

Date: 2009-11-07

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Advancement Autumn 2009, <http://sevolymp.uuuq.com/>, author: Alexey Shchepin

## SPOJ Problem Set (classical)

### 5294. Recurrence

#### Problem code: REC

Let  $F_0 = 1$ .  $F_n = a * F_{n-1} + b$  for  $n \geq 1$ . Find  $F_n \pmod{M}$ .

#### Input

The first line contains T the number of test cases. Each of the next T lines contains 4 space separated integers a, b, n and M.

#### Constraints

$T \leq 20000$   
 $0 \leq a, b, n \leq 10^{100}$   
 $1 \leq M \leq 100000$

#### Output

Output T lines, one corresponding to each test case.

#### Example

**Input :** 31 1 1 102 1 2 55 2 20 30**Output :** 227

---

Added by: abhijith reddy d  
Date: 2009-11-14  
Time limit: 3s-6s  
Source limit: 50000B  
Languages: All except: JS

## SPOJ Problem Set (classical)

### 5295. Adjacent Bit Counts

#### Problem code: GNYR09F

For a string of  $n$  bits  $x_1, x_2, x_3, \dots, x_n$  the adjacent bit count of the string ( $\text{AdjBC}(x)$ ) is given by

$$x_1 * x_2 + x_2 * x_3 + x_3 * x_4 + \dots + x_{n-1} * x_n$$

which counts the number of times a 1 bit is adjacent to another 1 bit. For example:

$\text{AdjBC}(011101101) = 3$

$\text{AdjBC}(111101101) = 4$

$\text{AdjBC}(010101010) = 0$

Write a program which takes as input integers  $n$  and  $k$  and returns the number of bit strings  $x$  of  $n$  bits (out of  $2^n$ ) that satisfy  $\text{AdjBC}(x) = k$ . For example, for 5 bit strings, there are 6 ways of getting  $\text{AdjBC}(x) = 2$ :

11100, 01110, 00111, 10111, 11101, 11011

#### Input

The first line of input contains a single integer  $P$ , ( $1 \leq P \leq 1000$ ), which is the number of data sets that follow. Each data set is a single line that contains the data set number, followed by a space, followed by a decimal integer giving the number ( $n$ ) of bits in the bit strings, followed by a single space, followed by a decimal integer ( $k$ ) giving the desired adjacent bit count. The number of bits ( $n$ ) will not be greater than 100 and the parameters  $n$  and  $k$  will be chosen so that the result will fit in a signed 32-bit integer.

#### Output

For each data set there is one line of output. It contains the data set number followed by a single space, followed by the number of  $n$ -bit strings with adjacent bit count equal to  $k$ .

#### Example

**Input:** 101 5 22 20 83 30 174 40 245 50 376 60 527 70 598 80 739 90 8410 100 90

**Output:**

1 62 634263 18612254 1682125015 448747646 1609167 229373088 991679 1547610 23076518

---

Added by: Tamer

Date: 2009-11-14

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: ACM Greater New York Regional Contest 2009

## SPOJ Problem Set (classical)

### 5296. Air Combat

#### Problem code: COMBAT

An air combat is on the way, you are asked to command this war. Now planes of enemy are full of the sky. A plane is described with three-dimensional coordinate  $(x, y, z)$  ( $1000 < x, y, z < 1200$ ), and all coordinates are integers. As is show below:

You have created a missile which can destroy all the planes in a cube whose center is  $(x, y, z)$ , and the cube can be as large as  $(x-r, y-r, z-r)$   $(x+r, y+r, z+r)$ . This missile is so fierce that it will destroy not only enemy in that space, but also friends. And after that a position is occupied by a plane belongs to the opposite side before the explosion, that is to say an enemy plane will be replaced by a friend, a friend will be replaced by an enemy.

You want to reduce our loss, so you need to know which side a plane belongs to in a position.

#### Input

The first line contains the number of scenarios.

For each scenario you are given a line containing  $x_1\ y_1\ z_1\ x_2\ y_2\ z_2$ , defining the two corners  $A(x_1, y_1, z_1)$ ,  $B(x_2, y_2, z_2)$  ( $1000 \leq x_1 < x_2, y_1 < y_2, z_1 < z_2 \leq 1200$ ) of the sky. The combat is so fierce that every point in the cube is occupied by an enemy plane at first.

Next line is a number of operation  $q$ .

Next  $q$  lines: ( $0 < q < 10000$ )

A character 'U': followed by 4 integers, a center point  $M(x_i, y_i, z_i)$ , the range is  $r_i$ .

A character 'Q': followed by 3 integers, a position  $N(x_i, y_i, z_i)$ , if a plane belongs to us, print "Friend" else print "Enemy".

Points  $M$  and  $N$  are all in cube given above.

#### Output

Print a line for every 'Q' operation.

#### Example

**Input:**11000 1000 1000 1002 1002 10024U 1000 1000 1000 0U 1001 1001 1001 1Q 1000 1000 1000Q 1001 1001 1001**Output:**EnemyFriend

---

Added by: Hemant Verma  
Date: 2009-11-14  
Time limit: 1s  
Source limit:2000B  
Languages: All  
Resource: Alkhwarizm 2009

## SPOJ Problem Set (classical)

### 5297. Family Problems

#### Problem code: FAMILYP

Asif and Nafisa are very interested in solving puzzles. They always try to give one another puzzles to see who is the best. So, as usual, one day, Nafisa gave Asif a matrix.

The matrix is as follows

```

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z A B C .....
B C D E F G H I J K L M N O P Q R S T U V W X Y Z A B C D .....
C D E F G H I J K L M N O P Q R S T U V W X Y Z A B C D E .....
D E F G H I J K L M N O P Q R S T U V W X Y Z A B C D E F .....
.....
.
.
```

Assume that the matrix is very huge (both row and column wise). Nafisa describes a special sequence as a sequence whose first term is 'A' [element at (0,0)], second term is 'B' [element at (0,1)], third term is 'B' [element at (1,0)], fourth term is 'C' [element at (2,0)]. Now, she asks Asif to find the  $n$ th term of this special sequence. Help Asif To solve the problem.

#### Input

There will be multiple test cases with number  $N$  ( $1 \leq N \leq 1000000$ ) per line.

#### Output

A character ['A'-'Z'] per line for each number  $N$  representing the  $N$ th number in the special sequence.

#### Example

```

Input: 3 6 10
Output:
TERM 3 IS B
TERM 6 IS C
TERM 10 IS D
```

---

Added by: Hemant Verma  
Date: 2009-11-14  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Alkhwarizm 2009



## SPOJ Problem Set (classical)

### 5298. Interval Challenge

#### Problem code: INTERVA2

Give you  $N$  ( $1 \leq N \leq 200000$ ) intervals, represented as  $[A, B]$ , for example, interval  $s$  represented as  $[A_s, B_s]$ .

For two intervals  $s$  and  $t$ , we say  $S$  covered by  $T$  if  $A_t \leq A_s$  and  $B_s \leq B_t$ . Now my problem is easy, just tell me the question below: For each interval, how many intervals can cover it but not covered by it?

#### Input

The input contains multiple test cases.

For each test case, the first line is an integer  $N$  ( $1 \leq N \leq 200000$ ), which is the number of intervals. Then come  $N$  lines, the  $i$ -th of which contains two integers:  $A_i$  and  $B_i$  ( $A_i, B_i$  will not exceed the 32-bit integer) specifying the two parameters described above.

#### Output

For each test case, output one line containing  $n$  space-separated integers, the  $i$ -th of which specifying the number of intervals that can cover it but not covered by it.

#### Example

**Input** 30 1-1 2-2 320 10 1 **Output** : 2 1 00 0

---

Added by: Hemant Verma

Date: 2009-11-14

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Alkhwarizm 2009

## **SPOJ Problem Set (classical)**

### **5300. Mexican Standoff**

#### **Problem code: MEXICAN**

The town of San Saba is too small for more than one gunslinger. Unfortunately, all of them turned up on the same day, one fine spring morning. As it turned out, love was in the air and they were all trying to woo Alice, the sheriff's daughter. As only one of them could win her love, they decided to do the only gentlemanly thing left to do - they decided to have a Mexican Standoff.

There are multiple rounds in this standoff. In each round, all gunslingers still alive first form a large circle, with each of them facing the centre of the circle. To prevent a fight for position while forming the circle, the men have decided that they will line up in the lexicographic order of their names, and then connect the ends of the line to form the required circle. Once they have taken their positions Alice drops a scarf from her hand, and the moment it hits the ground all the men simultaneously draw out their two guns (one from the left holster and one from the right) and fire both of them. Each man aims the gun from the left holster at the person to his immediate left in the circle and the other gun at the person to his immediate right. Of course, not all gunslingers are equal - they have different reaction times and hence fire their guns at different times. If a man is fired upon before he can fire, he dies and is thus unable to fire his own gun. If two men fire at each other at exactly the same time, they both die. After the round is over, the bodies of the dead men are removed from the circle by those alive, who then head to the next round. If there is only one man left standing after a round, the standoff is over and the lucky survivor gets to marry Alice. If no one survives after a particular round, then Alice remains single of course.

Unfortunately, Alice only likes some of the men. So she decided that before each round, she would remove a single bullet from the gun in either the left or the right holster (but not both) of at most one of the men. Being a little lazy, she wants to know the minimum number of rounds in which she must remove a bullet so that she gets to marry one of the men she likes. If she does not like anyone, it means that she wants to remain single.

#### **Input**

The first line contains  $T$  the number of test cases ( $1 \leq T \leq 30$ ). The first line of each test case contains  $N$ , the number of gunslingers in town ( $2 \leq N \leq 60$ ). Each of the next  $N$  lines contains the name of the gunslinger (between 1 and 20 lower case letters, each gunslinger will have a unique name), his reaction time in milliseconds ( $1 \leq \text{reaction time} \leq 1000$ ) and whether Alice likes him or not (Y or N), separated by spaces.

## Output

For each test case, a line containing a single integer equal to the minimum number of rounds in which Alice needs to remove a bullet, or -1 if it is impossible for her desire to be fulfilled.

### Example

```
Input: 2 Good 100 Yhad 200 Wugly 100 H3 Good 100 Yhad 200 Wugly 100 H3 Good 100 Yhad 100 Wugly 100 Output:
10 Explanation: Alice likes only Good, so she removes a bullet from the gun which Wugly will use to fire at Good. Good survives while Bad and Wugly are killed. 2. Alice doesn't like any of them, and she doesn't have to lift a finger to remain single. 3. Alice likes only Good, but all of them are equally fast, so she can't save him and will remain single in his memory.
```

Added by: Hemant Verma  
Date: 2009-11-15  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Alkhwarizm 2009

## SPOJ Problem Set (classical)

### 5301. Query Problem

#### Problem code: QUERYSTR

McFn interested in string problem recently. He found an interesting function and he felt he could use this function to invent a new match algorithm.

For a string  $S[1 \dots n]$  and  $i \in [1, n]$ , define  $F(i)$  is the length of the longest common suffix of  $S$  and  $S[1 \dots i]$ .

For example, for the string  $S[1 \dots 11] = \text{zaaxbaacbaa}$ , then  $F(1) = 0$ ,  $F(2) = 1$ ,  $F(3) = 2$  (note that  $S[1 \dots 3] = \text{zaa}$ ),  $F(4) = 0$ , ...  $F(10) = 1$ ,  $F(11) = 11$ ;

For the string  $S[1 \dots n]$ ,  $i \in [1, n]$ ,  $S[i \dots n]$  is its suffix;

#### Input

The first line is an integer  $T$ , the number of test cases

for each test case

The first line is a string  $S$ , composed of only lowercase letters,  $\text{len}(s)$  is the length of  $s$ ,  $1 \leq \text{len}(s) \leq 1000000$ ;

Next line, a number  $N$  ( $1 \leq N \leq 100000$ ), denote that the number of queries;

The next  $N$  lines, each line contains a number  $x$  ( $1 \leq x \leq \text{len}(s)$ ).

#### Output

For each  $x$  the output  $F(x)$ ;

#### Example

**Input:** 1zaaxbaacbaa111234567891011**Output:**  
012001300111

---

Added by: Hemant Verma

Date: 2009-11-15

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Alkhwarizm 2009

## SPOJ Problem Set (classical)

### 5317. Tetravex Puzzle

#### Problem code: TETRAVEX

TetraVex is a challenging computer brain teaser. The object of the game is to fill the grid with the tiles so that the numbers on the adjacent edges of each tile match, much like aligning domino tiles.

Given the 9 tiles, you have to find out whether it is possible to solve the puzzle. Each tile is represented using 4 digits. A tile is given in the order A B C D in the clockwise direction starting from top cell. So the top left tile is denoted as '2 1 4 9' and the bottom right as '2 1 6 6'. You cannot rotate the tiles, that is the original order must be preserved.

#### Input

There will be many cases in the input file. The first line gives the number of test cases (  $\leq 20$  ). Each case consists of 9 lines giving 4 integers each. Each line gives the information of a tile in the order A B C D. The tiles are randomly given.

#### Output

For each case, output YES or NO. Follow the sample for exact format

#### Example

Input :

```
22 8 4 61 1 3 50 4 2 82 5 3 37 6 0 47 3 0 64 8 7 70 3 1 22 2 2 81 1 1 12 2 2 23 3 3 34 4 4 45 5 5 56 6 6 67 7 7 78 8 8 89 9 9 9
```

Output :

```
Case 1: YESCase 2: NO
```

---

Added by: Hemant Verma  
Date: 2009-11-17  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: Alkhwarizm 2009

## SPOJ Problem Set (classical)

### 5453. Air Strike

#### Problem code: ANARC09F

General Gee is the commander of a military base. He has just received alarming news from one of his spies: the enemy's preparing an air missile strike. The base contains two magnetic towers. When activated and given sufficient power, each of the magnetic towers creates a powerful horizontal magnetic disk. If any missile passes through this disk it deflects away from the base. Although those towers seem to be an excellent air defense method, there is a problem: The area of the disk generated by a tower is proportional to the amount of energy it receives. The base has enough power plants to generate a certain amount of energy, which has to be divided among those two towers. That means that the total area of the two disks generated from the towers should not exceed the total energy generated by the power plants. Fortunately, the spy was able to know the exact target co-ordinates of the incoming missiles and he reported them to General Gee. The General needs your help in distributing the energy on the two magnetic towers to minimize the number of missiles that will not get deflected by the magnetic towers and therefore will hit the base. You may assume the following:

- The towers have different heights and therefore there are no problems associated with the magnetic disks interfering with each other.
- A missile will deflect if it passes through the magnetic disk of a tower or even if it just touches its boundary.
- A missile hitting a tower (landing exactly on its location) will deflect, even if the tower is not given any energy.
- All incoming missiles will go down simultaneously at the exact instant; therefore, there will not be any time available to redistribute the energy amongst the two towers during the strike.

#### Input

Input consists of several test cases. Each test case is specified on  $N + 2$  lines. The first line contains an integer ( $1 \leq N \leq 1,000$ ) representing the number of missiles. The second line contains 5 real numbers  $X_1, Y_1, X_2, Y_2$  and  $T$ :  $(X_1, Y_1)$  is the coordinates of the first tower,  $(X_2, Y_2)$  is the coordinates of the second tower and  $(0 \leq T)$  is the total amount of energy generated from the power plants (the total area of the two magnetic disks). Each line of the remaining  $N$  lines contains two real numbers representing the landing coordinates of a missile. The absolute value of all the given real numbers is less than or equal to 100 and may include a decimal point followed by up to 3 digits. Any two consecutive numbers on the same line are separated by one or more white-space characters. Zero or more blank lines may appear between test cases.

The last line of the input file is made of a single zero.

#### Output

For each test case, print the following line:

k. M

Where  $k$  is the test case number (starting at one,) and  $M$  is the minimum number of missiles that will NOT be deflected in the best distribution of energy among the two towers. Use  $p = 3.141$ .

## Example

**Input:** 6-3 0 3 0 40.833-1 4-2 2.51 25 2-4 0-3 -120 0 1 1 00 01 10**Output:** 1. 22. 0

---

Added by: Mohammad Kotb

Date: 2009-11-28

Time limit: 7s

Source limit: 50000B

Languages: All except: TECS

Resource: <http://www.icpc-anarc.org>



## SPOJ Problem Set (classical)

### 5566. Math with Bases

#### Problem code: BSMATH2

With your previous help, Little Ben managed to get a perfect score on his homework. He came running home to show his brother, Big Ben. Big Ben had done this type of thing before, you see, so he naturally wasn't too impressed. Big Ben boasted, "Back in my day, we had to multiply and divide as well, the numbers were much bigger, AND we had to do it in base 64."

Little Ben became intrigued by this and searched the Internet for a worksheet. It turns out that his teacher made a worksheet for one of the higher grades that was just like Big Ben's. She also forgot to write what base each question was in... again!

According to the worksheet,

The digits used for Base 64 are the same as that of Base 62, with the single- and double-quotes as the last two; the digits used are  
0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz'".

#### Input

The first line of input contains an integer  $n$  ( $1 < n < 64$ ) that indicates the amount of sections (test cases). Each test case is as follows:

```
A - B = C
I
X1 op Y1 =
X2 op Y2 =
...
XI op YI =
```

where  $A - B = C$  is the correct example,  $I$  ( $1 \leq I \leq 5000$ ) is the number of questions in that section,  $X_i$  and  $Y_i$  are the operands of each problem ( $0 < X, Y \leq 2^{100}$ ), and  $op$  is one of  $[+, -, *, \%]$ , denoting addition, subtraction, multiplication, or modulo.

#### Output

Your program should output in the following format:

```
SECTION 1 (BASE b) X1 op Y1 = Z1 X2 op Y2 = Z2 ... Xi op Yi = ZiSECTION 2 (BASE b) X1 op Y1 = Z1 X2 op Y2 = Z2 ... Xi op Yi = Zi...SECTION N (BASE b) X1 op Y1 = Z1 X2 op Y2 = Z2 ... Xi op Yi = Zi
```

where  $Z_i$  is the solution to  $X_i op Y_i$ , and  $b$  is the base used. ( $2 \leq b \leq 64$ ). *If the base is ambiguous, use the smallest base for which the example is correct and the questions are valid.*

#### Example

**Input:**

```

4
K72Q - 9C5U = APRR
3
11JH4 - BMEB =
PB04 % DQ9O =
F0GM - UQR0 =
A654A - 9A60E = AE3B
2
B94BA + 3460A =
123A29 % 5E065 =
37CR - 0lh = 2KSm
5
157W % 1bIJ =
1P56 % 1Eob =
1C6I * 1"uX =
1Ktc % 1BMf =
20ne * 22V" =
BQfC - 4Kdb = 761H
29aFL * 3WU3 =
5fcV + 7fWL =

```

### Output:

```

SECTION 1 (BASE 31)
  11JH4 - BMEB = KS2O
  PB04 % DQ9O = BFLB
  F0GM - UQR0 = -FQA9
SECTION 2 (BASE 15)
  B94BA + 3460A = EDAC5
  123A29 % 5E065 = 5594E
SECTION 3 (BASE 64)
  157W % 1bIJ = 157W
  1P56 % 1Eob = AIX
  1C6I * 1"uX = 2O3gS"I
  1Ktc % 1BMf = 9Wz
  20ne * 22V" = 46bA3EO
SECTION 4 (BASE 42)
  9aFL * 3WU3 = bBafS4L
  5fcV + 7fWL = DfTA

```

### Notes: large input/output data

---

Added by: Jargon  
 Date: 2009-12-10  
 Time limit: 1s-5s  
 Source limit: 50000B  
 Languages: All except: TECS  
 Resource: Own problem

## SPOJ Problem Set (classical)

### 5638. Mobile Service Hard

#### Problem code: SERVICEH

A company provides service for its partners that are located in different towns. The company has three mobile service staff employees. If a request occurs at some location, an employee of the service staff must move from his current location to the location of the request (if no employee is there) in order to satisfy the request. Only one employee can move at any moment. They can move only on request and are not allowed to be at the same location. Moving an employee from location  $p$  to location  $q$  incurs a given cost  $C(p,q)$ . The cost function is not necessarily symmetric, but the cost of not moving is 0, i.e.  $C(p,p)=0$ . The company must satisfy the received requests in a strict first-come, first-serve basis. The goal is to minimize the total cost of serving a given sequence of requests.

#### Task

You are to write a program that decides which employee of the service staff is to move for each request such that the total cost of serving the given sequence of requests is as small as possible.

#### Input

The first line contains two integers,  $L$  and  $N$ .  $L$  ( $3 \leq L \leq 300$ ) is the number of locations and  $N$  ( $1 \leq N \leq 3000$ ) is the number of requests. Locations are identified by the integers from 1 to  $L$ . Each of the next  $L$  lines contains  $L$  non-negative integers. The  $j$ th number in the line  $i+1$  is the cost  $C(i,j)$ , and it is less than 2001.

The last line contains  $N$  integers, the list of the requests. A request is identified by the identifier of the location where the request occurs. Initially, the three service staff employees are located at location 1, 2 and 3, respectively.

#### Output

The first line contains one integer,  $M$ , the minimal total cost of serving the input sequence of the requests. The second line contains exactly  $N$  integers. The  $i$ th number is the identifier of the service staff employee (1, 2 or 3) who will serve the  $i$ th request. If there are multiple possibilities, your program should output one sequence only; it does not matter which one.

#### Example

**Input:** 5 90 1 1 1 11 0 2 3 21 1 0 4 12 1 5 0 14 2 3 4 04 2 4 1 5 4 3 2 1 **Output:** 51 2 1 2 2 1 3 1 3

---

Added by: Frane Kurtović  
Date: 2009-12-19  
Time limit: 1s-75s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: CEOI 2005, Day 1

## SPOJ Problem Set (classical)

### 5640. Fractions on Tree

#### Problem code: NG0FRCTN

A fraction tree is an infinite binary tree defined as follows:

1) Every node of tree contains a fraction

2) Root of tree contains the fraction  $1/1$

3) Any node with fraction  $i/j$  has two children : left child with fraction  $i/(i+j)$  and right child with fraction  $(i+j)/j$

For example , fraction tree upto 3 levels is as shown:

#### Fraction tree upto 3 levels

We number the nodes according to increasing levels ( root is at level 1) and at any same level , nodes are numbered from left to right. So first node holds the fraction  $1/1$  , second one holds  $1/2$  , third one holds  $2/1$  fourth one holds  $1/3$  and so on.

Your task is simple. Given a number  $n$  , you are to find the fraction at the  $n$ th node.

#### Input

Every line of the input contains a single number  $n$ . You are to find the fraction at  $n$ th node of fraction tree. Input file terminates with a 0 which is not to be processed.

#### Output

For each input , print numerator and denominator of the lowest form of the fraction separated by a /. Output of each case to be done in separate lines.

#### Example

**Input :** 12370 **Output :** 1/11/22/13/1 **Constraints :**  $1 \leq \text{\# of test cases} \leq 30000$   $1 \leq N \leq 10^{10}$

1  
1  
uQs  
+  
Q  
Q  
Q

Q  
Q  
Q  
Q  
Q  
Q  
1  
2 u  
e  
e  
e  
e  
e  
e  
e  
%  
%  
%  
%  
%  
%  
2  
u1  
e  
e  
e  
e  
e  
e  
e  
%  
%  
%  
%  
%  
1 %  
3  
u  
A  
A  
A  
A  
A  
A  
A  
3  
2  
uA  
A  
A  
A  
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A

2  
3  
uA  
A  
A  
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3  
1  
uA  
A  
A  
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1  
4  
uA  
A  
4  
3  
uA  
A  
3  
5  
uA  
A  
5  
2  
uA  
A  
2  
5  
uA  
A  
5  
3  
uA  
A  
3  
4  
uA  
A  
4  
1  
uA

---

Added by: Nikhil Garg  
Date: 2009-12-19  
Time limit: 3s  
Source limit:50000B  
Languages: All except: TECS  
Resource: own

## SPOJ Problem Set (classical)

### 5911. Square-free Integers Factorization

#### Problem code: SQFFACT

Given the positive integers  $N = p_1 * p_2 * \dots * p_k$  and  $M = (p_1 - 1) * (p_2 - 1) * \dots * (p_k - 1)$ , i.e  $M = \phi(N)$  (Euler's totient function), where  $k \geq 1$ ,  $p_i \neq p_j$  for all  $i \neq j$  with  $i, j = 1, 2, \dots, k$  and  $p_i$  is prime number for all  $i = 1, 2, \dots, k$ , your task is factor  $n$ .

#### Input

The first line contains a positive integer  $T$ , the number of test cases, where  $T \leq 100$ . The following  $T$  lines each contains two numbers  $N$  and  $M$  in this order, where  $N < 10^{100}$ .

#### Output

Output  $T$  lines, with prime factorization of  $N$  according with example.

#### Example

**Input :**

```
3
210 48
983 982
14351 14112
```

**Output :**

```
210 = 2 * 3 * 5 * 7
983 = 983
14351 = 113 * 127
```

---

Added by: Paulo Roberto Santos de Sousa

Date: 2010-01-18

Time limit: 10s

Source limit: 50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 C99 strict JAVA PAS gpc PAS fpc

Resource: Own problem



## SPOJ Problem Set (classical)

### 6052. PBCGAME

#### Problem code: PBCGAME

The company "PBC" has made a game which consists of small platforms and pipes. There are 3 types of platforms: starting platforms (there are  $N_1$  of them), finishing platforms (there are  $N_3$  of them) and middle platforms (there are  $N_2$  of them). All starting platforms stand at identical height. Finishing platforms stand also at identical height. All heights of middle platforms are various. They have less height than starting, but greater height than finishing platforms. Each platform has an unique number from 1 up to  $N_1+N_2+N_3$ . First  $N_1$  numbers are starting platforms, next  $N_2$  numbers are middle platforms, and the last  $N_3$  numbers are finishing platforms. All middle platforms are numbered in order of decrease of height. It means that if number of middle platform A is less than number of platform B, than height of A is greater than height of B.

There is a ball on each of starting platforms. The ball can move from platform A to platform B if they are connected by a pipe, and height A is greater than height B. Each finishing platform can hold only one ball. If there is a ball on a platform the player can choose a direction of the further way of the ball, it means that he can choose a platform, where the ball will go. Also given a number  $C$  for each middle platform which means a maximum quantity of balls which can pass it during the game. The goal of the game is to drive the greatest possible number of ball to the finishing platforms.

You need to find out what maximum quantity of balls can appear on finishing platforms at the end of the game.

#### Input

The input file has the following order:

$N_1$   $N_2$   $N_3$

$C_{N_1+1}$

...

$C_{N_1+N_2}$

$K_1$   $A[1,1]$  ...  $A[1,K_1]$

$K_2$   $A[2,1]$  ...  $A[2,K_2]$

...

$K_{N_1+N_2}$   $A[N_1+N_2,1]$  ...  $A[N_1+N_2,K_{N_1+N_2}]$

Where  $N_1$ ,  $N_2$ ,  $N_3$  are the amounts of starting, middle and finishing platforms.  $C_j$  is the maximum amount of balls, which can pass the middle platform with the number  $j$  ( $N_1+1 \leq j \leq N_1+N_2$ ) during the game.  $K_i$  is the number of pipes, connected with the platform  $i$  ( $1 \leq i \leq N_1+N_2$ ). The elements of the array  $A$ , are the numbers of platforms where the ball can move from the appropriate platform (platforms with numbers  $i$  and  $A[i]$  are connected with a pipe).

## Output

The output file must contain a number, which means the max amount of balls, which can appear at the finishing platforms at the end of the game.

## Example

**Input:** 3 4 332121 41 41 42 5 61 71 73 8 9 10

**Output:** 2

### Limitations:

All the numbers are integer.

$0 < N1, N3 < 51$

$1 < N1+N2+N3 < 201$

$0 \leq Cj \leq 50$

There are no pipes between starting platforms.

There are no pipes between finishing platforms.

---

Added by: Phan Công Minh

Date: 2010-02-04

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: A.N. Danchenko - belarus

## SPOJ Problem Set (classical)

### 6072. Chocolate

#### Problem code: SOCOLA

Chocolate in its many forms is enjoyed by millions of people around the world every day. It is a truly universal candy, available in virtually every country around the world.

You find that the only thing better than eating chocolate is to share it with friends. Unfortunately, your friends are very picky and have different appetites: some would like more and others less of the chocolate that you offer them. You have found it increasingly difficult to determine whether their demands can be met. It is time to write a program that solves the problem once and for all!

Your chocolate comes as a rectangular bar. The bar consists of same-sized rectangular pieces. To share the chocolate, you may break one bar into two pieces along a division between rows or columns of the bar. You may then repeatedly break the resulting pieces in the same manner. Each of your friends insists on a getting a single rectangular portion of the chocolate that has a specified number of pieces. You are a little bit insistent as well: you will break up your bar only if all of it can be distributed to your friends, with none left over.

For example, Figure 9 shows one way that a chocolate bar consisting of 3 x 4 pieces can be split into 4 parts that contain 6, 3, 2, and 1 pieces respectively, by breaking it 3 times. (This corresponds to the first sample input.) [IMAGE]

Figure 9

#### Input

The input consists of multiple test cases, each describing a chocolate bar to share. Each description starts with a line containing a single integer  $n$  ( $1 \leq n \leq 15$ ), the number of parts into which the bar is supposed to be split. This is followed by a line containing two integers  $x$  and  $y$  ( $1 \leq x, y \leq 100$ ), the dimensions of the chocolate bar. The next line contains  $n$  positive integers, giving the number of pieces that are supposed to be in each of the  $n$  parts.

The input is terminated by a line containing the integer zero.

#### Output

For each test case, first display its case number. Then display whether it is possible to break the chocolate in the desired way: display "Yes" if it is possible, and "No" otherwise. Follow the format of the sample output.

#### Sample Input

```
4
3 4
6 3 2 1
```

2  
2 3  
1 5  
0

## Sample Output

Case 1: Yes  
Case 2: No

---

Added by: Ngô Minh Đức  
Date: 2010-02-09  
Time limit: 6s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: ACM ICPC World Final 2010

## SPOJ Problem Set (classical)

### 6187. Jane and Tarzan

#### Problem code: JANE

Jane and Tarzan have got cellphones and now they want to be available all the time. They live in a long line of trees and they are available iff the absolute difference between the heights of the two trees which they are on is not greater than  $D$ .

Jane and Tarzan are moving by the following rules: each second both Jane and Tarzan (simultaneously) jump, from the tree which they are on, on one of the adjacent trees (the left or the right one). It is forbidden to stay on the same tree. Moreover, in the very beginning and after each second they have to be available.

The trees in the line are numbered from 1 to  $N$ , respectively. Jane is interested in the pairs of trees ( $J$ ,  $T$ ) - let's call them good pairs - for which it holds: if Jane begins on the  $J$ -th tree, and Tarzan on the  $T$ -th tree, they can swap their positions after some time (moving by the rules) - so that Tarzan ends on the  $J$ -th tree, and Jane on the  $T$ -th tree.

Have a look on the first test example.  $D = 0$  means that the heights of the trees which Jane and Tarzan are on have to differ by at most 0 (therefore, have to be equal) all the time. Pair (1, 5) is a good pair since we can take 1-2-3-4-5-6-5 as Jane's route, and 5-6-5-4-3-2-1 as Tarzan's route - this results in Jane and Tarzan swapping their initial positions (and being available all the time).

Output all the good pairs ( $J$ ,  $T$ ) in which  $J < T$ .

#### Input

In the first line of input there are integers  $N$  ( $1 \leq N \leq 100\,000$ ) and  $D$  ( $0 \leq D \leq 10^9$ ).

In the next  $N$  lines there are  $N$  natural numbers less than  $10^9$  - heights of the trees in the line (from the 1st tree to the  $N$ -th tree).

#### Output

Output all the requested pairs in sorted order. We define a pair ( $A$ ,  $B$ ) to be smaller than the pair ( $C$ ,  $D$ ) iff ( $A < C$ ) or ( $A = C$  and  $B < D$ ).

In all of the test data, the number of these pairs will not exceed 100 000.

#### Example

**Input :**

```
6 0
2
1
2
3
2
1
```

**Output :**

1 3  
1 5  
2 6  
3 5

**Input :**

5 10  
10  
20  
10  
5  
10

**Output :**

1 2  
1 3  
1 4  
2 3  
2 5  
3 4  
3 5  
4 5

---

Added by: Stjepan Glavina

Date: 2010-02-21

Time limit: 1s-1.5s

Source limit:50000B

Languages: All except: TECS

Resource: author: Adrian Satja Kurdija

## **SPOJ Problem Set (classical)**

### **6219. Edit distance**

#### **Problem code: EDIST**

You are given two strings, A and B. Answer, what is the smallest number of operations you need to transform A to B.

Operations are:

- 1) Delete one letter from one of strings
- 2) Insert one letter into one of strings
- 3) Replace one of letters from one of strings with another letter

Input

T - number of test cases

For each test case:

String A

String B

Both strings will contain only lowercase characters and they won't be longer than 2000 characters.

Output

For each test case, one line, minimum number of operations.

Example

Input:

1

FOOD

MONEY

Output:

4

You are given two strings, A and B. Answer, what is the smallest number of operations you need to transform A to B?

Operations are:

- 1) Delete one letter from one of strings
- 2) Insert one letter into one of strings
- 3) Replace one of letters from one of strings with another letter

**Input**

T - number of test cases

For each test case:

String A

String B

Both strings will contain only uppercase characters and they won't be longer than 2000 characters.

There will be 10 test cases in data set.

### **Output**

For each test case, one line, minimum number of operations.

### **Example**

#### **Input:**

1  
FOOD  
MONEY

#### **Output:**

4

---

Added by: Mislav Balunović  
Date: 2010-02-28  
Time limit: 15s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: Internet



## SPOJ Problem Set (classical)

### 6221. Increasing Powers of K

#### Problem code: INCPOWK

Let's define  $S_k$  as the increasing sequence  $a_1, a_2, a_3, \dots$  consisting of all those positive integers which are powers of  $K$  or sums of distinct powers of  $K$ .

For example  $S_3 = \{1, 3, 4, 9, 10, 12, 13, 27, 28, 30, \dots\}$

Your task is given  $N$  and  $K$  find the  $N^{\text{th}}$  term of the sequence  $S_k$ .

#### Input

The first line of the input contains a single integer  $T$  ( $1 \leq T \leq 10^4$ ) representing the number of test cases. The next  $T$  lines consist of two numbers each one separated by a single space:  $K$  ( $3 \leq K \leq 9$ ) and  $N$  ( $1 \leq N \leq 10^{200}$ ).

#### Output

For each test case print a single line, the  $N^{\text{th}}$  term of the sequence  $S_k$ .

#### Example

**Input:** 8 3 4 3 100 4 3 5 12 6 7 7 239 8 17 9 500 **Output:** 9 981 5 150 43 958399 4097 48426822

---

Added by: Angel Paredes Ortiz

Date: 2010-03-02

Time limit: 25s

Source limit: 50000B

Languages: All except: TECS

Resource: American Invitational Mathematics Examination 1986

## SPOJ Problem Set (classical)

### 6236. Matches

#### Problem code: FERT21\_0

Upon a table there are two boxes. Each box has  $N$  matches inside. We want to know what is the probability of choose  $N$  times a random box and take one match from it, at the end have an empty box.

You have to print all digits.

Constrains

$1 \leq T \leq 1000$

$1 \leq N \leq 1000$

#### Input

T  
N1  
N2  
...  
NT

#### Output

P1  
P2  
...  
PT

#### Example

**Input :**  
12**Output :** 0.5

---

Added by: Leandro Castillo Valdes

Date: 2010-03-03

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS JS

Resource: own problem

## SPOJ Problem Set (classical)

### 6286. Sum of products

#### Problem code: SUMMUL

One boy Petya decided to practice in addition and multiplication of numbers. For this he chose some positive integer  $n$ , and ordered all the ways to decompose it into two or more terms of positive integers, and the ways in different order terms are considered to be different (for example, for  $n = 3$  there are three ways:  $1 + 2$ ,  $2 + 1$  and  $1 + 1 + 1$ ). Then he replaced all the plus signs with multiplication, and added the results (for  $n = 3$ :  $1 \times 2 + 2 \times 1 + 1 \times 1 \times 1 = 5$ ). After practicing for the day he decided to check the correctness of his calculations. Help Petya find the right answers.

#### Input

The first line contains  $T$  ( $1 \leq T \leq 1000$ ) - the number of tests. Following  $T$  lines contain  $n$  ( $1 \leq n \leq 10^9$ ).

#### Output

For each  $n$  from the input print the result Petya should get modulo 1000000007.

#### Example

**Input :**

3  
1  
2  
3

**Output :**

0  
1  
5

---

Added by: Spooky

Date: 2010-03-09

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: Advancement Spring 2010, <http://sevolymp.uuuq.com/>, author: Alexey Shchepin

## SPOJ Problem Set (classical)

### 6288. Treeramids

#### Problem code: PYRA

Daniel is building towers. He has a big amount of block of the size  $1 \times 1 \times K$  (for any  $K$ ). Out of them he is building towers according to the following rules: the longest block is put in the basement of the tower. Several towers built by the same rules can be put on this block. The distance between the bases of those towers should be 1 and the distance between the bases of the towers and the edges of the common basement should be 1. There should be a block of the length 1 on the top of each tower. Daniel encodes every tower with root tree. For example:

[IMAGE]

The root of the tree corresponds to the basement of the tower. Its descendants correspond to the towers standing on it. The leaves correspond to the blocks of the size  $1 \times 1 \times 1$  on the tops. Given the root tree describing one of those structures, calculate the total volume of the structure.

#### Input

The first line of input contains the number  $t$  - the number of tests. Next comes the description of  $t$  tests. Each test starts with an integer  $n$  - the number of nodes of the tree. This is followed by  $n-1$  line, consisting of two integers  $a$  and  $b$  - number of nodes connected by an edge. Nodes are numbered from 0 to  $n-1$ . The root of the tree will always be a node with number 0. Otherwise the nodes and edges can go in any order.

#### Constraints

$1 \leq t \leq 25$   
 $1 \leq n \leq 10^4$

#### Output

For each test case print the total volume of the structure build according to the rules in the problem statement.

#### Example

**Input :**

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

**Output :**

25

9

---

Added by: Spooky

Date: 2010-03-09

Time limit: 2s

Source limit:50000B

Languages: All except: TECS

Resource: Advancement Spring 2010, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 6289. Bomberman

#### Problem code: BOMBER

Alice and Bob love to play Bomberman. They decided to upgrade the game. Their version is played on a rectangular board divided into cells. The first player puts a bomb on any cell. The bomb destroys this cell, as well as all consecutive undestroyed cells left, right, above and below it. Then the second player puts his bomb, then again the first and so on. The player who destroys the last cell wins the game. Given the dimensions of the board, determine which player wins the game assuming that both players play optimally.

#### Input

The first line contains T ( $1 \leq T \leq 1000$ ) - the number of tests. The next T lines contain two integers m and n ( $1 \leq m, n \leq 100$ ) - the size of the board.

#### Output

For each test print 1 if the first player wins the game, or 2 if the second wins.

#### Example

Input :

```
1
2 2
```

Output :

```
2
```

#### Example of the first two moves of 7x7 board

[IMAGE]

---

Added by: Spooky

Date: 2010-03-09

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: Advancement Spring 2010, <http://sevolymp.uuuq.com/>, author: Alexey Shchepin

## SPOJ Problem Set (classical)

### 6290. Robbery 2

#### Problem code: ROBBERY2

**k** bandits robbed a bank. They took away **n** gold coins. Being a progressive group of robbers they decided to use the following procedure to divide the coins. First the most respected bandit takes **1** coin, then the second respected takes **2** coins, ..., the least respected takes **k** coins, then again the most respected takes **k+1** coins, and so on, until one of the bandits takes the remaining coins. Calculate how much gold each of the bandits gets.

#### Input

The first line of the input contains number **t** - the amount of tests. Then **t** test descriptions follow. Each test consists of two integers **n** and **k** - the amount of coins and bandits respectively.

#### Constraints

$1 \leq t \leq 500$   
 $> 10^6 \leq n \leq 10^{15}$   
 $> 2 \leq k \leq 100$

#### Output

For each test print the amounts of coins each bandit gets separated by spaces.

#### Example

**Input :**

```
3
1000000 2
1234567 3
123456789 4
```

**Output :**

```
499849 500151
411602 411887 411078
30869901 30858368 30862296 30866224
```

---

Added by: Spooky

Date: 2010-03-09

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: Advancement Spring 2010, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 6296. Experiment

#### Problem code: EXPER

The following experiment is taking place. There are  $n$  points of a plane. Each point is moving with the uniform velocity. It is needed to determine the minimum circle which encloses all the points after each second of the experiment during the fixed time  $T$ .

#### Input

The first line of input contains the number  $t$  - the number of tests. Next comes the description of  $t$  tests. The first line of each test consists of two integers  $n$  - number of points and  $T$  - the duration of the experiment in seconds. The next  $n$  lines contain four integers separated by spaces  $x$ ,  $y$ ,  $v_x$ ,  $v_y$  - initial coordinates and velocities of each point.

#### Constraints

$1 \leq t \leq 10$   
 $1 \leq n \leq 2000$   
 $1 \leq T \leq 50$   
 $-100 \leq x, y, v_x, v_y \leq 100$

#### Output

For each test case print  $T$  real numbers  $R_i$  for  $i$  from 1 to  $T$  rounded to two decimals after the point.  $R_i$  should be the radius of the minimal circle which encloses all the points.

#### Example

##### Input :

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

##### Output :

```
3.16
4.12
5.41
7.43
9.55
```

---



Added by: Spooky  
Date: 2010-03-09  
Time limit: 3s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: Advancement Spring 2010, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 6297. Decipher

#### Problem code: ROOTCIPH

Radar scanned the approaching enemy aircraft on the border. However due to some error part of the transmitted data can't be deciphered. It was possible only to obtain the coefficients of the cubic polynomial, whose roots are the coordinates of the aircraft relative to the radar. Now you need to calculate the distance to the aircraft. Write the program to solve this task.

#### Input

The first line contains T ( $1 \leq T \leq 1000$ ) - number tests. The next T lines contain three integers a, b and c - coefficients of the polynomial  $x^3 + ax^2 + bx + c$ , whose roots are the coordinates (the absolute value of the coordinates do not exceed  $10^8$ ).

#### Output

For each test print the square of the distance to the enemy aircraft.

#### Example

**Input :**

1  
-6 11 -6

**Output :**

14

---

Added by: Spooky

Date: 2010-03-09

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: Advancement Spring 2010, <http://sevolymp.uuuq.com/>, author: Alexey Shchepin

## SPOJ Problem Set (classical)

### 6299. Move Marbles

#### Problem code: MOVMRBL

You have  $N$  marbles and  $K$  slots. You have to follow the below mentioned rules :

1. You can put in a marble or take out a marble from slot numbered 1 at any time.
2. You can put in a marble or take out a marble from slot numbered  $i$  only if there exists a marble at the slot  $i - 1$ .
3. The game stops when a marble reaches the slot numbered  $K$  for the first time.

Your task is to finish the game in minimum number of valid moves.

#### Input

The first line contains  $t$ , the number of testcases. Then on each line is given two numbers  $N \leq 15$ ,  $K \leq 2^N - 1$ .

#### Output

Print two numbers namely the number of "put in" moves and the number of "remove from" moves respectively for all the tests such that you move to the  $K$ th slot in minimum number of valid moves. See explanation section below for more details.

#### Example

**Input:**

1

3 6

**Output:**

6 3

#### Explanation :

The following are the valid moves for the given input:

PUT IN 1  
PUT IN 2  
PUT IN 3  
REMOVE FROM 2  
REMOVE FROM 1

PUT IN 4  
PUT IN 5  
REMOVE FROM 4  
PUT IN 6

---

Added by: Paranoid Android  
Date: 2010-03-09  
Time limit: 30s  
Source limit:50000B  
Languages: All except: TECS  
Resource: -

## SPOJ Problem Set (classical)

### 6322. The hunt for Gollum

#### Problem code: ARDA1

*Along the skirts of the Dead Marshes I followed it, and then I had him. Lurking by a stagnant mere, peering in the water as the dark eve fell, I caught him, Gollum. He was covered with green slime. He will never love me, I fear; for he bit me, and I was not gentle. Nothing more did I ever get from his mouth than the marks of his teeth.*

*"The Lord of the Rings: The fellowship of the Ring"*

Hearing Gandalf's advice, Aragorn has started hunting creature Gollum. After several days following his footprints, he has arrived to the Dead Marshes. He has a map of the marshes, that can be viewed as an  $M_1 * M_2$  matrix containing lowercase letters form English alphabet (i.e. letters from 'a' to 'z').

Being a skilled ranger, Aragorn has been able to fully characterize Gollum preferred place (if you are interested, you should know that it must be dark, wet, creepy and full of fishes!). It can be described as an  $N_1 * N_2$  matrix containing lowercase letters form English alphabet.

Your task is simple: write a program that, given Gollum's preferred place description and Aragorn's map, output all possible locations of the creature.

Let's look at an example: suppose Gollum's preferred place is described by the following 3 \* 3 matrix:

aba

bab

aba

and that Aragorn's map looks something like this:

aababa

ababab

bababa

ababab

ababab

bababa

ababab

Then your program must output the following: (1,2), (1,4), (2,1), (2,3), (5,1) and (5,3), these being the upper-left corners of all places on the Dead Marshes that match Gollum's preferred place description. If none match is found, you should output the string "NO MATCH FOUND..." without the quotes.

## Input

Line 1: Two integers:  $N_1$  and  $N_2$ .

Lines 2...  $N_1 + 1$ : A string with  $N_2$  characters as described above.

Lines  $N_1 + 2$ : Two integers:  $M_1$  and  $M_2$ .

Lines  $N_1 + 3$ ...  $N_1 + M_1 + 3$ : A string with  $M_2$  characters as described above.

## Restrictions

$1 \leq N_1, N_2 \leq 300$

$1 \leq M_1 * M_2 \leq 2000$

$N_1 \leq M_1$

$N_2 \leq M_2$

## Output

On each line print the upper-left corner of all places that match Gollum's preferred place description on the form "(x,y)" without the quotes, where x stands for the row and y for the column. They should be lexicographically sorted, i.e. imagine them as an ordered pair. Then  $(x_1, y_1) < (x_2, y_2)$  if and only if  $x_1 < x_2$  or, if they are equal,  $y_1 < y_2$ .

## Example

Added by: Camilo Bravo Valdés  
Date: 2010-03-11  
Time limit: 0.5s-1s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: own problem

## SPOJ Problem Set (classical)

### 6325. Many polygons

#### Problem code: NGON

There is a regular  $n$ -gon. We mark some points on its sides:  $a_1$  points on the first side,  $a_2$  on the second ... and on the last. Marked points do not coincide with the vertices  $n$ -gon. The question is, how many different convex nondegenerate  $(n-1)$ -gons you can build, using marked points as vertices?

#### Input

The first line of input contains the number  $t$  - the number of tests. Next comes the description of  $t$  tests. Each test consists of two lines. The first line of the test contains an integer  $n$  - number of vertices of original  $n$ -gon. Second line of the test lists  $n$  integers  $a_1, a_2, \dots, a_n$  - number of points marked on each side.

#### Constraints

$1 \leq t \leq 20$   
 $4 \leq n \leq 1000$   
 $1 \leq a_i \leq 100$

#### Output

For each test, print out the answer to the problem modulo 1000000007.

#### Example

**Input :**

```
3
4
2 2 2 2
5
2 2 2 2 2
5
10 20 30 40 50
```

**Output :**

```
56
210
16207125
```

---

Added by: Spooky

Date: 2010-03-12

Time limit: 2s

Source limit: 50000B

Languages: All except: TECS

Resource: Advancement Spring 2010, <http://sevolymp.uuuq.com/>



## SPOJ Problem Set (classical)

### 6340. ZUMA

#### Problem code: ZUMA

One day Mirko, while he was walking through the high grass, stumbled upon a sequence of  $N$  colored marbles. Soon he noticed that if he touches  $K$  or more consecutive marbles of the same color, they start to twinkle and then he could wish them to magically vanish, although he doesn't have to do that immediately (see 2. sample). Fortunately, Mirko brought an inexhaustible supply of marbles from home, so he can insert a marble of any color anywhere in the array (at the beginning, between any two existing marbles, or at the end). Help Mirko find the smallest number of marbles he must insert into the sequence before he could make all of the marbles vanish

#### Input

The first line of input contains two integers  $N$  ( $1 \leq N \leq 100$ ) and  $K$  ( $2 \leq K \leq 5$ ) - the number of marbles in the initial sequence and the minimal number of consecutive marbles of the same color he could wish to vanish. The next line contains exactly  $N$  integers between 1 and 100 (inclusive), separated by one space. Those numbers represent colors of marbles in the sequence Mirko found.

#### Output

The output should contain only one line with a single integer number - the minimal number of marbles Mirko has to insert to achieve the desired effect.

#### Example

**Input:** 2 51 1 **Output:** 3 **Input:** 10 43 3 3 3 2 3 1 1 1 3 **Output:** 4

---

Added by: Phan Công Minh

Date: 2010-03-14

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: COCI 2009-1010

## SPOJ Problem Set (main)

### 6356. Rock-Paper-Scissors-Lizard-Spock

#### Problem code: RPSSL

Daniel enjoys watching TV series. One of his favorite is "The Big Bang Theory". The main characters of this series are: Sheldon - genius theoretical physicist, his friend Leonard - talented experimental physicist, their attractive, blonde neighbor Penny, and also their friends an aerospace engineer Howard and a particle astrophysicist Rajesh.

One time Rajesh tells Sheldon:

"I'll tell you what. How about we go rock-paper-scissors?"

"Ooh", - Sheldon replies - "I don't think so. Anecdotal evidence suggests that in the game of rock-paper-scissors, players familiar with each other will tie 75 to 80% of the time due to the limited number of outcomes. I suggest rock-paper-scissors-lizard-Spock".

"What?"

"It's very simple. Scissors cuts paper. Paper covers rock. Rock crushes lizard. Lizard poisons Spock. Spock smashes scissors. Scissors decapitates lizard. Lizard eats paper. Paper disproves Spock. Spock vaporizes rock. And as it always has, rock crushes scissors".

"Okay, I think I got it".

And the friends decided to play rock-paper-scissors-lizard-Spock. And we would determine what the probability that Rajesh beats Sheldon in this game. We know the probabilities that any of the friends choose any object in the game. Also we know that they play till two wins, so the winner of the game is the person who first wins two rounds.

#### Input

The first line of input contains the number  $t$  - the number of tests. Next comes the description of  $t$  tests. Each test case consists of two lines. The first line contains five integers  $R_R, R_{Sc}, R_P, R_L, R_{Sp}$  - the probabilities that Rajesh chooses rock, scissors, paper, lizard or Spock respectively. The second line contains five integers  $S_R, S_{Sc}, S_P, S_L, S_{Sp}$  - the probabilities that Sheldon chooses rock, scissors, paper, lizard or Spock respectively. (**Note:** the order of the objects in the input is rock, scissors, paper, lizard, Spock. The original problem is in Russian and we have scissors before paper in Russian variant of the game. Otherwise the rules are the same.)

#### Constraints

$$1 \leq t \leq 500$$

$$0 \leq R_R, R_{Sc}, R_P, R_L, R_{Sp} \leq 100, R_R + R_{Sc} + R_P + R_L + R_{Sp} = 100$$

$$0 \leq S_R, S_{Sc}, S_P, S_L, S_{Sp} \leq 100, S_R + S_{Sc} + S_P + S_L + S_{Sp} = 100$$

#### Output

For each test case print the probability that Rajesh beats Sheldon in percent rounded to the nearest integer.

## Example

**Input :**

```
2
10 20 30 40 0
10 10 10 10 60
20 20 20 20 20
20 20 20 20 20
```

**Output :**

```
66
50
```

---

Added by: Spooky

Date: 2010-03-17

Time limit: 1s

Source limit:50000B

Languages: C C99 strict C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA

Resource: Advancement Spring 2010, <http://sevolymp.uuuq.com/>

## SPOJ Problem Set (classical)

### 6377. Two Array Problem

#### Problem code: SAMTWARR

You are given two arrays each of length  $N$  ( $1 \leq N \leq 100000$ ) which are initially filled with zeros. You have to apply  $M$  ( $1 \leq M \leq 100000$ ) queries of three kind:

**0 arr left right** :calculate and output sum of elements from left to right in array arr (arr = 0 -- first array, arr = 1 -- second array);

**1 arr idx newValue** :change value of element at index idx of array arr on newValue;

**2 left right** :swap range of elements of two arrays from left to right ( for  $i = \text{left to right}$  do swap( $a[i]$ ,  $b[i]$ ));

#### Input

The first line of input contains two integers -  $N$ ,  $M$ . The following  $M$  lines contains information about queries.

On each query - one line:

First integer number cmd contains 0, 1 or 2 (type of query described above).

if cmd equals 0, then following 3 integers arr, left, right -  $0 \leq \text{arr} \leq 1$ ,  $0 \leq \text{left} \leq \text{right} \leq N - 1$ .

if cmd equals 1, then following 3 integers arr, idx, newValue -  $0 \leq \text{arr} \leq 1$ ,  $0 \leq \text{idx} \leq N - 1$ ,  $-10000 \leq \text{newValue} \leq 10000$ .

if cmd equals 2, then following 2 integers left, right -  $0 \leq \text{left} \leq \text{right} \leq N - 1$ .

#### Output

On each query with cmd equals 0 you should output corresponding value described above.

#### Example

##### Input:

```
5 10
1 0 0 1
1 1 4 2
0 0 0 4
0 1 0 4
2 0 0
0 0 0 4
0 1 0 4
2 0 4
0 0 0 4
0 1 0 4
```

##### Output:

```
1
2
0
```

3  
3  
0

---

Added by: rajeshsr  
Date: 2010-03-21  
Time limit: 2s  
Source limit:50000B  
Languages: All except: TECS  
Resource: <https://www.spoj.pl/users/cmd/>

## SPOJ Problem Set (classical)

### 6408. Counting Triangles 2

#### Problem code: KKKCT2

This is a new version of problem CT with the new limit:  $X, Y \leq 10000$ , and the result will be written in modulo 2009

#### Input

The input begins with C - number of test cases.  
Each test case consists of X, Y.

#### Output

For each test case, output the result in a line.

#### Limit

$C \leq 200$   
 $0 \leq X, Y \leq 10000$

#### Example

Input : 20 31 1 Output : 04

---

Added by: Ronaldo  
Date: 2010-03-26  
Time limit: 1s-5s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: From CT problem

## SPOJ Problem Set (classical)

### 6438. Giá trị lớn nhất 4

#### Problem code: QMAX4

Cho 1 tập S ban đầu không có phần tử nào. Máy tính sẽ đưa ra n lệnh có dạng sau :

- I x y : Thêm số x vào tập S giữ 2 vị trí y-1 và y ( $-10^9 \leq x \leq 10^9$ )

Quy định : Với i k là số phần tử trong tập S , y = 1 thì x được chèn vào đầu dãy, y = k+1 thì x được chèn vào cuối dãy.

- S x y : Đổi chỗ vị trí 2 phần tử thứ x và y ( $x < y, 1 \leq x, y \leq k$ )

- D x : Xóa phần tử thứ x ra khỏi tập S ( $1 \leq x \leq k$ )

- Q x y : Tìm giá trị lớn nhất vị trí x đến vị trí y. ( $1 \leq x \leq y \leq k$ )

Yêu cầu : Cho n lệnh. Hãy trả lời mỗi truy vấn

#### Input

- Dòng đầu là số n ( $n \leq 10^5$ )

- N dòng tiếp theo là các lệnh có mẫu như trên

#### Output

Gồm một số dòng , mỗi dòng trả lời cho 1 truy vấn theo thứ tự. trả lời trên xuống

#### Example

**Input:** 7 I 1 1 I 5 2 S 1 2 Q 1 2 D 1 Q 1 1 **Output:** 5 1

---

Added by: Fernando Torres

Date: 2010-04-01

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

## SPOJ Problem Set (classical)

### 6450. PP numbers

#### Problem code: MB1

PP numbers are prime numbers and palindromes in decimal notation at once. Your task is to find  $n$ -th PP number in ascending order. Then calculate product of its non-zero digits - let's call it  $m$  - and find  $m$ -th prime number in ascending order.

#### Input

In the first line of input there is one positive integer  $Z$  ( $1 \leq Z \leq 1000$ ) which states the number of test cases. Following  $Z$  lines contain test cases.

Each test case consists of one positive integer  $n$  ( $1 \leq n \leq 113$ ) which states the number of PP number to find.

#### Output

For each test case print in separate line two numbers:  $n$ -th PP number and  $m$ -th prime number.

#### Example

##### Input:

```
3
1
5
2
```

##### Output:

```
2 3
11 2
3 5
```

---

Added by: Maciej Boniecki

Date: 2010-04-02

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: 2nd Warsaw School of Computer Science Programming Championship



## SPOJ Problem Set (classical)

### 6470. Finding the Kth Prime

#### Problem code: TDKPRIME

The problem statement is really simple. There are some queries. You are to give the answers.

#### Input

An integer stating the number of queries Q(equal to 50000), and Q lines follow, each containing one integer K between 1 and 5000000 inclusive.

#### Output

Q lines with the answer of each query: the Kth prime number.

#### Example

**Input :**

```
8
1
10
100
1000
10000
100000
1000000
```

**Output :**

```
2
29
541
7919
104729
1299709
15485863
```

---

Added by: Alfonso2 Peterssen

Date: 2010-04-06

Time limit: 10s

Source  
limit: 10000B

Languages: C C99 strict C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA C# D FORT ADA BASH  
PERL PYTH 2.6.2 PYTH 2.5 RUBY

Resource: Thanks to TDuke

## SPOJ Problem Set (classical)

### 6471. Printing some primes

#### Problem code: TDPRIMES

The problem statement is really simple. You are to write all primes less than  $10^8$

#### Input

There is not input

#### Output

To make the problem less output related write out only the 1st, 101st, 201st, ... 1st mod 100.

#### Example

Input :

Output :

```
2
547
1229
...
99995257
99996931
99998953
```

---

Added by: Alfonso2 Peterssen

Date: 2010-04-06

Time limit: 10s

Source  
limit: 10000B

Languages: C C99 strict C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA C# D FORT ADA BASH  
PERL PYTH 2.6.2 PYTH 2.5 RUBY

Resource: Thanks to TDuke

## SPOJ Problem Set (classical)

### 6477. Bowling

#### Problem code: BOWLING1

It is well known that programmers enjoy bowling. Bowling is a competitive sport in which a player (the "bowler") rolls a bowling ball down a wooden or synthetic lane with the objective of scoring points by knocking down as many pins as possible.

For a beginner, scoring is probably the part of bowling which people find hard to understand. Fortunately, but it is not as hard as it seems.

As most bowling centers have a scoring computer, you do not usually have to score yourself. I am sure that this makes people lazy and there are probably some regular bowlers who would not be able to score manually if they had to. One day, when it all breaks down, or you are needed to correct a mistake (yes, computers do make mistakes sometimes), an understanding of the scoring rules are necessary.

The most difficult part of bowling scoring to comprehend is when a strike or spare is scored, as the score on the scorecard does not get updated immediately.

A game consists of ten frames, which start with a full rack of ten pins. In each frame, you have two deliveries of your ball, in which to knock down as many of the ten pins as you can.

If you knock down all the pins on your first ball, it is called a strike. The score doesn't get added on straight away because for a strike, you get the values of your next two balls as a bonus. For example, if you score a strike in the first frame, then an 7 and 1 in the second frame, you would score 18 ( $10+7+1$ ) for the first frame, and 8 for the second frame, making a total of 26 after two frames. If you knock down some of the pins on the first ball, and knocked down the remainder of the pins in the second ball, it is known as a spare. Again, the score doesn't get added on straight away because for a spare, you get the values of your next ball as a bonus. For example, you if score a spare in the first frame, say an 6 and a 4, then got an 8 and a 1 in the second frame, you would score 18 ( $6+4+8$ ) for the first frame, and 9 for the second frame, making a total of 27 after two frames.

When it comes to the final frame, it is slightly different. In the final frame, you get bonus balls if you strike or spare, to a maximum of three deliveries. If you strike in the first delivery you have the opportunity to strike in the remaining two and have three deliveries in total. If you scored strikes in each of your final three deliveries, the score for the final frame would be 30 ( $10+10+10$ ). If you spare the final frame, you get the third delivery as a bonus. So, a spare, 9 and 1, followed by a strike would equal 20 ( $9+1+10$ ).

You have to write a program which will calculate the score the player gets for the game given the information about the pins knocked down after each delivery of the ball.

#### Input

The first line of the input contains number  $t \leq 1000$  - the amount of test cases. Then the description of each of  $t$  test cases follow one per line. Each test case consists of several integers  $0 \leq a \leq 10$  - the amount of pins knocked down after each delivery of the ball. Each test case describes a full game for one player. All the games in the input file are correct.

## Output

For each test case output the number of points the player gets in a game on a separate line.

## Example

**Input :**

```
3
10 10 10 10 10 10 10 10 10 10 10 10 10
3 5 1 5 7 1 10 1 6 10 6 2 1 2 0 5 8 1
9 1 5 0 3 0 8 1 6 4 7 2 7 1 6 3 10 4 4
```

**Output :**

```
300
89
101
```

---

Added by: Spooky

Date: 2010-04-09

Time limit: 1s

Source limit:50000B

Languages: All except: TECS

Resource: Open All-Ukrainian Collegiate Contest Semi-Final, 2010

## SPOJ Problem Set (classical)

### 6478. Hamster Flight 2

#### Problem code: HAMSTER2

[IMAGE] There is a competition of flying hamsters in Hamsterburg. Each competing hamster is thrown from a sling. The initial speed of the hamsters is  $V_0$  m/s. Free fall acceleration is  $g = 10$  m/s<sup>2</sup>. There is no air friction. The size of the hamster and the sling are negligible. When the hamster is thrown from the sling its altitude is 0 meters. There is a number of vertical gates in the air. Each gate has a lower and an upper bound. If we mark the points directly under each of the gates on the ground - those points are positioned in one line and on one side from the starting point. A hamster gets as many points as the amount of gates he flies through. You have to calculate the maximal amount of points that a hamster can get in one flight. It is considered that a hamster flies through the gate if he touches the bounds of the gate during the flight or flies between the bounds.

#### Input

The first line of the input contains number  $0 < t \leq 10$  the amount of test cases. The description of each test case follows. Each test starts with two integers  $0 < V_0 \leq 1000$  - the initial speed of the hamster and  $0 < n \leq 20000$  - the total amount of gates. Each of the next  $n$  lines contains the description of one of the gates: three integers  $0 < x \leq 10000$  - the distance from the starting point to the point directly under the gate,  $0 < y_1 \leq y_2 \leq 10000$  - lower and upper bound of the gate.

#### Output

For each test case output the maximal amount of gates a hamster can fly through in one flight on a separate line.

#### Example

**Input :**

```
3
10 2
3 1 2
3 2 3
10 3
1 1 1
2 2 3
3 4 6
10 3
1 1 2
2 3 4
3 5 6
```

**Output :**

```
2
1
2
```

---

Added by: Spooky  
Date: 2010-04-09  
Time limit: 2s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: Open All-Ukrainian Collegiate Contest Semi-Final, 2010

## SPOJ Problem Set (classical)

### 6479. The Very Greatest Common Divisor

#### Problem code: VGCD

Given two integers a and b find their greatest common divisor.

#### Input

The first line of the input file contains number  $0 < n < 1000$  the amount of tests. The description of n test cases follow. The description of a test case consists of two lines. The first line contains integer a ( $0 < a < 10^{12540}$ ), the second - integer b ( $0 < b < 10^{12540}$ ). It is also known that all the numbers in the input file are the determinants of the square matrix of the form:  
[IMAGE]

#### Output

For each test case print the greatest common divisor of integers a and b on a separate line.

#### Example

**Input :**

```
3
2
3
3
21
6765
610
```

**Output :**

```
1
3
5
```

---

Added by: Spooky

Date: 2010-04-09

Time limit: 4s

Source limit: 50000B

Languages: All except: TECS

Resource: Open All-Ukrainian Collegiate Contest Semi-Final, 2010

## SPOJ Problem Set (classical)

### 6488. Printing some primes (Hard)

#### Problem code: PRIMES2

The problem statement is really simple (the constraints maybe not). You are to write all primes less than  $10^9$

#### Input

There is not input

#### Output

To make the problem less output related write out only the 1st, 501st, 1001st, ... 1st mod 500.

#### Example

**Input :**

**Output :**

```
2
3581
7927
...
999978527
999988747
999999151
```

---

Added by: Alfonso2 Peterssen

Date: 2010-04-09

Time limit: 10s

Source limit: 50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 PAS gpc PAS fpc JAVA

Resource: Thanks to TDuke



## SPOJ Problem Set (classical)

### 6499. Breaking Chocolates

#### Problem code: BCHOCO

Bored of setting problems for Bytecode, Venkatesh and Akhil decided to take some time off and started to play a game. The game is played on an  $R \times C$  bar of chocolate consisting of Black and White chocolate cells. Both of them do not like black chocolate, so if the bar consists only of black chocolate cells, it is discarded (Discarding the bar is not considered as a move). If the bar consists only of white chocolate cells, they do not break it further and the bar can be consumed at any time (Eating the bar is considered as a move). If the bar consists of both black and white chocolate cells, it must be broken down into two smaller pieces by breaking the bar along any horizontal or vertical line (Breaking the bar is considered as a move). The player who cannot make a move on any of the remaining bars loses.

Assuming Venkatesh starts the game and both players are infinitely intelligent, determine who wins the game.

#### Input

The first line of input contains a number 't', the number of test cases.

For each testcase, first line contains two space separated integers 'R' and 'C'. The following R lines contain C space separated integers which are either 0 (White) or 1 (Black).

#### Output

For each testcase output "Venkatesh wins" or "Akhil wins" (quotes for clarity).

#### Example

**Input:** 43 30 0 00 0 00 0 0 3 31 1 11 1 11 1 1 21 0 3 31 0 10 1 00 0 1 **Output:** Venkatesh winsAkhil winsAkhil winsVenkatesh wins

## Explanation:

**Case 1:** Unkatesh can win in one move by eating all the 0's, which is the only move possible. **Case 2:** The initial bar consists only of black chocolate cells, so it has to be discarded. So no move is possible in the game. **Case 3:** Unkatesh is forced to cut the bar into two. Now Abhil can eat the white chocolate cell and the black cell is discarded. **Constraint:**

$t \leq 251$ ,  $R, C \leq 30$

---

Added by: suhash

Date: 2010-04-13

Time limit: 2s

Source limit: 50000B

Languages: All except: TECS

Resource: ByteCode 2010

## SPOJ Problem Set (classical)

### 6500. Counting Diameter

#### Problem code: DCOUNT

Given an integer 'K', construct a set 'S' containing all integers from 1 to  $2 \cdot K - 1$  (both inclusive). Construct a graph 'G' with vertices represented by all the  $K-1$  element subsets of 'S'. There is an edge from vertex 'u' to vertex 'v' in 'G', if the corresponding subsets of 'u' and 'v' do not have any element in common. The distance  $d(u,v)$  between a vertex 'u' to a vertex 'v' is defined as the shortest path from 'u' to 'v' in 'G'. The diameter of 'G' is defined as the longest distance between any two vertices in 'G'. Output the diameter of the graph and the number of pairs of vertices which have distance equal to the diameter.

#### Input

The first line of input contains a number 't', the number of test cases.

Each of the following 't' lines contains an integer 'K'.

#### Output

For each testcase output two space separated integers, the diameter and the number of pairs. Since the numbers can be huge, output all the numbers modulo 1,000,000,007.

#### Example

**Input :**

223

**Output :**

1 62 60

**Explanation:**

**For Case 1:**

The graph is a triangle, so the diameter is 1 and the distance between any 2 pairs of different vertices is 1. The 6 pairs are:  $(\{1\}, \{2\})$ ,  $(\{2\}, \{1\})$ ,  $(\{1\}, \{3\})$ ,  $(\{3\}, \{1\})$ ,  $(\{2\}, \{3\})$ ,  $(\{3\}, \{2\})$ .

**Constraints:**

$t \leq 252$   $K \leq 100,000$

---

Added by: suhash  
Date: 2010-04-13  
Time limit: 2s  
Source limit:50000B  
Languages: All except: TECS  
Resource: ByteCode 2010

## SPOJ Problem Set (classical)

### 6517. Farmer Sepp

#### Problem code: JOCHF

Chief Farmer Josef aka Sepp needs to crop hay several times through the summer. Due to high petrol costs he can currently use his truck exactly once to drive to a spot where he will harvest the dried grass. Lazy by nature, John does not want to harvest those parts of the field which contain cows, since this would involve too much energy. Furthermore, John just crops a rectangular part of the field.

#### Input

Input contains multiple test cases. You are given three integers  $M, N, F$  ( $0 < M, N \leq 4000$ ), ( $0 \leq F \leq 1000000$ ) which describe the size of the field ( $M$  rows,  $N$  columns,  $F$  unit area of such a field). Then follows the actual map which consists of  $M$  lines, each line containing  $N$  times the letters 'H' or 'C' standing for "Hay" or "Cow". Input terminates with  $M=N=0$ .

#### Output

Print the size of the largest field, which "Sepp" would harvest.

#### Example

##### Input :

```
9 10 1
CHCHHHCCCC
CCHCHCHHHHC
CCHCHHCCCC
CHHHHHCHHH
CHCHHHCCCH
CCCCHHHCHH
HHHCCHCCCC
HCHHHHCCCH
CHHCCCCHHC
0 0
```

##### Output :

```
8
```

---

Added by: Josef Ziegler

Date: 2010-04-15

Time limit: 1s-3s

Source limit: 50000B

Languages: All except: TECS

Resource: Josef Ziegler

## SPOJ Problem Set (classical)

### 6556. N DIV PHI\_N

**Problem code: NDIVPHI**

Given an integer  $N \leq 10^{40}$  find the smallest  $m \leq N$  such that  $m/\phi(m)$  is maximum.

#### Input

N1

N2

•

•

•

N20

#### Output

m1

m2

•

•

•

m20

#### Example

**Input :**

10

•

•

**Output :**

6

•

•

Added by: Frank Rafael Arteaga  
Date: 2010-04-22  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: ProjectEuler

## SPOJ Problem Set (classical)

### 6560. N DIV PHI\_N (Hard)

#### Problem code: NDIVPHI2

Given an integer  $N \leq 10^{25000}$  find the smallest  $m \leq N$  such that  $m/\phi(m)$  is maximum. Where  $\phi$  is euler's totient function.

#### Input

The first line in the input gives the number of test cases  $T$  ( $T \leq 200$ ), and then  $T$  lines follow each containing an integer  $N$ .

#### Output

Output the smallest required value of  $m$ .

#### Example

**Input :** 110**Output :** 6

---

Added by: SALVO

Date: 2010-04-23

Time limit: 4s

Source limit: 50000B

Languages: All except: TECS

Resource: Frank Rafael Arteaga



## SPOJ Problem Set (classical)

### 6562. Esferas

#### Problem code: PRUBALL

##### Balls

The classic *Two Glass Balls* brain-teaser is often posed as: "Given two identical glass spheres, you would like to determine the lowest floor in a 100-story building from which they will break when dropped. Assume the spheres are undamaged when dropped below this point. What is the strategy that will minimize the worst-case scenario for number of drops?" Suppose that we had only one ball. We'd have to drop from each floor from 1 to 100 in sequence, requiring 100 drops in the worst case. Now consider the case where we have two balls. Suppose we drop the first ball from floor  $n$ . If it breaks we're in the case where we have one ball remaining and we need to drop from floors 1 to  $n-1$  in sequence, yielding  $n$  drops in the worst case (the first ball is dropped once, the second at most  $n-1$  times). However, if it does not break when dropped from floor  $n$ , we have reduced the problem to dropping from floors  $n+1$  to 100. In either case we must keep in mind that we've already used one drop. So the minimum number of drops, in the worst case, is the minimum over all  $n$ . You will write a program to determine the minimum number of drops required, in the worst case, given  $B$  balls and an  $M$ -story building.

##### Input

The first line of input contains a single integer  $P$ , ( $1 \leq P \leq 1000$ ), which is the number of data sets that follow. Each data set consists of a single line containing three (3) decimal integer values: the problem number, followed by a space, followed by the number of balls  $B$ , ( $1 \leq B \leq 50$ ), followed by a space and the number of floors in the building  $M$ , ( $1 \leq M \leq 1000$ ).

##### Output

For each data set, generate one line of output with the following values: The data set number as a decimal integer, a space, and the minimum number of drops needed for the corresponding values of  $B$  and  $M$ .

##### Sample Input

```
4
1 2 10
2 2 100
3 2 300
4 25 900
```

##### Sample Output

1 4

2 14

3 24

4 10

---

Added by: Alvaro

Date: 2010-04-23

Time limit: 2s

Source limit:50000B

Languages: C++ 4.0.0-8 C++ 4.3.2 JAVA

## SPOJ Problem Set (classical)

### 6576. Divide and conquer

#### Problem code: DIVCON

Anne and Brenda found some cookies scattered on the lattice points in the 2D coordinate system. They agreed to divide them in the following manner.

First, Anne draws a vertical line (that is, a line with the equation  $x = c$ , for any real number  $c$ ) somewhere in the plane. Then Brenda draws a horizontal line ( $y = d$ ) somewhere in the plane. Now they have divided the plane in four quadrants.

Anne gets all the cookies lying in the upper right and the lower left quadrant, and Brenda gets all the cookies lying in the upper left and the lower right quadrant. Cookies which lie on the vertical or the horizontal line are ignored.

Anne's goal is to maximize the number of cookies she gets, knowing that Brenda plays optimally (in order to maximize her number of cookies).

#### Input

In the first line of input there is an integer  $T$  ( $1 \leq T \leq 600$ ), the number of test cases.

Each test case starts with an integer  $N$  ( $1 \leq N \leq 1000$ ), the number of cookies. In the next  $N$  lines there are coordinates  $(X_i, Y_i)$  of the cookies, integers in the interval  $[1, 1000]$ . There can be multiple cookies at the same point.

#### Output

For each of the  $T$  cases, output in a separate line the maximal number of cookies Anne can surely get.

#### Example

**Input :**

251 14 14 55 13 3117 107 117 107 116 65 54 81 51 61 47 1  
25

**Output :**

---

Added by: Stjepan Glavina

Date: 2010-04-26

Time limit: 5s

Source limit: 50000B

Languages: All except: TECS

Resource: authors: Filip Pavetić, Adrian Satja Kurdija

## SPOJ Problem Set (classical)

### 6578. Segment Tree

#### Problem code: SEGTREE

It was Arbor Day. Alice implemented an RB-tree, Bob composed a segment tree, I made a binary tree - we all have a bright outlook.

Lambda is always making mistakes while implementing segment trees (See his history of submissions). He then decides to draw a "segment tree". He puts  $n$  points on a plane, link certain pairs of them to form segments and all the segments form a tree. As a normal tree, it satisfies the following conditions:

1. Consider points as vertices, segments as edges, it forms a rooted tree.
2. Each node  $u$  is **strictly higher** than its parent, namely  $y_u > y_{parent\_of\_u}$ .
3. Segments may only intersect on their endpoints.

Lambda wants to minimize the total length of segments. **The tree can be rotated to satisfy above conditions.**

#### Input

First line of input contains single integer  $n$  ( $1 \leq n \leq 500$ ).

Next  $n$  lines each contain two integers  $x_i, y_i$  denoting the coordinate of  $i$ -th point ( $0 \leq x_i, y_i \leq 1000$ ). Points are distinct.

#### Output

The one and only line contains a real number representing the minimum length.

Your answer must be rounded up to 4 digits after the decimal point.

#### Example 1

**Input:**60 11 02 14 15 06 1**Output:**7.6569**Illustration:**sample1

#### Example 2

**Input:**100 00 11 22 31 43 4-1 2-2 3-1 4-3 4**Output:**12.3137**Illustration:**sample1 This is just a sample test case. There's no negative in the real test data.

---

Added by: Lordxfastx

Date: 2010-04-27

Time limit: 1s-3.5s

Source limit:50000B

Languages: All except: TECS

Resource: Own problem. Description by Lambda

## SPOJ Problem Set (classical)

### 6622. Islands and Hotel Chains

#### Problem code: HCHAINS

In Croatia there are  $N$  small islands. For the purposes of further tourism development, the government has decided to build exactly one hotel on each island. The government has contracts with two hotel chains: let's call them A and B. Unfortunately, there is a problem since each hotel chain wants to build as many hotels as possible.

Thus, the following agreement has been made: the hotels will be built such that, for each horizontal or vertical line (that is, if we imagine the problem in the 2D coordinate system, for each line with the equation  $y = c$  or  $x = c$ ), the absolute difference between the number of hotels (on that line) of the chain A and the number of hotels (on that line) of the chain B is at most 1.

Write a program that will, for each small island, determine the hotel chain (A or B) which will build the hotel on that island, such that the upper agreement holds.

#### Input

In the first line of input there is an integer  $T$ , the number of test cases.

For each test case, in the first line there is an integer  $N$ , the number of islands.

In the next line there are eight integers:  $X(1)$ ,  $Y(1)$ ,  $A_x$ ,  $B_x$ ,  $M_x$ ,  $A_y$ ,  $B_y$ ,  $M_y$ ; each from the interval  $[1, 100\,000]$ , except for  $X(1)$  and  $Y(1)$  which are from the interval  $[0, M_x-1]$  and  $[0, M_y-1]$ , respectively.

2D coordinates of the  $i$ -th island (for  $2 \leq i \leq N$ ) are:

$$X(i) = (A_x * X(i-1) + B_x) \bmod M_x;$$

$$Y(i) = (A_y * Y(i-1) + B_y) \bmod M_y.$$

It is guaranteed that no two islands will have the same position and the solution, not necessarily unique, will always exist.

**Note:** Author's solution doesn't depend on properties of pseudo-random generator.

Data set is divided into 2 parts:

First part:  $1 \leq T \leq 100$ ,  $1 \leq N \leq 5000$

Second part:  $1 \leq T \leq 10$ ,  $1 \leq N \leq 100\,000$

#### Output

For each test case, output in a separate line a string of size  $N$ , containing only the letters A and B. The  $i$ -th letter of the string denotes the hotel chain which will build the hotel on the  $i$ -th island.

### Example

**Input:**

1  
10  
2 4 8 2 5 6 9 5

**Output:**

AAAABBBBBBA

*The points in this example are:*

2 4  
3 3  
1 2  
0 1  
2 0  
3 4  
1 3  
0 2  
2 1  
3 0

---

Added by: Ivan Katanić

Date: 2010-05-07

Time limit: 4s

Source  
limit: 50000B

Languages: All except: TECS

Resource: derived from the problem of International Mathematical Olympiad. prepared by I.  
Katanić, A. S. Kurdija and S. Glavina

## SPOJ Problem Set (classical)

### 6624. Snowball Game

#### Problem code: SNOWGAME

Farmer John's  $N$  ( $1 \leq N \leq 10^{18}$ ) cows went for a trip around the world. Now they are at the North Pole. They decided to play a snowball game. Each of the cows made one snowball. As it is known, heavier snowballs make more harm. FJ is sure that cows' snowballs are of the same weight except one snowball, which is heavier. FJ has one balance scale. With it he can know which of two snowball groups is heavier. Snowballs get damaged when weighed, so each snowball can take part in a weighing at most  $K$  ( $1 \leq K \leq 10000$ ) times. Help FJ find the minimal number of weighings after which he can find the heaviest snowball.

#### Input

The only line of input file contains numbers  $N$  and  $K$ .

#### Output

The only line of output file contains minimum number of weighings.

#### Example

**Input :**

19 2

**Output :**

3

---

Added by: Hayk

Date: 2010-05-07

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: RAU School Contest 2010 (Own task)

## SPOJ Problem Set (acm)

### 6647. Tu+’ giác đe.p

#### Problem code: NICEQUAD

Có  $N$  điểm tọa độ nguyên trên mặt phẳng, một tứ giác  $ABCD$  với 4 đỉnh trong  $N$  điểm trên đồ thị là đẹp nếu  $A_x > 0$  và  $A_y > 0$ ;  $B_x > 0$  và  $B_y < 0$ ;  $C_x < 0$  và  $C_y < 0$ ;  $D_x < 0$  và  $D_y > 0$ ;  $ABCD$  có diện tích nguyên. Nhiệm vụ của bạn là đếm tất cả các cách chọn 4 đỉnh tạo nên tứ giác đẹp.

#### Dữ liệu đầu vào

- Dòng đầu tiên là số bộ test  $T$  ( $T < 11$ ).
- $T$  nhóm dòng tiếp theo, mỗi nhóm dòng gồm số điểm  $N$  ( $N < 30001$ ), sau đó là  $N$  dòng, mỗi dòng gồm tọa độ 1 điểm  $(x, y)$  ( $-3000 < x, y < 30000$ ).

#### Kết quả

Ghi trên  $T$  dòng, mỗi dòng là kết quả tổng ứng với từng bộ test.

#### Ví dụ.

Dữ liệu đầu vào:

```
1
6
1 1
2 2
-1 -1
-2 2
2 -1
-3 -4
```

Kết quả

```
2
```

---

Added by: Tran Hai Dang

Date: 2010-05-14

Time limit: 1s

Source limit: 50000B

Languages: All except: TCL SCALA ERL TECS JS

Resource: Codechef MAY 2010



## SPOJ Problem Set (classical)

### 6665. Easy Longest Common Substring

#### Problem code: ELCS

In this problem, a string only consists of lowercase letters.

Substring, is a consecutive sequence of characters occurrences at least once in a string.

Common substring means a substring of two strings.

After getting TLE on LCS and LCS2, lqp18\_31 felt really depressed. So he came up with an interesting idea. He want to modify the definition of LCS and call it ELCS.

ELCS: for two given strings  $s1[0...n-1]$  and  $s2[0...m-1]$ , the ELCS of them is a string  $p[0...k-1]$   $k \leq \min(n,m)$  so that  $s1[i]=s2[i]=p[i]$  ( for  $0 \leq i < k$  ) and  $s1[k] \neq s2[k]$  or  $k=n$  or  $k=m$  .

Now your task is easy.

You are given  $N$  strings and  $Q$  queries.

Each query consists two intergers  $a$  and  $b$ . You must answer the length of the ELCS of the  $a$ -th string and  $b$ -th string.

#### Input

Firtst line consists one interger  $N$ .

Next  $N$  lines consist  $N$  strings.

Next one line consists one interger  $Q$ .

Next  $Q$  lines consist two intergers  $a$  and  $b$ . ( $0 \leq a, b < N$ )

30% of the testdata :  $N \leq 100$   $Q \leq 10000$   $\text{length}(\text{string}[i]) \leq 100$

100% of the testdata : the number of total characters  $\leq 500000$   $N \leq 100000$   $Q \leq 100000$

#### Output

$Q$  lines. Each line consists the length of the ELCS of the  $a$ -th string and  $b$ -th string

#### Example

Input:5dyljq1qpwsjzt30 11 20 2Output:010

---

Added by: ???

Date: 2010-05-18

Time limit: 1.5s

Source limit:50000B

Languages: All except: TECS

Resource: my own problem

## SPOJ Problem Set (classical)

### 6678. Load Testing

**Problem code: GCJ101C**

#### Problem

Now that you have won Code Jam and been hired by Google as a software engineer, you have been assigned to work on their wildly popular programming contest website.

Google is expecting a lot of participants (**P**) in Code Jam next year, and they want to make sure that the site can support that many people at the same time. During Code Jam 2010 you learned that the site could support at least **L** people at a time without any errors, but you also know that the site can't yet support **P** people.

To determine how many more machines you'll need, you want to know within a factor of **C** how many people the site can support. This means that there is an integer **a** such that you know the site can support **a** people, but you know the site can't support **a \* C** people.

You can run a series of *load tests*, each of which will determine whether the site can support at least **X** people for some integer value of **X** that you choose. If you pick an optimal strategy, choosing what tests to run based on the results of previous tests, how many load tests do you need in the worst case?

#### Input

The first line of the input gives the number of test cases, **T**. **T** lines follow, each of which contains space-separated integers **L**, **P** and **C** in that order.

#### Output

For each test case, output one line containing "Case #x: y", where x is the case number (starting from 1) and y is the number of load tests you need to run in the worst case before knowing within a factor of **C** how many people the site can support.

#### Limits

$1 \leq T \leq 1000$ .

$2 \leq C \leq 10$ .

**L**, **P** and **C** are all integers.

#### Small dataset

$1 \leq L < P \leq 10^3$ .

## Large dataset

$1 \leq L < P \leq 10^9$ .

### Input

```
4
50 700 2
19 57 3
1 1000 2
24 97 2
```

### Output

```
Case #1: 2
Case #2: 0
Case #3: 4
Case #4: 2
```

## Explanation

In Case #2, we already know that the site can support between 19 and 57 people. Since those are a factor of 3 apart, we don't need to do any testing.

In Case #4, we can test 48; but if the site can support 48 people, we need more testing, because  $48 * 2 < 97$ . We could test 49; but if the site can't support 49 people, we need more testing, because  $24 * 2 < 49$ . So we need two tests.

---

Added by: Kumar Anurag  
Date: 2010-05-23  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: Google Code Jam 2010 Round 1C

## SPOJ Problem Set (challenge)

### 6690. A - Comparison Expressions

#### Problem code: BOCOMP

##### PROBLEM A

##### COMPARISON EXPRESSIONS

Automated Compilers Manufacture, is developing a new, intelligent compiler. One of the problems its scientists are facing is how to determine whether two expressions are equivalent. An expression consists of one or more alphabetic lowercase letters, representing *variables*, separated by addition and multiplication signs, respectively + and \*, totally parenthesized. Recursively, an expression is either a variable, or a string of the form  $(E1 + E2)$  or  $(E1 * E2)$ , where E1 and E2 are both expressions. Examples of expressions: a, (a+b),  $((a*b)*b)$ . Examples of non-expressions: ab,  $a*(b+c)$ .

Two expressions are *equivalent* if, for every integer assignment to their variables, both expressions assume the same value. For example,  $((a+b)*c)$  and  $((b*c)+(c*a))$  are equivalent, whereas  $(a+(b*c))$  and  $((a+b)*c)$  are not equivalent. Your task is to write a program that decides whether two given expressions are equivalent.

##### Input

The input contains several test cases, each case consists of one line, containing two expressions separated by precisely one space. The variables of the expressions are represented by lowercase alphabetic letters. The number of occurrences of variables in an expression is at most 20 (for example,  $((a+b)*a)$  has three occurrences of variables). Thus, an expressions consists of at most 77 characters, including variables, parentheses, plus and multiplication signs. The end of the input is indicated by a line containing only one zero.

##### Output

For each test case in the input, your program must print a single line, containing one single character, a Y if the two expressions are equivalent, an N otherwise.

##### Sample Input

```
(a+(b*c)) ((a+b)*c)
((a+b)*c) ((c*b)+(a*c))
0
```

##### Sample Output

N

Y

---

Added by: Alvaro

Date: 2010-05-25

Time limit: 10s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 JAVA

## SPOJ Problem Set (classical)

### 6691. Picking Up Chicks

#### Problem code: GCJ101BB

A flock of chickens are running east along a straight, narrow road. Each one is running with its own constant speed. Whenever a chick catches up to the one in front of it, it has to slow down and follow at the speed of the other chick. You are in a mobile crane behind the flock, chasing the chicks towards the barn at the end of the road. The arm of the crane allows you to pick up any chick momentarily, let the chick behind it pass underneath and place the picked up chick back down. This operation takes no time and can only be performed on a pair of chicks that are immediately next to each other, even if 3 or more chicks are in a row, one after the other.

Given the initial locations ( $X_i$ ) at time 0 and natural speeds ( $V_i$ ) of the chicks, as well as the location of the barn ( $B$ ), what is the minimum number of swaps you need to perform with your crane in order to have at least  $K$  of the  $N$  chicks arrive at the barn no later than time  $T$ ?

You may think of the chicks as points moving along a line. Even if 3 or more chicks are at the same location, next to each other, picking up one of them will only let one of the other two pass through. Any swap is instantaneous, which means that you may perform multiple swaps at the same time, but each one will count as a separate swap.

#### Input

The first line of the input gives the number of test cases,  $C$ .  $C$  test cases follow. Each test case starts with 4 integers on a line --  $N, K, B$  and  $T$ . The next line contains the  $N$  different integers  $X_i$ , in increasing order. The line after that contains the  $N$  integers  $V_i$ . All distances are in meters; all speeds are in meters per second; all times are in seconds.

#### Output

For each test case, output one line containing "Case #x:S", where  $x$  is the case number (starting from 1) and  $S$  is the smallest number of required swaps, or the word "IMPOSSIBLE".

#### Limits

$1 \leq C \leq 100$ ;  
 $1 \leq B \leq 1,000,000,000$ ;  
 $1 \leq T \leq 1,000$ ;  
 $0 \leq X_i < B$ ;  
 $1 \leq V_i \leq 100$ ;  
 $1 \leq N \leq 50$ ;  
 $0 \leq K \leq N$ ;

All the  $X_i$ 's will be distinct and in increasing order.

## Example

**Input :**

35 3 10 50 2 5 6 71 1 1 1 45 3 10 50 2 3 5 72 1 1 1 45 3 10 50 2 3 4 72 1 1 1 4

**Output :**

Case #1: 0Case #2: 2Case #3: IMPOSSIBLE

---

Added by: Mohammad Kotb

Date: 2010-05-25

Time limit: 1s

Source limit:50000B

Languages: All except: TECS JS

Resource: Google Code Jam 2010



## **SPOJ Problem Set (challenge)**

### **6692. B - Esperanto Lessons**

#### **Problem code: BOLESSON**

##### **Problem B**

##### **Esperanto Lessons**

In a Latin American high school the directors had decided to implement esperanto lessons, because they have observed many of their students started studying the universal language on their own. Because of this, all kids have really different levels before the courses are implemented. The directors decided to implement two levels: basic and advanced. Because of bureaucracy, they cannot put students of different divisions in the same English course. Also, to be fair, the basic and advanced levels have to be equal among all divisions of the school.

Therefore, each division will be partitioned in two subgroups, one for the basic level and one for the advanced level (note that it is possible that a division does not contain any students in one of the levels). To determine the levels, an Esperanto test has been taken by all students of all division, each getting a grade between 0 and 1000, inclusive. To accomplish their mentioned goals, the directors have decided that all students with a score greater than or equal to  $T$  will be assigned the advanced level and all students with a score less than  $T$  will be assigned the basic level.

However, they cannot decide on the best value of  $T$ . They decided to choose the value that better splits all divisions. For this, they have come up with a metric: They want the value of  $T$  that minimizes the accumulated difference. That is, the sum of the difference of the number of students in the two groups (basic and advanced) within each division.

##### **Input**

Each test case will be given in several lines. The first line contains a single integer  $N$  ( $1 \leq N \leq 10^6$ ), the number of divisions in the school.  $2N$  lines follow, with each division being described in 2 consecutive lines. The first line of each group of two contain a single integer  $K$  ( $1 \leq K \leq 10^6$ ) the number of people on the division. The second line contains  $K$  integers separated by single spaces with the scores of each of the students in the division. The scores will all be between 0 and 1000, inclusive. Total number of students within each test case (that is, the sum of the values of all  $K$  lines) will not be greater than  $10^6$ .

##### **Output**

For each test case, output a single line with a single integer representing the value of the accumulated difference if  $T$  is chosen optimally.

##### **Sample Input**

2

2

1 2

2

3 4

2

2

1 4

2

2 3

3

4

1 10 100 1000

3

5 55 555

5

4 16 64 256 1000

1

4

500 500 500 500

-1

### **Sample Output**

2

0

2

4

---

Added by: Alvaro  
Date: 2010-05-25  
Time limit: 1s  
Source limit:50000B  
Languages: C C++ 4.0.0-8 C++ 4.3.2 JAVA

## SPOJ Problem Set (challenge)

### 6693. C - Karaoke

#### Problem code: BOKO

##### PROBLEM C

##### KARAOKE

"But I sing awfully!" - Gonzo kept saying. "Come on! Nobody cares, it just for fun!" - was the common reply of his friends. "And we'll give you all our support!". But Gonzo was not convinced. Although he was an accomplished shower singer, he didn't like to do it in public. He had played karaoke games before and his problems were always the same: he could pronounce the words and keep a note very well, but typically it was not the right one, and not at the correct time. That's why in these games his scores were always poor.

But there was something in his pocket to save the day. He had a friend who just came from a programming contest and had given him a pendrive with the solution: A Corrector for Music (ACM), a program that can adjust the notes that the game detects, so that he could achieve the a better score. Gonzo was relieved. For once he wouldn't be the worst singer of the group. Now he had just to use the program properly. The karaoke game displays a screen with several horizontal bars, representing words of the song, at different heights over a time axis. The y-coordinate of each bar indicates the *pitch* of that word. This is, the note that the game expects to detect from the singer. The game receives the voice of the singer from the microphone, and detects the pitch and the time interval where the note was detected. By comparison with the original song, the game displays a new set of horizontal bars in the same graph of the originals, and calculates the score according to the following rules:

- \* The singer starts the game with 0 points.
- \* If the song pitch and the singer pitch coincides, the singer wins 100 points by each second that the coincidence continues.
- \* If the song pitch and the singer pitch differ, the singer loses the absolute difference between the pitches each second that such difference exists.
- \* If there is no song pitch, but the singer sings; or inversely, if there is a song pitch, but the singer doesn't make a sound, the singer loses 100 points each second that this happens.
- \* While there is no song pitch, and no input from the microphone, the score remains the same.

ACM modifies the pitch of all the singer words by adding an integer to all of them. There is no possibility of modifying just an specific part of the singer's notes. The pitch is always a positive number. If by any chance a pitch number drops to zero or less, the game interprets that no sound has been received. The program can also delay the time when the song begins or the time when the singer's voice begins to be read, by adding an integer number of seconds in order to better adjust the intervals. The figure shows an example with the song words (solid lines) and the singer's words (dashed lines).

Figura1

You will receive the details of the song that is stored in the game, and the words detected by the microphone. With that information you must determine the maximum possible score that can be obtained by adjusting the pitch of the singer's words, and delaying the song or the voice.

### Input

The input contains several test cases. The first line of a test case contains one integer  $N$  indicating the number of words that are included in the song ( $1 \leq N \leq 200$ ). Each of the next  $N$  lines contain six integers  $s_{i1}$ ,  $f_{i1}$ ,  $p_{i1}$ ,  $s_{i2}$ ,  $f_{i2}$  and  $p_{i2}$ . The first three of those integers represent the continuous interval of time  $[s_{i1}, f_{i1})$ , where the word  $i$  must be sung with pitch  $p_{i1}$ . The following three integers represent the continuous interval  $[s_{i2}, f_{i2})$ , where the word  $i$  of the singer is detected with pitch  $p_{i2}$ . For all cases,  $0 < s_{i1} < f_{i1}$ ,  $0 < s_{i2} < f_{i2}$ ,  $20 < p_{i1}$ ,  $p_{i2} < 120$ . The end of input is indicated by a line containing only one zero.

### Output

For each test case in the input, your program must print a single line, containing the maximum score that can be achieved in the game by using the ACM program.

### Sample Input

```
1
1 4 60 6 9 70
1
1 4 60 6 8 70
2
0 2 50 1 3 40
3 6 80 4 7 60
0
```

### Sample Output

```
300
100
280
```

---

Added by: Alvaro  
Date: 2010-05-25  
Time limit: 10s  
Source limit: 50000B  
Languages: C C++ 4.0.0-8 JAVA

## SPOJ Problem Set (challenge)

### 6694. D - Playing with Marbles

#### Problem code: BOMARBLE

##### PROBLEM D

##### PLAYING WITH MARBLES

Pablo was assigned in his class to construct pentagons inside pentagons with marbles but he doesn't know how many marbles he will need. He knows that for one pentagon he needs 5 marbles

Imagen2

The only way he knows to insert a second pentagon is putting a marble in the middle of each segment and drawing three lines as shown. He puts a marble in the intersecting lines and removes them. To insert a third pentagon inside he first divides all segments in two including the ones that are not needed, and repeats the procedure. Drawing a second pentagon will require 12 marbles. A third pentagon will require 22 marbles. Given the information of how many pentagons will be created, write a program to calculate the number of marbles needed.

##### Input

The input contains several test cases. Each test case contains one integer  $N$  indicating the number of pentagons to create ( $1 \leq N \leq 10^3$ ). The end of input is indicated by a line containing only one zero.

##### Output

For each test case in the input, your program must print a single line, containing one single integer, the number of marbles required.

##### Sample Input

1  
2  
3  
0

##### Sample Output

5  
12  
22

---

Added by: Alvaro  
Date: 2010-05-25  
Time limit: 1s  
Source limit:50000B  
Languages: C C++ 4.0.0-8 C++ 4.3.2 JAVA

## SPOJ Problem Set (challenge)

### 6695. E - Publish or Perish

#### Problem code: BOPERISH

##### PROBLEM E

##### PUBLISH OF PERISH

"Publish or perish" is the academic life's fundamental motto. It refers to the fact that publishing your work frequently is the only way to guarantee access to research funds, bright students and career advances. But publishing is not enough. It is necessary that your work is *referenced* (or *cited*). That is, your papers must be mentioned as source of information in other people's publications, to attest the quality and relevance of your research. The more citations a paper receives from other authors, the more it is considered influential.

In 2005 Jorge E. Hirsch, a physicist at the University of California at San Diego, proposed a way to evaluate the scientific impact of a researcher, based on the citations his or her papers have received. The *h-index*, as Hirsch's proposal became known, is a number based on the set of a researcher's most cited papers. It is defined in Hirsch's own words as: A scientist has index  $h$  if  $h$  of his  $N_p$  papers have at least  $h$  citations each, and the other  $(N_p - h)$  papers have at most  $h$  citations each.

Albert Einstein, for example, published 319 papers in scientific journals and has an  $h$ -index equal to 46. It means 46 of his papers have received 46 or more citations each, and all of his remaining 273 papers have 46 citations or less each. Given the information of how many citations each paper from a given researcher has received, write a program to calculate that researcher's  $h$ -index.

##### Input

The input contains several test cases. The first line of a test case contains one integer  $N$  indicating the number of papers a researcher has published ( $1 \leq N \leq 10^3$ ). The second line contains a list of  $N$  integers  $M_i$ , separated by one space, representing the number of citations each of the  $N$  papers from that author has received ( $0 \leq M_i \leq 10^3$ , for  $1 \leq i \leq N$ ). The end of input is indicated by a line containing only one zero.

##### Output

For each test case in the input, your program must print a single line, containing one single integer, the  $h$ -index for the given list of citations.

##### Sample Input

4

1003 1 200 2



10

1 1 1 0 1 1 0 1 1 1

7

6 5 4 3 2 1 0

0

### **Sample Output**

2

1

3

---

Added by: Alvaro

Date: 2010-05-25

Time limit: 1s

Source limit:50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2 JAVA

## SPOJ Problem Set (classical)

### 6700. Make it Smooth

#### Problem code: GCJ101AB

You have a one-dimensional array of  $N$  pixels. Each pixel has a value, represented by a number between 0 and 255, inclusive. The distance between two pixels is the absolute difference of their numbers.

You can perform each of the following operations zero or more times:

1. With cost  $D$ , delete any pixel, so its original neighbors become neighboring pixels.
2. With cost  $I$ , insert one pixel of any value into any position - either between two existing pixels, or before the first pixel, or after the last pixel.
3. You can change the value of any pixel. The cost is the absolute difference of the old value of the pixel and the new value of the pixel.

The array is smooth if any neighboring pixels have distance at most  $M$ . Find the minimum possible cost of a sequence of operations that makes the array smooth.

Note: The empty array - the array containing no pixels - is considered to be smooth.

#### Input

The first line of the input gives the number of test cases,  $T$ .  $T$  test cases follow, each with two lines. The first line is in the form " $D\ I\ M\ N$ ", the next line contains  $N$  numbers  $a_i$ : the values of the pixels from left to the right.

#### Output

For each test case, output one line containing "Case #x: y", where x is the case number (starting from 1), and y is the minimum cost to make the input array smooth.

#### Limits

All the numbers in the input are integers.

$1 \leq T \leq 100$

$0 \leq D, I, M, a_i \leq 255$

$1 \leq N \leq 100$

#### Example

Input :

```
2
6 6 2 3
1 7 5
100 1 5 3
1 50 7
```

**Output:**

Case #1: 4

Case #2: 17

---

Added by: Ruslan Sennov

Date: 2010-05-26

Time limit: 30s

Source limit: 50000B

Languages: All except: TECS

Resource: Google Code Jam 2010

## SPOJ Problem Set (classical)

### 6706. Making Chess Boards

#### Problem code: CT101CC

The chess board industry has fallen on hard times and needs your help. It is a little-known fact that chess boards are made from the bark of the extremely rare Croatian Chess Board tree, (*Biggus Mobydiccus*). The bark of that tree is stripped and unwrapped into a huge rectangular sheet of chess board material. The rectangle is a grid of black and white squares.

Your task is to make as many large square chess boards as possible. A chess board is a piece of the bark that is a square, with sides parallel to the sides of the bark rectangle, with cells colored in the pattern of a chess board (no two cells of the same color can share an edge).

Each time you cut out a chess board, you must choose the largest possible chess board left in the sheet. If there are several such boards, pick the topmost one. If there is still a tie, pick the leftmost one. Continue cutting out chess boards until there is no bark left. You may need to go as far as cutting out 1-by-1 mini chess boards.

Here is an example showing the bark of a Chess Board tree and the first few chess boards that will be cut out of it.

#### Input

The first line of the input gives the number of test cases, **T**. **T** test cases follow. Each one starts with a line containing the dimensions of the bark grid, **M** and **N**. **N** will always be a multiple of 4. The next **M** lines will each contain an (**N**/4)-character hexadecimal integer, representing a row of the bark grid. The binary representation of these integers will give you a strings of **N** bits, one for each row. Zeros represent black squares; ones represent white squares of the grid. The rows are given in the input from top to bottom. In each row, the most-significant bit of the hexadecimal integer corresponds to the leftmost cell in that row.

#### Output

For each test case, output one line containing "Case #x: **K**", where x is the case number (starting from 1) and **K** is the number of different chess board sizes that you can cut out by following the procedure described above. The next **K** lines should contain two integers each -- the size of the chess board (from largest to smallest) and the number of chess boards of that size that you can cut out.

#### Limits

$1 \leq T \leq 100$ ;

**N** will be divisible by 4;

Each hexadecimal integer will contain exactly **N**/4 characters.

Only the characters 0-9 and A-F will be used.

The input file will be at most 200kB in size.

## Example

**Input:** 4 15 20 55555 FFAAA 2AAD5 D552A 2AAD5 D542A 4AD4D B52B2 52AAD AD552 AA52D AAAAA 5AA55 A55AA 5AA55 4 4 0 0 0 0 4 4 3 3 C C 4 4 6 9 9 **Output:** Case #1: 5 6 2 4 3 3 7 2 15 1 57 Case #2: 1 1 16 Case #3: 2 2 1 1 12 Case #4: 1 2 4

---

Added by: Phan Công Minh  
Date: 2010-05-28  
Time limit: 0s-10s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: Google Code Jam 2010

## SPOJ Problem Set (classical)

### 6709. Multiplying by Rotation

#### Problem code: MBR

Multiplication of natural numbers in general is a cumbersome operation. In some cases however the product can be obtained by moving the last digit to the front.

Example:  $179487 * 4 = 717948$

Of course this property depends on the numbersystem you use, in the above example we used the decimal representation. In base 9 we have a shorter example:

$17 * 4 = 71$  (base 9)

as  $(9 * 1 + 7) * 4 = 7 * 9 + 1$

#### Input

The input for your program is a textfile. Each line consists of three numbers separated by a space: the base ( $\leq 36$ ) of the number system, the least significant digit of the first factor, and the second factor. This second factor is one digit only hence less than the base. The input file ends with the standard end-of-file marker.

All Numbers in input are greater than 1 and will fit in the standard "int" data type. For base  $> 10$  you can assume the digits to be 'A' ... 'Z'.

Note: Numbers in Input may or may not be expressed using the above digits (refer example)

#### Output

Your program determines for each input line the number of digits of the smallest first factor with the rotamultproperty. The output-file is also a textfile. Each line contains the answer for the corresponding input line.

#### Example

##### Input

10 7 4  
9 7 4  
17 14 12  
17 E C

##### Output:

6  
2  
4  
4

The Last two inputs are actually the same.

---

Added by: SALVO  
Date: 2010-05-29  
Time limit: 1s  
Source limit:50000B  
Languages: All except: TECS  
Resource: UVA (own input)

## SPOJ Problem Set (classical)

### 6711. Transform a sequence

#### Problem code: BLOCK

An integer sequence is called **block** iff it is made of two identical and neighboring sequences. For example, (3, 3) and (5, 2, 5, 2) are blocks, while (9, 6, 6, 9) and (1, 1, 1) are not blocks.

An integer sequence is called **non-decreasing** iff its each element (except the last one) is less than or equal to the next one. A sequence containing one or zero elements is also non-decreasing.

You are given an integer sequence and you are to transform it into a **non-decreasing** sequence by multiple using of two types of operations:

**Type 1:** removing a block from the sequence (if that block is a consecutive subsequence);

**Type 2:** inserting a block into the sequence (so that it becomes a consecutive subsequence).

In all of the test data there will be at least one solution.

#### Input

In the first line there is an integer  $N$  ( $3 \leq N \leq 40$ ), the size of the given sequence.

In the next line there are  $N$  space-separated integers (of size 0 - 100), the elements of the sequence (in order).

#### Output

Output at most 2340 operations.

For each operation, write two or three lines (depending on the type of operation). In the first line write the type of the operation (1 or 2).

If the type of the operation is 1 (removing the block), in the next line write the two numbers: positions in the sequence of the first and the last element of the block you are removing.

If the type of the operation is 2 (adding the block), in the second line write the two numbers: positions in the sequence of the first and the last element of the block after it is added to the sequence. In the next line, write all the elements of the added block (in order). The elements must be integers from the interval  $[-1000, 1000]$ .

There must be less than 1000 elements in the sequence at any time.



## Example

**Input:** 610 20 70 20 70 80**Output:**

1 2 5**Input:** 60 4 0 4 4 0**Output:** 23 44 413 8

---

Added by: Adrian Satja Kurdija

Date: 2010-05-30

Time limit: 1s

Source limit: 50000B

Languages: All except: PERL 6

Resource: derived from the problem of Polish Mathematical Olympiad

## SPOJ Problem Set (classical)

### 6717. Two Paths

#### Problem code: TWOPATHS

In Flatland there are  $N$  cities, connected by  $N-1$  two-way roads. The cities are numbered from 1 to  $N$ . You can get from one city to another moving along the roads.

The "Two Paths" company, has won a tender to repair two paths in Flatland. A path is a sequence of different cities, connected sequentially by roads. The company is allowed to choose by itself the paths to repair. The only condition they have to meet is that the two paths shouldn't cross (i.e. shouldn't have common cities).

It is known that the profit, the "Two Paths" company will get, equals the product of the lengths of the two paths. Let's consider the length of each road equals 1, and the length of a path equals the amount of roads in it. Find the maximum possible profit for the company.

#### Input

The first line contains an integer  $N$  ( $2 \leq N \leq 100000$ ), where  $N$  is the amount of cities in the country. The following  $N-1$  lines contain the information about the roads. Each line contains a pair of numbers of the cities, connected by the road  $a$  and  $b$  ( $1 \leq a, b \leq N$ )

#### Output

Output the maximum possible profit.

#### Example

Input :

4

1 2

2 3

3 4

Output :

1

---

Added by: Oleg  
Date: 2010-05-31  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: Codeforces round 14 with larger limits

## SPOJ Problem Set (classical)

### 6720. Paper Fold

#### Problem code: PFOLD

Sedrak likes making various things from paper (and he's very good at that). But after he finishes the job, his table is covered with a lot of useless creased, scrappy paper. Can he use them somehow?

Imagine a thin strip of paper marked with creases at regular intervals, which we can think of as a line segment divided into equal-length subsegments. Each crease point is marked with *asmountain, valley, or flat* to specify the orientation of the crease (?, ?, -). For example the input might look as follows:

Sedrak thinks, he can use the scrap, if it is possible to fold it using *all* the marked creases with the specified orientations. The operations he is allowed are as follows. Given a particular crease (or ?), *simple fold* rotates the portion of the segment to the left of the crease around the portion of the segment to the right of the crease. The rotation is counterclockwise for a mountain fold, and clockwise for a valley fold. When multiple layers of paper come in contact, they become inseparable; in other words, each simple fold must fold all layers of paper. For example, here is how he might fold the example above:

Notice that when a subsegment is folded, the crease turns upside-down, inverting ? <-> ?. Thus, for a simple fold to be *valid*, the inversions of the creases to the left must match the creases to the right.

#### Input

The first line of input file contains the number  $1 \leq N \leq 20$  - the number of paper scraps on Sedrak's table. Next  $N$  lines contain descriptions of paper scraps as a string containing symbols '^', 'v' and '-'. The length of a single description does not exceed  $10^6$ .

#### Output

For each description line of the input file, output a single line containing "Yes", if Sedrak can use the scrap, and "No" otherwise.

#### Example

Input:

6

-^vv-

--v-

-vv-

$^v v^$

$v-v^{^^}$

$--^v^{^^}v--$

Output:

Yes

Yes

No

Yes

No

Yes

NOTE: The last example corresponds to the scrap in the figure.

---

Added by: Narek Saribekyan

Date: 2010-06-01

Time limit: 5s

Source limit:50000B

Languages: All except: TECS

Resource: RAU School Contest 2010

## SPOJ Problem Set (classical)

### 6726. Goldbach graphs

#### Problem code: GOLDG

Christian Goldbach sent a letter to Leonhard Euler in 1742 in which he made the following conjecture:

*"Every even number greater than 4 can be written as the sum of two odd prime numbers"*

To find the solutions of Goldbach's conjecture for a given even number  $n$  ( $n > 0$ ), let us define the directed graph  $GG(n)$  (the Goldbach Graph of  $n$ ) as follows:

Nodes are prime numbers  $p$  such that  $1 < p < n$ .

For each node  $p$  there are zero or more outgoing edges, determined by the following rules:

If  $p + q = n$  and  $q = 1$ , then no outgoing edges are related to  $p$ .

If  $p + q = n$  and  $q = p_1 p_2 p_3 \dots p_k$  is the prime factorization of  $q$  (assuming  $q > 1$ ), then for each  $i = 1..k$  an edge  $p \rightarrow p_i$  is added to graph  $GG(n)$ . Notice that each  $p_i$  must be a prime number. Besides, if  $k = 1$  then  $q$  is prime and we have a solution to Goldbach's conjecture.

#### For example:

- $GG(2)$  is empty (it has zero nodes)
- $GG(4)$  has two nodes and one edge.  
nodes = {2, 3}  
edges = {2→2}
- $GG(6)$  has three nodes and three edges  
nodes = {2, 3, 5}  
edges = {2→2, 2→3, 3→3}

Notice that edge 2→2 appears twice in  $GG(6)$  because when  $p = 2$  then  $q = 4 = 2 \cdot 2$

Solutions to Goldbach's conjecture are cycles in graph  $GG(n)$  of the following types:

- Single-node cycles (Type I): a node  $p$  with only one outgoing edge  $p \rightarrow p$ .
- Double-node cycles (Type II): two nodes  $p_1$  and  $p_2$ , such that each one has a unique outgoing edge ( $p_1 \rightarrow p_2$ ,  $p_2 \rightarrow p_1$ ).

Your task is to inspect the directed graph  $GG(n)$  starting from a given node  $x$  and searching every node reachable from  $x$  for a solution to Goldbach's conjecture. The procedure is successful if a node belonging to a Type I or Type II cycle is found. In such a case the minimum distance from  $x$  to the first node of the cycle found must be reported. Otherwise it should be stated that a solution can not be found.

Your algorithm should take into account that  $GG(n)$  can contain other types of cycles besides the ones described here. Otherwise, it can run forever.

## Input

The input contains several lines each one with a different test case. Each line includes a pair of numbers representing the values  $n$  and  $x$ . You should assume that  $n$  is even and also that  $2 \leq n \leq 1000$ . Although  $0 < x < n$  is true, do not assume that  $x$  is a valid node of  $GG(n)$ . The last line of the input contains the number 0 (it is not a test case).

## Output

For each test case output a single line with one of the following:

- Solution found at distance  $D$ .
- Solution not reachable.
- $x$  is not a node!

Where  $D$  is the minimum distance from  $x$  to the solution found, as described before.

## Example

**Input :**

```
2 1
4 2
6 2
6 3
12 3
12 11
14 7
20 5
38 11
50 17
540 340
540 31
540 33
0
```

**Output :**

```
1 is not a node!
Solution found at distance 0.
Solution not reachable.
Solution found at distance 0.
Solution not reachable.
Solution not reachable.
Solution found at distance 0.
Solution found at distance 1.
Solution found at distance 2.
Solution found at distance 1.
340 is not a node!
Solution found at distance 0.
33 is not a node!
```

---

Added by: Coach UTN FRSF  
Date: 2010-06-01  
Time limit: 2s-10s  
Source limit:50000B  
Languages: All except: TECS  
Resource: Author: Pablo A. Marchetti (FRSF-UTN)



## SPOJ Problem Set (classical)

### 6731. Coeficientes

#### Problem code: COEF

The problem is to calculate the coefficients in expansion of polynomial  $(x_1 + x_2 + \dots + x_k)^n$ .

#### Input

The input will consist of a set of pairs of lines. The first line of the pair consists of two integers  $n$  and  $k$  separated with space ( $0 < K, N < 13$ ). These integers define the power of the polynomial and the amount of the variables. The second line in each pair consists of  $k$  non-negative integers  $n_1, \dots, n_k$ , where  $n_1 + \dots + n_k = n$ .

#### Output

For each input pair of lines the output line should consist of one integer, the coefficient by the monomial  $x_1^{n_1} x_2^{n_2} \dots x_k^{n_k}$  in expansion of the polynomial  $(x_1 + x_2 + \dots + x_k)^n$ .

#### Example

**Input:** 2 21 12 121 0 0 0 0 0 0 0 0 1 0

**Output:**

22

---

Added by: Coach UTN FRSF

Date: 2010-06-02

Time limit: 1s-3s

Source limit: 50000B

Languages: All except: TECS

Resource: <http://uva.onlinejudge.org/external/101/10105.html>

## SPOJ Problem Set (classical)

### 6732. Camels

#### Problem code: CT14E

Bob likes to draw camels: with a single hump, two humps, three humps, etc. He draws a camel by connecting points on a coordinate plane. Now he's drawing camels with  $t$  humps, representing them as polylines in the plane. Each polyline consists of  $n$  vertices with coordinates  $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$ . The first vertex has a coordinate  $x_1 = 1$ , the second--  $x_2 = 2$ , etc. Coordinates  $y_i$  might be any, but should satisfy the following conditions:

- there should be  $t$  humps precisely, i.e. such indexes  $j$  ( $2 \leq j \leq n - 1$ ), so that  $y_{j-1} < y_j > y_{j+1}$ ,
- there should be precisely  $t - 1$  such indexes  $j$  ( $2 \leq j \leq n - 1$ ), so that  $y_{j-1} > y_j < y_{j+1}$ ,
- no segment of a polyline should be parallel to the  $Ox$ -axis,
- all  $y_i$  are integers between 1 and 4.

For a series of his drawings of camels with  $t$  humps Bob wants to buy a notebook, but he doesn't know how many pages he will need. Output the amount of different polylines that can be drawn to represent camels with  $t$  humps for a given number  $n$ .

#### Input

The first line of input contains the number of testcases,  $N_{test}$ .

Each testcase contains a pair of integers  $n$  and  $t$  ( $3 \leq n \leq 20$ ,  $1 \leq t \leq 10$ ).

#### Output

For each testcase, output the required amount of camels with  $t$  humps.

#### Example

**Input:** 16 **Output:** 6 **Note:** In the first sample test sequences of  $y$ -coordinates for six camels are: 123421, 123431, 123432, 124321, 134321 i 234321 (each digit corresponds to one value of  $y_i$ ).

---

Added by: Phan Công Minh

Date: 2010-06-02

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: Codeforces.

## SPOJ Problem Set (classical)

### 6738. Nice Quadrangles

#### Problem code: CHEFMAY

There are  $n$  points with integer coordinates. We can form different quadrangles out of them by taking four different points and connecting them with lines. Let's call a quadrangle ABCD nice if and only if:

- $A_x > 0$  and  $A_y > 0$ ;
- $B_x > 0$  and  $B_y < 0$ ;
- $C_x < 0$  and  $C_y < 0$ ;
- $D_x < 0$  and  $D_y > 0$ ;
- ABCD has an integer area.

Your task is to count all different nice quadrangles that can be formed on the given points.

#### Input

The first line of input file contains number  $t$  - the number of test cases. Then the description of each test case follows. The first line of each test case contains number  $n$  - the number of points. Then  $n$  lines follow each consisting of two integers  $x, y$  - the coordinates of a point. No two points in the same test case coincide.

#### Constraints

$1 \leq t \leq 10$   
 $1 \leq n \leq 30000$   
 $-30000 \leq x, y \leq 30000$

#### Output

For each test case print the number of nice quadrangles that can be formed using given points.

#### Example

**Input :**

```
1
6
1 1
2 2
-1 -1
-2 2
2 -1
-3 -4
```

**Output :**

```
2
```

---

Added by: Spooky  
Date: 2010-06-04  
Time limit: 1s  
Source limit:50000B  
Languages: All except: TECS  
Resource: CodeChef May Challenge

## SPOJ Problem Set (classical)

### 6767. Sequence Function

#### Problem code: SEQFUN

We define a sequence  $\{x\}$ :  $\{x\} = \{x_0, x_1, \dots, x_{n-1}\}$  where  $x_i$  is a integer.

We have a function  $f: \{x\} \rightarrow \{x'\}$  where  $\{x\}$  is a finite sequence.

After we have a finite sequence  $\{x\}$ , we can get  $f(\{x\})$  follow these rules :

- (1). Remove all 0 in  $x$  : a 0 b 0 c d 0 e f 0 g  $\Rightarrow$  a b c d e f g
- (2). Turn 1 into 100 and -1 into -100 : a 1 b 1 -1 c d e f g  $\Rightarrow$  a 100 b 100 -100 c d e f g
- (3). Add all  $2^k$  ( $k > 1$ ) at the end of the sequence : a 2 b 8 c d e 1024 f g  $\Rightarrow$  a 2 b 8 c d e 1024 f g 2 8 1024
- (4). Add any positive odd prime  $x$  at the end of the sequence  $x-1$  times: a 3 b c 7 d e f 5 g  $\Rightarrow$  a 3 b c 7 d e f 5 g 3 3 7 7 7 7 7 5 5 5 5
- (5). For any positive composite number (not  $2^k$ ,  $k > 1$ ), we just keep it once: a 6 b 6 c d 6 e 4 4 f g  $\Rightarrow$  a 6 b c d e 4 4 f g
- (6). Keep any  $t$  ( $t < -1$ ) in the sequence.

For a example:

$\{x\} = \{-5, 1, 0, 2, 9, 16, 7, 5, 3, 2, 9, 9, -1\}$

$f(\{x\}) = \{-5, 100, 2, 9, 16, 7, 5, 3, 2, -100, 2, 2, 16, 7, 7, 7, 7, 7, 5, 5, 5, 5, 3, 3\}$

We define  $g(\{x\})$  is the sum of all the element in sequence  $x$ .

We define  $h(\{x\}) = g(f(\{x\})) - g(\{x\})$ .

A consecutive sequence of  $x$  is a sequence  $\{x_i, x_{i+1}, x_{i+2}, \dots, x_j\}$  where  $0 \leq i \leq j < n$ .

Now I will give you a sequence  $\{x\}$  .

I want to ask you the maximal  $h(\{y\})$  where  $\{y\}$  is a consecutive sequence of  $\{x\}$ .

## Input

One line consists one interger  $N$ , the length of  $\{x\}$ . ( $N \leq 10^5$ ,  $|x_i| \leq 10000$ )

Next  $N$  lines, each line consists one interger.

## Output

The maximal  $h(\{y\})$  where  $\{y\}$  is a consecutive sequence of  $\{x\}$ . (  $|h(\{y\})| \leq 2^{63}-1$  )

## Example

**Input :**

512663**Output :**

101

---

Added by: ???

Date: 2010-06-08

Time limit: 1s

Source limit:50000B

Languages: All except: TECS

Resource: ALL41 CONTEST #2

## SPOJ Problem Set (classical)

### 6772. Happy Coins

#### Problem code: HC

##### Happy Coins

A line of coins are given, some belongs to lxh while others belongs to hhb. Now the two guys are about to play a game. In every round of game, each player can select any two consecutive coins and change them into one coin, if the two coins belongs to the same person, the new one will be gained to hhb, or else it will belongs to lxh. The two guys take turns playing this game, lxh always play first. The game runs round by round. You can easily make sense that we will get only one coin at the end of game. Now the question is, suppose the two players perform optimally in the game, which person does the final coin belongs to?

#### Input

The first line of the input contains one integer  $T$ , which indicate the number of test cases.

Following each test, the first line contains an integer  $N$  ( $N \leq 10^5$ ), the number of coins. Following  $N$  lines, each line contains a name, lxh or hhb, the name of whom this coins belongs to.

#### Output

For each case, output a line contains the name of whom the final coin belongs to.

#### Sample Input

```
121xhhhb
```

#### Sample Output

```
lxh
```

---

Added by: Kumar Anurag  
Date: 2010-06-09  
Time limit: 1s  
Source limit: 50000B  
Languages: All except: TECS  
Resource: TJU

## SPOJ Problem Set (classical)

### 6779. Can you answer these queries VII

#### Problem code: GSS7

Given a tree with  $N$  ( $N \leq 100000$ ) nodes. Each node has a integer value  $x_i$  ( $|x_i| \leq 10000$ ).

You have to apply  $Q$  ( $Q \leq 100000$ ) operations:

1.  $1\ a\ b$  : answer the maximum contiguous sum (maybe empty, will always larger than or equal to 0) from the path  $a \rightarrow b$  ( inclusive ).
2.  $2\ a\ b\ c$  : change all value in the path  $a \rightarrow b$  ( inclusive ) to  $c$ .

#### Input

first line consists one integer  $N$ .

next line consists  $N$  integer  $x_i$ .

next  $N-1$  line , each consists two integer  $u, v$  , means that node  $u$  and node  $v$  are connected

next line consists 1 integer  $Q$ .

next  $Q$  line :  $1\ a\ b$  or  $2\ a\ b\ c$  .

#### Output

For each query, output one line the maximum contiguous sum.

#### Example

**Input :**

```
5
-3 -2 1 2 3
1 2
2 3
1 4
4 5
3
1 2 5
```



2 3 4 2

1 2 5

**Output :**

5

9

---

Added by: ???

Date: 2010-06-14

Time limit: 1s-4s

Source limit:50000B

Languages: All except: TECS

Resource: my own problems

## SPOJ Problem Set (classical)

### 6803. Absurd prices

#### Problem code: ABSURD

Surely you know that supermarkets, shopping centres, and indeed all kind of vendors seem to have fallen in love with the digit 9, for that digit occurs most often in the price of a product, preferably at the least significant positions. Your favourite chocolate bar might cost 99 cents, just right to be able to advertise that it costs less than 1 euro. Your new bicycle might cost 499.98 euros, which, of course, is less than 500 euros.

While such comparisons are mathematically sound, they seem to impose a certain amount of stupidity on the customer. Moreover, who wants to carry home those annoying small coins you get back as change?

Fortunately, the FIFA has not adopted this weird pricing scheme: a ticket for the final in the first category for example costs 900 dollar, in the second category 600 dollar and in the third category 400 dollar. These prices may only be regarded weird for other reasons.

We want to distinguish between **absurd** prices like 99 cents, 499.98 euros, etc. and normal prices. To measure the absurdity of a positive integer, do the following:

- Eliminate all trailing zeros, i.e., those in the least significant positions, from the number. You now have a positive integer, say  $x$ , with a non-zero digit  $d$  at its end.
- Count the number of digits, say  $a$ , of the number  $x$ .
- if  $d=5$  the absurdity of the number is  $2 * a - 1$
- otherwise, the absurdity of the number is  $2 * a$

For example, the absurdity of 350 is 3 and the absurdity of 900900 is 8. Using the measure of absurdity, we can define what we call an absurd price: A price  $c$  is absurd if and only if the closed interval  $[0.95 * c, 1.05 * c]$  contains an integer  $e$  such that the absurdity of  $e$  is less than the absurdity of  $c$ . Given a price in cents, go ahead and tell whether it is absurd!

#### Input

The first line of the input consists of the number  $t$  of test cases to follow. Each test case is specified by one line containing an integer  $c$ . You may assume that  $1 \leq c \leq 10^9$ .

#### Output

For each test case output if  $c$  is absurd or not. Adhere to the format shown in the sample output.

#### Example

Input :

```
4
99
49998
90000
```

970000000

**Output :**

absurd  
absurd  
not absurd  
absurd

---

Added by: Adrian Kuegel

Date: 2010-06-18

Time limit: 1s

Source  
limit: 50000B

Languages: All except: TECS

Resource: German Collegiate Programming Contest 2010 (Authors: Walter Guttman/Adrian Kuegel)

## SPOJ Problem Set (classical)

### 6804. Cheating or Not

#### Problem code: CHEATING

For the organizers of a soccer world championship the final draw is a very delicate job. It determines the compositions of the groups for the first stage of the tournament and indirectly also the possible matches in the knockout stage. The importance lies in the fact that the success of a team might depend on the opponents it faces - and, maybe, even the winner of the tournament.

The final draw is often subject to accusations of fraud. Some teams tend to think that their group is stronger than others and therefore complain they were cheated. Your job is to provide some facts that can help convince them of the opposite.

The draw is somewhat complicated due to a number of fairness considerations. The objective is not to assign too many good teams to the same group. Also teams from the same confederation should be drawn into different groups. This is ensured by the following rules.

- There are  $g$  groups with  $m$  members each.
- The hosting nation will be seeded first in the first group.
- $g-1$  selected teams will be seeded first in the remaining groups.
- The remaining positions are drawn from  $m-1$  pots, one team from each pot per group.
- You will be told which teams belong to the same confederation and you have to ensure that no two teams of the same confederation are in the same group. For confederations with more than  $g$  teams this is impossible, so for these confederations you can ignore this rule.
- You may assume that for confederations with at most  $g$  teams, all teams of the confederation which are not seeded are in the same pot.
- Note that each team belongs to exactly one confederation and each team is either seeded or contained in exactly one pot.

We want to compute the average strength of the opponents of a given team. The strengths of the teams will be given in the input. Now you have to compute the average of the sum of the strengths of the other teams in the group of the given team. The average is evaluated over all correct draws which are assumed to have the same likelihood.

#### Input

The input starts with the number of test cases. Each test case is described as follows.

The first line contains the number of groups  $g \leq 8$  and the number of teams per group  $m \leq 4$ . A line with  $g * m$  integers follows. The  $i$ -th integer  $0 \leq s_i \leq 10000$  denotes the strength of the  $i$ -th team.

The team indices start from 0. By convention, the hosting nation is assigned number 0. The next line lists the  $g-1$  seeded teams by their numbers. Each of the  $m-1$  following lines contains  $g$  teams which are allocated to the same pot.

The next line specifies the number of confederations  $c$ .  $c$  lines follow which describe one confederation each. Each confederation description starts with the number of teams  $n_i > 0$ . Then  $n_i$  numbers with the team indices follow.

The last line contains the number  $t$  of the team, whose average group strength has to be evaluated.

## Output

Output the average of the sum of strengths of the opponents of team  $t$  in the group stage with 3 decimals on a single line.

## Example

**Input :**

```
2
2 3
1 2 3 4 5 6
1
2 5
3 4
1
6 0 1 2 3 4 5
5
2 3
1 2 3 4 5 6
1
2 5
3 4
2
2 0 5
4 1 2 3 4
5
```

**Output :**

```
6.000
6.500
```

---

Added by: Adrian Kuegel

Date: 2010-06-18

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: German Collegiate Programming Contest 2010 (Author: Stephan Ritscher)

## SPOJ Problem Set (classical)

### 6819. Yet Another Assignment Problem

#### Problem code: ASSIGN5

New term is coming. Our monitor Cathy Yin is going to make necessary preparations. Now she has  $m$  jobs to do, and  $n$  classmates are going to help her. Each job requires some classmates working on it for certain time, say the  $i$ -th classmate must work on the  $j$ -th job for  $A_{ij}$  minutes. As an OIer of great responsibility she wishes to finish all jobs as soon as possible. But a classmate can do only one job at a time, and two classmates can **not** do the same job at the same moment. For example, to decorate the classroom, Alpha must work on it for 3 minutes **plus** Beta works on it for 4 minutes, then one possible assignment will be ABABBAB, taking 7 minutes in total.

Now she is going to make a detailed schedule specifying who is doing what at each moment. Jobs are independent, i.e. they may be done in arbitrary order. Also for each job anyone can do it for arbitrarily long, but not longer than the required time  $A_{ij}$ . Anyone can be free at any time. Time for certain classmate doing certain work need **not** be consecutive.

As her friend, you are to help her to work out the schedule minimizing the time needed. (The time of this assignment itself does not count!)

#### Input

First line of the input contains two positive integers  $m, n$  ( $1 \leq m, n \leq 2000$ ), number of jobs and classmates.

$m$  lines follow, each describing a job.  $i$ -th line contains  $n$  non-negative integers ( $\leq 10^6$ ), where the  $j$ -th number is  $A_{ij}$ , meaning that the  $j$ -th classmate has to work on the  $i$ -th job for  $A_{ij}$  minutes as described above.

#### Output

First line contains single integer  $T$ , minimum time needed. Next line contains  $n$  non-negative integers ( $\leq m$ ), giving one possible schedule for the **first** minute, where the  $i$ -th number specifying the job for the  $i$ -th classmate to do, and 0 denotes that the corresponding classmate is free.

If there are multiple solutions, any one is accepted.

#### Example

**Input:** 2 22 55 1 **Output:** 71 0

#### Explanation:

Two jobs are assigned to two classmates, say Lambda and Mu. To tidy up the classroom Lambda needs to work for 2 minutes and Mu 5 minutes; and to move desks for new comers Lambda needs 5 minutes and Mu 1 minute.

One optimal schedule is:

T	Lambda	Mu
0	Tidy	Free
1	Move	Tidy
2	T	M
3	M	T
4	M	T
5	M	T
6	M	T

7 minutes in total. It is obvious that it is impossible to finish it in less than 7 minutes.

---

Added by: Tony Beta Lambda  
Date: 2010-06-20  
Time limit: 1s-5s  
Source limit:50000B  
Languages: All  
Resource: own problem

## SPOJ Problem Set (classical)

### 6823. Seller Bob

#### Problem code: CFJUN21

Last year Bob earned by selling memory sticks. During each of  $n$  days of his work one of the two following events took place:

- A customer came to Bob and asked to sell him  $a \cdot 2^x$  MB memory stick. If Bob had such a stick, he sold it and got  $2^x$  berllars.
- Bob won some programming competition and got  $a \cdot 2^x$  MB memory stick as a prize. Bob could choose whether to present this memory stick to one of his friends, or keep it.

Bob never kept more than one memory stick, as he feared to mix up their capacities, and deceive a customer unintentionally. . Now, knowing all the customers' demands and all the prizes won at programming competitions during the last  $n$  days, Bob wants to know, how much money he could have earned, if he had acted optimally.

#### Input

The first input line contains number  $n$  ( $1 \leq n \leq 5000$ ) -- amount of Bob's working days. The following  $n$  lines contain the description of the days. Line  $i$  stands for a day when a customer came to Bob to buy  $a \cdot 2^x$  MB memory stick ( $0 \leq x \leq 2000$ ). It's guaranteed that for each  $x$  there is not more than one line  $i$  with  $x$ . Line  $i$  stands for a day when Bob won  $a \cdot 2^x$  MB memory stick ( $0 \leq x \leq 2000$ ).

#### Output

Output the maximum possible earnings for Bob in berllars, that he would have had if he had known all the events beforehand. Don't forget, please, that Bob can't keep more than one memory stick at a time.

#### Example

**Input:** 7 win 10 win 5 win 3 sell 5 sell 3 win 10 sell 10

**Output:** 1056

---

Added by: Phan Công Minh

Date: 2010-06-21

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: Codeforces



## SPOJ Problem Set (classical)

### 6824. Flag

#### Problem code: CTFLAG

According to a new ISO standard, a flag of every country should have, strangely enough, a chequered field  $n \times m$ , each square should be wholly painted one of 26 colours. The following restrictions are set:

- In each row at most two different colours can be used.
- No two adjacent squares can be painted the same colour.

Pay attention, please, that in one column more than two different colours can be used.

Berland's government took a decision to introduce changes into their country's flag in accordance with the new standard, at the same time they want these changes to be minimal. By the given description of Berland's flag you should find out the minimum amount of squares that need to be painted different colour to make the flag meet the new ISO standard. You are as well to build one of the possible variants of the new Berland's flag.

#### Input

The first input line contains 2 integers  $n$  and  $m$  ( $1 \leq n, m \leq 500$ ) -- amount of rows and columns in Berland's flag respectively. Then there follows the flag's description: each of the following  $n$  lines contains  $m$  characters. Each character is a letter from  $a$  to  $z$ , and it stands for the colour of the corresponding square.

#### Output

Output the minimum amount of squares that need to be repainted to make the flag meet the new ISO standard

#### Example

**Input :**

```
3 4aaaabbbbcccc
```

**Output :** 6

---

Added by: Phan Công Minh

Date: 2010-06-21

Time limit: 0.5s-1s

Source limit: 50000B

Languages: All except: TECS

Resource: Codeforces

## SPOJ Problem Set (classical)

### 6825. Field Plan

#### Problem code: FPLAN

World Soccer Championship is coming soon and coach Yogi wants to prepare his team as well as possible. So he made up a strategy field plan for every player of the team. One plan describes a number of possible locations for the player on the field. Moreover, if Yogi wants the player to be able to move from one location  $A$  to another location  $B$  then the plan specifies the ordered pair  $(A,B)$ . He is sure that his team will win if the players run over the field from one location to another using only moves of the plan.

example image

Yogi tells every player to follow his plan and to start from a location that reaches every other location on the plan (by possibly multiple moves). However, it is quite difficult for some soccer players, simple minded as they are, to find a suitable starting location. Can you help every player to figure out the set of possible start locations?

#### Input

The first line gives the number of field plans. The input contains at most eleven field plans (what else?). Every plan starts with a line of two integers  $N$  and  $M$ , with  $1 \leq N \leq 100000$  and  $1 \leq M \leq 100000$ , giving the number of locations and the number of moves. In the following  $M$  lines a plan specifies moves  $(A,B)$  by two white space separated integers  $0 \leq A,B < N$ . The plans are separated by a blank line.

#### Output

For every plan print out all possible starting locations, sorted increasingly and one per line. If there are no possible locations to start, print **Confused**. Print a blank line after each plan output.

#### Example

**Input :**

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

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

**Output :**

```
0
```

1  
2

Confused

---

Added by: Adrian Kuegel

Date: 2010-06-21

Time limit: 10s

Source limit:50000B

Languages: All except: TECS

Resource: German Collegiate Programming Contest 2010 (Author: Christian Hundt)

## SPOJ Problem Set (classical)

### 6826. Hacking

#### Problem code: HACKING

A coach of one of the soccer world finals teams (lets call him Hugo Hacker) wants to find out secret information about an opposing team before the game. The coach of the opposing team has a website with public information about his team. Hugo suspects that also secret information is stored on the computer which hosts the website.

The website contains a form which allows to search for key words and returns a chunk of a text file which contains the key word. Hugo has found out that by entering words which cannot be found in the documents publicly available, he can exploit a bug in the search and get access to other files on the computer. He already knows the publicly available documents. However the search box has a restriction on the maximum length of a word and the characters which can be entered. Can you tell him a word which can be entered in the search box and which does not occur as a substring in the documents?

#### Input

The first line of the input consists of the number of test cases which are to follow. Each test case consists of two lines: in the first line there are three integers  $n$  ( $1 \leq n \leq 10000$ ),  $m$  ( $1 \leq m \leq 100$ ) and  $k$  ( $1 \leq k \leq 26$ ), where  $n$  is the length of the publicly available documents,  $m$  is the maximum allowed length of words which can be entered in the search box, and  $k$  specifies that the search box allows only the first  $k$  characters of the alphabet. The second line of each test case describes the publicly available documents and consists of  $n$  lower-case letters.

#### Output

For each test case in the input, print one line in the output containing a word which does not occur as a substring in the given text. The word should have at most  $m$  lower-case characters from the first  $k$  letters in the alphabet. You may assume that for each given test case, there is always at least one such word (you may print any such word).

#### Example

**Input :**

```
2
9 3 2
bbbaababb
9 3 2
aaabbabaa
```

**Output :**

```
aaa
bbb
```

---

Added by: Adrian Kuegel

Date: 2010-06-21

Time limit: 2s

Source limit:50000B

Languages: All except: TECS

Resource: German Collegiate Programming Contest 2010 (Authors: Simon Gog/Adrian Kuegel)

## SPOJ Problem Set (classical)

### 6828. Lineup

#### Problem code: LINEUP

On June 13th team Germany has its first match in the FIFA world cup against team Australia. As the coach of team Germany, it is your duty to select the lineup for the game. Given this is your first game in the cup, naturally you want to make a good impression. Therefore you'd like to play with the strongest lineup possible.

example image

You have already decided on the tactical formation you wish to use, so now you need to select the players who should fill each of the 11 positions in the team. Your assistant has selected the 11 strongest players from your squad, but this still leaves the question where to put which player.

Most players have a favoured position on the field where they are strongest, but some players are proficient in different positions. Your assistant has rated the playing strength of each of your 11 players in each of the 11 available positions in your formation, where a score of 100 means that this is an ideal position for the player and a score of 0 means that the player is not suitable for that position at all. Find the lineup which maximises the sum of the playing strengths of your players for the positions you assigned them. All positions must be occupied, however, do not put players in positions they are not proficient with (i.e. have a score of 0).

#### Input

The input consists of several test cases. The first line of input contains the number  $C$  of test cases. For each case you are given 11 lines, one for each player, where the  $i$ -th line contains 11 integer numbers  $s_{ij}$  between 0 and 100.  $s_{ij}$  describes the  $i$ -th player's strength on the  $j$ -th position. No player will be proficient in more than five different positions.

#### Output

For each test case output the maximum of the sum of player strengths over all possible lineups. Each test case result should go on a separate line. There will always be at least one valid lineup.

#### Example

Input :

```
1
100 0 0 0 0 0 0 0 0 0 0
0 80 70 70 60 0 0 0 0 0 0
0 40 90 90 40 0 0 0 0 0 0
0 40 85 85 33 0 0 0 0 0 0
0 70 60 60 85 0 0 0 0 0 0
0 0 0 0 0 95 70 60 60 0 0
0 45 0 0 0 80 90 50 70 0 0
```

```
0 0 0 0 0 40 90 90 40 70 0
0 0 0 0 0 0 50 70 85 50 0
0 0 0 0 0 0 66 60 0 80 80
0 0 0 0 0 0 50 50 0 90 88
```

**Output :**

970

---

Added by: Adrian Kuegel

Date: 2010-06-21

Time limit: 2s

Source limit:50000B

Languages: All except: TECS

Resource: German Collegiate Programming Contest 2010 (Author: Holger Frydrych)

## SPOJ Problem Set (classical)

### 6829. Polynomial

#### Problem code: POLYNOM

The number of spectators at the FIFA World Cup increases year after year. As you sell the advertisement slots during the games for the coming years, you need to come up with the price a company has to pay in order to get an advertisement slot. For this, you need a good estimate for the number of spectators in the coming games, based on the number of spectators in the past games.

Your intuition tells you that maybe the number of spectators could be modeled precisely by a polynomial of degree at most 3. The task is to check if this intuition is true.

#### Input

The input starts with a positive integer  $N$ , the number of test cases. Each test case consists of one line. The line starts with an integer  $1 \leq n \leq 500$ , followed by  $n$  integers  $x_1, \dots, x_n$  with  $0 \leq x_i \leq 50000000$  for all  $i$ , the number of spectators in past games.

#### Output

For each test case, print **YES** if there is a polynomial  $p$  (with real coefficients) of degree at most 3 such that  $p(i) = x_i$  for all  $i$ . Otherwise, print **NO**.

#### Example

**Input :**

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

**Output :**

```
YES
YES
NO
```

---

Added by: Adrian Kuegel

Date: 2010-06-21

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: German Collegiate Programming Contest 2010 (Author: Christoph Dittmann)



## SPOJ Problem Set (classical)

### 6830. Soccer Bets

#### Problem code: SBETS

The teams have finished the group stage of the FIFA World Cup and the teams that are in the round of the last sixteen are known. My boss has all of the games analyzed and bets on the whole rest of the tournament by writing the outcome of each match on a single sheet of paper. It was my job to bring his bets to the next betting office and set 1000 dollar. Being nervous with so much cash in my pockets I fell over (I am a bit clumsy) and the bets got shuffled. So I don't know if a bet corresponds to the final match or the semi-final or something else.

I do not want to disappoint my boss, so I decided to place only one bet on the winner of the tournament. Everything I know is that in each round the teams that win (a team wins if it shoots more goals than the opposing team) are in the next round, the other teams are eliminated from the tournament. This is not true for the semi-finals where the losers also play for the third place. So we have in total 16 matches.

Can you please tell me which team will win the World Cup based on the bets of my boss?

#### Input

The first line of the input is the number of test cases  $c$  ( $1 \leq c \leq 100$ ). Each test case consists of 16 lines describing the matches in random order. A match description looks as follows:  $t_1 \ t_2 \ g_1 \ g_2$ .  $t_1$  and  $t_2$  are the names of teams (abbreviated as exactly three uppercase letters),  $g_1$  and  $g_2$  ( $0 \leq g_1, g_2 \leq 10$ ;  $g_1 \neq g_2$ ) are the goals of the two teams.

#### Output

For each test case, print one line containing the team that will win the FIFA World Cup (based on the analysis of my boss which is always correct!).

#### Example

**Input :**

```
1
ITA URU 2 0
ITA IRE 1 0
ITA ARG 3 4
YUG ARG 2 3
GER CZE 1 0
ENG GER 3 4
ITA ENG 2 1
CAM COL 2 1
ENG CAM 3 2
ENG BEL 1 0
GER ARG 1 0
CZE CRC 4 1
NET GER 1 2
BRZ ARG 0 1
```

SPA YUG 1 2  
ROM IRE 4 5

**Output :**  
GER

---

Added by: Adrian Kuegel  
Date: 2010-06-21  
Time limit: 1s  
Source limit:50000B  
Languages: All except: TECS  
Resource: German Collegiate Programming Contest 2010 (Author: Tobias Werth)

## SPOJ Problem Set (classical)

### 6832. To Score or not to score

#### Problem code: TOSCORE

Robot soccer matches in the very early days were quite funny, since most of the time there wasn't any action in the game. Robots only moved to catch a ball that a robot from the other team had shot. The reason for this somewhat strange behavior was attributed to the used strategy. The robots made a map of all players from the same team and the opponents. If one player was in possession of the ball before even shooting he tried to check whether it was possible to score from the current situation. In the process he checked if there was a way for the ball to reach the goal via several other players of his team. It was possible to shoot the ball to another player if no opponent was close enough to the shooting line to catch the ball. The opponent always moved perpendicular to the shooting line and only if he was sure that he could intercept the shot. The ball always traveled three times as fast as a robot could move, i.e. the player had to be quite near the shooting line to intercept the shot.

The other part of the game was fouling another player in order to prevent the other team from reaching the goal. The rules stated that only one player could be fouled at a time, so this only happened if fouling this one player prevented the other team from scoring. Also the initial shooter may not be fouled at any time. Fouling happens almost instantly by knocking the robot out with an electromagnetic pulse, thus the distance between the two opponents does not matter and the fouling robot does not move.

example image

Let's have a look at the figure. There are four players in each team, indicated by the black and white circles. Suppose player **A** has the ball. Then only the shown shots are possible (note the directions). In all other cases a white player is near enough to intercept the shot (e.g. the direct shot from **A** to the goal). Thus in principle the black team could score. However, if player **D** is fouled the goal can no longer be scored.

Your university has decided to program a simulator for these ancient robot football matches and your task is to write the part that checks if the team in possession of the ball is able to score or not, based on the current positions of all robots. As a summary of the description above, a team may score if the ball cannot be intercepted by an opponent player and if more than one player would have to be fouled.

#### Input

The first line contains the number of testcases  $1 \leq k \leq 10$  that follow. The first line of each testcase holds the number  $n$  of players per team ( $1 \leq n \leq 20$ ). The next  $2n$  lines contain the coordinates of all players, the first  $n$  lines being the first team, the second  $n$  lines the second team. A coordinate is given as two non-negative floating point numbers separated by spaces. The first player of the first team is in possession of the ball. The coordinates of the goal follow below the two teams. You may assume that the inputs are chosen in such a way that small floating point errors do not lead to wrong results.

## Output

Output **Goal** if the first team is able to score or **No goal** if the ball can be intercepted or if fouling one player is enough to prevent the team from scoring.

## Example

### Input :

```
2
4
407.89 297.33
396.64 80.21
190.26 96.43
210.73 290.67
345.43 315.24
462.45 218.22
291.76 60.82
104.98 113.45
0 191.18
4
407.89 297.33
396.64 80.21
190.26 96.43
210.73 290.67
521.43 369.86
565.14 368.22
563.25 328.18
521.31 334.00
0 191.18
```

### Output :

```
No goal
Goal
```

---

Added by: Adrian Kuegel

Date: 2010-06-21

Time limit: 1s

Source limit:50000B

Languages: All except: TECS

Resource: German Collegiate Programming Contest 2010 (Author: Thorsten Meinl)

## SPOJ Problem Set (classical)

### 6851. Fence

#### Problem code: CT10R3B

We are looking into building a very long fence. We have already found a nice place to build it, and all that remains is to collect the materials.

From local hardware stores, we can buy unlimited numbers of wooden boards, each of which can come in a variety of different lengths. To avoid waste, we want to make sure that the total length of these boards is *exactly* equal to the length of the fence we are trying to build.

Given the length of the fence, and the possible board lengths that we can use, what is the minimum number of boards that we need to purchase in order to get exactly the right length?

*Beware:* the fence is going to be very long!

#### Input

The first line of the input file contains the number of cases, **T**. **T** test cases follow.

Each test case consists of two lines. The first line contains space-separated integers **L** and **N**. These represent the total length of the fence, and the number of different board lengths that can be purchased. The second line contains **N** space-separated integers **B**<sub>1</sub>, **B**<sub>2</sub>, ..., **B**<sub>N</sub>, representing all the possible board lengths.

#### Output

For each test case, output one line containing "Case #x: M", where x is the case number (starting from 1) and M is as follows:

- If it is possible to purchase one or more boards so that their total length is exactly equal to **L**, then M should be the minimum number of boards required to do this.
- Otherwise, M should be the string "IMPOSSIBLE".

#### Limits

$1 \leq T \leq 50$ .

$10^{10} \leq L \leq 10^{18}$ .

$1 \leq N \leq 100$ .

$1 \leq B_i \leq 100000$ .

All the **B**<sub>i</sub> values in a single test case are distinct.

## Example

**Input:** 2 100000000001 3 23 51 100 100000000001 3 100 52 22 **Output:** Case #1: 1000000004 Case #2: IMPOSSIBLE

---

Added by: Phan Công Minh

Date: 2010-06-22

Time limit: 10s

Source limit: 50000B

Languages: All except: TECS

Resource: GCJ 2010

## SPOJ Problem Set (classical)

### 6852. Fish

#### Problem code: CT16E

$n$  fish, numbered from 1 to  $n$ , live in a lake. Every day right one pair of fish meet, and the probability of each other pair meeting is the same. If two fish with indexes  $i$  and  $j$  meet, the first will eat up the second with the probability  $a_{ij}$ , and the second will eat up the first with the probability  $a_{ji} = 1 - a_{ij}$ . The described process goes on until there are at least two fish in the lake. For each fish find out the probability that it will survive to be the last in the lake.

#### Input

The first line contains integer  $n$  ( $1 \leq n \leq 18$ ) -- the amount of fish in the lake. Then there follow  $n$  lines with  $n$  real numbers each -- matrix  $a$ .  $a_{ij}$  ( $0 \leq a_{ij} \leq 1$ ) -- the probability that fish with index  $i$  eats up fish with index  $j$ . It's guaranteed that the main diagonal contains zeros only, and for other elements the following is true:  $a_{ij} = 1 - a_{ji}$ . All real numbers are given with not more than 6 characters after the decimal point.

#### Output

Output  $n$  space-separated real numbers accurate to not less than 6 decimal places. Number with index  $i$  should be equal to the probability that fish with index  $i$  will survive to be the last in the lake.

#### Example

**Input:** 50 1 1 1 10 0 0.5 0.5 0.50 0.5 0 0.5 0.50 0.5 0.5 0 0.50 0.5 0.5 0

**Output:**

1.000000 0.000000 0.000000 0.000000 0.000000

---

Added by: Phan Công Minh

Date: 2010-06-22

Time limit: 2s

Source limit: 50000B

Languages: All except: TECS

Resource: Codeforces

## SPOJ Problem Set (classical)

### 6860. Asistent

#### Problem code: ASISTENT

You are given a permutation of first  $N$  natural numbers on which you are to perform  $K$  operations of following type: given integers  $A$  and  $B$ , your task is to swap elements on positions  $A$  and  $B$  in permutation and then output permutation rank modulo  $1000\,000\,007$ .

**Note:** Difference from original task is that elements remain swapped after query.

#### Input

On first line of standard input you are given two integers ( $2 \leq N \leq 50\,000$ ,  $1 \leq K \leq 30\,000$ ), length of permutation and number of operations.

On the next line there is permutation of first  $N$  natural numbers.

In next  $K$  lines there are two integers  $A, B$  ( $1 \leq A, B \leq N$ ).

#### Output

Output permutation rank after applying each of  $K$  operations.

#### Example

**Input:** 5 31 5 4 2 31 32 32 5 **Output:** 917790

---

Added by: Ivan Katanić

Date: 2010-06-23

Time limit: 8s

Source limit: 50000B

Languages: All except: TECS

Resource: Modified task from Croatian IOI Team Selection Test



## SPOJ Problem Set (classical)

### 7099. Advanced Edit Distance

#### Problem code: ADVEDIST

The edit distance of two strings  $S$  and  $T$  is the minimum number of edit operations that need to be done to transform  $S$  into  $T$ . The valid edit operations are:

- \* Insert a single character at any position.
- \* Modify an existing character.
- \* Remove an existing character.

For example, the edit distance of "pantera" and "aorta" is 5, because the following chain of edits is valid (and there is no shorter chain):

"pantera" >>> "antera" >>> "aotera" >>> "aoera" >>> "aora" >>> "aorta".

We define the advanced edit distance in a similar way, but adding the swap of two adjacent characters as an extra valid operation. With this setting, the advanced edit distance of "pantera" and "aorta" is 4:

"pantera" >>> "antera" >>> "antra" >>> "aotra" >>> "aorta".

You need to write a program that calculates the advanced edit distance of two given words.

#### Input

The input contains several test cases. Each test case is described in a single line that contains two non-empty words, each of them of at most 1000 lowercase letters, separated by a single space. The last line of the input contains two asterisks separated by a single space and should not be processed as a test case.

#### Output

For each test case output a single line with an integer representing the advanced edit distance of the two input words.

#### Example

**Input:** pantera aortazero zero\* **\*Output:** 40

---

Added by: Pablo Ariel Heiber

Date: 2010-08-13

Time limit: 180s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2007

## SPOJ Problem Set (classical)

### 7100. Back To The Polygon

#### Problem code: BACKTPOL

A simple polygon is a polygon that does not overlap with itself. A diagonal of a simple polygon is a segment within the polygon that connects two non-consecutive vertices. A triangulation of a simple polygon of  $N$  edges is the drawing of exactly  $N - 3$  diagonals that do not touch each other anywhere, with the possible exception of their endpoints. A triangulation divides the polygon in exactly  $N - 2$  triangles that do not overlap and only touch each other along their edges.

In this problem, you are given the triangulation of a simple polygon, which means, the set of triangles in which a polygon was divided. From them, you need to reconstruct the original polygon.

#### Input

The input contains several test cases, each one described in several lines. The first line of each test case contains an integer  $N$  ( $3 \leq N \leq 500$ ), the number of edges of the original polygon. Each of the next  $N - 2$  lines describes one triangle in the triangulation of the polygon. Each triangle is given by six integers  $X_1, Y_1, X_2, Y_2, X_3$  and  $Y_3$  separated by single spaces, where  $X_i$  and  $Y_i$  are the coordinates in the  $XY$  plane of the  $i$ -th vertex of the triangle ( $-1000 \leq X_i, Y_i \leq 1000$ ). The triangles and their vertices are not given in any specific order. The last line of the input contains a single  $-1$  and should not be processed as a test case.

#### Output

For each test case output a single line with  $2N$  integers separated by single spaces. These integers must represent the coordinates in the  $XY$  plane of the vertices of the original polygon, in clockwise order. To make the output unique, the first vertex to be listed is the one with the smallest  $X$  coordinate, and if there are many of those, the one with the smallest  $Y$  coordinate among them.

#### Example

Input: 50 0 10 9 10 9 0 9 0 0 10 9 0 9 5 1330 1 1 1 1 010-1 -2 2 -2 2 -1-1 -2 0 -1 -2 3-2 3 2 3 1 20 -1 2 1 1 2-1 -2 2 -1 0 -12 1 0 -1 2 02 3 2 2 1 20 -1 -2 3 1 2-1Output: 10 0 0 9 5 13 10 9 10 00 1 1 1 1 0-2 3 2 2 1 2 2 1 2 0 0 -1 2 -2 -1 -2

---

Added by: Pablo Ariel Heiber

Date: 2010-08-13

Time limit: 1s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2007

## SPOJ Problem Set (classical)

### 7101. Charly And Nito

#### Problem code: CANDN

Charly and Nito are friends and they like to be together at a nice bar in Palermo Hollywood. About at 3 a.m. they start to feel sleepy and want to go home. They want to get home quickly so each of them uses a path that minimizes the distance to his home. However, Charly and Nito also like to walk together while they talk about the "good old times", so they want to walk together as much as possible.

Charly and Nito live in a city that can be modeled as a set of streets and junctions. Each street connects a pair of distinct junctions and can be walked in both directions. No two streets connect the same pair of junctions. Charly and Nito do not live together, and they do not live at the bar. There is at least one path from the bar to Charly's home; the same occurs with Nito's home.

Given information about the streets and junctions in the city, the locations of the bar, Charly's home and Nito's home, you must tell Charly and Nito the maximum distance that they can walk together without forcing them to walk more than the minimum distance from the bar to their respective homes. Charly and Nito also want to know how much each of them will walk alone.

#### Input

The input contains several test cases, each one described in several lines. The first line of each test case contains five integers  $J$ ,  $B$ ,  $C$ ,  $N$  and  $S$  separated by single spaces. The value  $J$  is the number of junctions in the city ( $3 \leq J \leq 5000$ ); each junction is identified by an integer number between 1 and  $J$ . The values  $B$ ,  $C$  and  $N$  are the identifiers of the junctions where the bar, Charly's home and Nito's home are located, respectively ( $1 \leq B, C, N \leq J$ ); these three junction identifiers are different. The value  $S$  is the number of streets in the city ( $2 \leq S \leq 150000$ ). Each of the next  $S$  lines contains the description of a street. Each street is described using three integers  $E1$ ,  $E2$  and  $L$  separated by single spaces, where  $E1$  and  $E2$  identify two distinct junctions that are endpoints of the street ( $1 \leq E1, E2 \leq J$ ), and  $L$  is the length of the street ( $1 \leq L \leq 10^4$ ). You may assume that each street has a different pair of endpoints, and that there exist paths from junction  $B$  to junctions  $C$  and  $N$ . The last line of the input contains the number -1 five times separated by single spaces and should not be processed as a test case.

#### Output

For each test case output a single line with three integers  $T$ ,  $C$  and  $N$  separated by single spaces, where  $T$  is the maximum distance that Charly and Nito can walk together,  $C$  is the distance that Charly walks alone, and  $N$  is the distance that Nito walks alone.

## Example

**Input:** 5 3 2 1 63 4 104 5 105 1 35 2 41 3 232 3 248 1 7 8 81 2 12 4 12 3 14 5 13 5 15 6 16 8 16 7 1 -1 -1 -1 -1 **Output:** 20 4 34 1 1

---

Added by: Pablo Ariel Heiber

Date: 2010-08-13

Time limit: 5s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2007

## SPOJ Problem Set (classical)

### 7102. Doing The Word Wrap

#### Problem code: DTWW

You are developing a visual component for a web browser. The component is known as textarea, and its main functionality is to show a given text using one or more lines. Every textarea has a linewidth  $W$ , which is the number of characters that can fit in a single line.

The text that needs to be shown is a sequence of words. The textarea must display the text using lines of  $W$  characters, without breaking any word, and placing a single space between each pair of consecutive words that are in the same line. Any number of trailing spaces may be left at the end of each line. So the behavior of the textarea is quite simple: it keeps adding words to a line until the next word does not fit; each time this occurs, a new line is started.

With the permanent growing in the amount of information that web pages must show, you have to make a smart textarea that uses as little space as possible, even when dealing with very long texts. Given a text to show and a number of lines  $L$ , you must set the linewidth  $W$  to the minimum possible value such that the text is shown using at most  $L$  lines.

#### Input

The input contains several test cases, each one described in exactly two lines. The first line of each test case contains two integers  $L$  and  $N$  separated by a single space, where  $L$  is the maximum number of lines the textarea can have ( $1 \leq L \leq 10^8$ ), and  $N$  is the number of words the text to show is made of ( $1 \leq N \leq 10^5$ ). The second line contains the text to show, formed by  $N$  non-empty words of at most 25 lowercase letters each, separated by an arbitrary number of spaces. The last line of the input contains the number -1 twice separated by a single space and should not be processed as a test case.

#### Output

For each test case output a single line with an integer  $W$  representing the minimum linewidth such that the textarea has at most  $L$  lines.

#### Example

```
Input: 1 2hello      word2 2racing club-1 -1Output:
106
```

---

Added by: Pablo Ariel Heiber

Date: 2010-08-13

Time limit: 1s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2007

## SPOJ Problem Set (classical)

### 7107. G Key

#### Problem code: GK

Leandro and Fede are traveling by train and to spend some time they decided to start playing the guitar. They want to play together some songs, but Fede's memory is not working well because he caught a little cold. To work it out, Leandro wants to show to Fede some music scores of several punk rock songs. A punk rock song is a sequence of notes, and there are twelve possible notes, divided in two groups. The first group has seven natural notes called A, B, C, D, E, F and G, while the second group has five alterations called A#, C#, D#, F# and G#. The way to draw a music score is as follows: you start with an empty one, and then you draw note by note from left to right in the same order they appear in the song. In the following picture you can see an empty music score with two lines. The symbol at the beginning of each line is called G key. Each line is divided in four groups, each group having room for four notes.

In this figure, the song "E, F, F#, G, G#, A, A#, B, C, C#, D, D#" is depicted.



Can you help Leandro writing a program for drawing punk rock songs given the sequence of notes?

#### Input

The input contains several test cases. Each test case is described in a single line that contains the number of notes  $N$  ( $1 \leq N \leq 100$ ), followed by the sequence of  $N$  notes. Each note is one of A, A#, B, C, C#, D, D#, E, F, F#, G and G#. Values in each line are separated by single spaces. The last line of the input contains a single -1 and should not be processed as a test case.

#### Output

For each test case output the music score of the input song and print a blank line after each test case (even after the last one). You have to follow the sample input and output for drawing the music scores. Every score line has the same background formed by the characters "|" (pipe) and "-" (hyphen). They differ in the borders (first and last borders are doubled), and of course in the notes they have inside. Each eighth note is drawn consecutively as in the sample, and the different heights are those shown. Alterations are preceded by a character "#" (sharp sign). There must be no trailing spaces at the end of printed lines, neither empty score lines (without notes inside).

## Example

---

Added by: Pablo Ariel Heiber

Date: 2010-08-13

Time limit: 1s

Source limit:50000B

Languages: All except: PERL 6

Resource: FCEyN UBA ICPC Selection 2007

## SPOJ Problem Set (classical)

### 7108. Heptadecimal Numbers

#### Problem code: HEPNUM

The Factory of Computer Enhanced Numbers (FCEN) has asked its Development Committee (DC) to come up with a way to handle numbers written in base 17.

As everybody knows, base 17 is very important for many scientific applications, as well as for engineering and other practical uses. Numbers in base 17 can be tough, but are kind and soft if treated appropriately.

Numbers in base 17 are written by using a set of 17 characters: digits 0 to 9 with their usual values, and uppercase letters A to G that have values from 10 to 16, respectively.

Base 17, probably because its basement on a prime number, does not require numbers to start with a non-zero digit, so each number has many representations. For instance, the decimal number 117 can be written as 6F, but also as 06F or even 00000006F.

Because of this leading-zeroes thing, heptadecimal numbers are hard to compare. As a member of the FCEN-DC, you were asked to write a program that helps in this difficult and challenging task.

#### Input

The input contains several test cases. Each test case is described in a single line that contains two non-empty strings of at most  $10^5$  heptadecimal digits, separated by a single space. The last line of the input contains two asterisks separated by a single space and should not be processed as a test case.

#### Output

For each test case output a single line with the sign "<" if the first heptadecimal number is smaller than the second one, the sign ">" if the first heptadecimal number is greater than the second one, or the sign "=" if both heptadecimal numbers are equal.

#### Example

**Input:** 006F B3B0000 0\* **\*Output:**  
<=

---

Added by: Pablo Ariel Heiber

Date: 2010-08-13

Time limit: 1s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2007



## **SPOJ Problem Set (classical)**

### **7109. Indicator of progression**

#### **Problem code: INDIPROG**

When dealing with a long task, computers often provide a progress indicator to help users estimate how much longer they will have to wait. This is especially useful when copying a large number of data files from one drive to another.

In the Institute of Computer Power Control (ICPC) are very concerned about their brand new file copier, which they think will change forever the way people copy files. While this is a great accomplishment for the engineers in ICPC, the lack of a progress indicator is threatening the future of the project and the well being of most computer users around the world!

The Supremum Principal Director Manager of ICPC has called you personally to ensure you are up for the task. The interface provided by the developing team of the file copier only gives two integers  $M$  and  $N$ .  $M$  is the number of files that have already been copied, and  $N$  is the total number of files to be copied. Using this information, you must write a module that displays the progress indicator.

The indicator must be drawn as a string of exactly 20 characters. The first  $K$  of them must be asterisks ("\*") and the rest must be hyphens ("-"). The number  $K$  must be chosen in such a way that  $K/20$  correctly approximates  $M/N$ ; this means that the distance between the two mentioned fractions is minimum. If there is more than one possible value for  $K$ , the greatest one must be chosen.

Also, for more precision, a number  $P$  without leading zeroes and followed by a percentage sign ("%") must be written on top of the described indicator. Since the goal is to represent the finished percentage, the number  $P$  must be such that  $P/100$  correctly approximates  $M/N$ , with the same policy as before. The finished percentage must be centered on top of the display. This means that if possible, the same number of display characters ("\*" or "-") must be seen to the left and to the right of the percentage; if this is not possible, exactly one extra character must be seen to the left.

#### **Input**

The input contains several test cases. Each test case is described in a single line that contains two integers  $M$  and  $N$  as explained above ( $0 \leq M \leq N \leq 10^9$  and  $N \neq 0$ ). These values are separated by a single space. The last line of the input contains the number -1 twice separated by a single space and should not be processed as a test case.

#### **Output**

For each test case output a single line with exactly 20 characters representing the mentioned display.

## Example

**Input:** 2 52 60 10-1 -1 **Output:** \*\*\*\*\*-40%-----\*\*\*\*\*--33%-----0%-----

---

Added by: Pablo Ariel Heiber

Date: 2010-08-13

Time limit: 1s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2007

## SPOJ Problem Set (classical)

### 7184. Axis of Symmetry

#### Problem code: AXIS

Given a point  $p$  and a line  $L$  on the plane, the reflection of  $p$  against  $L$  is a point  $q$  such that the segment  $pq$  is perpendicular to  $L$  and its middle point is on  $L$ . If  $p$  is on  $L$ , then  $p = q$ .

Given a set of points on the plane, an axis of symmetry is a line on the plane such that the reflection of any point of the set against that line gives a point of the set.  
In this problem you are given a set of points on the plane, and you must decide whether there exists at least one axis of symmetry or not.

#### Input

The input contains several test cases, each one described in several lines. The first line of each test case contains an integer  $N$  indicating the number of points in the set ( $3 \leq N \leq 1000$ ). Each of the next  $N$  lines describes a different point of the set using two integers  $X$  and  $Y$  separated by a single space ( $-2000 \leq X, Y \leq 2000$ ); these numbers represent the coordinates of the point in the  $XY$  plane. You may assume that no two points of each test case have the same location. The last line of the input contains a single  $-1$  and should not be processed as a test case.

#### Output

For each test case output a single line with an uppercase "Y" if there exists at least one axis of symmetry for the provided set of points, or an uppercase "N" otherwise.

#### Example

**Input:** 4 -10 010 010 1010 -104 -10 010 110 1010 -106 -1000 30 -100 20 -10 101000 30100 2010 10 -1 **Output:** YNY

---

Added by: Pablo Ariel Heiber

Date: 2010-08-19

Time limit: 6s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2008

## SPOJ Problem Set (classical)

### 7185. Bye Bye Cakes

#### Problem code: BYECAKES

John is moving to a different city and he wants to use all his perishable food before doing it, to avoid wasting. Luckily all he has now is eggs, flour, sugar and milk, so he is going to make his famous cakes and give them to his friends as a goodbye gift.

John only knows how to make an entire cake and not half a cake, a third of a cake, or any other portion. So, he will buy whatever is needed of each ingredient so that he can make an integer number of cakes and have nothing left. Of course, he wants to spend as little money as possible. You must help John to decide how much he should buy of each ingredient.

#### Input

The input contains several test cases. Each test case is described in a single line that contains eight integers E, F, S, M, E', F', S' and M' separated by single spaces. Values E and E' are numbers of eggs, F and F' are grams of flour, S and S' are grams of sugar, and M and M' are centiliters of milk. For each ingredient, X is the amount John has ( $0 \leq X \leq 1000$ ), while X' is the amount needed to make a single cake ( $1 \leq X \leq 1000$ ). The last line of the input contains the number -1 eight times separated by single spaces and should not be processed as a test case.

#### Output

For each test case output a single line with four non-negative integers separated by single spaces, representing the amount of each ingredient John needs to buy, in the same order and units as the input.

#### Example

**Input:** 2 3 4 5 1 1 1 13 6 9 0 1 2 3 4 -1 -1 -1 -1 -1 -1 -1 -1 **Output:**  
3 2 1 00 0 0 12

---

Added by: Pablo Ariel Heiber

Date: 2010-08-19

Time limit: 1s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2008

## SPOJ Problem Set (classical)

### 7186. Counting Pascal

#### Problem code: COUNTPAS

Pascal's triangle is a common figure in combinatorics. It is a triangle formed by rows of integers. The top row contains a single 1. Each new row has one element more than the previous one and is formed as follows: the leftmost and rightmost values are 1, while each of the other values is the sum of the two values above it. Here we depict the first 7 rows of the triangle.

```

      1
    1 1
  1 2 1
1 3 3 1
  1 4 6 4 1
    1 5 10 10 5 1
      1 6 15 20 15 6 1
```

Pascal's triangle is infinite, of course, and contains the value 1 an unbounded number of times. However, any other value appears a finite number of times in the triangle. In this problem you are given an integer  $K \geq 2$ . Your task is to calculate the number of values in the triangle that are different from 1 and less than or equal to  $K$ .

#### Input

The input contains several test cases. Each test case is described in a single line that contains an integer  $K$  ( $2 \leq K \leq 10^9$ ). The last line of the input contains a single -1 and should not be processed as a test case.

#### Output

For each test case output a single line with an integer indicating the number of values in Pascal's triangle that are different from 1 and less than or equal to  $K$ .

#### Example

Input :  
26-1Output : 110

---

Added by: Pablo Ariel Heiber  
Date: 2010-08-19  
Time limit: 6s  
Source limit:50000B  
Languages: All except: PERL 6 TECS  
Resource: FCEyN UBA ICPC Selection 2008

## SPOJ Problem Set (classical)

### 7187. Dinosaur Menace

#### Problem code: DINOSM

After a failed but interesting DNA project, a lot of dinosaurs spread over the lab devouring most of the staff. Jeff, a scientist that worked in the project, managed to survive by hiding in the southwest corner of the lab. Now that all dinosaurs are asleep, he is going to try to leave. The exit of the lab is located at the northeast corner.

Jeff knows that if any of the dinosaurs wakes up, he does not stand a chance, so he needs to minimize the likelihood of that happening. For that, he wants to follow a path that maximizes the minimum distance from him to a dinosaur along the path. The length of the path is of no interest to Jeff.

For this problem we consider that Jeff and the dinosaurs are points on the plane, and that Jeff's path is a continuous curve connecting the southwest and northeast corners of the lab. As we mentioned, Jeff wants to maximize the minimum distance between this curve and the position of any dinosaur.

#### Input

The input contains several test cases, each one described in several lines. The first line of each test case contains three integers  $N$ ,  $W$ , and  $H$  separated by single spaces. The value  $N$  is the number of dinosaurs in the lab ( $1 \leq N \leq 300$ ). The values  $W$  (width) and  $H$  (height) are the size of the lab on the  $x$  and  $y$  coordinates, respectively ( $2 \leq W, H \leq 10^6$ ). This means that the starting position of Jeff is at  $(0, 0)$ , while the exit of the lab is located at  $(W, H)$ . Each of the next  $N$  lines contains two integers  $X$  and  $Y$  separated by a single space, representing the coordinates of a different dinosaur ( $1 \leq X \leq W - 1$  and  $1 \leq Y \leq H - 1$ ). Note that no dinosaur is located on the border of the lab. You may assume that no two dinosaurs have the same location. The last line of the input contains the number -1 three times separated by single spaces and should not be processed as a test case.

#### Output

For each test case output a single line with the maximum possible distance to the closest dinosaur. Write the result rounded to the closest number with exactly three decimal places, using the highest in case of ties, as usual.

#### Example

**Input:** 1 2 21 13 5 41 34 11 22 5 41 34 -1 -1 -1 **Output:**  
1.0001.5811.803

---

Added by: Pablo Ariel Heiber  
Date: 2010-08-19  
Time limit: 9s  
Source limit:50000B  
Languages: All except: PERL 6 TECS  
Resource: FCEyN UBA ICPC Selection 2008



## SPOJ Problem Set (classical)

### 7188. Escape from Jail

#### Problem code: ESJAIL

Harry is currently a prisoner of the International Common Prison for Criminals (ICPC), the most secure prison in the world. It was designed by an old gamer and as such, the prison is not necessarily closed, but only an incredibly logical and fast mind can get out.

The prison is made of  $N$  chambers connected by  $M$  corridors. Each corridor connects exactly two chambers and can be traversed in any direction. Each chamber is either empty, contains a single unbreakable door, or contains a single key. No chamber contains both a door and a key. There are  $K$  doors and  $K$  keys in the whole prison. Each key opens a different door, and each door is opened by a different key. If a chamber contains a door, the corresponding key is needed to enter the chamber, regardless of which corridor was used to reach it.

Harry found the complete map of the prison, including the location of each door and each key, and wants to know how to get out that hell hole. According to the map, Harry is now in chamber number 1, and the exit is in chamber  $N$ . Given the information on the map, let Harry know if it is possible to escape or if he is doomed forever.

#### Input

The input contains several test cases, each one described in several lines. The first line of each test case contains three integers  $N$ ,  $K$ , and  $M$  separated by single spaces. The value  $N$  is the number of chambers in the prison ( $4 \leq N \leq 10^5$ ); each chamber is identified by an integer number between 1 and  $N$ . The value  $K$  is the number of doors and keys ( $1 \leq K \leq N/2$ ), while  $M$  is the number of corridors ( $1 \leq M \leq 10^5$ ). Each of the next  $K$  lines describes a door and its corresponding key using two integers  $A$  and  $B$  separated by a single space, with the following meaning: chamber  $A$  contains the key that opens the door in chamber  $B$  ( $2 \leq A, B \leq N - 1$ ). The last  $M$  lines of the test case describe the corridors. Each of these lines contains two integers  $C$  and  $D$  separated by a single space, indicating that there is a corridor connecting chambers  $C$  and  $D$  ( $1 \leq C < D \leq N$ ). You may assume that no two corridors connect the same pair of chambers. The last line of the input contains the number -1 three times separated by single spaces and should not be processed as a test case.

#### Output

For each test case output a single line with an uppercase "Y" if it is possible for Harry to escape from the prison, or an uppercase "N" otherwise.

#### Example

**Input :** 4 1 42 33 42 31 32 46 2 55 43 22 62 51 41 53 44 1 13 22 3 -1 -1 -1 **Output :**  
NYN

---

Added by: Pablo Ariel Heiber  
Date: 2010-08-19  
Time limit: 9s  
Source limit:50000B  
Languages: All except: PERL 6 TECS  
Resource: FCEyN UBA ICPC Selection 2008

## SPOJ Problem Set (classical)

### 7189. Falta Envigo

#### Problem code: FALTAENV

Envigo is an important part of the typical argentinian game Truco. It is even more important when Falta Envigo is called, because in this case the winner of the Envigo wins the entire game. In this problem you are asked to calculate the envigo advantage of a cheater.

Truco is played with a limited deck of spanish cards. This deck contains four suits: espada, basto, copa and oro. There are 10 cards of each suit: 1, 2, 3, 4, 5, 6, 7, 10, 11 and 12. Cards 10, 11 and 12 have an envigo value of 0, while the envigo value for any of the other cards is simply its number. Each player holds three cards. The winner of an Envigo is the player with the higher envigo score. When calculating his envigo score each player can either:

1. select a single card and have as envigo score the envigo value of the card; or
2. select two cards of the same suit and have as envigo score 20 plus the sum of the envigo value of each selected card.

Players always select the card or cards that yield the highest envigo score. For instance, a player having a 10 and a 2 of the same suit, together with a 5 of a different suit, would inform an envigo score of 22 because  $20 + 0 + 2 = 22$ .

A cheater playing Truco thinks that he can change one of his three cards without anybody else in the table noticing. If he changes more than one card, he surely will be discovered, so he does not do that. Since even changing one card is risky, he only does it when the envigo score of the resulting hand is much higher than the one of his original hand.

Given the cards the cheater has in hand, you must calculate the maximum increase he can get in the envigo score by exchanging one of his cards with a card from the deck. Notice that the resulting hand must be formed by two of his original cards and one new card selected from the deck, and that he cannot have two equal cards (same number and suit).

#### Input

The input contains several test cases. Each test case is described in a single line that contains six values  $N_1$ ,  $S_1$ ,  $N_2$ ,  $S_2$ ,  $N_3$ , and  $S_3$  separated by single spaces. Each pair  $(N_i, S_i)$  describes a card in the hand of the cheater ( $1 \leq i \leq 3$ ), where  $N_i$  is the number of the card (1, 2, 3, 4, 5, 6, 7, 10, 11 or 12), and  $S_i$  is its suit (espada, basto, copa or oro). You may assume that the three cards are different. The last line of the input contains three times the number -1 and an asterisk, with the six values separated by single spaces, and should not be processed as a test case.

#### Output

For each test case output a single line with an integer representing the maximum increase in the envigo score that can be obtained by replacing exactly one card of the input hand.

## Example

**Input:**12 espada 10 basto 11 basto7 espada 1 oro 2 oro7 espada 1 oro 6 espada-1 \* -1 \* -1 \***Output:**  
7100

---

Added by: Pablo Ariel Heiber

Date: 2010-08-19

Time limit: 1s

Source limit:50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2008

## SPOJ Problem Set (classical)

### 7190. Guess the Number

#### Problem code: GUESSTHE

You are playing the funny game "Guess the number" with a friend. In this game, one of the players choose a positive integer and the other has to guess it by using the clues that are revealed. The  $i$ -th clue is either "Y" or "N" indicating whether the hidden number is a multiple of  $i$  or not, respectively. For instance, if the clues so far are "YYNYY" it means that the number is a multiple of 1, 2, 4 and 5, but it is not a multiple of 3. Given the clues of the game so far, you have to guess the minimum possible number according to them, or call your friend a cheater if there is no number such that the clues were correctly given.

#### Input

The input contains several test cases. Each test case is described in a single line that contains a non-empty string of at most 20 characters. The string is formed entirely of uppercase letters "Y" and "N", and represents the clues given so far, in order from left to right. The last line of the input contains a single asterisk and should not be processed as a test case.

#### Output

For each test case output a single line with the minimum positive integer that satisfies all the clues, or -1 if there is no such a number.

#### Example

**Input :** YYNYYYYYNNN\***Output :**  
20-1

---

Added by: Pablo Ariel Heiber

Date: 2010-08-19

Time limit: 3s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2008

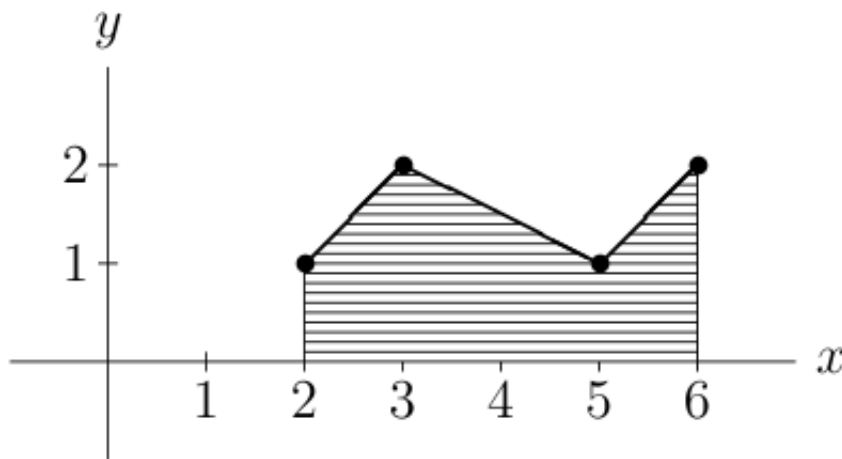


## SPOJ Problem Set (classical)

### 7192. Integral Maximization

#### Problem code: INTEGMAX

A set of points on the XY plane, all of them with different x coordinate, defines a polygonal line in the following way: sort the points in increasing order of their x coordinates, and connect each point with its neighbors. The integral of such polygonal line is the area contained below the line and above the x axis, between the first and last values of x. For instance, the set of points  $\{(5, 1), (3, 2), (6, 2), (2, 1)\}$  defines the polygonal line shown in the figure; the integral of the polygonal line is the shaded area, with a value of 6.



Given a set of  $N$  different values for  $x$ , and a set of  $N$  values for  $y$ , we want to pair them to form  $N$  points on the plane such that the integral of the polygonal line defined by the points is as large as possible.

#### Input

The input contains several test cases, each one described in exactly three lines. The first line of each test case contains an integer  $N$  indicating the number of points in the set ( $2 \leq N \leq 10^4$ ). The second line contains  $N$  different integers  $X_i$  separated by single spaces ( $1 \leq X_i \leq 10^4$  for  $1 \leq i \leq N$ ); these integers represent the values of  $x$  and are given in increasing order ( $X_i < X_{i+1}$  for  $1 \leq i \leq N - 1$ ). The third line contains  $N$  integers  $Y_i$  separated by single spaces ( $1 \leq Y_i \leq 10^4$  for  $1 \leq i \leq N$ ); these integers represent the values of  $y$  and are not given in any particular order. The last line of the input contains a single -1 and should not be processed as a test case.

## Output

For each test case output a single line with the maximum integral of a polygonal line formed by pairing the input values, using exactly one decimal digit. Notice that one decimal digit is always enough to represent the exact value of the integral of a polygonal line defined by points with integer coordinates.

## Example

**Input:** 21 21 242 3 5 61 2 1 2-1**Output:**  
1.57.0

---

Added by: Pablo Ariel Heiber

Date: 2010-08-19

Time limit: 1s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2008



## SPOJ Problem Set (classical)

### 7207. Alchemy

#### Problem code: ALCHE

Alchemy is a discipline that is believed to span at least 2500 years of human history. It is most known for its intention of transforming matter, typically trying to come up with a recipe to make gold based on much less valued metals, aided by some non-metal components.

Most scientists and scholars think that alchemy has failed. They surely do not know that a particular alchemist named Albert Ainstain, managed to create gold from a simple combination of ordinary iron (much more common and cheap than gold) and some good-old-fashioned water. However, the combination must have the exact proportion of grams of iron and centiliters of water to work, otherwise the alchemist would end up with useless rusty iron.

Many alchemists and bussinessman had tried to recreate Albert Ainstain's findings to achieve recognition, fame, prestige or economical welfare, but none of them have succeeded. Since you know very little about chemistry, alchemy and ancient practices, you believe that your chances for success in this task are bounded to using a computer in your benefit. Therefore, you decide to create a program that automatically tests a given combination of iron and water, and informs whether that combination has the correct proportion to produce gold. Of course, once you find the right proportion, you can double both amounts and get double the gold, cut both in half and get half the gold, or multiply both by any other real number to obtain the amount of gold you want. Your task is then, given the number of grams of iron and the number of centiliters of water, say whether the proportion between both components is the right one.

#### Input

The input contains several test cases, each one described in a single line. The line contains two integers I and W separated by a single space, representing grams of iron and centiliters of water, respectively ( $1 \leq I, W \leq 10^6$ ). The last line of the input contains the number -1 twice separated by a single space and should not be processed as a test case.

#### Output

For each test case output a single line containing an uppercase "Y" if the combination produces gold, or an uppercase "N" otherwise.

#### Example

**Input :**1000 37999 3710000 37010001 370-1 -1**Output :**YNYN

---

Added by: Pablo Ariel Heiber  
Date: 2010-08-22  
Time limit: 1s  
Source limit:50000B  
Languages: All except: PERL 6 TECS  
Resource: FCEyN UBA ICPC Selection 2009

## SPOJ Problem Set (classical)

### 7208. Black or White

**Problem code: BORW**

*"It's Black, It's White, It's Tough For You To Get By"*  
Michael Jackson (1958-2009)

You have a sequence of integers. You can paint each of the integers black or white, or leave it unpainted. The black integers must appear in ascending order and the white integers must appear in descending order. The ascending/descending order must be strict, that is, two integers painted with the same color cannot be equal. Paint the sequence so as to minimize the number of unpainted integers.

#### Input

The input contains several test cases, each one described in exactly two lines. The first line contains an integer  $N$  indicating the number of elements in the sequence ( $1 \leq N \leq 200$ ). The second line contains  $N$  integers  $X_i$  separated by single spaces, representing the sequence to paint ( $1 \leq X_i \leq 10^6$  for  $1 \leq i \leq N$ ). The last line of the input contains a single -1 and should not be processed as a test case.

#### Output

For each test case output a single line with an integer representing the minimum number of unpainted elements of the sequence, when the sequence is painted optimally following the rules described above.

#### Example

**Input :** 81 4 2 3 3 2 4 1127 8 1 2 4 6 3 5 2 1 8 7-1**Output :**  
02

---

Added by: Pablo Ariel Heiber

Date: 2010-08-22

Time limit: 120s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2009

## SPOJ Problem Set (classical)

### 7209. Closest Triplet

#### Problem code: CLOSEST

Closest pair is an old problem that asks to find, given a set of  $N$  points in the plane, the pair that minimizes the distance between them. This problem can easily be solved using roughly  $N^2$  operations by testing all possible pairs of points and keeping at each step the optimal pair. With a more clever approach, the problem has been solved using  $\sim N \log N$  operations.

Closest triplet is an analogous problem which also takes a set of  $N$  points as input, and asks for the triplet (group of three points) that minimizes the sum of the three distances between each pair of them. In this case there is also a trivial solution that tests all possible triplets using roughly  $N^3$  operations. However, since you are a clever programmer, we are confident that you are able to find a better algorithm.

#### Input

The input contains several test cases, each one described in several lines. The first line contains an integer  $N$  indicating the number of points in the set ( $3 \leq N \leq 3000$ ). Each of the next  $N$  lines describes a different point of the set using two integers  $X$  and  $Y$  separated by a single space ( $1 \leq X, Y \leq 10^6$ ); these values represent the coordinates of the point in the  $XY$  plane. You may assume that within each test case no two points have the same location. The last line of the input contains a single  $-1$  and should not be processed as a test case.

#### Output

For each test case output a single line with a real number representing the sum of the distances between each pair of points of any closest triplet of the set of points. Round the result to the closest rational number with three decimal places. In case of ties, round up. Always use exactly three digits after the decimal point, even if it means finishing with a zero.

#### Example

**Input:** 41 14 11 51000 10009100000 200000200000 200000150000 28660360000 140000240000 140000150000 3400001 340000300000 340000150000 87087-1 **Output:** 12.000300000.796

---

Added by: Pablo Ariel Heiber

Date: 2010-08-22

Time limit: 150s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2009

## SPOJ Problem Set (classical)

### 7210. Draw Mountains

#### Problem code: DRAWM

You are a member of a team that is working in a new wonderful graphics program. Your task is to write a module for drawing skylines of mountains. However, for now the program is in beta version, so each skyline is discretized. This means that your module receives as input a sequence of integers representing heights. Each pair of consecutive heights in the sequence may differ by at most 1 and produces a column of output, each column containing a single character. The particular character to write and its position in the column depend on the pair of heights. When both heights are equal an underscore (" ") must be printed. If the heights within the pair increase or decrease, you must write a slash ("/") or a backslash ("\"), respectively. The position of the character in the column is such that the skyline visually respect the given heights. For instance, the sequence of heights (1, 2, 3, 2, 3, 3, 2, 1, 0) must produce the skyline shown in the following figure.

```
  _  
 /\ \  
 /\ \  
  \
```

Notice that when the sequence of heights has  $C + 1$  elements, the corresponding skyline has only  $C$  columns. Given a sequence of heights, you must draw the skyline according to the rules given above. See the examples for further clarification.

#### Input

The input contains several test cases, each one described in exactly two lines. The first line contains an integer  $C$  indicating the number of columns of the skyline ( $1 \leq C \leq 70$ ). The second line contains  $C + 1$  integers  $H_i$  separated by single spaces representing the sequence of heights ( $0 \leq H_i \leq 30$  for  $1 \leq i \leq C + 1$ ). You may assume that there exist an height  $H_i = 0$ , and that the difference between successive heights is at most 1 (i.e.  $|H_i - H_{i+1}| \leq 1$  for  $1 \leq i \leq C$ ). The last line of the input contains a single -1 and should not be processed as a test case.

#### Output

For each test case output the corresponding skyline, followed by a line with exactly three asterisks ("\*\*\*"). While writing the skyline, use only regular spaces, newlines, and the three characters mentioned in the statement. The skyline must be left aligned and it must contain exactly  $C$  columns. There must be no trailing spaces at the end of printed lines, neither empty lines.

## Example

**Input:** 81 2 3 2 3 3 2 1 031 0 0 1-1**Output:** \_/\ / \ / \ \\*\*\*\\_/\*\*\*

---

Added by: Pablo Ariel Heiber

Date: 2010-08-22

Time limit: 2s

Source limit:50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2009

## SPOJ Problem Set (classical)

### 7211. Elastic Bands

#### Problem code: ELASTIC

The Institute of Circles with Perimetral Connections (ICPC) has recently discovered that several machines that were working in their diverse productive areas were totally obsolete. Of course, all machines in the Institute contain several circles.

The Supreme Chief Director Manager President of the ICPC asked their Computer Aided Problem Solving department to help in overcoming this situation. They have signaled you as the maximum responsible, so you better get to work.

Many machines in the Institute have mechanical parts in the shape of a circle that need to be rotated clockwise in order for the machine to work. Currently, each circular part is connected to a different electrical engine that does the job. You noted, however, that when many circles are coplanar, you can connect them with elastic bands and they will rotate all together with the energy of one engine.

This marvelous idea lead you to a new problem. What's the optimal way to connect all the circles? In general, there are many ways to place elastic bands and make all the circles be connected. Since some of the rotating power of the system is lost in the tension of the elastic bands, you want to minimize the total length of elastic bands used.

Formally, the length of the elastic band that connects two cricles is the perimeter of the smallest convex area that contains both circles. The total length is the sum of the lengths of all used elastic bands. Two circles can be connected with an elastic band even if the band touches or goes through any number of other circles or elastic bands.

#### Input

The input contains several test cases, each one described in several lines. The first line contains an integer  $N$  indicating the number of circles to connect ( $2 \leq N \leq 3000$ ). Each of the next  $N$  lines describes a different circle using three integers  $X$ ,  $Y$  and  $R$  separated by single spaces ( $1 \leq X, Y, R \leq 10^6$ ). The values  $X$  and  $Y$  represent the coordinates of the center of the circle in the  $XY$  plane, while the value  $R$  indicates its radius. You may assume that within each test case no two circles overlap or touch each other. The last line of the input contains a single  $-1$  and should not be processed as a test case.

#### Output

For each test case output a single line containing a real number representing the minimum total length of elastic band needed to connect all the circles. Round the result to the closest rational number with three decimal places. In case of ties, round up. Always use exactly three digits after the decimal point, even if it means finishing with a zero.

## Example

**Input :** 32 2 21 6 16 1 121 1 11 4 1-1  
**Output :**  
35.82912.283

---

Added by: Pablo Ariel Heiber

Date: 2010-08-22

Time limit: 240s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2009



## SPOJ Problem Set (classical)

### 7212. Find String Roots

#### Problem code: FINDSR

In mathematics, the  $N$ -th root of a number  $M$ , is a number  $K$  such that  $K^N = M$ , i.e.  $KKK \dots K = M$  where  $K$  is multiplied  $N$  times.

We can translate this into strings. In string notation, the juxtaposition is concatenation instead of multiplication. So, the  $N$ -th root of a string  $S$  is another string  $T$  such that  $T^N = S$ , where  $T^N = T T T \dots T$  is the string  $T$  concatenated  $N$  times. For instance, if  $S = \text{"abcabcabcabc"}$ , for  $N = 2$  the string  $T = \text{"abcabc"}$  is the  $N$ -th root of  $S$ , while for  $N = 4$  its  $N$ -th root is  $T = \text{"abc"}$ . Note that for  $N = 1$  any string  $S$  is the  $N$ -th root of  $S$  itself.

Given a string  $S$  you have to find the maximum  $N$  such that the  $N$ -th root of  $S$  exists. In the above example the answer would be 4, because there is no  $N$ -th root of  $S = \text{"abcabcabcabc"}$  for  $N > 4$ .

#### Input

The input contains several test cases, each one described in a single line. The line contains a non-empty string  $S$  of at most  $10^5$  characters, entirely formed of digits and lowercase letters. The last line of the input contains a single asterisk (" $*$ ") and should not be processed as a test case.

#### Output

For each test case output a single line with the greatest integer  $N$  such that there exists a string  $T$  that concatenated  $N$  times is equal to  $S$ .

#### Example

**Input :** abcabcabcabcabcdefgh012aaaaaaaaa\***Output :**  
4110

---

Added by: Pablo Ariel Heiber

Date: 2010-08-22

Time limit: 2s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2009

## SPOJ Problem Set (classical)

### 7230. Garbage Collection

#### Problem code: GARBAGE

A big office uses a cleaning robot to empty the trash can in every cubicle. The surface of each cubicle is a square and the office floor plan is organized as a rectangular matrix of  $R$  rows of  $C$  cubicles each. The cleaning process begins by the robot entering the floor by a door that accesses the topmost leftmost cubicle, and finishes with the robot exiting using the same door. Both entering and leaving take 26 seconds each. When the cleaning robot is in a cubicle it can empty the trash can using 13 seconds. The robot can also move to a cubicle that shares a side with its current location, using 38 seconds. The robot needs to enter in each cubicle at least once to empty its trash can.

The total time the robot takes for the entire process depends on the actual tour through the different cubicles. Among all possible tours, we are interested in those of minimum time.

Given the description of the office, you must indicate the minimum time required for the entire cleaning process (including entering, leaving, emptying the trash can in every cubicle, and moving around). Notice that it is possible that an optimal tour passes through a cubicle several times, but the robot has to take the time to empty the trash can only once.

#### Input

The input contains several test cases, each one described in a single line. The line contains two integers  $R$  and  $C$  separated by a single space, representing the number of rows and cubicles per row, respectively ( $1 \leq R, C \leq 100$ ). The last line of the input contains the number -1 twice separated by a single space and should not be processed as a test case.

#### Output

For each test case output a single line with an integer representing the minimum number of seconds that the robot needs to complete the cleaning process.

#### Example

**Input:** 4 23 3 -1 -1 **Output:**  
460549

---

Added by: Pablo Ariel Heiber

Date: 2010-08-24

Time limit: 1s

Source limit: 50000B

Languages: All except: PERL 6 TECS

Resource: FCEyN UBA ICPC Selection 2009

## SPOJ Problem Set (classical)

### 7232. Inversion Sort

#### Problem code: INVESORT

You have just bought an old fashioned jukebox that can hold 10 music albums. Albums are maintained as a sequence, each album represented by a unique lowercase letter between "a" and "j", inclusive. The jukebox allows you to select a subsequence of contiguous albums and a mechanical arm inverts that part of the sequence. For instance, if the current sequence is "abcdefghij" and you select the subsequence "bcd", the result of the inversion would be "adcbefghij". Soon you notice that it is possible to get the albums into any desired order using simply inversions. However, you are interested in doing so with the minimum number of operations.

Given the current order and a desired order of the 10 music albums, find the minimum number of inversion operations needed to obtain the desired order.

#### Input

The input contains several test cases, each one described in a single line. The line contains two strings C and D separated by a single space, representing the current and desired orders of the music albums, respectively. Each of the strings has exactly 10 characters and contains the characters of "abcdefghij" in some order. The last line of the input contains two asterisks ("\*\*") separated by a single space and should not be processed as a test case.

#### Output

For each test case output a single line with an integer representing the minimum number of inversions needed to transform the current order given by C, into the desired order given by D.

#### Example

**Input :** abcdefghij adcbefghij abcdefghij abcdefghij bcdaefghji beagfcdhji\* **\*Output :**  
102

---

Added by: Pablo Ariel Heiber  
Date: 2010-08-24  
Time limit: 240s  
Source limit: 50000B  
Languages: All except: PERL 6 TECS  
Resource: FCEyN UBA ICPC Selection 2009

## SPOJ Problem Set (classical)

### 7239. Cells

#### Problem code: IPCELLS

Tim loves spreadsheets. Everything he does on a computer, he does in a spreadsheet. Track his expenses? Create a spreadsheet! Decide which car to buy? Create a spreadsheet to compare them! Make an inventory of his games? Create a spreadsheet! Decide which girl he loves most? ...

Unfortunately his spreadsheet software just crashed and he needs some of the data right now and does not have the time to install a competing office suit.

Given the formulas used in the cells of a spreadsheet, calculate the values of all the cells.

#### Input

The first line of the input file contains an integer  $T$  specifying the number of test cases. Each test case is preceded by a blank line.

Each test case starts a single number  $N$  giving the number of expressions. Each of the following  $N$  lines contains a single cell formula of the form "CELL = EXPRESSION", where CELL is the name of the cell and EXPRESSION is a mathematical expression consisting of cell names and the operators +, -, \*, and /. A cell name is a non-empty sequence of letters followed by a positive integer.

Each test case is correct: there are no cycles, and all cells referenced in expressions have definitions.

Evaluating expressions

When evaluating an expression, usual priorities apply: first we evaluate all \* and / (left to right), and only then all + and - (again, left to right).

You may assume that the expressions are such that when evaluating the expression in correct order, the result and also all intermediate values will fit into 32-bit signed integer variables.

The operator / represents integer division which is always rounded down. The dividend will always be non-negative and the divisor will always be positive.

#### Output

For each test case output the calculated values of cells, one per line, in the form "CELL = VALUE". The rows in the output should be ordered alphabetically. (To compare two rows, take a look at the first character where they differ. The one with a smaller ASCII value goes first.)

Optionally, output a blank line between test cases.

## Example

**Input :**

23A47=5+ZZ22ZZ22=3A9=13+A47\*ZZ222A1=4/7+4/7B2=3\*3/7

**Output :**

A47=8A9=37ZZ22=3A1=0B2=1

---

Added by: Mohammad Kotb

Date: 2010-08-27

Time limit: 5s

Source limit:50000B

Languages: All except: TECS

Resource: IPSC

## SPOJ Problem Set (classical)

### 7240. Playground

#### Problem code: PLYGRND

George has  $K \leq 20$  steel wires shaped in the form of half-circles, with radii  $a_1, a_2, \dots, a_K$ . They can be soldered (connected) at the ends, in any angle. Is it possible for George to make a closed shape out of these wires? He does not have to use all the wires. The wires can be combined at any angle, but may not intersect. Beware of floating point errors.

George has  $K \leq 20$  steel wires shaped in the form of half-circles, with radii  $a_1, a_2, \dots, a_K$ . They can be soldered (connected) at the ends, in any angle. Is it possible for George to make a closed shape out of these wires? He does not have to use all the wires. The wires can be combined at any angle, but may not intersect. Beware of floating point errors.

### Input

Each data set consists of a number  $0 < K \leq 20$  on a line by itself, followed by a line of  $K$  space-separated numbers  $a_i$ . Each number is in the range  $0 < a_i < 10^7$ , and has at most 3 digits after the decimal point.

The input will be terminated by a zero on a line by itself.

### Output

For each test case, there should be one word on a line by itself; "YES" if it is possible to make a simple connected figure out of the given arcs, and "NO" if it isn't.

## Example

### Input :

```
1
4.000
2
1.000 1.000
3
1.455 2.958 4.424
7
1.230 2.577 3.411 2.968 5.301 4.398 6.777
0
```

### Output :

```
NO
YES
NO
YES
```

---

Added by: Mohammad Kotb

Date: 2010-08-27

Time limit: 1s

Source limit: 50000B

Languages: All except: TECS

Resource: NCPC 2005

## SPOJ Problem Set (classical)

### 7249. Perfume

#### Problem code: PERFUME

One of the largest perfume shops is making perfumes by mixing fragrant essential oils with other compounds. The shop representative told you that what really matters in the mixture is the percentages of two main components (call them A and B), all other stuff is complementary. For example their first sold perfume had 10% of component A and 35% of component B, while the most successful one had 16% of A and 20% of B. Sometimes the store needs to create a new mixture with specific percentages of A and B and they wonder if this can be achieved by mixing some of the mixtures they already have and this is where they need your help. For example a new mixture which has 12% of A and 30% of B can be created by mixing the two mixtures above in the ratio 2:1, while it is impossible to create a mixture which has 13% of A and 22% of B using the same two mixtures.

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#### Input

The first line contains  $T \leq 100$ , the number of test cases. The first line of each test case contains an integer ( $1 \leq N \leq 200$ ), the number of mixtures the shop already has. The next  $N$  lines each contain two floating point numbers ( $0 \leq A, B \leq 100$ ,  $A+B \leq 100$ ) representing the percentages of components A and B in each mixture. The next line contains an integer ( $1 \leq Q \leq 5151$ ) the number of mixtures to verify. The next  $Q$  lines each contain two floating point numbers ( $0 \leq A, B \leq 100$ ,  $A+B \leq 100$ ) representing the percentages of components A and B in each new mixture. Test cases are separated by one or more empty lines.



## Output

For each mixture query print "Yes" if the new mixture can be created from the already existent ones or "No" otherwise. Print a blank line between test cases.

## Example

**Input :**

```
2
2
10.0000 35.0000
16.0000 20.0000
2
12.0000 30.0000 13.0000 22.0000
10 35
16 20
7 15
1
13 22
```

**Output :**

```
Yes
NoYes
```

---

Added by: Mohammad Kotb

Date: 2010-08-31

Time limit: 5s

Source limit: 50000B

Languages: All except: TECS

Resource: ENC09

## SPOJ Problem Set (classical)

### 7264. Digital LED Number

#### Problem code: DIGNUM

Given a digital LED pattern of a number. You have to find the number and print it. All inputs will be valid as shown.

#### Input

Input consists of LED patterns. Each pattern is given in set of fixed number of lines. You have to read input till EOF.

#### Output

Print the number corresponding to each pattern.

#### Example

Input: Output: 232095164610799518

---

Added by: XeRon!X

Date: 2010-09-05

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 7301. Lucky Controller

#### Problem code: LCKYCONT

Egor works as a controller in the bus. Each day he is given a pack of tickets which he then sells. Recently he has become interested about how many tickets in the pack are lucky. He thinks that the more tickets are lucky the luckier day he will have. No he wants to find out how lucky for him will the next day be. The numbers of all tickets consist of  $n$  digits. The ticket is considered to be lucky if the sum of the first  $n/2$  digits equals to the sum of the last  $n/2$  digits. Egor knows that the numbers in the pack that he will be given can start with equal probability from any number in the interval from  $a$  to  $b$  inclusive. The pack holds  $k$  tickets. The numbers in the tickets are consecutive. Help Egor find out the expected amount of lucky tickets in the pack.

#### Input

The first line of the input file contain number  $n$  - the amount of tests. The next  $n$  lines consist of three integers  $a, b, k$  ( $0 \leq a \leq b < 10^{12}$ ,  $1 \leq k \leq 100000$ ). Integers  $a, b$  and  $b+k$  consist of the same amount of digits which is equal to the amount of digits in the number of each ticket. They may start with zeroes. The amount of digits in  $a$  and  $b$  is always even.

#### Output

Output the expected quantity of lucky tickets in the pack in the form of irreducible fraction. In case the result is an integer, no slash should appear in the output.

#### Example

**Input :**

```
3
0123 4567 150
10 10 20
4000 4999 11
```

**Output :**

```
6519/635
2
103/125
```

---

Added by: Spooky

Date: 2010-09-12

Time limit: 15s

Source limit: 50000B

Languages: All

Resource: Open All-Ukrainian Collegiate Contest Final, 2010

## SPOJ Problem Set (classical)

### 7430. Tower Of Hanoi - Revisited

#### Problem code: RANJAN02

Given 3 three pegs: leftmost peg A, middle peg B and rightmost peg C. Find the shortest sequence of moves that transfers a tower of n disks from the left peg A to the right peg C, if direct moves between A and C are disallowed. (Each move must be to or from the middle peg B.)

Constraints:

1. Initially the left peg A is stacked by n disks in the order of decreasing size.
2. Only one move can be done at a time and never moving a larger one onto a smaller.
3. Number of moves will always be less than  $2^{64}$ .

#### Input

Input begins with a integer t, followed by t lines. Each line has the no. of pegs n.

#### Output

For each test case, output the minimum no. of move required to transfer the n disks from peg A to peg C.

#### Example

**Input :** 412510**Output :** 2824259048

---

Added by: lost

Date: 2010-09-28

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: IIITM Local Contest

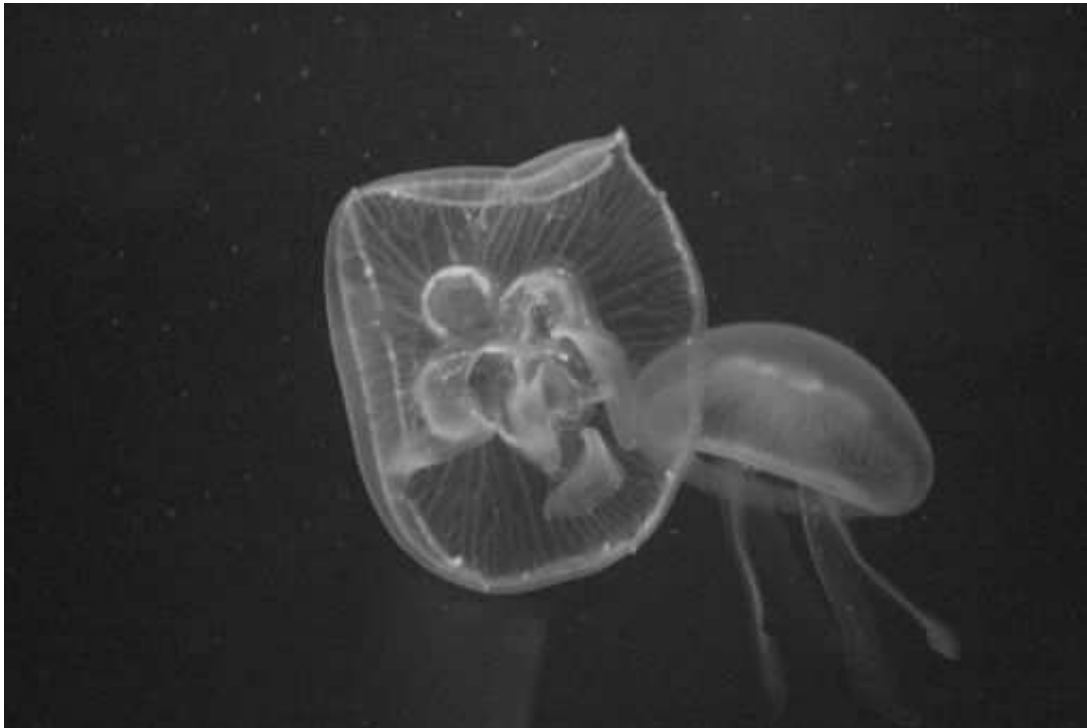
## SPOJ Problem Set (classical)

### 7490. Biology

#### Problem code: BIO

It was no later than 1869 that Jules Verne succeeded to vulgarize interest in the depths of the oceans through his science-fiction novel "Twenty thousand leagues under the sea". On board the Nautilus manoeuvred by captain Nemo, the crew visits the lost city of Atlantis and gets to know strangest kinds of sea dwellers.

Nearly a century later, one of the deepest points on Earth, the Challenger Deep was visited by Piccard and Walsh and a Swiss flag was dabbled at 10'924 metres below sea level. The ridership of the Trieste submarine was amazed by the animal life in these depths.



Recently a team of biologists decided to investigate these depths of the Mariana Trench and especially their So Weird Exotic Rare Citizens (SWERC). To this goal a preliminary study was performed, which showed that the species in the Mariana Trench have very local biotopes, which if projected onto the sea surface, can be described by convex polygons. All the biotopes are located at the same depth and some may overlap. The biologists now want to install racks and cameras in each biotope in order to attract and film them. As delicious as the food at the racks might be, no species would ever take the risk to transgress the borders of its habitat. As these cameras and the associated telecommunication system are extremely expensive, their number is to be minimized. Can you tell the biologists for how

many cameras they need to account in their budget planning in order not to miss any species if they choose the locations in a clever way? You may consider each camera-rack couple as a mathematical point which must lie strictly inside the biotope in order to attract the related species.

## INPUT

The input consists of several test-cases separated by an empty line. Each test-case starts with the number of species  $S$  ( $0 \leq S \leq 20$ ). Each of the next  $S$  lines describes one biotope. The first entry indicates the number  $n_i$  of vertices of the convex polygon. Then follow their coordinates in the order  $x_1 y_1 x_2 y_2 \dots x_{n_i} y_{n_i}$  ( $|x_i|, |y_i| \leq 1000$ ). Input terminates on a test-case with  $S=0$ , which must not be evaluated.

## OUTPUT

For each test-case, output the minimum number of camera-rack couples necessary to screen all the species listed in the input.

## SAMPLE INPUT

3

3 11.00 0.00 -2.50 7.79 -2.50 -7.79

4 4.00 -3.00 -3.00 4.00 -10.00 -3.00 -3.00 -10.00

4 4.00 2.00 3.00 3.00 2.00 2.00 3.00 1.00

10

7 -317.00 99.00 -330.55 127.15 -361.01 134.10 -385.43 114.62 -385.43 83.38 -361.01 63.90 -330.55 70.85

6 -99.00 93.00 -238.50 334.62 -517.50 334.62 -657.00 93.00 -517.50 -148.62 -238.50 -148.62

4 113.00 -134.00 42.00 -63.00 -29.00 -134.00 42.00 -205.00

3 90.00 -68.00 -261.00 134.65 -261.00 -270.65

7 218.00 -342.00 147.22 -195.02 -11.83 -158.71 -139.38 -260.43 -139.38 -423.57 -11.83 -525.29 147.22 -488.98

6 131.00 -286.00 38.00 -124.92 -148.00 -124.92 -241.00 -286.00 -148.00 -447.08 38.00 -447.08

4 -170.00 -247.00 -172.00 -245.00 -174.00 -247.00 -172.00 -249.00

4 -332.00 -102.00 -395.00 -39.00 -458.00 -102.00 -395.00 -165.00

6 -52.00 -224.00 -196.50 26.28 -485.50 26.28 -630.00 -224.00 -485.50 -474.28 -196.50 -474.28

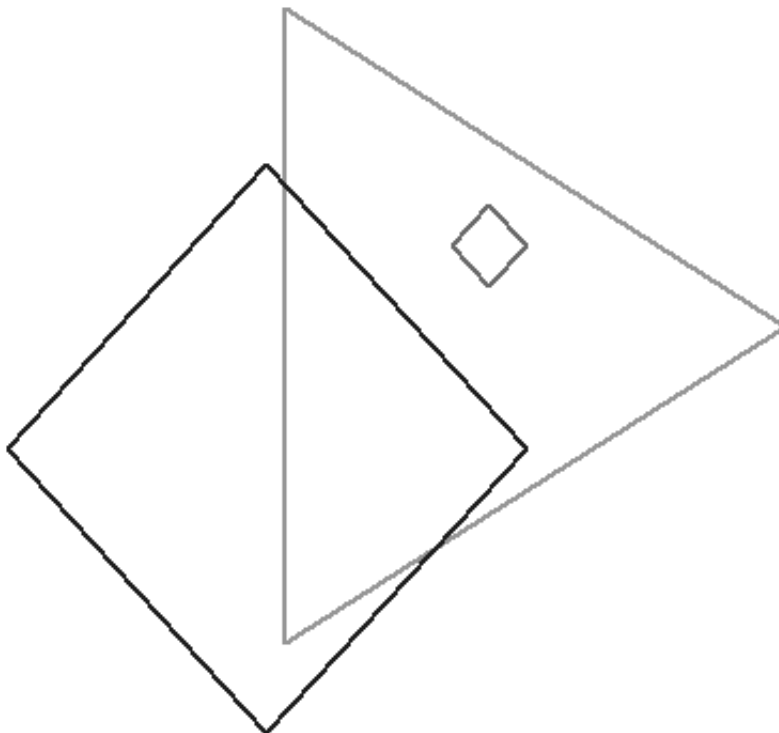
5 -101.00 163.00 -210.87 314.22 -388.63 256.46 -388.63 69.54 -210.87 11.78

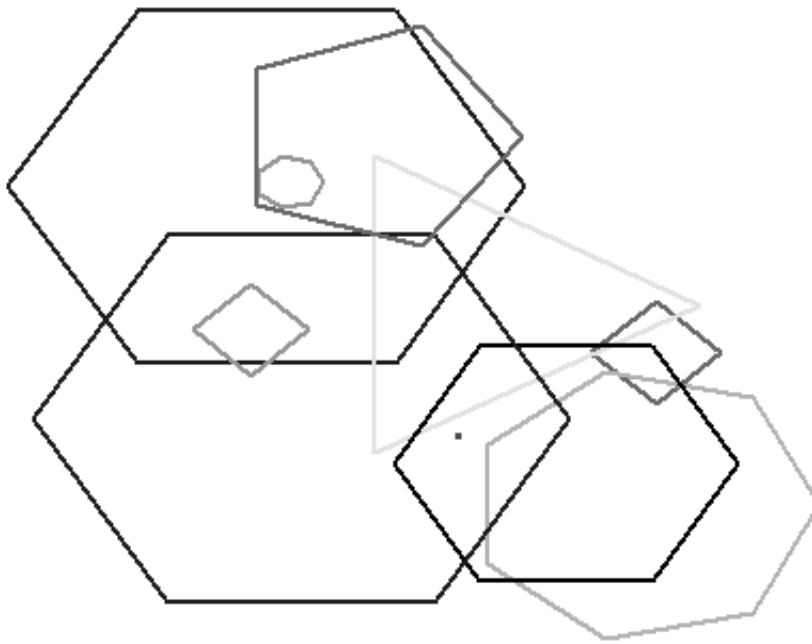
0

### SAMPLE OUTPUT

2

5





Sample input 1 Sample input 2

---

Added by: Christian Kauth  
Date: 2010-10-05  
Time limit: 15s  
Source limit: 50000B  
Languages: All



## SPOJ Problem Set (classical)

### 7603. Fibonacci Factor

#### Problem code: FIBFACT

Let  $F(n)$  be  $n$ th fibonacci number.  $F(0) = 0$ ,  $F(1) = 1$ ,  $F(2) = 1$ ,  $F(3) = 2$ ,  $F(4) = 3$  and so on. Given a positive integer  $n > 2$ , print the smallest prime number  $P$  such that  $P$  divides  $F(n)$  but it does not divide any  $F(k)$  smaller than  $F(n)$ . Maximum value of  $n$  is limited by  $P$  where  $P < 2^{64}$ . You should print IMPOSSIBLE if no such  $P$  exists.

#### Input

First line of input contains a single positive integer  $T$  denoting number of test cases.  $T \leq 20$ . Next  $T$  lines contains value of  $n$ .

#### Output

Output value of  $P$  corresponding to each  $n$  in separate lines.

#### Example

**Input:** 238 **Output:** 27PS : Source Code Limit changed to 700B.

---

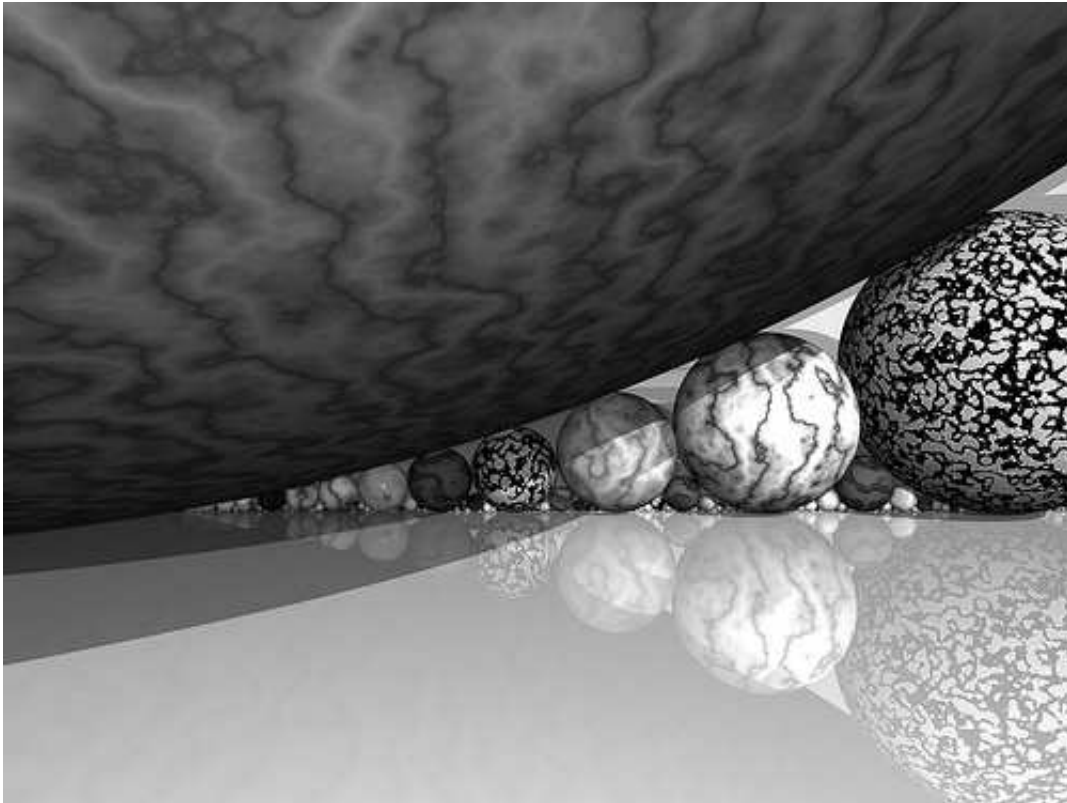
Added by: XeRon!X  
Date: 2010-10-19  
Time limit: 20s  
Source limit: 700B  
Languages: All

## SPOJ Problem Set (classical)

### 7628. Mathematics

#### Problem code: MATHS

One could define mathematics as the study of quantity, structure, space and change and as the science of infinity. Sometimes very abstract, mathematics finds nevertheless applications in many engineering domains. The figure below shows so-called Ford circles. These circles are disjoint or tangent and fill the space in a very compact way! Starting with large circles, the space between these circles can be filled with circles of smaller diameter, and so on and so forth.



Mathematicians observed that the diameters and positions of the centers of these circles follow a given scheme, which can be described with the help of Farey sequences. The Farey sequence of order  $N$  is the sequence of completely reduced fractions between 0 and 1, which have denominators less than or equal to  $N$ , arranged in increasing size. Thus each Farey sequence starts with the value 0, denoted by the fraction  $0/1$ , and ends with the value 1, denoted by the fraction  $1/1$ .

The Amazing Circle Mathematicians (ACM) are interested in the number of terms contained in such a Farey sequence as well as in certain precise terms, which they name Interesting and Curious Position In Circle (ICPC). Your job is to provide the ACMs with this abstract information, which helps them to

better understand the Ford circles.

## INPUT

The input consists of several test-cases, one per line. Each test-case consists of two numbers, the first is the order  $N$  ( $2 \leq N \leq 10^6$ ) of the Farey sequence the ACM is interested in and the second is the ICPC  $P$  ( $1 \leq P \leq 10^4$ ). Input terminates on a line containing 0 0 which must not be processed.

## OUTPUT

For each test-case, output first the ICPC, then the total number of terms in the given Farey sequence.

## SAMPLE INPUT

2 2

6 12

14 35

0 0

## SAMPLE OUTPUT

1/2 3

5/6 13

6/11 65

---

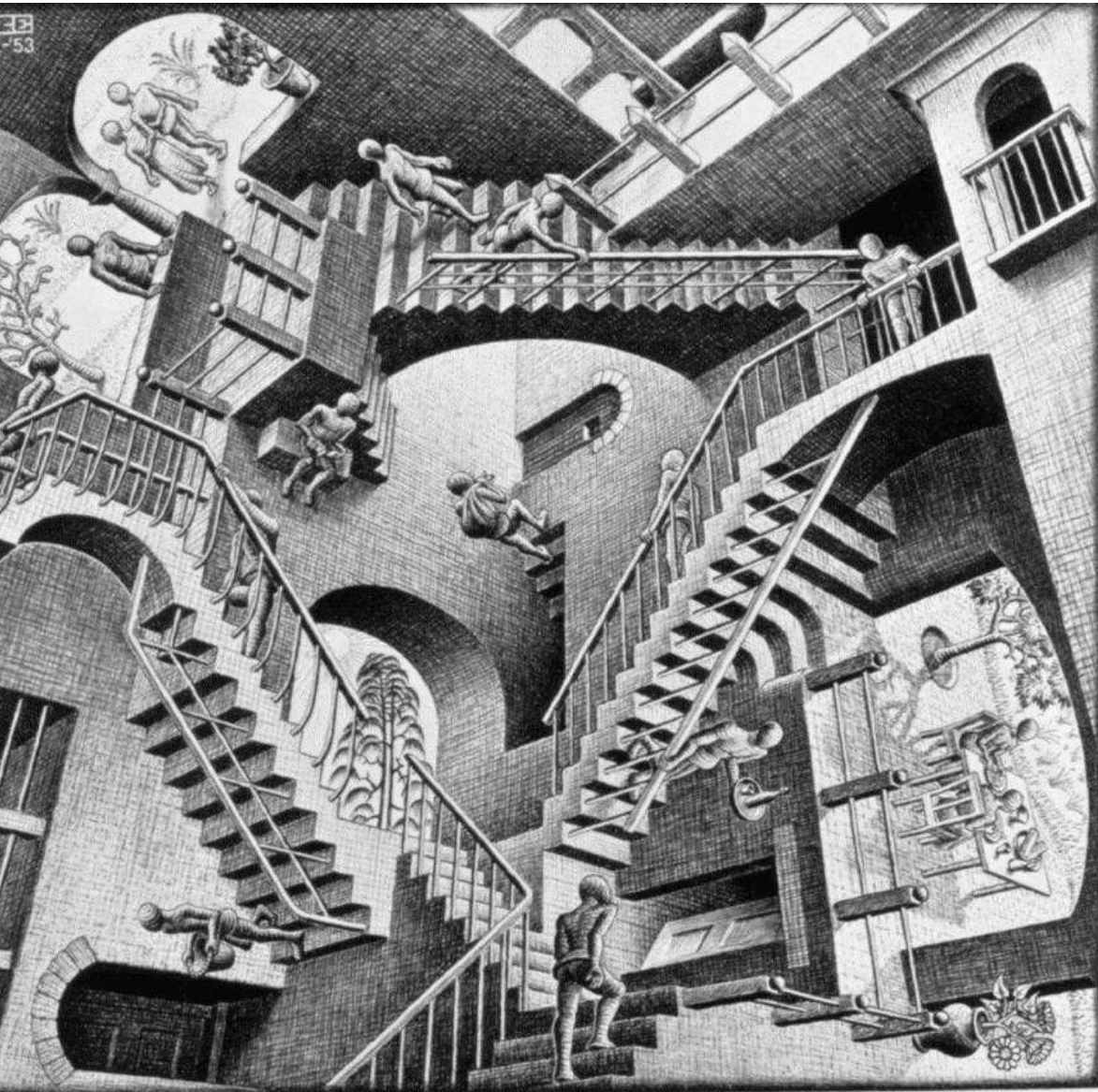
Added by: Christian Kauth  
Date: 2010-10-22  
Time limit: 7s  
Source limit: 50000B  
Languages: All

## **SPOJ Problem Set (classical)**

### **7632. Architecture**

#### **Problem code: ARCHI**

Architecture, a tightrope walk between engineering and art! There are probably few invariants shared by the architectural styles around the world and throughout time. Precisely this diversity makes the domain so interesting and challenging.



Any domains may serve as sources of inspiration, mathematical shapes, nature, organisms and even arched slices of Swiss cheese J. Some of our university friends from architecture plan to participate in the prestigious Erect a Palace From Lines (EPFL) contest. This contest is about designing a huge single-floor palace by building horizontal and vertical walls inside the preset square fundament.

The students just finished their creative prototypes, and you are to revise their projects before they enter the contest. Some were obviously overwhelmed by the cryptographic protocol required for the palace description and do not know how many rooms their palace has. Walls are one unit thick and are described by their horizontal and vertical start and end positions. As the palace is huge, these coordinates are expressed in a base 26 system (the latin alphabet). Having overlapping walls is not a problem. For the encryption, read 'A' as zero and 'Z' as twenty-five. All other letters cover the remaining range in the conventional lexicographic order.

## INPUT

The input consists of several test-cases, separated by an empty line. Each test-case starts with the side length of the square palace  $n$  ( $A \leq n \leq Z^Z$ ) and the number of walls  $w$  ( $0 \leq w \leq 500$ ) the student placed inside the palace. The palace's interior spreads thus from 0 to  $n-1$ , vertically and horizontally. The following  $w$  lines each describe a wall in the form  $x1\ y1\ x2\ y2$ , the horizontal and vertical endpoints of the wall such that ( $0 \leq x1, y1, x2, y2 \leq n-1$ ). Input terminates on a test-case with  $n=A$  and  $w=0$ , which must not be processed. You may safely assume that no student placed walls that transgress the fundamentals of the palace and that no palace has more than 10'000 rooms.

## OUTPUT

For each test-case, output the number of rooms in the palace.

## SAMPLE INPUT

P 17

G N G F

F G C G

F O F K

G M N M

C F C M

I E K E

O C O E

B L B N

J M J E

M O J O

H O C O

L H L I

N F K F

M E O E

N D O D

E C E L

G O G L

*ZZZZZZZZZZZZZZZZZZ 4*

A GH *ZZZZZZZZZZZZZZZZZY* GH

POLYPROG SELECTION POLYPROG CONTEST

TOBE ORNOT TOBE THATSTHEQUESTION

LEADINGZEROS NO LEADINGAS NO

## **SAMPLE OUTPUT**

4

2

---

Added by: Christian Kauth

Date: 2010-10-23

Time limit: 10s-30s

Source limit:50000B

Languages: All

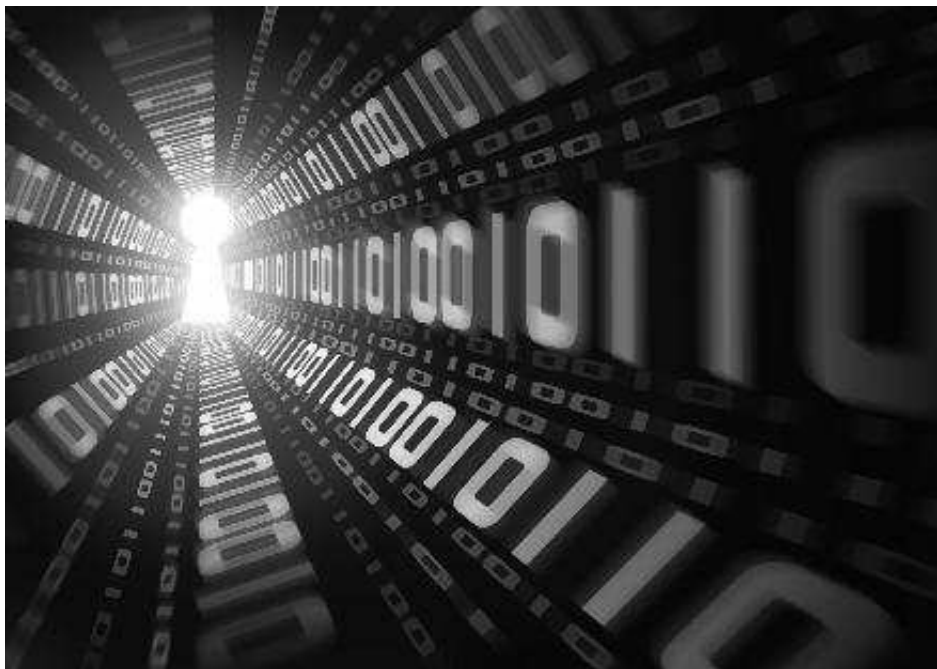
## SPOJ Problem Set (classical)

### 7666. Telecommunications

#### Problem code: TELECOM

From beacons over telegraphs and telephones towards radio and television and ultimately computer networks and internet - telecommunication systems knew a tremendous evolution within the last century! This was also clear to Richard Hamming, who was bothered by erroneous data transmission.

As the transmission channel is often very noisy, the received information is not necessarily the information that was sent out. Looking at digital data transmission, a straight-forward way to check for errors would be a supplementary bit of information, a so-called parity bit. Each package of data on  $n-1$  bits is completed by 1 parity bit, whose value is chosen such that the number of ones in the  $n$ -bit package is even. Although there is little overhead, parity checking is not very robust. If an even number of bits is flipped during transmission, the check bit remains valid and the error will not be detected. Moreover, although parity can detect errors, it provides no indication on the position of the flipped bit. The data must be discarded entirely and re-transmitted.



If more error-correcting bits are included with a message, and if those bits can be arranged such that different incorrect bits produce different error results, then bad bits could be identified and corrected! Among others, Hamming invented the following algorithm that generates a single-error correcting code for any number of bits.



## Hamming Codes:

1. Number the bits starting from 1: bit 1, 2, 3, 4, 5, etc.
2. Write the bit numbers in binary. 1, 10, 11, 100, 101, etc.
3. All bit positions that are powers of two (have only one 1 bit in the binary form of their position) are parity bits.
4. All other bit positions, with two or more 1 bits in the binary form of their position, are data bits.
5. Each data bit is included in a unique set of 2 or more parity bits, as determined by the binary form of its bit position.

a) Parity bit 1 covers all bit positions which have the least significant bit set: bit 1 (the parity bit itself), 3, 5, 7, 9, etc.

b) Parity bit 2 covers all bit positions which have the second least significant bit set: bit 2 (the parity bit itself), 3, 6, 7, 10, 11, etc.

c) Parity bit 4 covers all bit positions which have the third least significant bit set: bits 4-7, 12-15, 20-23, etc.

d) Parity bit 8 covers all bit positions which have the fourth least significant bit set: bits 8-15, 24-31, 40-47, etc.

e) In general each parity bit covers all bits where the binary AND of the parity position and the bit position is non-zero.

Imagine you want to transmit the data '42'. Its binary representation is 101010. According to the above algorithm, some of these data bits must shift their position and will be interlaced by parity bits. We obtain 10-101-0--, where each hyphen is a placeholder for a parity bit. To get an even number of ones on positions 1,3,5,7,9, parity bit 1 must be **0**. Setting parity bit 2 to **0** ensures an even number of ones on positions 2,3,6,7,10. For similar reasons on positions 4,5,6,7, parity bit 4 must be **0** and parity bit 8 must be **1** because of positions 8,9,10. Thus the Hamming code for data '42' is '1011010000' i.e. '720'. Let's suppose the transmission channel is noisy and the received code is '724', i.e. '1011010100'. Then the parity check for parity bit 1 counts an odd number of ones and so does the check for parity bit 2. Parity bit checks 4 and 8 result in an even value. Thus the bit that occurs in parity checks 1 and 2 (i.e. position 3) is wrong and can be corrected! We found back the '720' code. Removing the parity overhead (bits 1,2,4,8) yields the correct data '42'!

Assuming that the noise in the channel is not sufficient to flip more than one bit per package, you are to write a program that extracts the data from a received Hamming code.

## INPUT

The input consists of several test-cases, one per line. Each test-case consists of a single decimal number  $C$  ( $0 \leq C < 2^{64}$ ), which is the received Hamming code. The last line is -1, which is obviously not a Hamming code and terminates the test sequence.

## OUTPUT

For each test-case, output the correct data that was transmitted, assuming the above algorithm was used to generate the Hamming code.

#### **SAMPLE INPUT**

7

28

109

-1

#### **SAMPLE OUTPUT**

1

3

5

From beacons over telegraphs and telephones towards radio and television and ultimately computer networks and internet - telecommunication systems knew a tremendous evolution within the last century! This was also clear to Richard Hamming, who was bothered by erroneous data transmission.

As the transmission channel is often very noisy, the received information is not necessarily the information that was sent out. Looking at digital data transmission, a straight-forward way to check for errors would be a supplementary bit of information, a so-called parity bit. Each package of data on  $n-1$  bits is completed by 1 parity bit, whose value is chosen such that the number of ones in the  $n$ -bit package is even. Although there is little overhead, parity checking is not very robust. If an even number of bits is flipped during transmission, the check bit remains valid and the error will not be detected. Moreover, although parity can detect errors, it provides no indication on the position of the flipped bit. The data must be discarded entirely and re-transmitted.

If more error-correcting bits are included with a message, and if those bits can be arranged such that different incorrect bits produce different error results, then bad bits could be identified and corrected! Among others, Hamming invented the following algorithm that generates a single-error correcting code for any number of bits.

---

Added by: Christian Kauth

Date: 2010-10-24

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 7668. Pebble Solver

#### Problem code: PEBBLE

Pebble is a popular turn-based multi-player game played by kids. In this game, all the players are given a binary string (i.e., a string consisting only of 0's and 1's) of some fixed length. The goal of the game is to convert this binary string to a string containing all 0's.

In a turn, a player is allowed to perform only one operation:- Replace a 1 by a 0 or vice-versa. But each such operation will flip the states of all the bits following the bit you changed.

Take for example, the string: 1001010. You decide to flip the 1 located at the 4th position. The new string after the operation will be : 1000101. (Note that 5th to 7th bits flipped as a result of flipping the 4th bit.)

Your small sister loves to play this game very much. So, you decide to gift her the pebble-solver software which solves this game with the minimum number of operations(how else will you make sure that she always wins?!). And we want to make sure that your software doesn't have any bugs. (he he)

#### Input

There are going to multiple test cases. Each test case consists of a single line which is the initial bit-string.

#### Output

Output corresponding to the each test case in the following format :

"Game #x: y", where x indicates the test case number and y is the minimum number of steps required for your program to solve the game.

#### Example

**Input :**

```
0101
10000
00
```

**Output :**

```
Game #1: 3
Game #2: 2
Game #3: 0
```

---

Added by: Siddharth Kothari  
Date: 2010-10-25  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Own problem

## SPOJ Problem Set (classical)

### 7676. Sum of Digits

#### Problem code: CPCRC1C

Majid is a 3rd-grade elementary student and quite well in mathematics. Once, Majid's teacher asked him to calculate the sum of numbers 1 through n.

Majid quickly answered, and his teacher made him another challenge. He asked Majid to calculate the sum of the digits of numbers 1 through n.

Majid did finally find the solution. Now it is your turn, can you find a solution?

#### Input

Two space-separated integers  $0 \leq a \leq b \leq 10^9$ .

Program terminates if a and b are -1.

#### Output

The sum of the digits of numbers a through b.

#### Example

**Input:** 1 10100 777-1 -1**Output:** 468655

---

Added by: Tii

Date: 2010-10-25

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: <http://cs.ikiu.ac.ir/cms/icpc/training/7-contest/86-contest1>

## SPOJ Problem Set (classical)

### 7680. Electrical Engineering

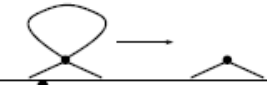


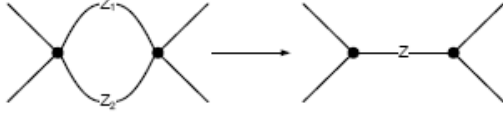
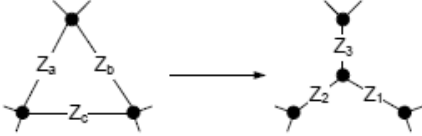
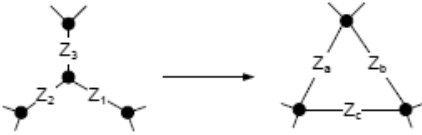
#### Problem code: ELEC

The electrical engineers' indefatigable strive towards environmentally friendly energy production translated into the recent boom of hydro, solar, wind and geothermal power plants. While the production side seems ready, these ambitious projects have their bottleneck in the transportation and distribution: Besides the energy losses that occur during transportation over long distances, the renewable energy sources cannot provide power on demand - they must be taken as provided by nature. Used at large scale in today's networks, unreliable green energy can disrupt the balance of power grids easily and cause huge damage along with large-scale power outages.



Serious effort is thus put on researching transient and dynamic phenomena in power grids. You are offered a position in the lab for linear and planar distribution networks. Given a description of the distribution network's line impedances  $Z_i$ , you are to find the equivalent impedance between some couples of nodes. The knowledge of such equivalent impedances may speed up the network analysis considerably! Impedances are complex number whose real part represents the resistive line behaviour while the imaginary part stands for the capacitive (negative) or inductive (positive) characteristic. Lines are bidirectional, that is  $\text{impedance}(a,b)$  equals  $\text{impedance}(b,a)$ .

It was proven that any linear and planar graph (can be drawn in a way that its edges intersect only at their endpoints) can be reduced into a single equivalent edge that represents the equivalent impedance between its ending nodes, using the following six transformations:

Empty loop reduction		
Pendant edge reduction		
Series reduction		$\underline{Z} = \underline{Z}_1 + \underline{Z}_2$
Parallel reduction		$\underline{Z} = \frac{1}{\frac{1}{\underline{Z}_1} + \frac{1}{\underline{Z}_2}}$
Delta-wye transformation		$\underline{Z}_1 = \frac{\underline{Z}_b \cdot \underline{Z}_c}{\underline{Z}_a + \underline{Z}_b + \underline{Z}_c}$ $\underline{Z}_2 = \frac{\underline{Z}_c \cdot \underline{Z}_a}{\underline{Z}_a + \underline{Z}_b + \underline{Z}_c}$ $\underline{Z}_3 = \frac{\underline{Z}_a \cdot \underline{Z}_b}{\underline{Z}_a + \underline{Z}_b + \underline{Z}_c}$
Wye-delta transformation		$\underline{Z}_a = \frac{\underline{Z}_1 \cdot \underline{Z}_2 + \underline{Z}_2 \cdot \underline{Z}_3 + \underline{Z}_3 \cdot \underline{Z}_1}{\underline{Z}_1}$ $\underline{Z}_b = \frac{\underline{Z}_1 \cdot \underline{Z}_2 + \underline{Z}_2 \cdot \underline{Z}_3 + \underline{Z}_3 \cdot \underline{Z}_1}{\underline{Z}_2}$ $\underline{Z}_c = \frac{\underline{Z}_1 \cdot \underline{Z}_2 + \underline{Z}_2 \cdot \underline{Z}_3 + \underline{Z}_3 \cdot \underline{Z}_1}{\underline{Z}_3}$

Now that you have all the necessary operations available, are you able to determine the equivalent impedance between several couples of nodes?

## INPUT

The input consists of several test-cases separated by an empty line. Each test-case starts with the number of nodes  $N$  ( $1 \leq N \leq 100$ ), the number of bidirectional connections  $C$  ( $0 \leq C \leq 1000$ ) and the number of equivalent impedances to compute  $Z$  ( $0 \leq Z \leq 10$ ) on a line. Then follow  $C$  lines, each describing one bidirectional connection in the form 'EndPoint\_1' 'EndPoint\_2' 'Impedance'. 'EndPoint\_1' and 'EndPoint\_2' are in the range 1 to  $N$  and impedance has the format 're im' where *re* and *im* designate the real and imaginary parts respectively, both being real numbers  $d$  such that  $10^{-3} < |d| < 10^3$ . The next  $Z$  lines each hold two integers, the indices of the nodes between which you are to compute the equivalent impedance. Input terminates on a test-case with  $N=C=Z=0$ , which must not be evaluated.

## OUTPUT

For each couple of endpoints, output the equivalent impedance in the form '*re im*' where *re* and *im* designate the real and imaginary parts respectively. If the nodes are not connected, output 'no connection'. Electrical engineers will consider your result as correct if the absolute error on the real and imaginary parts is below  $10^{-2}$ . Finish each test-case on a blank line.

## SAMPLE INPUT

```
5 10 3
3 1 12.317 -0.779
5 3 30.107 0.289
5 1 27.447 -22.649
4 2 15.351 24.371
5 5 19.63 -3.549
2 2 11.841 18.757
4 5 4.834 -16.542
3 5 5.022 -22.387
2 5 24.768 -22.356
5 2 27.351 12.053
1 2
2 3
3 3
10 10 4
9 8 6.36 17.411
1 3 27.596 -6.484
9 10 4.735 -8.282
8 8 6.901 27.939
8 4 14.894 3.729
5 4 14.311 -2.422
```

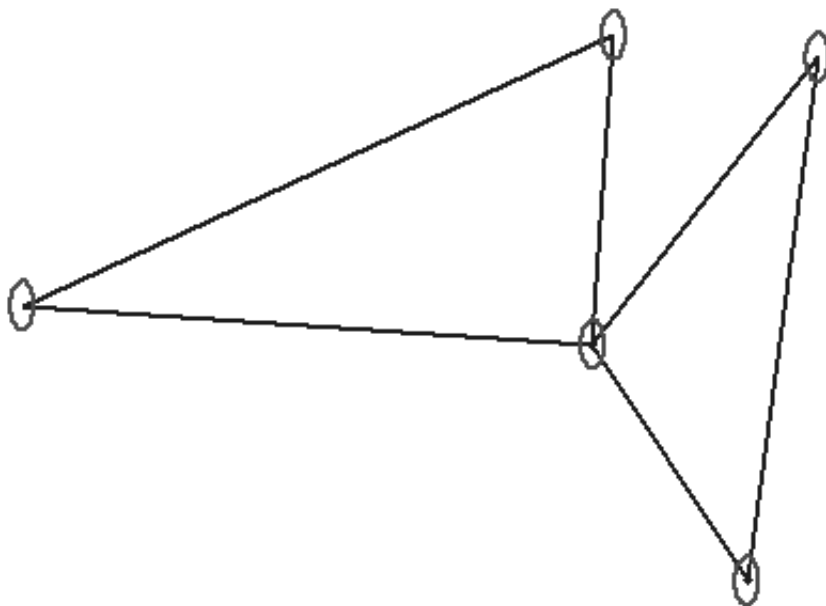


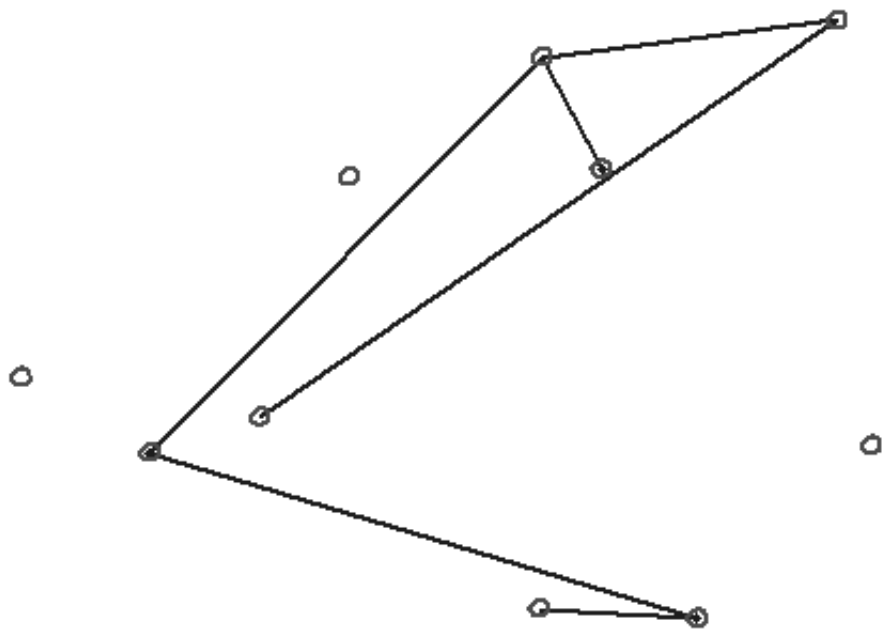
10 10 11.009 6.225  
4 4 3.196 -32.703  
10 9 15.282 -14.799  
3 9 20.473 27.158  
10 9  
8 1  
2 9  
9 6

### SAMPLE OUTPUT

23.37 -7.26  
19.61 -6.97  
0.00 0.00

3.79 -5.46  
54.43 38.09  
no connection  
no connection





Sample input 1 Sample input 2

---

Added by: Christian Kauth

Date: 2010-10-25

Time limit: 30s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 7683. Powered and Squared

#### Problem code: CSQUARE

**Description :**

Marko is learning method of successive squaring so that he can calculate  $a^b \bmod m$  quickly. To give himself practice he wrote many tuples of  $a$ ,  $b$  and  $m$  and went to school thinking that he will do it after school.

After school he found that tuples he wrote are modified by his little sister. His sister converted each  $b$  into base 3. Marko wrote everything in base 10.

Help Marko to do his exercise.

**Input:**

First line of input contains a number  $t$ , number of test cases. Then  $t$  test cases follows each containing three numbers  $a$  ( $\leq 10^9$ ),  $b$  and  $m$  ( $\leq 10^5$ ) ( $a$  in base 10,  $b$  in base 3 and  $m$  in base 10). Number of digits in  $b$  will be less than 250.

**Output:**

Output a number for each test case  $a^b \bmod m$  in base 10.

**Sample****Input:**

```
2
2 10 10
3 21101 19
```

**Output:**

```
8
3
```

---

Added by: divyanshu  
Date: 2010-10-26  
Time limit: 2s  
Source limit: 50000B  
Languages: All

## **SPOJ Problem Set (classical)**

### **7692. Chemistry**

#### **Problem code: CHEM**

The story started some 5'000 years ago in Ancient Egypt, was continued by the Greeks and Arabs, reached France, Europe, and finally conquered the world. The studies on the compositions of waters, the humans' greed for purified materials, millions of experiments and many brilliant minds made chemistry what it is today: No more the quest of the Philosopher's stone, but the study of matter and the changes it undergoes.



There remain nevertheless still groups of stout-hearted followers of ancient believes, so-called alchemist. Keeping their research top-secret, they meet once a year for a conference where they share their recent findings. This year's location is Lausanne and Extremely Purified Fluorescent Liquids (EPFL) is the topic. The idea is that the chemists brew together some new EPFLs. As we speak about state of the art EPFLs, it is necessary that certain chemists put their very specific knowledge together. Thus for a certain EPFL  $E_1$ , the presence of chemists  $C_1$ ,  $C_2$  and  $C_3$  may be required. For another  $E_2$ , chemists  $C_1$  and  $C_4$  might be necessary.

Although chemists are generally very patient people, as their reactions might take long times, they get very impatient if they are to observe experiments in which they are not involved. As an example, chemist  $C_4$  would go crazy if he had to assist to the brewage of  $E_1$ . To ensure a pleasant stay in Lausanne to every chemist, you are to arrange their departure and arrival dates so that each chemist is available whenever his knowledge is required, but is not in Lausanne when other EPFLs are created.

To this purpose, you are given a schedule with ones and zeros. Each column stands for one EPFL, each row for one chemist. There is a 1 at position  $(C_i, E_i)$  if chemist  $C_i$  is needed for EPFL  $E_i$ , and a zero otherwise. Your task boils now down on rearranging the columns in a way that all ones are consecutive in every line. For traditional reasons, the organizers' EPFL is always brewed first and corresponds to the first column of the input schedule ( $E_1$ ).

## INPUT

The input consists of several test-cases separated by an empty line. Each test-case starts with the number of chemists  $C$  ( $1 \leq C \leq 400$ ), followed by the number of EPFLs  $E$  ( $1 \leq E \leq 400$ ). Then follow  $C$  lines of  $E$  characters, '1' or '0'. You may assume that there exists exactly one order of EPFLs (initiated by  $E_1$ ) that meets the above constraints. Input terminates on a test-case with  $C=E=0$ , which must not be processed.

## OUTPUT

Print each output on a line by itself, which holds  $E$  numbers, corresponding to the initial position in the planning, arranged such that all chemists are available when necessary and away from Lausanne otherwise. (the first number must always be 1 as a tribute to the host).

## SAMPLE INPUT

6 5

00010

01000

10101

10100

00011

00101

0 0

## SAMPLE OUTPUT

1 3 5 4 2

---

Added by: Christian Kauth  
Date: 2010-10-27  
Time limit: 2s  
Source limit: 50000B  
Languages: All

## **SPOJ Problem Set (classical)**

### **7693. Environmental Engineering**

#### **Problem code: ENVIRON**

One of the major challenges for environmental engineers in the future will be the overall scarcity of potable water. Not only vegetation and wildlife are fundamentally dependent upon adequate freshwater resources, but also humans. Several desalination processes were developed to make sea water drinkable.

Nonetheless, the water distribution is not uniform on planet, and so some regions are lacking water while others possess it on excess. The International Committee for Precious Consumables (ICPC) worked out an ambitious project fostering the uniform distribution of water on Earth (a perfect ball). The richest and poorest regions in terms of water resources were found to lie equidistantly distributed along a circle of maximum length around the Earth (i.e. the centre of the Earth is also the centre of this circle). So the idea came to construct gigantic pipelines that can transport water along this circle.







Each pipeline has two terminals, starting at a location with water abundance and ending in a region with water scarcity. As drilling the Earth on so long distances is not a reasonable option, all pipelines will be above Earth. Further are there dedicated ducts for the pipelines at different heights. That is, a pipeline grows vertically into the sky until one of the allowed heights is reached, makes a  $90^\circ$  angle, and follows the duct at constant height until it is above the depletion region, where it forms another  $90^\circ$  angle to descent vertically to ground.

As all pipelines' projection to ground must follow the same circle, the ICPC faces a serious problem. They must make sure that no pipelines cross each other in this 2D plane! Further they are concerned about the total length of the pipes, which they'd like to minimize. Your task is to calculate the minimal total length of all the pipes, knowing that the allowed duct heights are non-zero integer multiples of the distance between two adjacent locations (measured along the circle on surface level), which for our purpose has a value of 1.

## INPUT

The input consists of several test-cases separated by an empty line. Each test-case starts with the number of locations  $N$  ( $0 \leq N \leq 500$ ), followed by a line containing  $N$  numbers ('0' or '1') and describing the locations along the circle. A '0' stands for a location with water depletion, a '1' for a region with water abundance. You may safely assume that there are as many '0' as '1'. Input terminates on a test-case *with*  $N=0$ , which must not be evaluated.

## OUTPUT

For each test-case, output the minimum total length (to a precision of  $10^{-2}$ ) of the pipes so that each abundance region connects to exactly one depletion region.

## SAMPLE INPUT

4

1 0 0 1

8

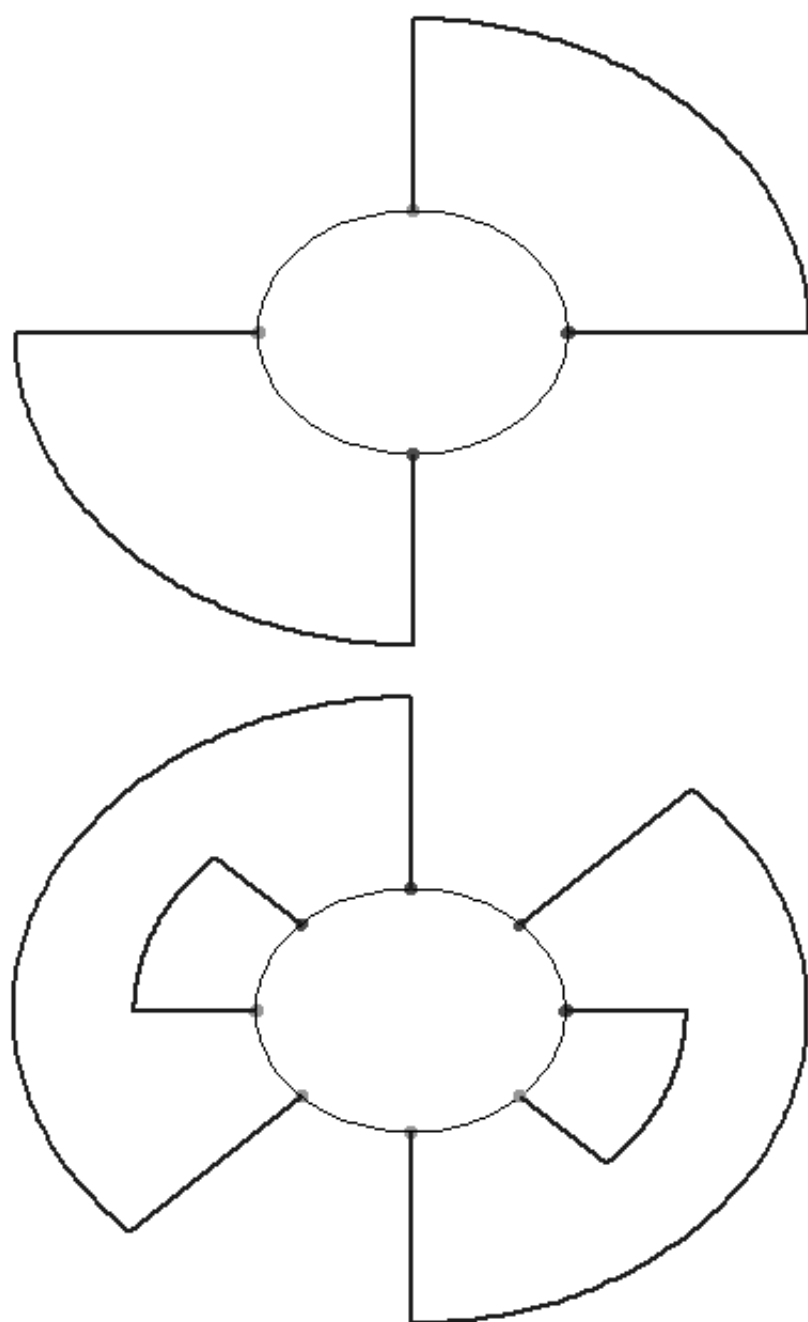
1 1 1 1 0 0 0 0

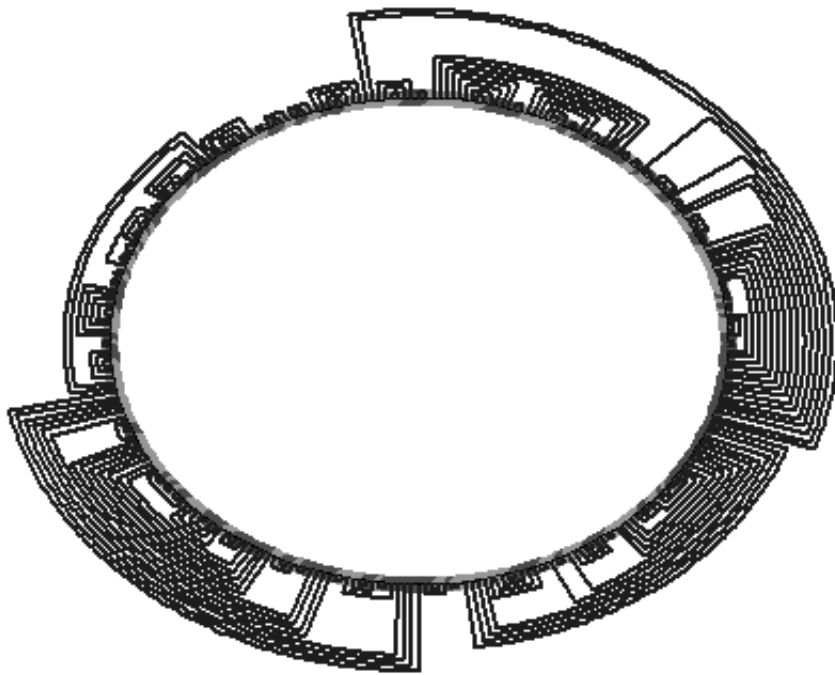
0

## SAMPLE OUTPUT

9.14

31.00





Sample input 1   Sample input 2   A larger test-case

---

Added by: Christian Kauth

Date: 2010-10-27

Time limit: 10s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 7696. Encryption

#### Problem code: CENCRY

Marko is going to write a secret letter to a friend. He thought it is better to encrypt letter so that no other person can read it. After long thought he came up with an encryption scheme which was lame but he thought it will work anyways.

To encrypt a text he first wrote two infinite strings of characters first string consists only of vowels and second string consists of consonants only.

aeiouaeiouaeiouaeiouaeiou.....  
bcdfghjklmnpqrstvwxyzbcdfghjklmnpqrstvwxyz...

Following is the scheme for encryption :

1. let c be any character to be encrypted.
2. let k be the count of number of times c character occurred in text to be encrypted till now.
3. first find which of two infinite string contains that character.
4. then look for kth occurrence of that character in that string.
5. replace character c by corresponding character in second string.

For example encrypted text of "baax" will be "abho".

#### Input

First line of input will contain t, number of test cases. Then t test case follows each test case in a line. Each test case will be a string of small latin alphabets. Length of string will be less than  $5 \cdot 10^4$

#### Output

For each test case print encrypted text.

#### Sample :

##### Input:

2  
baax  
aaa

##### Output:

abho  
bhn

---

Added by: divyanshu  
Date: 2010-10-27  
Time limit: 1s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 7704. Civil Engineering

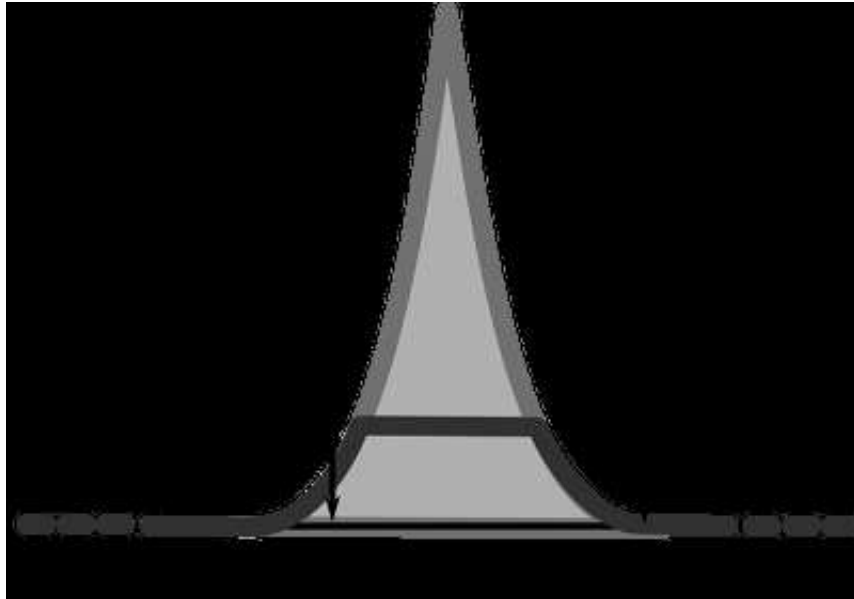
#### Problem code: CIVIL

Civil engineers are people who build impressive structures from concrete and steel. Throughout the world, sky scrapers get ever higher, bridges get ever wider, and tunnels get ever longer. Most recently, the Gotthard Base Tunnel just pushed the limits a bit further...



In this task, you take the role of a civil engineer who is to build a tunnel through a mountain. Unfortunately, you have a very limited budget, and must construct the cheapest possible tunnel.

Because engineers have a habit of simplifying things, we will model the mountain and the tunnel using basic geometric shapes. First of all, consider that the earth is flat, and two-dimensional. On this flat surface stands a mountain of height  $h$  and width  $w$ . Each side of the mountain is parabolic (i.e. satisfies  $y = ax^2 + bx + c$  for some  $a, b, c$ ). You also know that the base of the mountain is smooth, which means that its steepness at the base is zero.



The tunnel is modeled as a horizontal line through the mountain. The best possible tunnel is the one which minimizes construction cost. This cost is proportional to the length of the road which leads to the tunnel, plus the length of the tunnel itself. Consider that each meter of the tunnel is a factor  $f$  times as expensive as a meter of road.

## Input

The input file consists of several test cases. Each case is given on a line by itself and consists of the three numbers  $h$ ,  $w$  and  $f$ , separated by a space. All these are strictly positive floating point numbers. The input file ends with a test case where all numbers are zero (which must not be processed).

## Output

Print for each test case a single number, the optimal height  $t$  of the tunnel. Always print three digits after the decimal point. You may assume that it is always cheaper to build some tunnel than to drive over the top of the mountain.

## Example

```
Input :  
1 2 1.5  
9033.66 29752.4 1.56382  
0 0 0Output:0.3138852.956
```

---

Added by: Jonas Wagner  
Date: 2010-10-29  
Time limit: 1s  
Source limit:50000B  
Languages: All



## SPOJ Problem Set (classical)

### 7718. Number of common divisors

#### Problem code: COMDIV

You will be given  $T$  ( $T \leq 10^6$ ) pair of numbers. All you have to tell is the number of common divisors between two numbers in each pair.

#### Input

First line of input:  $T$  (Number of test cases)

In next  $T$  lines, each have one pair  $A B$  ( $0 < A, B \leq 10^6$ )

#### Output

One integer describing number of common divisors between two numbers.

#### Example

**Input :** 3100000 10000012 24747794 238336

**Output :**

3662

---

Added by: Mir Wasi Ahmed

Date: 2010-10-31

Time limit: 6s

Source limit: 50000B

Languages: All

Resource: Own problem, used in UODA TST

## SPOJ Problem Set (classical)

### 7733. Happy Numbers I

#### Problem code: HPYNOS

The process of "**breaking**" an integer is defined as summing the squares of its digits. For example, the result of breaking the integer **125** is  $(1^2 + 2^2 + 5^2) = 30$ . An integer **N** is **happy** if after "**breaking**" it repeatedly the result reaches 1. If the result never reaches 1 no matter how many times the "**breaking**" is repeated, then N is not a happy number.

#### TASK

Write a program that given an integer N, determines whether it is a happy number or not.

#### CONSTRAINTS

$2 \leq N \leq 2,147,483,647$

#### Input

\* A single line containing a single integer N.

#### Output

\* A single line containing a single integer **T** which is the number of times the process had to be done to determine that N is happy, or **-1** if N is not happy.

#### Example

Input: 19 Output: 41 19 : 1<sup>2</sup> + 9<sup>2</sup> = 82 82 : 8<sup>2</sup> + 2<sup>2</sup> = 68 68 : 6<sup>2</sup> + 8<sup>2</sup> = 100 100 : 1<sup>2</sup> + 0<sup>2</sup> + 0<sup>2</sup> = 1 The solution is 4 because we discovered that the integer 19 is happy after we repeated the process 4 times. **Example**

204 -> 20 -> 4 -> 16 -> 37 -> 58 -> 89 -> 145 -> 42 -> 20 -> 4 -> 16 -> 37 -> 58 -> 89  
-> 145 .....

204 is not a happy number because after breaking it several times the results start repeating so we can deduce that if we continue breaking it, the result will never reach 1.

Number of test cases is 32.

**Don't use pre-calculated values (Don't Cheat)!!!**

---

Added by: Rofael Emil

Date: 2010-11-03

Time limit: 0.5s

Source limit:50000B

Languages: All

Resource: Egyptian Olympiad in Informatics ( EOI ) 2009, August 14 - 21, Cairo

## SPOJ Problem Set (classical)

### 7737. Escape

#### Problem code: BOI7ESC

A group of war prisoners are trying to escape from a prison. They have thoroughly planned the escape from the prison itself, and after that they hope to find shelter in a nearby village. However, the village (marked as B, see picture below) and the prison (marked as A) are separated by a canyon which is also guarded by soldiers. These soldiers sit in their pickets and rarely walk; the range of view of each soldier is limited to exactly 100 meters. Thus, depending on the locations of soldiers, it may be possible to pass the canyon safely, keeping the distance to the closest soldier strictly larger than 100 meters at any moment.

You are to write a program which, given the width and the length of the canyon and the coordinates of every soldier in the canyon, and assuming that soldiers do not change their locations, first determines whether prisoners can pass the canyon unnoticed. If this is impossible then the prisoners (having seen enough violence) would like to know the minimum number of soldiers that have to be eliminated in order to pass the canyon safely. A soldier may be eliminated regardless of whether he is visible to any other soldier or not.

#### Input

The first line contains three integers  $L$ ,  $W$ , and  $N$  - the length and the width of the canyon, and the number of soldiers, respectively. Each of the following  $N$  lines contains a pair of integers  $X_i$  and  $Y_i$  - the coordinates of  $i$ -th soldier in the canyon ( $0 \leq X_i \leq L$ ,  $0 \leq Y_i \leq W$ ). The coordinates are given in meters, relative to the canyon: the southwestern corner of the canyon has coordinates  $(0, 0)$ , and the northeastern corner of the canyon has coordinates  $(L, W)$ , as seen in the picture above.

Note that passing the canyon may start at coordinate  $(0, y_s)$  for any  $0 \leq y_s \leq W$  and end at coordinate  $(L, y_e)$  for any  $0 \leq y_e \leq W$ . Neither  $y_s$  nor  $y_e$  need to be integer.

#### Output

In the first and only line of the output file the program should print the minimum number of soldiers that have to be eliminated in order for the prisoners to pass the canyon safely. If the prisoners can escape without any elimination, the program should print 0 (zero).

#### Constraints

$1 \leq W \leq 50,000$   $1 \leq L \leq 50,000$   $1 \leq N \leq 250$

#### Example

**Input:** 130 340 510 50130 13070 1700 18060 260 **Output:** 1

---

Added by: Race with time  
Date: 2010-11-04  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Baltic Olympiad 2007

## SPOJ Problem Set (classical)

### 7782. Largest Labeled Common Ancestor

#### Problem code: LLCA

Given a labeled complete k-ary tree, find the largest labeled common ancestor of two given nodes. In a complete k-ary tree, the node in the tree is labeled sequentially from the left most child to right most child, level by level. Largest labeled common ancestor of A and B is defined as the largest labeled node in the tree which has A and B as descendants. A node is a descendant of itself.

**Be careful with your finger, the source limit is 256 bytes.**

#### Input

The first line of input contains an integer T ( $1 \leq T \leq 100$ ) the number of cases. Each cases contains three integers K, A and B ( $2 \leq K \leq 100$ ;  $1 \leq A, B \leq 2,000,000,000$ ).

#### Output

For each test case, output in a line the largest labeled common ancestor node.

#### Example

**Input:**  
43 42 72 2 62 1 1054 10 13  
**Output:**  
2113  
**Whitespace Explanation:** If there no input in any line, then the output for that line is a blank line :)) Sorry for inconvenience. >:)

---

Added by: Lukmanul Hakim

Date: 2010-11-08

Time limit: 1s

Source limit: 256B

Languages: All

Resource: ACM-ICPC Indonesia National Contest 2010, Problem B

## SPOJ Problem Set (classical)

### 7807. The Lucky Prisoner

#### Problem code: LPRISON

(Maybe) someday there is a planet used to jail much prisoners from universe. One time, the prison manager collects all of prisoners, with handcuff in their hand locked. He orders to officers to unlock all handcuffs. Then, he orders to officers to look at prisoners whose number can divided by two. If his/her handcuff is locked, the open it, otherwise, lock it. Then, he orders again to all officers to look at prisoners whose number can divided by three, and so on.

You, the universe criminal researcher, is requested to calculate the environmental criminal impact by calculating ratio of freed prisoners about all prisoners to the number of prisoners are known.

#### Input

Line 1 contains one integer  $T$  ( $1 \leq T \leq 100$ ) number of test cases. Then  $T$  next lines contains one number  $K$  ( $1 \leq K \leq 10^{1000}$ ), the number of prisoners.

#### Output

Output contains  $K$  lines, contains the probability of freed prisoners about all prisoners. the probability accuration is  $10^{-500}$  with bankers' rounding method.

#### Example

---

Added by: Lukmanul Hakim  
Date: 2010-11-09  
Time limit: 20s-60s  
Source limit: 1024B  
Languages: All  
Resource: My Own Problem

## SPOJ Problem Set (classical)

### 7826. Tree Isomorphism

#### Problem code: TREEISO

Given two undirected trees  $T1$  and  $T2$  with equal number of vertices  $N$  ( $1 \leq N \leq 100,000$ ) numbered 1 to  $N$ , find out if they are isomorphic.

Two trees  $T1$  and  $T2$  are isomorphic if there is a bijection  $f$  between the vertex sets of  $T1$  and  $T2$  such that any two vertices  $u$  and  $v$  of  $T1$  are adjacent in  $T1$  if and only if  $f(u)$  and  $f(v)$  are adjacent in  $T2$ .

#### Input

The first line of input contains the number of test cases  $nTest$  ( $1 \leq nTest \leq 400$ ). Each test case contains:

- The first line contains the number of nodes  $N$ .
- Each of next  $N-1$  lines contain two integers  $A, B$ , denoting that there is an edge in  $T1$  between nodes  $A$  and  $B$  ( $1 \leq A, B \leq N$ ).
- Each of next  $N-1$  lines contain two integers  $A, B$ , denoting that there is an edge in  $T2$  between nodes  $A$  and  $B$  ( $1 \leq A, B \leq N$ ).

The sum of  $N$  over all test cases will not exceed 100,000.

#### Output

For each test case print YES if  $T1$  and  $T2$  are isomorphic and NO otherwise.

#### Example

**Input :**

244 24 12 34 22 34 153 43 23 53 13 44 22 52 1

**Output :**

YESNO

---

Added by: Andrey Naumenko

Date: 2010-11-10

Time limit: 3s

Source limit: 50000B

Languages: All



## SPOJ Problem Set (classical)

### 7851. Stacks of Zippy

#### Problem code: JZPSTA

Recently Zippy recieved four stacks, named A B C D respectively. Firstly, there are  $n$  elements in stack A (the element sequence is a permutation of  $1..n$ ), and stack B C D are empty. He can do four types of operations:

operation a: push the top element of stack A to stack B (if stack A is not empty, this operation can be done)

operation b: push the top element of stack B to stack D (if stack B is not empty, this operation can be done)

operation c: push the top element of stack A to stack C (if stack A is not empty, this operation can be done)

operation d: push the top element of stack C to stack D (if stack C is not empty, this operation can be done)

He can do  $2*n$  operations in total. Obviously, there are  $n$  elements in stack D after he did the  $2*n$  operations. Then he take out the top element in stack D one by one. If the first element he takes out is  $n$ , the second is  $n-1$ , ... , the last is 1, he will be very happy. Also, he wants to make the operation sequence he did lexicographic smallest.

#### Input

First line is a number  $t$ , which is the number of testcases.

The following  $t$  lines, each line contains a integer  $n$ , which is the number of sectors. ( $5 \leq n \leq 10^4$ )

Then following  $t$  testcases. For each test case, the first line contains a number  $n$ , which denotes the number of the elements in stack A. The second line contains  $n$  numbers, separated by a space, which are the elements in stack A, from top to the bottom.

#### Output

For each case, output a line. If there exists an answer, output the lexicographic smallest one. If not, output 0.

#### Example

Input:

```
2
4
1 3 4 2
4
2 3 4 1
```

Output:

```
a b a c a b b d
```

0 Zippy jumps for years, and finally knows that jump is very boring. Then he found out a new way to

## Input

First line is a number  $t$ , which is the number of testcases.

Then following  $t$  testcases. For each test case, the first line contains a number  $n$ , which denotes the number of the elements in stack A. The second line contains  $n$  numbers, separated by a space, which are the elements in stack A, from top to the bottom.

You can be sure that the sum of all  $n$  does not exceed 200000, and each  $n$  is not bigger than 100000.

## Output

For each case, output a line. If there exists an answer, output the lexicographic smallest one (the operations Zippy does, separated by a space). If not, output 0.

## Example

**Input:** 2 41 3 4 2 42 3 4 1 **Output:** a b a c a b b d 0

**Previous testdata wrong. All submissions have been rejudged. Sorry for inconvenience. (2011.10.5)**

---

Added by: sevenkplus  
Date: 2010-11-14  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: CNOIP2008 && POI17

## SPOJ Problem Set (classical)

### 7909. CALCULATE PATH FOR JERRY

#### Problem code: FINDPATH

In Tom and Jerry, Jerry, tired of Tom, decided to leave for his cousin *Muscle* for few days. *Muscle* is characterized as *A very strong Mouse that has a fondness for beating up cats.*

Jerry has some mysterious anti-Tom numbers ( $a_1, a_2, a_3, \dots, a_{m-1}, a_m$ ) so that he can jump from position (say  $x$ ) to  $x * a_i$ , for any value of  $a_i$  ( $0 < i \leq m$ ). These jumps are safe from Tom and other cats also. The goal is to reach *Muscle* safely, without making a single jump which can be sensed by cats. Since Jerry knew you are good at puzzles, he ask you to Help Him!!!

Find whether Jerry can reach cousin *Muscle*. If yes, print the minimum number of steps required, followed by the path in the next line, otherwise -1.

The starting position is 1.

#### Constraints:

$$0 < n \leq 10^{10}$$

$$0 < m \leq 10$$

$$0 < a_i \leq 20 \quad (1 \leq i \leq m)$$

#### Input

There are about 100 test cases. Each test case consists of two lines. In first, there is  $n$  and  $m$ , position of Uncle Muscle and number of anti-Tom number, respectively. Follows,  $m$  space separated anti-Tom number in the next line. Read test cases upto end of file.

#### Output

For each test case, if the path is possible, print the minimum number of jumps required to reach Cousin *Muscle*, followed by the stops (including starting and final position) in the next line. If there are more than one path, print the lexicographically smallest one. If no such path exists, print -1.

#### Example

Input:12 22 310 32 3 513 62 4 6 8 10 120Output:31 2 4 1222 2 10-1Explanation for Test case:12 22 3There minimum no. of stops are 3,but there are more than one path with 3 steps,a) 1 2 4 12b) 1 2 6 12c) 1 3 6 12Since the lexicographically smallest term has to be printed(a) 1 2 4 12 is the answer.

---

Added by: lost  
Date: 2010-11-18  
Time limit: 6s  
Source limit:50000B  
Languages: All  
Resource: IIITM Local Contest

```
(function() { var po = document.createElement('script'); po.type = 'text/javascript'; po.async = true;
po.src = 'https://apis.google.com/js/plusone.js'; var s =
document.getElementsByTagName('script')[0]; s.parentNode.insertBefore(po, s); })();
```

## SPOJ Problem Set (classical)

### 8042. Possible Friends

#### Problem code: SOCIALNE

Josué, one of the undergraduate students in PUCMM, is developing a Social Network, but he is having difficulties in identifying the person that has more possible friends. Two persons are possible friends if they are not friends and they have at least one common friend, for example if person A is friend only to person B, and person B is friend of C, then, A and C are possible friends. You are about to help him in this task. Given the network table, you have to write a program that finds the person that has more possible friends, if more than one person matches this criteria, then select the one that comes first ( the one that has the lower ID).

#### Input

The first line is **T** ( $1 \leq T \leq 1,000$ ), the number of test cases, then **T** test cases follow.

Each test case consists in a 'Y' or 'N' square matrix (**M**×**M**) representing the friendship of the network, where **M** is the number of persons.

#### Constraints

**M** ( $1 \leq M \leq 50$ )

The square matrix has **M** lines, each line has **M** characters.

The first line of the matrix corresponds to person 0, the next line to person 1, and so on.

On each line the leftmost character corresponds to person 0, the next character to person 1, and so on.

So if character *j* of the line *i* is 'Y', it means that person '*i*' is a friend of '*j*'.

For each person *i*, character *i* of line *i* will be 'N'.

For each *i,j* character *j* of line *i* will be the same as character *i* of line *j*.

#### Output

For each test case, you have to output one line containing the ID of the person(0-based) that has more possible friends and the number of possible friends this person has, separated by a blank space.

### Example

**Input :** 3NYNNYNNYYNYYYNNYYNNYYNNNNYNNNNNYNNNYYNNNNNNNYNNNNNNNYNNNNNNNYNNNNNNNYNNNNNNNNNNOutput : 0 12 23 4

Added by: Olson Ortiz

Date: 2010-12-09

Time limit: 1s-2s

Source limit:50000B

Languages: C C# C++ 4.0.0-8 C++ 4.3.2 JAVA

Resource: Used in 1st Programming contest PUCMM ACM-ISC 2010 (Dominican Republic)

## SPOJ Problem Set (main)

### 8316. Win gold medal

#### Problem code: WINGOLD

In a game there are infinite number of levels. In order to go to the next level, a player has to clear all the preceding levels. A player can't go further if he fails to clear the level. Each player has a probability  $p$  of clearing the level (which is independent of the other players and the level number). For example, if  $p = 1/2$  there is a probability  $2^{-(n-1)}$  that a particular game will have exactly  $n$  levels cleared. A player will get Gold medal if he clears the maximum number of levels. If the maximum number of levels reached is common between two or more players, then no one wins the gold medal. What is the probability that a Gold medal is given to any player?

#### Input

$T$  number of test cases each case follow

$p$   $n$   $m$  . probability of clearing level for each player, number of player, number of levels in game

#### Output

$T$  line each probability that gold medal is given round off to 4 significant digits

limit:

$1 \leq T \leq 10000$

$1 \leq n \leq 1000$

$1 \leq m \leq 100$

$0 \leq p \leq 1.0$

#### Example

**Input :** 60.43 3 20.5 3 40.2 3 40.1 4 50.9 3 31.0 4 4 **Output :**  
0.44900.62440.41840.30140.02750.0000

---

Added by: pankaj

Date: 2011-02-13

Time limit: 1s

Source limit: 50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2

Resource: own, DOPE 2011

## SPOJ Problem Set (classical)

### 8317. Red Balls

#### Problem code: SIGNGAME

After the previous game ,each ball is either red or green in color. Dope tells you that he is changing the color of all balls in the range  $i$  to  $j$  (both inclusive),that is red balls to green and green balls to red.And then he asks you to tell the total extra mass of red balls over green balls for some range between  $i$  to  $j$  (inclusively). As you like red balls,you will try to maximize the total mass of red balls mass over the green balls. So He allows you to choose any range inside the range  $i, j$  inclusively which gives the maximum extra mass of red balls over the green balls .When you choose a range, you have to take all the green and red balls that belong to the range.

Convention:

(+) positive mass represents red ball mass

(-) negative mass represents green ball mass

#### Input

T number of test cases

next T test cases follow each contains:

N number of balls

next line contains N mass of ball ( positive or negative)

next line Q number of operation and query next Q lines contain

c a b

c =0 change the color of balls in range a, b inclusively

c =1 print the maximum extra mass of red bass over green in the range a,b inclusively

#### Output

each line for print query

limit:

$1 \leq T \leq 10$

$1 \leq N \leq 100000$

$1 \leq Q \leq 100000$

$0 \leq a \leq b \leq N$

c = 0 or 1

$\text{abs}(\text{individual mass}) < 1000$

#### Example

Input:

1

5

2 -3 4 5 -2

4



0 0 2

1 0 2

1 1 3

0 1 1

**Output:**

3

5

[you have to choose a range, if all balls are green in the range you have to print (-)ve answer]

---

Added by: pankaj

Date: 2011-02-13

Time limit: 5s

Source limit:50000B

Languages: All

Resource: own, DOPE 2011

## SPOJ Problem Set (main)

### 8318. color the balls

#### Problem code: PLAYSIGN

You and Dope are visiting DAKSH. Suddenly Dope found some balls having some mass on it and all balls are white in color. They found an interesting thing of the balls that they can change color from red to green and vice versa on clicking the switch on it. Dope is in a funny mood and wants to play a game with you. He tells you that each player will switch the balls to either red or green color alternatively and only white ball can be chosen to change the color. After changing the color of all balls you need to pay an amount equal to the absolute difference between mass of the red balls and green balls. Dope would try to maximize the pay and obviously you want to give him as less as possible. Dope invites you to play first. If you and Dope play optimally, what is the amount you have to pay to Dope?

#### Input

T number of test cases. Each case consists of two lines. first line N number of white balls. Next line contains a b c use to generate N mass using  $\text{mass} = (a*i+b)\%c$ ; for  $1 \leq i \leq N$

#### Output

single line for each case the amount you need to pay

limit:

$1 \leq T \leq 1000$

$1 \leq N \leq 10000$

$1 \leq a, c \leq 1000$

$0 \leq b \leq 1000$

#### Example

**Input:** 231 0 1042 1 10**Output:**

210  
explanation: case1: 3 mass = 1 2 3; output = 2 case2: 4 mass=3 5 7 9; output=10

---

Added by: pankaj

Date: 2011-02-13

Time limit: 1s-2s

Source limit: 50000B

Languages: C C++ 4.0.0-8 C++ 4.3.2

Resource: own, DOPE 2011

## SPOJ Problem Set (classical)

### 8319. GLJIVE

#### Problem code: GLJIVE

In front of Super Mario there are 10 mushrooms, arranged in a row. A certain amount of points is awarded for picking each of the mushrooms. Super Mario must pick mushrooms in order they appear, but is not required to pick them all - his goal is to score a number of points as close as possible to 100.

In case there exist two such numbers which are equally close to 100 (e.g. 98 and 102), Mario will pick the greater one (in this case 102).

Help Super Mario and tell him how many points he will score.

#### Input

Input consists of 10 lines, each of which contains one positive integer less than or equal to 100, denoting the scores awarded for picking each mushroom, in the order that Mario can pick them in.

#### Output

The first and only line of output must contain the required number of points.

#### Example

**Input :**

```
102030405060708090100
```

**Output :**

```
100
```

---

Added by: akaki  
Date: 2011-02-13  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: coci

## SPOJ Problem Set (classical)

### 8320. Spreadsheet scrolling

#### Problem code: SCROLL

Sruthi is looking at a spreadsheet containing  $N$  rows. Only  $K$  rows of the spreadsheet are visible at a time (If the top row is  $i$ , the bottom row will be  $i+K-1$ ). In the beginning, rows  $1..K$  are visible. Sruthi needs to read certain values from rows  $r_1, r_2 \dots r_M$  in that order. It is possible to scroll the spreadsheet so that the rows  $j..j+K-1$  can be viewed instead of the current  $i..i+K-1$ . This operation counts as one scroll and its scroll length is defined as  $|j-i|$ .

Find the minimum number of scrolls required so that Sruthi can read of all the  $M$  values in the given order. As there may be more than one way to do this, also find the minimum total scroll length required to do the reading in so many scrolls.

#### Input

The first line of the input contains the integer  $T$  ( $\leq 20$ ), the number of test cases to follow.

The description of each test case begins with a line containing 3 integers  $N$  ( $\leq 10^8$ ),  $K$  ( $\leq 10^8$ ) and  $M$  ( $\leq 50000$ ) as defined in the problem. Following this are  $M$  lines giving the row numbers from which values have to be read sequentially.

#### Output

Output two space separated integers in a line per test case : The minimum number of scrolls required and the minimum scroll length required for the minimum number of scrolls.

#### Example

**Input :**

```
2
20 10 2
10
20
20 10 2
10
7
```

**Output :**

```
1 10
0 0
```

---

Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 5s  
Source limit:50000B  
Languages: All  
Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8321. Chocolate distribution

#### Problem code: CHOCDIST

In Dystopia, chocolates are being distributed to children waiting in a queue. The distribution proceeds as follows. Each chocolate bar is rectangular in shape with integer edge lengths. If the chocolate bar is a square, it is given away completely to the first child in the queue. Otherwise the largest possible square piece of chocolate is broken off from the chocolate bar and given to the first child. After a child receives his share of chocolate, he leaves the queue. The remaining portion of the chocolate bar is dealt with in the same fashion and the whole or a portion of it is given to the next child in the queue.

For example, if we start with a 5x3 chocolate bar, the first child in the queue receives a 3x3 chocolate bar, leaving a 2x3 bar. The second child gets a 2x2 bar while the third and fourth children get 1x1 bars. Thus four children have been fed using the 5x3 bar.

The Dystopian government has got a carton of chocolate bars to be distributed to children in the country. To make sure that maximum inequality is achieved while distributing chocolates, the chocolate bars in the carton are all of different sizes. For every  $i$  such that  $M \leq i \leq N$  and every  $j$  such that  $P \leq j \leq Q$  (where  $M, N, P, Q$  are integers) there is exactly one chocolate bar of length  $i$  and breadth  $j$  in the carton. Here a bar of length  $i$  and breadth  $j$  is considered to be different from a bar of length  $j$  and breadth  $i$ .

Given the values of  $M, N, P, Q$  find the number of children that can be fed with the chocolate in the carton.

#### Input

The first line of the input contains the number of test cases,  $T$  ( $\leq 1000$ )

Following this are  $T$  lines, each describing a test case with four integers  $M, N, P, Q$  separated by spaces ( $1 \leq M \leq N \leq 1000000000$ ,  $1 \leq P \leq Q \leq 1000$ )

#### Output

Output  $T$  lines, each containing an integer : The number of children that can be fed using the chocolate in the carton

#### Example

**Input :**

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

**Output :**

```
6
14
```

---

Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8323. Triangle equality

#### Problem code: TRIEQUAL

Consider three distinct points A,B,C on a plane. The sum of straight line distances from A to B and B to C is always greater than or equal to the straight line distance from A to C. Equality holds only when ABC is a degenerate triangle. This is the famous **triangle inequality**

In this case, distance between points is measured by the Euclidean metric. ie, the distance between points  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by  $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ . However, this is not the only metric possible. Another common metric used is the **Manhattan metric** where the distance between the pair of points is given by  $|x_1 - x_2| + |y_1 - y_2|$

You are given N distinct points on a plane where distances are measured using the Manhattan metric. Find the number of ordered triplets of distinct points (A,B,C) such that the sum of distances from A to B and B to C is equal to the distance from A to C.

#### Input

The first line of input contains an integer T ( $\leq 10$ ), the number of test cases to follow.

Following this are the descriptions of T test cases. Each test case description begins with an integer N ( $\leq 50000$ ), the number of points. Following this are N lines, each giving the x and y coordinates of a point ( $0 \leq x_i, y_i \leq 10^8$ ) separated by a space.

#### Output

Output T lines, each containing the number of ordered triplets of distinct points in every test case with the given property

#### Example

**Input :**

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

**Output :**

```
2
0
```

---



Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 5s  
Source limit:50000B  
Languages: All  
Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8324. Military patrol

#### Problem code: MILPATR

Dystopia consists of  $N$  cities. There are one-way roads connecting some pairs of cities. The dysfunctional state has recently seen a lot of protests to overthrow the tyrannical ruler and the government plans to use military patrol vehicles to make sure that the protests are suppressed. Every patrol vehicle is assigned a sequence of cities. If a patrol vehicle is assigned the cities  $c_1, c_2, \dots, c_k$  then it starts from the city  $c_1$  and takes the direct one-way road to  $c_2$ , from there it takes the one-way road to  $c_3$  and so on. Finally the vehicle takes the one way road from  $c_k$  to  $c_1$ . This routine is repeated everyday to keep the protestors perpetually under fear.

Now note that:

- Every city has to appear in exactly one vehicle's patrol sequence exactly once
- Every patrol vehicle has to move - so it has to be assigned more than one city

The government does not have any limit on the number of patrol vehicles it can use. However, they want to make sure that the least possible amount of money is spent on the patrol mission and hence they want to minimise the total distance travelled by the patrol vehicles.

Given the road network of Dystopia, find the minimum total distance the patrol vehicles need to move so that all the cities can be patrolled. If it is impossible to organise a nationwide patrol with the given constraints, report the same.

#### Input

First line of the contains  $T$ , the number of test cases ( $T \leq 10$ )

This is followed by the descriptions of the  $T$  testcases. The first line of the description contains two integers  $N$  and  $R$ , the number of cities and one way roads respectively ( $N \leq 200, R \leq 10000$ ). The cities are numbered  $1, 2, 3, \dots, N$  This is followed by  $R$  lines, each representing a one way road by 3 integers  $N_1, N_2$  and  $D$  : the start city, the end city and the length of the road respectively ( $N_1 \neq N_2, 1 \leq D \leq 1000000$ ). You are assured that there is no more than one one way road from any  $N_1$  to  $N_2$

#### Output

For each test case output one line. If the patrol can be done, output the minimum total distance that the patrol vehicles have to travel. Otherwise output Impossible

## Example

### Input :

```
2
3 3
1 2 1
2 3 1
1 3 1
4 6
1 2 2
2 3 2
3 4 2
4 1 2
1 4 1
3 2 1
```

### Output :

```
Impossible
6
```

---

Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8325. Partitioning the plane

#### Problem code: PARTPLNE

You are given the coordinates of  $4K+5$  points on a plane such that no three of them are collinear. You need to select five points from these : a central point O and four arm points A,B,C,D such that:

- Rays from the centre to the arm points divide the plane into four regions containing an equal number of points
- None of the four central angles is a reflex angle
- Sum of absolute values of the cotangents of the central angles is as low as possible

If it is possible to choose points satisfying this condition, output the lowest possible value for the sum of absolute values of the cotangents of the central angles. Otherwise report that it is not possible.

#### Input

The first line of input contains  $T(≤4)$ , the number of test cases. Following this are the descriptions of the  $T$  test cases.

The first line in the description of each test case gives  $K(≤100)$ . Following this are  $4K+5$  lines giving the  $x$  and  $y$  coordinates of each point separated by a space ( $0 ≤ x, y ≤ 10^6$ )

#### Output

For each test case output in a different line the minimum sum of absolute values of the cotangents of the central angles, with six digits after the decimal point. If the division cannot be done in the manner explained, print Impossible

#### Example

**Input :** 200 00 11 11 02 300 02 00 12 11 2**Output :** 4.500000Impossible

---

Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 6s  
Source limit: 50000B  
Languages: All  
Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8326. Leaky containers

#### Problem code: LEAKCONT

The acid manufacturing company has a special room to store leaky acid containers. The container holders in the room, which have the capacity to hold one leaky container each, are arranged in a rectangular grid of  $R$  rows and  $C$  columns such that the columns are in the North-South direction while the rows are in the East-West direction. Currently there are  $N$  leaky containers in some of the holders and  $M$  more have just arrived and need to be placed in the holders.

The company has realised that the containers being produced these days are exceptionally leaky. So much so that the acid that is leaking is corroding the holders completely.

Every acid container leaks either in the North-South direction or the East-West direction. Containers can be rotated by 90 degrees and thus a container that is leaking in the East-West direction can be made to leak North-South and vice versa. Given enough time, a leaky container can corrode the holder completely and start corroding the two adjacent holders in the leak direction and this process can go on.

The company employee has to make a decision fast. He needs to rotate some of the existing containers and place the new containers in proper holders and directions such that the total number of holders that will be corroded is minimised.

Find out the minimum number of holders that will be corroded after proper placement of the new containers and proper orientation of all containers.

#### Input

The first line of the input contains the number of test cases  $T$  ( $\leq 10$ ).

For each test case, the first line has four numbers  $R$ ,  $C$ ,  $N$  and  $M$  ( $1 \leq R, C \leq 100$ ,  $1 \leq M, N \leq 20$ ,  $M+N \leq R \cdot C$ ). This is followed by  $N$  lines, each giving the location and leak direction of an existing container by 3 integers  $r$  (row number),  $c$  (column number) and  $d$  (1 if leakage is N-S, 0 if E-W). Numbering of rows and columns begins with 1.

#### Output

For each test case, output on a different line the smallest number of holders that will get corroded after rotating the existing containers and placing the newly arrived containers.

#### Example

**Input :**

```
2
4 6 4 4
1 2 0
2 4 0
3 2 1
```

```
3 5 1
50 50 5 10
1 35 1
17 44 0
17 46 1
42 35 1
42 46 0
```

**Output :**

```
12
148
```

---

Added by: Raziman T V

Date: 2011-02-13

Time limit: 2s

Source limit:50000B

Languages: All

Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8327. Progressive progressions

#### Problem code: PROGPROG

An arithmetic progression is a sequence of numbers  $a_1, a_2, \dots, a_n$  such that  $a_{i+1} - a_i$  is equal for all  $0 \leq i < n$ . This difference is called the common difference of the arithmetic progression.

Now consider a sequence of arithmetic progressions  $A_1 = (a_{1,1}, a_{1,2}, \dots, a_{1,n_1})$ ,  $A_2 = (a_{2,1}, a_{2,2}, \dots, a_{2,n_2})$ , ...  $A_k = (a_{k,1}, a_{k,2}, \dots, a_{k,n_k})$

A progressive progression is such a sequence with the additional properties that:

- $a_{i,n_i} = a_{i+1,1}$  for  $1 \leq i < k$
- $c_i$ , the common difference of  $A_i$ , is a positive factor of  $a_{i,1}$  for  $1 \leq i \leq k$
- $c_i < c_{i+1}$  for  $1 \leq i < k$
- $n_i > 1$  for  $1 \leq i \leq k$
- $k \geq 1$

Find the number of progressive progressions such that  $a_{1,1} = 1$  and  $a_{k,n_k} = N$ . As this number can be quite large, output it modulo 100000007.

#### Input

The first line of input contains  $T$  ( $\leq 100$ ), the number of testcases. This is followed by the description of the testcases. The description of each testcase consists of a single integer  $N$  ( $1 < N \leq 1000000$ ).

#### Output

For each testcase, output modulo 100000007 the number of progressive progressions such that  $a_{1,1} = 1$  and  $a_{k,n_k} = N$

#### Example

Input :

2  
5  
10

Output :

1  
6

---

Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 7s  
Source limit:50000B  
Languages: All  
Resource: IOPC2011



## SPOJ Problem Set (classical)

### 8328. Move the books

#### Problem code: MOVEBOOK

Sheldon and Lenard are a pair of nerds playing an unimaginatively named game, "Move the books". The game board is an infinitely long strip of cells numbered 1,2,3.... from left to right. On certain cells, their favourite physics books have been placed. A player's move consists of taking any one of the books and moving it to any cell which lies to its left. But there is a constraint that you are not allowed to make your book jump over a cell that contains a book already (ie, You cannot move a book from cell  $j$  to cell  $i < j$  if there is a cell  $k$  which contains one or more books such that  $i < k < j$ ). However, you can place a book into a cell even if it contains one or more books already. But books that are placed in a cell are stacked in the order in which they arrive and hence only the topmost book (the last arrived one) can be moved from there. The players make moves alternately, and the person unable to move any book loses.

They have been playing the game for a long time. Sheldon makes the first move in all the games and wins most of the time. Lenard is fed up and wants to make the first move. However, Sheldon doesn't yield and this leads to an argument. This is the final agreement they have come up with:

- They start with  $N$  books placed in different cells. The arrangement is computer generated and hence there is no player role in this step
- Lenard picks two natural numbers  $a$  &  $c$  while Sheldon picks a natural number  $b$ . Both are unaware of the number(s) the other person has chosen while choosing their own number(s). Three more books are now added to the set :  $a$  cells to the right of the rightmost current book,  $b$  cells to the right of this book and  $c$  cells to the right of the latter book.
- They start the game with the same rules as earlier, with Sheldon making the first move.

Now Lenard feels that there might be certain pairs  $(a,c)$  such that independent of which number Sheldon chooses, Lenard is assured to win the game. Given the initial configuration of the board find all such pairs, sort them lexicographically  $[(a_1, c_1) < (a_2, c_2)]$  iff  $a_1 < a_2$  or  $(a_1 = a_2 \text{ and } c_1 < c_2)$  and output the  $K$ th such pair. If there are less than  $K$  pairs with this property, output Impossible

#### Input

The first line of the Input contains  $T$  ( $\leq 50$ ), the number of test cases. Following this are the descriptions of the  $T$  test cases

The first line in the description of each test case contains two space separated integers  $N$  ( $\leq 1000$ ) and  $K$  ( $\leq 10^8$ ). Following these are  $N$  lines, each containing the location of a book. The book positions are given in increasing order and will each fit in a 32 bit signed integer.

## Output

For each test case output the Kth lexicographically smallest pair of integers that will assure Lenard a win. The two integers should be separated by a space and pairs for each test case should be output on a new line. If for any test case there are less than K pairs of integers that assure Lenard a win, on the line for that test case output Impossible

## Example

**Input :**

```
1
1 1
1
```

**Output :**

```
1 1
```

---

Added by: Raziman T V

Date: 2011-02-13

Time limit: 1s

Source limit:50000B

Languages: All

Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8329. Road trip

#### Problem code: ROADTRIP

Phileas Fogg and Passepartout are now going on a road trip in their brand new car. They start at location  $A_0$  and need to go to  $A_N$ . Their car has a capacity to hold only  $C$  units of fuel and can travel unit distance on unit amount of fuel. They start by filling some amount of fuel from the filling station at  $A_0$ . On the way, there are several filling stations  $A_1, A_2, \dots, A_{N-1}$ . The cost of fuel is not the same at all filling stations. Find the minimum amount that they have to spend on fuel to make the journey. Note that it is assured that the journey can be completed with the car of the given capacity.

#### Input

The first line of input contains  $T$  ( $\leq 10$ ), the number of test cases. Following this are the descriptions of the testcases

The first line in the description of each test case contains two space integers  $N$  ( $\leq 50000$ ) and  $C$  ( $\leq 10^8$ ). This is followed by  $N$  lines, each containing an integer. The integer on the  $i$ th line is the distance from  $A_0$  to  $A_i$  and is  $\leq 10^8$ . The distances are in increasing order. This is followed by  $N$  more lines, each containing an integer. The integer on the  $i$ th line is the cost of one unit of fuel at the filling station  $A_{i-1}$  and is  $\leq 10^8$ .

#### Output

Output one integer per test case, the minimum total amount that needs to be spent on fuel to complete the journey

#### Example

**Input :**

```
2
5 10
10
20
30
40
50
1
2
1
2
1
5 15
10
20
30
40
50
1
```

2  
1  
2  
1

**Output :**

70  
60

---

Added by: Raziman T V

Date: 2011-02-13

Time limit: 5s

Source limit:50000B

Languages: All

Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8330. Giant fountain

#### Problem code: GNTFNTN

The Dystopian government has installed a giant fountain in front of the parliament building. The fountain consists of  $N$  levels stacked one on top of the other and is situated on top of a large tank of infinite capacity. The levels of the fountain are numbered 1 to  $N$  from top to bottom. The top  $l_1$  levels are identical with capacity  $c_1$ , the next  $l_2$  levels identical with capacity  $c_2$ ,... the final  $l_K$  levels with capacity  $c_K$ . Here  $l_1 + l_2 + \dots + l_K = N$ .

When water is added to level  $i$  beyond its capacity, the excess water overflows to level  $i+1$ . Water overflowing from level  $N$  is collected in the tank. Water is added to the levels in the following fashion. First,  $w_1$  amount of water is added to each level  $i$  such that  $s_1 \leq i \leq e_1$ . Then  $w_2$  amount of water is added to each  $s_2 \leq i \leq e_2$ ... Finally  $w_M$  amount is added to  $s_M \leq i \leq e_M$ . Note that water might be added to the same level multiple times in this fashion. You have to find out the amount of water that has overflowed to the tank at the bottom, and the total number of levels of the fountain that are completely filled

#### Input

The first line of the input contains  $T$  ( $\leq 10$ ), the number of test cases. Following this are the descriptions of the test cases.

The first line of the description of a test case contains space separated integers  $N$  ( $\leq 2 \times 10^8$ ),  $K$  ( $\leq 2000$ ) and  $M$  ( $\leq 10^4$ ). Following this are  $K$  lines, each containing a space separated pair of integers. These are the  $(l_i, c_i)$  pair as explained in the problem statement. Here  $l_1 + l_2 + \dots + l_K = N$  and  $c_i \leq 10^8$ . This is followed by  $M$  lines, each containing a space separated triplet of integers. These are  $(s_i, e_i, w_i)$  as explained in the problem statement.  $1 \leq s_i \leq e_i \leq N$  and  $w_i \leq 10^6$

#### Output

For each test case output a space separated pair of integers : The total amount of water that has overflowed to the tank and the number of levels of the fountain that are completely filled.

#### Example

**Input :**

```
1
10 2 1
5 6
5 3
3 9 5
```

**Output :**

```
5 5
```

---

Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8331. Sister cities

#### Problem code: SSTRCITS

Unlike Dystopia, the neighbouring nation of Utopia believes in economic development. To improve the economy of the nation, the Utopian government has decided to select some pairs of cities as sister cities and take steps to improve trade relations between each pair.

There are  $N$  cities in Utopia, numbered 1 to  $N$ . There are two-way roads connecting some pairs of cities. The total number of roads in Utopia is  $R$ . Now the road network in Utopia has been created efficiently so that there is no road that is redundant. That is, there is exactly one way to travel between any pair of cities without using the same road twice. Now when a pair of cities is chosen as sister cities, the government wants to make sure that there is a direct road between them. Also, a given city cannot have more than one sister.

Given the road network of Utopia, find the number of ways of selecting  $K$  pairs of sister cities under these constraints. As the answer can be quite large, output it modulo 100000007.

For example, assume that there are 6 cities in Utopia. There are direct roads between the following pairs of cities : (1,2), (2,3), (2,4), (4,5), (4,6). Notice that there is exactly one way to travel between any pair of cities. If the government wants to select two pairs of sister cities, it can do it in four ways : {(1,2),(4,5)}, {(3,2),(4,5)}, {(1,2),(4,6)}, {(3,2),(4,6)}

#### Input

First line of the input contains  $T$  ( $\leq 10$ ), the number of test cases. This is followed by the description of the test cases.

The description of each test case begins with a line containing 3 space separated integers  $N$  ( $< 400$ ),  $R$  ( $< 10000$ ) and  $K$  ( $< 400$ ). Following these are  $R$  lines, each representing a road in Utopia. The line will contain two different space separated integers  $N_1$  and  $N_2$  implying that there is a two way road between  $N_1$  and  $N_2$ . You are assured that the road network has the property as described in the problem statement.

#### Output

For each test case, output modulo 100000007 the number of ways of selecting  $K$  pairs of sister cities satisfying the conditions in the problem statement.

#### Example

**Input :**

```
2
3 2 1
1 2
2 3
6 5 2
1 2
```

2 3  
2 4  
4 5  
4 6

**Output :**

2  
4

---

Added by: Raziman T V

Date: 2011-02-13

Time limit: 5s

Source limit:50000B

Languages: All

Resource: IOPC2011



## SPOJ Problem Set (classical)

### 8332. Ski slopes

#### Problem code: SKISLOPE

A skier wants to ski down from the top of a mountain to its base. There are several possible routes, using different slopes enroute, and passing through some flat areas. The effort expended in skiing down a slope depends upon the length of the slope and the speed of skiing. For each slope, there is a maximum advisable speed. The skier wants to use a route that minimizes the **average effort spent per unit distance traveled** (i.e. the total effort expended divided by the total distance traveled).

The flat regions on the mountain are numbered 1 to N from top to bottom. The skier begins at level 1 and needs to reach level N. You are given the numbers of the flat regions each slope connects. Note that on a slope, one can only ski downwards. For each slope, you are also given the length of the slope and the maximum advisable speed for it. The effort expended in skiing down a particular slope is given by the following formula:

$$e = d \cdot (70 - s) \text{ if } s \leq 60, \text{ and } e = d \cdot (s - 50) \text{ if } s > 60$$

where e is the effort required, d is the distance traveled and s is the speed of travel.

You have to determine the minimum average effort per unit distance that the skier has to expend in order to reach the mountain base, while staying within the maximum advisable speed at every slope.

#### Input

The first line of input gives the number of test cases T ( $T \leq 20$ ). This is followed by the descriptions of the test cases

For each test case, the first line of input gives the number of flats, N ( $N \leq 1000$ ), and the number of slopes, R ( $R \leq 20000$ ), connecting them respectively. Each of the next R lines describes a slope by giving: the numbers of the flats at the top and the bottom of the slope, the maximum advisable speed for the slope ( $\leq 100$ ), and the length of the slope ( $\leq 1000$ ) respectively.

#### Output

For each test case, output a single number (with four places after the decimal point, rounded up) that gives the minimum average effort per unit distance that needs to be expended to ski down from the mountain top to the base. The output for each test case should be on a separate line.

#### Example

Input :

```
2
4 5
1 4 30 60
1 2 50 40
1 3 60 20
2 4 60 50
```

```
3 4 50 50
3 3
1 2 50 40
1 3 40 20
2 3 20 30
```

**Output :**

```
14.4445
30.0000
```

---

Added by: Raziman T V

Date: 2011-02-13

Time limit: 3s

Source limit:50000B

Languages: All

Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8333. Place-name game

#### Problem code: PLCNMGME

Place-name game is a favourite pastime among the few children that go to school in Dystopia. The game is played as follows : One player says the name of a city and the next player has to say the name of a city that begins with the last letter of the said city. The game then goes on.

Dystopian cities recently went through a massive renaming. Now each city has a name that begins with a consonant and ends with a consonant.

Anaximander is a student with a very poor knowledge of geography. Hence he fares very poorly in the game. He has recently come up with a new idea. He would just remember the name of 21 Dystopian cities. He wants to choose the 21 cities such that there is exactly one city name starting with each consonant and exactly one city name ending with each. This would give him a good advantage in the game, whether he is playing first or second.

Given the names of the N cities in Dystopia, find out the number of ways Anaximander can select 21 city names out of the lot satisfying the properties. As this number can be very large, output it modulo 100000007.

#### Input

The first line of the input contains N ( $\leq 1000$ ), the number of cities. This is followed by N lines, each containing the name of a city in Dystopia. Each city name will begin and end with a consonant, and will contain at least 2 and at most 10 letters.

#### Output

Output modulo 100000007 the number of ways Anaximander can choose 21 city names out of the N with the intended properties.

#### Example

**Input :**

```
23
BBBB
CCCC
DDDD
FFFF
GGGG
HHHH
JJJJ
KKKK
LLLL
MMMM
NNNN
PPPP
QQQQ
```

RRRR  
SSSS  
TTTT  
VVVV  
WWWW  
XXXX  
YYYY  
ZZZZ  
BAAC  
CAAB

**Output :**

2

---

Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 5s  
Source limit:50000B  
Languages: All  
Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8334. Enumeration of rationals

#### Problem code: ENUMRTNL

It is well known that rational numbers form a countable set. Hence the set of rational numbers in the open interval  $(0,1)$  also form a countable set.

Here we enumerate the rationals in  $(0,1)$  in the following fashion. First, every rational is expressed in the lowest terms : ie, as  $p/q$  where  $p$  and  $q$  are positive integers with no common factor other than one. Then we sort the fractions in the ascending order of  $p+q$ . In case of a tie, the smaller fraction comes first.

The first few terms in this enumeration are  $1/2, 1/3, 1/4, 2/3, 1/5, 1/6, 2/5...$

Given a natural number  $N$ , find the numerator and denominator of the  $N$ th term in the enumeration.

#### Input

The first line of the input contains  $T$  ( $\leq 1000$ ), the number of test cases. This is followed by  $T$  lines, each containing an integer  $N$  ( $\leq 10^{11}$ ).

#### Output

For each value of  $N$ , output separated by space the numerator and denominator (in lowest terms) of the  $N$ th fraction in the enumeration

#### Example

**Input :** 236**Output :** 1 41 6

---

Added by: Raziman T V

Date: 2011-02-13

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8335. Counting the teams

#### Problem code: CNTTEAMS

The teacher in the Dystopian School for Politics and other Dirty Games (DSPDG) is training students in group activities. She feels that to really understand group behavior, students need to practice working in groups of different sizes. This is how she groups the students:

There are  $N$  students in the class, with roll numbers from 1 to  $N$  ( $2 \leq N \leq 10^{12}$ ). The teacher generates using her laptop a random permutation of the roll numbers. The student with the roll number equal to the  $i^{\text{th}}$  number in the permutation is assigned as a "target" to the student with roll number as  $i$  (Note that "targetship" is not mutual. If 1 is the target for 2, 2 need not be the target for 1). If any student is assigned himself as the target, the teacher generates another permutation till no student is assigned himself.

The  $N$  students stand far from each other. Now student 1 goes and joins his target. After this, student 2 (and any student who is with him) joins 2's target. At the  $i^{\text{th}}$  step, student  $i$  and anyone who is already with him joins  $i$ 's target. In case  $i$ 's target is already with him, nothing is done.

By following this procedure, when all students have joined their targets, the class gets split into some groups. For example, assume that there are 6 students in the class and the permutation that has been generated is  $\{2,4,5,6,3,1\}$ . First, 1 goes and joins 2. Then 1 and 2 join 4. Then 3 joins 5. Then 1, 2 and 4 join 6. 5 is already with 3 and hence does not move. Similarly 6 is already with 1 and does not move. In the end, we have 2 teams :  $\{1,2,4,6\}$  and  $\{3,5\}$

Given  $N$ , find out the expectation value of the number of teams that will be formed when the teacher groups the class in this fashion.

#### Input

First line of the input contains  $T$  ( $\leq 100$ ), the number of test cases. Following this are  $T$  lines, each containing an integer  $N$  ( $2 \leq N \leq 10^{12}$ ).

#### Output

For each  $N$ , output the expectation value of the number of groups formed. Output 6 digits after the decimal point while printing the expectation value

#### Example

**Input :**

2  
3  
4

**Output :**

1.000000  
1.333333

---

Added by: Raziman T V  
Date: 2011-02-13  
Time limit: 4s  
Source limit:50000B  
Languages: All  
Resource: IOPC2011

## SPOJ Problem Set (classical)

### 8349. BRODOVI

#### Problem code: BRODOVI

Mirko lives in a small town with a harbour: once in a blue moon a ship passes by. However, to this day Mirko remembers the day when all the ships who had ever visited the harbour showed up. He denoted this day by index 1.

Many days have passed since, but Mirko noted each day when at least one ship visited the harbour, naming these days entertaining.

Additionally, Mirko has noticed that each ship visits the harbour periodically, at regular intervals. For instance, an interval of length 3 implies that some ship visited the harbour on days 1, 4, 7, 10 etc.

Given Mirko's list of entertaining days (including today which is considered to be an entertaining day as

well), compute the minimum possible number of ships visiting his harbour.

Notes: All entertaining days appear on Mirko's list. It is guaranteed that the given data is consistent - in

other words, a solution will always exist.

#### Input

The first line of input contains an integer  $N$  ( $2 \leq N \leq 5000$ ), the number of entertaining days.

The following  $N$  lines contain indices of entertaining days, one per line, in ascending order. The first and the last indices, representing the day from which Mirko started monitoring harbour traffic and today, respectively, will always appear on the list. The first index will always be 1, and the last one (index of today) will be less than 109.

#### Output

The first and only line of output must contain the required minimum number of ships.

#### Example

**Input :** 517101319**Output :** 2

---

Added by: akaki

Date: 2011-02-15

Time limit: 0.5s

Source limit: 50000B

Languages: All

Resource: coci



## **SPOJ Problem Set (classical)**

### **8351. KOSARK**

#### **Problem code: MIDO**

Slavko has started to follow the NBA league. The game duration is exactly 48 minutes. When a game ends, the statistics are shown. Slavko has written down whenever a team scored. He is curious about how long each team was in the lead.

##### **INPUT**

The first line of input contains one integer  $N$  ( $1 \leq N \leq 100$ ). The following  $N$  lines describe events when a team scored.

Each description consists of a team that scored, which is either 1 or 2, and a timestamp in format MM:SS (minutes:seconds), the time when a team scored. Minutes and seconds are zero padded and from ranges [00, 47] and [00, 59] (inclusive). The given timestamps are unique.

##### **OUTPUT**

The first line of output must contain the duration that the first team was in the lead.

The second line of output must contain the duration that the second team was in the lead.

All durations should be in MM:SS format, with leading zeros

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##### **INPUT**

The first line of input contains one integer  $N$  ( $1 \leq N \leq 100$ ). The following  $N$  lines describe events when a team scored.

Each description consists of a team that scored, which is either 1 or 2, and a timestamp in format MM:SS (minutes:seconds), the time when a team scored. Minutes and seconds are zero padded and from ranges [00, 47] and [00, 59] (inclusive). The given timestamps are unique.

##### **OUTPUT**

The first line of output must contain the duration that the first team was in the lead.

The second line of output must contain the duration that the second team was in the lead.

All durations should be in MM:SS format, with leading zeros.

### **SAMPLE TESTS**

#### **input**

3

1 01:10

2 21:10

2 31:30

#### **output**

20:00

16:30

---

Added by: kawmia institutes problem setters

Date: 2011-02-16

Time limit: 1s

Source limit:50000B

Languages: All

Resource: COCI

## SPOJ Problem Set (classical)

### 8363. COSTLY CHESS

#### Problem code: CCHES

In the country of Rome, Chess is a royal game. For every move the players had to give some bucks to the Emperor Jurg. The LGMs or Little Green Men, are very good players of chess. But as the chess is an expensive game, that's why it is royal, they asked you to help them find the minimum bucks which they had to pay for moving their Knight from one position to another. Any number of steps can be used to reach the destination.

#### Constraints:

The chess has a dimension of 8X8, and the index of left bottom cell (0, 0).

Knight move only in a standard way, i.e. 2 row and 1 col or 1 row and 2 col.

If in a step Knight move from (a, b) to (c, d), then LGM had to pay  $a*c + b*d$  bucks to Emperor Jurg.

$0 \leq a, b, c, d \leq 7$

#### Input

There are 100-150 test cases. Each test case is composed of four space-separated integers. The first two numbers, a, b, are the starting position of the Knight and the next two, c, d, are the destination of the Knight. Read upto End Of File.

#### Output

For each test case, print the minimum amount of bucks they had to pay in separate line. If it's impossible to reach the destination then print -1.

#### Example

Input: 2 5 5 24 7 3 21 2 3 Output: 147818 Explanation for test case #1: 2 5 5 24 For moving Knight from (2, 5) to (5, 2) in minimum cost, one of the path is (2, 5) -> (3, 3) -> (5, 2) Bucks paid: (2, 5) = 0(2, 5) -> (3, 3) = 0 + (2\*5 + 5\*2) = 21(3, 3) -> (5, 2) = 21 + (3\*5 + 5\*2) = 42 To infinity and beyond...

---

Added by: lost

Date: 2011-02-18

Time limit: 0.5s

Source limit: 50000B

Languages: All

Resource: IIITM Local Contest

## SPOJ Problem Set (classical)

### 8371. TRIANGULAR PRISM

#### Problem code: PRISMSA

In a far away nation, all the liquid substance are stored in a can of shape of a triangular prism. According to belief, this will bring security to their children. As they are very resource conservative people, unlike the earth natives, they want to use as less as possible amount of the raw material to be used for producing the can, which directly depends on the surface area of the can. Mr. Buzz Light Year, of Star Command, is provided with the responsibility to find the minimal surface area required to produce a can of a given volume.

#### Notes

- Consider the material the can is made of to be infinitely thin.

- The base of the prism is equilateral triangle.

- Some formulas:

a: triangle side's length.

h: height of the prism.

Volume,  $V = (a^2 * \sin(60^\circ) * h)/2$

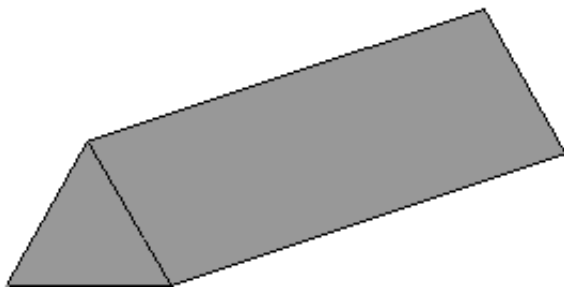
Surface Area,  $S = a^2 * \sin(60^\circ) + 3*a*h$

- If not provided by a library, use the value of  $2*\cos(0)$  for  $\text{PI}(p)$ .

- Reminder

If your result is within  $10^{-2}$  of the expected result, your solution will be evaluated as correct.

If your result is between  $(1-10^{-2})*\text{expected}$  and  $(1+10^{-2})*\text{expected}$ , it will be evaluated as correct.



**Constrains:**

- Volume will be between 1 and 100000, inclusive.
- Volume will always be a integer.

**Input**

Input begins with a integer t, number of test cases. Then follows t lines, each one containing an integer, V, given volume.

**Output**

For each volume, print the minimum surface area required to produce the can in separate line.

**Example**

**Input:** 51051002455421**Output:** 30.387283708919.1427891970141.0452767471256.33186866112020.2796324002**Explanation for test case 1:** Volume = 10 a = 3.41995 h = 1.97451 Minimum Surface Area = 30.3872837089

---

Added by: lost  
Date: 2011-02-18  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: IIITM Local Contest

## SPOJ Problem Set (classical)

### 8373. AVION

#### Problem code: AVION1

Mirko and Slavko are USKOK agents tracking the movements of an unnamed corrupt government official. Anonymous sources have tipped them about his upcoming escape attempt. They now know he plans to use his diplomatic liaisons to try and hitch a ride on a CIA blimp leaving from Severin na Kupa blimp port.

It's common knowledge that all CIA blimps have the string "FBI" somewhere in their registration codes. They obtained a list of all blimps scheduled for the designated day. There are exactly 5 blimps on the list. Write a program that will point out all CIA blimps.

#### INPUT

There are exactly 5 rows of input, each row representing one blimp registration code from the list. A registration code is a sequence of at most 10 uppercase letters of the English alphabet, digits '0' to '9', or dashes '-'.

#### OUTPUT

The first and only line of output must contain a space separated list of integers, sorted in increasing order, indicating the corresponding input rows containing registrations of CIA blimps. If there are no CIA blimps, output the string "HE GOT AWAY!"

Mirko and Slavko are USKOK agents tracking the movements of an unnamed corrupt government official. Anonymous sources have tipped them about his upcoming escape attempt. They now know he plans to use his diplomatic liaisons to try and hitch a ride on a CIA blimp leaving from Severin na Kupa blimp port.

It's common knowledge that all CIA blimps have the string "FBI" somewhere in their registration codes. They obtained a list of all blimps scheduled for the designated day. There are exactly 5 blimps on the list. Write a program that will point out all CIA blimps.

#### INPUT

There are exactly 5 rows of input, each row representing one blimp registration code from the list. A registration code is a sequence of at most 10 uppercase letters of the English alphabet, digits '0' to '9', or dashes '-'.

### **OUTPUT**

The first and only line of output must contain a space separated list of integers, sorted in increasing order, indicating the corresponding input rows containing registrations of CIA blimps.

If there are no CIA blimps, output the string "HE GOT AWAY!"

#### **input**

N-FBI1

9A-USKOK

I-NTERPOL

G-MI6

RF-KGB1

#### **output**

1

#### **input**

N321-CIA

F3-B12I

F-BI-12

OVO-JE-CIA

KRIJUMCAR1

#### **output**

HE GOT AWAY!

---

Added by: kawmia institutes problem setters

Date: 2011-02-18

Time limit: 1s

Source limit:50000B

Languages: All

Resource: COCI



## SPOJ Problem Set (classical)

### 8374. PARKET

#### Problem code: PARKET1

Ivica has set up a new parquet flooring in his room. The room is  $L$  decimeters long and  $W$  decimeters wide.

The blocks are of quadratic shape and each has an area of one quadratic decimeter. Once Ivica had set

up the flooring, which consists of brown.colored blocks, he decided to paint the blocks on the edge of the room red.

The picture below illustrates the scenario from the test case #2 - outer blocks are red, while the remaining two inner blocks are brown:

Marica has come to visit Ivica. While Ivica was serving her cookies, she counted the number of blocks

of each color. When she returned home, she recalled of the two numbers and wished to calculate the dimensions of Ivica's room. Help her!

#### INPUT

The first and only line of input contains two integers separated by a space,  $R$  (the number of red blocks) and  $B$  (the number of brown blocks). The following constraints will apply:  $8 \leq R \leq 5000$ ,  $1 \leq B \leq 2\,000\,000$ .

#### OUTPUT

The first and only line of output must contain the dimensions of the room,  $L$  and  $W$ , respectively. If the numbers differ, output the greater one first. The test data will ensure that a unique solution always exists

Ivica has set up a new parquet flooring in his room. The room is  $L$  decimeters long and  $W$  decimeterswide.

The blocks are of quadratic shape and each has an area of one quadratic decimeter. Once Ivica had setup the flooring, which consists of brown.colored blocks, he decided to paint the blocks on the edge of the room red.

The picture below illustrates the scenario from the test case #2 - outer blocks are red, while theremaining two inner blocks are brown:



Marica has come to visit Ivica. While Ivica was serving her cookies, she counted the number of blocks of each color. When she returned home, she recalled the two numbers and wished to calculate the dimensions of Ivica's room. Help her!

### INPUT

The first and only line of input contains two integers separated by a space, R (the number of red blocks) and B (the number of brown blocks). The following constraints will apply:  $8 \leq R \leq 5000$ ,  $1 \leq B \leq 2\,000\,000$ .

### OUTPUT

The first and only line of output must contain the dimensions of the room, L and W, respectively. If the numbers differ, output the greater one first. The test data will ensure that a unique solution always exists.

**input**

8 1

**output**

3 3

**input**

10 2

**output**

4 3

Added by: kawmia institutes problem setters

Date: 2011-02-19

Time limit: 1s

Source limit:50000B

Languages: All

Resource: COCI

## SPOJ Problem Set (classical)

### 8391. The Ball

#### Problem code: BALL

In a coordinate plane, there are  $N$  horizontal conveyor belts, each moving either leftwards or rightwards. When the ball falls on a belt, the belt drags it in direction it's moving. When the ball reaches the end of the belt, it falls vertically downwards. For example, if the belt is moving rightwards and it ends in the unit square with x-coordinate 12, the ball will fall from the belt on the x-coordinate 13, and continue falling on the same x-coordinate until it falls on another belt or reaches the ground (the height of 0).

Frane drops a ball many times (from the height that is greater than any of the belt heights), from various x-coordinates, and your task is: for each ball Frane drops, determine the direction of each belt such that this ball falls on as many belts as possible.

<b>B</b>			<b>B</b>	<b>B</b>	<b>B</b>	
→	→	→	→			
				←	←	←
	→	→	→			

This picture represents the first test example:

#### Input

In the first line of input, there is an integer  $N$  (the number of conveyor belts,  $1 \leq N \leq 100000$ ).

In each of the next  $N$  lines, there are integers  $X1, Y1, Z$  ( $X1 \leq X2$ ,  $0 < X1, X2, Y < 10^9$ ) representing the belt. Imagine the belt as a segment of which the bounding unit squares are  $(X1, Y)$  and  $(X2, Y)$ . The belt's thickness is zero and it lies on the bottom of the given unit squares. The belts will not touch or overlap each other.

In the next line, there is an integer  $Q$  (the number of falling balls,  $1 \leq Q \leq 100000$ ).

In the next  $Q$  lines there is an integer less than  $10^9$ , representing the x-coordinate of the unit square Frane drops the ball from.

#### Output

For each of the  $Q$  queries, output the greatest possible number of the conveyor belts visited by the ball.

## Example

**Input :**

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

**Output :**

```
3

3

2

2
```

**Input :**

```
3
5 20 20
15 30 15
10 14 11
3
5
30
516546
```

**Output :**

```
3
2
0
```

---

Added by: Adrian Satja Kurdija

Date: 2011-02-21

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Frane Kurtović

## SPOJ Problem Set (classical)

### 8392. Youtube

#### Problem code: YOUTUBE

N students are bored in computer class so they watch funny video clips on YouTube.

The site contains K popular clips, numbered 1 through N. When a video clip is watched, a list of similar video clips is displayed on the side.

Every student picks a video clip from the main page and starts watching it. After exactly one minute every student gets bored of his or her video clip, so he opens the **first** video clip from the list of similar clips on the side (even if he already watched that clip).

Write a program that determines for each student which video clip he will be watching **during the M-th minute** of the class.

#### Input

The first line contains three integers N, K and M ( $1 \leq N, K \leq 100\,000$ ) ( $1 < M \leq 1\,000\,000\,000$ ), the numbers of students, video clips and minutes.

The second line contains N integers, each between 1 and K, the indices of video clips the students start watching.

The third line contains K integers, each between 1 and K, the index of the first similar clip for each video clip.

#### Output

Output N integers, the indices of video clips that students will be watching during the M-th minute.

#### Example

**Input:** 4 5 21 2 4 35 5 1 2 3

**Output:**

5 5 2 1 **Input:** 2 6 51 62 3 4 1 4 5 **Output:** 1 2

---

Added by: Stjepan Glavina

Date: 2011-02-21

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Croatian Nationals 2009

## SPOJ Problem Set (classical)

### 8398. Quadratic Equation

#### Problem code: QUADRATE

Manohar is new to mathematics and now a days he is learning quadratic equations. He is learning that how to find for a given quadratic equation that whether equation has equal roots ,imaginary roots or real but distinct roots. His teacher has given him some quadratic equations and told him to tell the nature of roots. Manohar is not sure for his solutions so he want your help . Write a program that determine the nature of roots.

#### Input

In the first line no of test cases is given( $T \leq 10$ ). Then T lines follows each containing a quadratic equation in the form  $a*x*x + b*x + c = 0$  ,where a,b,c are constants  $0 < a < 1000$  and  $-10000 \leq b, c \leq 10000$ .

#### Output

For each test case output "Equal roots." ,"Imaginary roots." or "Distinct real roots." according to nature of the roots as explained above.

#### Example

**Input :**

```
2
x*x-2*x+1=0
2*x*x+5*x-3=0
```

**Output :**

```
Equal roots.
```

```
Distinct real roots.
```

---

Added by: Manohar Singh

Date: 2011-02-23

Time limit: 1s

Source  
limit: 50000B

Languages: BF C C# C++ 4.0.0-8 C++ 4.3.2 C99 strict LISP clisp LISP sbcl F# HASK JAVA JS PAS  
fpc PERL PERL 6 PHP PRLG PYTH 2.5 PYTH 3.1.2 RUBY SCALA TEXT

Resource: Manohar Singh

**SPOJ Problem Set (classical)**

**8406. Temple Queues**

**Problem code: TEMPLEQ**





Through it  
 Annual gets  
 temple is  
 temple is  
 immediately  
 after that.  
 place of  
 worship in  
 the world.  
 As the  
 number of  
 pilgrims  
 who visit  
 the temple  
 each day is  
 very high,  
 the head of  
 the temple  
 should keep  
 monitoring  
 the queue  
 system.  
 Today is  
 another  
 lovely day  
 and he has  
 started his  
 work. There  
 are N  
 queues at  
 the entrance  
 of the  
 temple and  
 some of  
 them are  
 already  
 filled with  
 pilgrims.  
 Each queue  
 has a metal  
 door at the  
 beginning,  
 which leads  
 to the  
 temple.  
 When the  
 door is  
 opened, it  
 allows only  
 one pilgrim  
 to get

New pilgrims are rushing in to the queues and the head needs to monitor the current sizes of the queues and decide which doors to be opened. At any time, he wants to know how many queues currently have at least **X** pilgrims. He also decides an integer **Y** and wants to open the doors of all the queues having at least **Y** pilgrims at that time. You are the controller of the queue system and are following his instructions. Respond quickly and win yourself a big laddu (sweet) from him :).

Read the input section for rest of the details.

## Input

The first line contains two integers **N** and **Q**. **N** - The number of queues [  $1 \leq N \leq 100,000$  ], **Q** - The number of queries [  $0 \leq Q \leq 500,000$  ]. The second line contains **N** integers, which are the initial sizes of the queues. *i*th integer ( 1-based ) is the initial size of queue *i* [  $0 \leq \text{initial size} \leq 100,000,000$  ]

Each of the next **Q** lines is one of the following

1 **A** [ One pilgrim enters the queue# **A** (  $1 \leq A \leq N$  ) ]

2 **X** [ Find the number of queues having atleast **X** pilgrims currently (  $0 \leq X \leq 1,000,000,000$  ) ]

3 **Y** [ Open the doors of all the queues having atleast **Y** pilgrims (  $1 \leq Y \leq 1,000,000,000$  ), and thus allowing only one pilgrim to enter the temple from each of them ]

## Output

For each query of type "2 **X**" , print the answer in a new line.

## Example

Input: 5 620 30 10 50 402 312 22 313 112 202 50 Output: 2300 Note : Ideal time limit should be 2s. It has been increased to 7s, to let Java solutions pass, as the I/O is huge.\* There are multiple test sets, and the judge shows the sum of the time taken over all test sets of your submission, if Accepted.

---

Added by: Anil Kishore

Date: 2011-02-25

Time limit: 7s

Source limit: 50000B

Languages: All

Resource: CodeMutants 2011 , DA-IICT, India

## SPOJ Problem Set (classical)

### 8407. Candies and Milestones

#### Problem code: CANDYSTN

Little Pratya loves collecting candies and she also likes playing games :).

Today Pratya is travelling in bus and she has a bag full of  $N$  candies. She looks outside the window and notices milestones with numbers written on them. She decides to play a game. She wants to select some initial *non-zero* number of candies from the bag and call it her collection of candies. When she sees a milestone on the way, she will add or remove some candies from her collection as following.

Let the previous milestone number be  $a_1$  and the current milestone number be  $a_2$ .



$a_2 > a_1$  : Pratya adds (  $a_2 - a_1$  ) candies to her collection (thus, her bag of candies loses them). If the bag doesn't contain at least (  $a_2 - a_1$  ) candies, she starts crying.

$a_2 < a_1$  : Pratya removes (  $a_1 - a_2$  ) candies from her collection (thus, her bag of candies gains them). If her collection doesn't contain more than (  $a_1 - a_2$  ) candies, she starts crying.

$a_1 = a_2$  : Pratya is bored to see the same number again and so she eats one of the candies from her collection.

Moreover, Pratya always wants her candy collection to have at least one candy, otherwise she starts crying. Given the numbers written on all the milestones in order, find the minimum number of candies Pratya should select in the beginning so that she doesn't have to cry at all. If it is not possible , print -1. Note that no change to the collection happens when she sees the first milestone.

#### Input

The first line contain the number of test cases  $T$ . Each test case has two lines. The first line specifies  $N$  and  $M$ .  $N$  is the number of candies in the bag and  $M$  is the total number of milestones. Second line contains  $M$  integers, the numbers written on the milestones, in the order Pratya sees them.

^ is used for power.

$T \leq 150$

$1 \leq N \leq 10^7$

$2 \leq M \leq 10^4$

Each milestone number will be between  $[-10^6, 10^6]$ .

## Output

For each test case output the minimum number of candies that should be selected from the bag or -1 if its not possible

## Example

**Input:** 3 10 51 5 1 -1 -22 51 5 1 -1 -2100 31 2 3 **Output:** 4 -11

Note : Large input, prefer using scanf / printf to cin / cout

\* *There are multiple test sets, and the judge shows the **sum** of the time taken over all test sets of your submission, if Accepted.*

---

Added by: Anil Kishore

Date: 2011-02-25

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: CodeMutants 2011 , DA-IICT, India

## SPOJ Problem Set (classical)

### 8408. Min Max 01 Path

#### Problem code: MNMXPATH

I have been asked to set a problem by spoj, what do I do now ? Lets see the standard stuff in most of the programming contests and make one problem out of it. Hmm... many problems are having Binary digits, Grids, Paths, Coins, Maximize or Minimize something, so let me mix them all now in to one problem, the one problem to rule them all ;)

Lets have a grid of size  $N \times M$  having  $N$  rows and  $M$  columns, and put gold coins in it. How many in each cell ? , lets involve binary here. I'll give you two binary strings  $A[1...N]$  and  $B[1...M]$ . Cell  $(i,j)$  (1-based indexing) Row- $i$  and Column- $j$  in the grid contains  $A[i] * B[j]$  gold coins. From a cell  $(i,j)$ , you can move to any of the 4 adjacent cells  $(i-1,j)$ ,  $(i+1,j)$ ,  $(i,j-1)$ ,  $(i,j+1)$  in one step. I want a path of *minimum length* from top-left cell  $(1,1)$  to bottom-right cell  $(N,M)$ , and the value of this path = number of gold coins it covers. Find the maximum value of such a path. Not every one wants to become a Raja, also find the minimum value of such a path.

#### Input

First line contains  $T$  [ number of test cases, around 10 ].  $T$  cases follow, each having 2 lines, " $N$   $A$ " and " $M$   $B$ " (quotes for clarity only). [  $1 \leq N, M \leq 100,000$  and each character in  $A, B$  is either 0 or 1 ]

#### Output

For each test case, print the maximum value of a path followed by the minimum value of a path, in the same line, separated by a single space. Output of each case should be in a separate line.

#### Example

```
1  1  0
```

```
0  0  0
```

```
0  0  0
```

```
1  1  0
```

```
1  1  0
```

```
0  0  0
```

```
0  0  0
```

```
1  1  0
```

---

Added by: Anil Kishore  
Date: 2011-02-25  
Time limit: 2s  
Source limit: 50000B  
Languages: All  
Resource: CodeMutants 2011 , DA-IICT, India

**SPOJ Problem Set (classical)**

**8409. Favorite Sub Hair**

**Problem code: FAVSUBS**



Little old  
 Princess  
 Rapunzel  
 is blessed  
 with a long  
 path of long  
 hair (after  
 loosing!) A  
 favorite  
 which is  
 golden  
 color and  
 part of the  
 hair is  
 pulled. has  
 a lot of the  
 hair of a  
 favorite  
 happy  
 braid. she  
 has a lot  
 of hair.  
 her lover  
 Flynn.  
 They  
 decide to  
 lead a  
 normal  
 life by  
 getting rid  
 of the  
 mysterious  
 hair,  
 which  
 when cut  
 loses its  
 power and  
 turns  
 brown.  
 There are  
 many  
 colorful  
 beads on  
 her hair in  
 order.  
 Rapunzel  
 has some  
 K favorite  
 colors  
 B[1...K]  
 To  
 remember



For the purpose of this problem, we represent a color as an integer and Hair as an array  $A[1...N]$ , which has exactly  $N$  colored beads in the given order. Could you please tell her the total number of ways she can cut her favorite sub hair (sub-array). Two sub-arrays are different, if their starting or ending index in  $A$  differ.

## Input

First line contains  $T$  [ number of test cases, around 10 ]. Each test case is preceded by a blank line, including the 1st case. [  $-2,000,000 \leq A[i], B[j]$  ( colors )  $\leq 2,000,000$  ]

Each test case has 4 lines, as described below.

$N$  [  $1 \leq N \leq 100,000$  ]

< Array  $A$  :  $N$  integers, separated by spaces >

$K$  [  $1 \leq K \leq 1,000$  ]

< Array  $B$  :  $K$  integers, separated by spaces, her favorite colors, without repetition >

## Output

For each test case, output the number of different sub-arrays, which has her favorite color appearing at least once, in a separate line.

## Example

**Input :**

3

4

1 2 3 1

2

1 2

6

10 20 30 40 50 60

1

20

5

1 2 3 4 5

2

2 6

**Output :**

4

10

0

**Explanation:**

Case 1 : Favorite sub-arrays in bold [ **1 2 3 1** ], [ **1 2 3 1** ] , [ **1 2 3 1** ], [ **1 2 3 1** ]

Note: Large input, prefer using scanf / printf to cin / cout

*There are multiple test sets, and the judge shows the **sum** of the time taken over all test sets of your submission, if Accepted.*

---

Added by: Anil Kishore  
Date: 2011-02-25  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: CodeMutants 2011 , DA-IICT, India

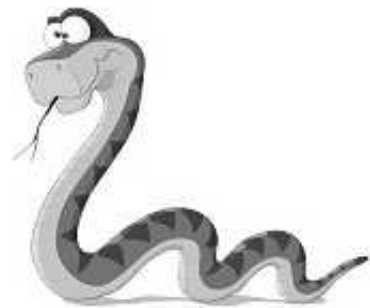
## SPOJ Problem Set (classical)

### 8410. Snaky Numbers

#### Problem code: SNAKYNUM

Sanky is a school kid and is very fond of numbers. His teacher gave his class a home work, asking each of them to invent a new series of numbers, with a large collection of numbers in them. His friend Evan has already invented one, which starts from 0 and picks every alternate number : {0, 2, 4, ...} and he named them 'Evan' numbers :). Sanky is not happy because he couldn't invent that first and thinks picking every alternate number starting from 1 : {1, 3, 5, ... } would not be very odd ;).

After refreshing at home, he comes up with a new series of numbers in which the digits alternate between increasing and decreasing when compared with the digit before it, in a zig-zag fashion. To make it clear, if the number is abcde, either  $a < b > c < d > e$  or  $a > b < c > d < e$ . He cleverly named them 'Snaky Numbers' :). Eg: 8, 90, 243516 and 31524 are Snaky while 44, 123 and 4235 are not. He is now wondering if his Snaky series is large enough. Particularly, he wants to know how many 'Snaky Numbers' are there of length *at most* N. Count only non-negative integers, without leading zeros.



The answer may get very big and not fit in Sanky's book, so please just tell him the ( answer modulo M )

#### Input

First line contains T [ number of test cases, around 50 ]. Each of the next T lines contains two integers N M.

$1 \leq N \leq 1,000,000,000$

$2 \leq M \leq 1,000,000,007$

#### Output

For each test case, output ( Number of Snaky numbers of length at most N ) % M, in a separate line

#### Example

**Input:** 31 1012 1073 1001 **Output:** 1091616

**Hint:** You may have to use the mod operator wisely !

\* There are multiple test sets, and the judge shows the **sum** of the time taken over all test sets of your submission, if Accepted.

---

Added by: Anil Kishore  
Date: 2011-02-25  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: CodeMutants 2011 , DA-IICT, India

## SPOJ Problem Set (classical)

### 8418. Revenge of the squares

#### Problem code: SQUA\_REV

Given a number calculate the product  $N$  of their digits bigger than zero. The output is the number  $R$  of different (!) presentations of  $N$  in the form  $A*A+B*B$  with  $A$  and  $B$  being positive integers including zero.

#### Input

Twenty tests with one positive integer  $< 10^{20}$ .

#### Output

Print the illustrated above number  $R$  for each test.

#### Example

**Input :**

5778185824586267361855

**Output :**

103

---

Added by: HWK

Date: 2011-02-25

Time limit: 10s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 8419. Traversing Grid

#### Problem code: BTCODE\_A

Given 2 points in 2 dimensional space  $(x_s, y_s)$  and  $(x_d, y_d)$ , your task is to find whether  $(x_d, y_d)$  can be reached from  $(x_s, y_s)$  by making a sequence of zero or more operations.

From a given point  $(x, y)$ , the operations possible are:

- a) Move to point  $(y, x)$
- b) Move to point  $(x, -y)$
- c) Move to point  $(x+y, y)$
- d) Move to point  $(2*x, y)$

#### Input

The first line of input contains  $T$ , the number of test cases.  $T$  lines follow, one for each test case. For each test case, the input contains one line denoting the 4 integers  $x_s, y_s, x_d, y_d$

#### Output

Output  $T$  lines, one for each test case. For each test case, output "YES" if  $(x_d, y_d)$  is reachable from  $(x_s, y_s)$  and "NO" otherwise. (quotes for clarity)

#### Example

**Input:**

```
1
1 1 2 2
```

**Output:**

```
YES
```

**Constraints:**

$T \leq 25$

$-10^{10} \leq x_s, y_s, x_d, y_d \leq 10^{10}$

Note that, although the input values are constrained by the above inequality, the coordinates of the points at the intermediate steps need not be.

#### Explanation:

Test case 1: We can move in the following manner:  $(1,1) \rightarrow (2,1)$ , using the operation  $(x,y) \rightarrow (2*x,y)$ . Then, move from  $(2,1) \rightarrow (1,2)$ , using the operation  $(x,y) \rightarrow (y,x)$ . Finally use the operation  $(x,y) \rightarrow (2*x,y)$  to move from  $(1,2) \rightarrow (2,2)$ .

---

Added by: suhash

Date: 2011-02-26

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India

## SPOJ Problem Set (classical)

### 8420. Finding Minimum

#### Problem code: BTCODE\_B

You are given 'n' integers  $k_1, k_2, \dots, k_n$  and an integer 'x', which satisfy the equation  $x_1^{k_1} * x_2^{k_2} * \dots * x_n^{k_n} = x$ . You are also given values  $a_1, a_2, \dots, a_n$  and  $y_1, y_2, \dots, y_n$ . Your task is to find the least positive value 'v', that can be taken by the expression:  $a_1 * x_1^{y_1} + a_2 * x_2^{y_2} + \dots + a_n * x_n^{y_n}$ . Note that  $x_1, x_2, x_3, \dots, x_n$  are some variables (not necessarily integers), which can only take positive values.

#### Input

The first line of input contains a single integer 't', denoting the number of test cases.

The first line of each testcase contains two space separated integers 'n' and 'x'.

Next line contains 'n' integers  $k_1, k_2, \dots, k_n$ .

Next line contains 'n' integers  $a_1, a_2, \dots, a_n$ .

Next line contains 'n' integers  $y_1, y_2, \dots, y_n$ .

#### Output

For each testcase output the least positive value 'v' that can be taken by the expression. To avoid floating point errors, round it off to the nearest integer.

For example, 12.6 is rounded off to 13, and 12.4 is rounded off to 12. To avoid ambiguity, there will be no test case for which the fractional part of the answer equals 0.5.

#### Example

##### Input :

```
2
1 4
2
3
3
2 6
1 1
1 1
1 1
```

##### Output :

```
24
5
```

##### Constraints:

```
t <= 25
1 <= n <= 20
1 <= x <= 1000000
1 <= ki, ai, yi <= 20
xi > 0
```

**Explanation:**

Test case 1:  $x_1^2 = 4$ . Therefore,  $x_1 = 2$  and  $3 \cdot x_1^3 = 24$ .

Test case 2:  $x_1 \cdot x_2 = 6$ . Minimum value of  $x_1 + x_2$  is  $2 \cdot \sqrt{6} = 4.89897$ .  $x_1 = \sqrt{6}$  and  $x_2 = \sqrt{6}$  gives this solution. Answer is 4.89897, which when rounded off to the nearest integer equals 5.

---

Added by: suhash

Date: 2011-02-26

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India



## SPOJ Problem Set (classical)

### 8421. Fun With Inequalities

#### Problem code: BTCODE\_C

You are given 'n' inequalities. Each inequality is of one of the following 4 types:

Type 1:  $x > v$

Type 2:  $x < v$

Type 3:  $x = v$

Type 4:  $x \neq v$

where 'x' is a variable which can only take non-negative integral values.

Your task is to find the maximum number of inequalities which are satisfied for some value of 'x'. You are also required to find the minimum value of 'x' for which the maximum number of inequalities are satisfied.

#### Input

The first line of input contains a single integer 'n', denoting the total number of inequalities.

Each of the next 'n' lines contain 2 space separated integers  $t_i$  and  $v_i$ .  $t_i$  denotes the type of inequality and  $v_i$  denotes the value on the right hand side of the inequality.

#### Output

Output two space separated integers, the first integer denoting the maximum number of inequalities which are satisfied for some value of 'x', and the second integer denoting the minimum value of 'x' for which the maximum number of inequalities are satisfied.

#### Example

**Input :**

```
4
1 10
2 9
3 7
4 4
```

**Output :**

```
3 7
```

**Constraints:**

$1 \leq n \leq 100000$

$1 \leq t_i \leq 4$

$1 \leq v_i \leq 10^{18}$

**Explanation:**

The given inequalities are: 1)  $x > 10$ , 2)  $x < 9$ , 3)  $x = 7$ , 4)  $x \neq 4$ . For  $x=7$ , the inequalities 2), 3) and 4) are satisfied.

---

Added by: suhash

Date: 2011-02-26

Time limit: 3s

Source limit:50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India

## SPOJ Problem Set (classical)

### 8422. Maximum Profit

#### Problem code: BTCODE\_D

Chakra is a young and dynamic entrepreneur, who is developing rapidly as a successful hotelier. He owns the Quickbyte chain of restaurants, 'M' of which are fully functional now. He divides each day into 'N' time slots. For each time slot 'j', in every restaurant 'i', there are  $A_{ij}$  waiters and  $B_{ij}$  customers. Being a quality conscious person, he wants each waiter to handle atmost one customer in a given time slot. Since he is really busy, in a day each restaurant is open only during one of the time slots. Since the hunger and demand for food varies during the day, the price which the customer is willing to pay varies, and is given by  $C_{ij}$  for a restaurant 'i' during a time slot 'j'.

Given the values of  $A_{ij}$ ,  $B_{ij}$  and  $C_{ij}$ , find the maximum profit which Chakra can make in a day.

#### Input

The first line of input contains an integer 't', denoting the number of test cases.

For each testcase, the first line contains 2 space separated integers 'M' and 'N'.

Each of the next 'M' lines contains 'N' integers. The  $j^{\text{th}}$  integer on the  $i^{\text{th}}$  line denotes the value of  $A_{ij}$

Each of the next 'M' lines contains 'N' integers. The  $j^{\text{th}}$  integer on the  $i^{\text{th}}$  line denotes the value of  $B_{ij}$

Each of the next 'M' lines contains 'N' integers. The  $j^{\text{th}}$  integer on the  $i^{\text{th}}$  line denotes the value of  $C_{ij}$

#### Output

For each test case output one value, denoting the maximum profit which Chakra can make in a day.

More than one restaurant can be open during a given time slot.

#### Example

##### Input :

```
1
2 3
1 2 3
3 2 1
3 2 1
1 2 3
4 5 2
3 1 6
```

##### Output :

```
16
```

##### Constraints:

```
t <= 50
1 <= M, N <= 100
1 <=  $A_{ij}$ ,  $B_{ij}$  <= 5000
0 <=  $C_{ij}$  <=  $10^9$ 
```

**Explanation:**

Test case 1: By opening the first restaurant at time slot 2 and second restaurant at time slot 3, Chakra makes a profit =  $2*5 + 1*6 = 16$ . Note that although there are 3 customers for the second restaurant at time slot 3, since there is only 1 waiter, only 1 customer can be served.

---

Added by: suhash

Date: 2011-02-26

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India

## SPOJ Problem Set (classical)

### 8423. Recover Polynomials

#### Problem code: BTCODE\_E

Venkatesh is an expert in mathematics, and loves playing around with polynomials during his free time. His favourite mathematical equation is pretty obviously:  $f(x) = a_n * x^n + a_{n-1} * x^{n-1} + \dots + a_1 * x + a_0$ . His friend Suhash loves posing challenges to Venkatesh. Once they were discussing a particular problem at Snacky, which goes as follows:

Suhash would choose an integer 'n' as the degree of the polynomial and give Venkatesh the value of the polynomial at 'n+1' equally spaced points, i.e he gives Venkatesh integers 'n', 'x<sub>0</sub>', 'd' and g<sub>0</sub>, g<sub>1</sub>, g<sub>2</sub>, ..., g<sub>n</sub> such that:  $f(x_0) = g_0$ ,  $f(x_0+d) = g_1$ ,  $f(x_0+2*d) = g_2$ , ..... $f(x_0+n*d) = g_n$ . Now, Venkatesh is required to find the polynomial. Since he hates floating point values, he decides to find the polynomial in coefficient form, modulo a prime number. Can you help Venkatesh find the polynomial?

#### Input

The first line of input contains an integer 't', denoting the number of test cases.

For each test case, the first line contains 3 space separated integers 'n', 'x<sub>0</sub>', 'd'. The next line contains 'n+1' space separated integers g<sub>0</sub>, g<sub>1</sub>, g<sub>2</sub>, .....g<sub>n</sub>.

#### Output

For each test case output 'n+1' integers, denoting the coefficients of the polynomial a<sub>0</sub>, a<sub>1</sub>, a<sub>2</sub>,..... a<sub>n</sub>. All the coefficients that are printed should be non-negative and should be less than 1000000007.

You are required to find coefficients of the polynomial a<sub>0</sub>, a<sub>1</sub>, a<sub>2</sub>,..... a<sub>n</sub>, which satisfy the equations:  $f(x_0) \% 1000000007 = g_0$ ,  $f(x_0+d) \% 1000000007 = g_1$ , .....  $f(x_0+n*d) \% 1000000007 = g_n$ . It is guaranteed that there is a unique solution for every test case.

#### Example

##### Input :

```
1
3 1 1
10 26 58 112
```

##### Output :

```
4 3 2 1
```

##### Constraints:

```
t <= 25
1 <= n <= 1000
0 <= x0 <= 100000
0 < d <= 10000
0 <= gi <= 109
```

**Explanation:**

Test case 1: It can be seen that the polynomial  $f(x) = x^3 + 2x^2 + 3x + 4$  satisfies the above input.

---

Added by: suhash

Date: 2011-02-26

Time limit: 15s

Source limit: 50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India

## SPOJ Problem Set (classical)

### 8425. Coloring Trees

#### Problem code: BTCODE\_G

Nivash and Bhoopathi play a game of memory, which goes as follows: There is a tree containing 'N' nodes, all of which are initially uncoloured. In the game, Nivash has 2 moves:

- 1) Command: Color a particular node with a given color.
- 2) Query: Ask Bhoopathi if the path from node 'a' to node 'b' (both inclusive), is monochromatic or not.(i.e Whether all nodes on the path have the same color).

Nivash can do these steps in any order he wishes and he colors each node atmost once. Whenever Nivash puts forth a 'Query' at Bhoopathi, Bhoopathi has to recollect the colouring of the tree and reply either "YES" or "NO". Can your help Bhoopathi answer these queries?

#### Input

The first line of input contains an integer 'N', denoting the number of nodes in the tree. The next 'N-1' lines contain 2 space separated integers 'u' and 'v', denoting an edge between vertex 'u' and vertex 'v'.

The next line contains an integer 'Q', denoting the number of inputs (commands and queries) which Nivash wants to give. The next 'Q' lines contain 3 space separated integers 'x', 'a', 'b'. If 'x' is 1, it denotes a command to color node 'a' with a color 'b'. If 'x' is 2, it denotes a query and Bhoopathi should answer if the path from node 'a' to node 'b' (both inclusive), is monochromatic or not.

All vertices of the tree are 0 based.

#### Output

For each query, output "YES" or "NO" (quotes for clarity), denoting whether the path from node 'a' to node 'b' (both inclusive), is monochromatic or not.

Output "NO", even if all nodes on the path from node 'a' to node 'b' (both inclusive) are uncolored.

#### Example

**Input :**

```
3
0 1
1 2
7
1 0 11
2 0 1
2 0 2
1 2 12
1 1 11
2 0 1
2 0 2
```

**Output :**

NO  
NO  
YES  
NO

**Constraints:**

1 <= N <= 100000  
1 <= Q <= 200000  
1 <= color value <= 30.

**Explanation:**

Initially node '0' is colored with color '11', so path between node '0' and node '1' is not monochromatic. Hence, the answer is "NO". The same explanation holds for the path between node '0' and node '2'. Then node '2' is colored with color '12' and node '1' with color '11'. Now, all nodes on the path between node '0' and node '1' are colored with only one color ('11'), so the answer is "YES". The path between node '0' and node '2' has 2 colors ('11' and '12'), hence the answer is "NO".

---

Added by: suhash

Date: 2011-02-26

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India



## SPOJ Problem Set (classical)

### 8426. Trie Expectation

#### Problem code: BTCODE\_H

What is the expected number of nodes in a trie when 'N' words, each of length 'L' are inserted into it. The words are made up only of 0's and 1's. The words may be repeated and all possible permutations of words are equally likely. Initially the trie consists of only one node (root node).

#### Input

The first line of input contains an integer 't', denoting the number of test cases. Each of the next 't' lines contain 2 space separated integers 'N' and 'L'.

#### Output

For each test case, output one floating point value denoting the expected number of nodes in the trie. Output the values rounded off to 2 decimal places. Always print 2 digits after the decimal point.

To know more about tries visit [here](#).

#### Example

**Input :**

```
2
1 3
2 2
```

**Output :**

```
4.00
4.25
```

**Constraints:**

```
t <= 25
1 <= N <= 300
1 <= L <= 300
```

**Explanation:**

Test case 1: There are 8 possible words of length 3. Which ever word is inserted into the trie, we get only 4 nodes.

---

Added by: suhash

Date: 2011-02-26

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India

## SPOJ Problem Set (classical)

### 8427. Permutation Game

#### Problem code: BTCODE\_I

Harsha is given 9 integers  $a_1, a_2, a_3, \dots, a_9$ . This denotes that he is given  $a_1$  1's,  $a_2$  2's,..... $a_9$  9's. Let  $'x' = (a_1 + a_2 + \dots + a_9)$ . Now, Harsha makes all possible  $'x'$  digit numbers by using these given digits. Let  $S$  be the set of all such numbers which he makes. Now he constructs a directed graph containing  $|S|$  nodes, in which each node denotes a unique number from the set. For all numbers  $u, v$  belonging to  $S$ , there is a directed edge from node  $'u'$  to node  $'v'$  in the graph iff  $u > v$ . It is easy to note that we obtain a directed acyclic graph. Whats more, the edges of the graph are weighted. The weight of an edge joining node  $'u'$  and node  $'v'$  is equal to  $u+v$ . Now, Deepak decides to test Harsha's memory and gives him  $'Q'$  queries. Each query consists of two numbers  $'u', 'v'$  ( $u > v$ , both belonging to the set  $S$ ). For each query Harsha must provide the following answers:

- 1) How many distinct paths are there from node  $'u'$  to node  $'v'$  in the graph.
- 2) For each distinct path  $'i'$  from node  $'u'$  to node  $'v'$ , let  $S_i$  denote the sum of weights of all edges on this path. Calculate the value of  $\text{sum}(S_i)$ , for every distinct path  $'i'$  from node  $'u'$  to node  $'v'$ .

#### Input

The first line of input contains 9 integers  $a_1, a_2, \dots, a_9$ . The second line contains a single integer  $'Q'$ , denoting the number of queries. Each of the next  $'Q'$  lines contain 2 numbers  $'u'$  and  $'v'$ .

#### Output

For each query, output 2 space separated integers denoting the number of distinct paths and sum of weights of all paths respectively. Since the output can be large, output these quantities modulo 1000000007.

Two paths  $(v_1, v_2, \dots, v_m)$  and  $(u_1, u_2, \dots, u_n)$  are distinct if:

- 1)  $m \neq n$
- 2)  $m = n$ , there exists some index  $'k'$  ( $1 \leq k \leq m$ ) such that  $v_k \neq u_k$

#### Example

##### Input :

```
2 0 1 0 0 0 0 0 0
1
311 113
```

##### Output :

```
2 1110
```

##### Constraints:

```
1 <= (a1 + a2 + ..... a9) <= 500
1 <= Q <= 20
ai >= 0
```

**Explanation:**

Test case 1: The set S for the above problem is {311, 113, 131}. The edges of the graph are 311->131, 311->113, 131->113. There are 2 distinct paths from 311 to 113, namely (311->131->113) and (311->113). The sum of weights of edges on path-1 = (311+131)+(131+113) = 686. For path-2, the sum of weights of edges = (311+113) = 424. Therefore, answer = 686 + 424 = 1110.

---

Added by: suhash

Date: 2011-02-26

Time limit: 15s

Source limit:50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India

## SPOJ Problem Set (classical)

### 8428. Grid Tiling

#### Problem code: BTCODE\_J

Vikas is the chief interior designer incharge of the Taj Palace, Mumbai. He wants to make an impressive and colourful pattern in the courtyard. Importing exotic tiles has become very difficult after the Mumbai terror attacks, and therefore Vikas has only 4 kinds of tiles to choose from:

A	B	C	D
==	==	==	==
XX	X	X	X
XX	X	XX	

Any rotation of above tiles is also permitted.

Each tile is available in 'k' different colors, and there's an infinite supply of all tiles. The courtyard has dimensions  $2 * 'n'$ . Vikas wants to tile the courtyard in such a way that no two adjacent tiles have the same color. Two tiles are considered adjacent if they share a common side. Two tilings are considered different if:

- 1) The arrangement of tiles is different.
- 2) There is atleast 1 position ( $1*1$  square) which has different colors in the two arrangements.

Can you help Vikas find the number of different ways in which he can tile the courtyard, subject to the above conditions?

#### Input

The first line of input contains a single integer 't', denoting the number of test cases. Each of the next 't' lines contains 2 space separated integers 'n' and 'k'.

#### Output

For each test case output one integer, denoting the number of different ways in which the courtyard can be tiled.

Two tiles are considered adjacent if they share an edge. Two tiles which just share a common point are not considered adjacent.

Since the answers can be large, print all the quantities modulo 1000000007.

#### Example

**Input :**

```
2
1 1
1 2
```

**Output :**

1  
4

**Constraints:**

$t \leq 1000$   
 $1 \leq n \leq 10^9$   
 $1 \leq k \leq 1000$

**Explanation:**

Test case 1: There is only 1 way to tile the courtyard, by using a 2\*1 tile.

Test case 2: Let '1' and '2' be the available colors. The grid can be tiled in 4 ways - 1) place one 2\*1 tile of color '1', 2) place one 2\*1 tile of color '2', 3) Place two 1\*1 tiles (color '1' above and color '2' below), 4) Place two 1\*1 tiles (color '2' above and color '1' below)

---

Added by: suhash

Date: 2011-02-26

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Bytocode 2011, NIT Trichy, India

## SPOJ Problem Set (classical)

### 8429. Array Sorting

#### Problem code: BTCODE\_K

Sumit specialises in sorting algorithms, and Abhishek decides to test Sumit's coding skills. An array of 'n' numbers  $a[0], a[1], a[2], \dots, a[n-1]$  is given. Abhishek gives a sequence of inputs of the form "v i j". Each input is either a query or an update (query if 'v' is 0, update otherwise).

For any input of the form "0 i j", Sumit's output should be as follows:

If the subarray  $a[i], a[i+1], \dots, a[j]$  is unsorted, output 0.

If the subarray  $a[i], a[i+1], \dots, a[j]$  is sorted in non-descending order, output 1.

If the subarray  $a[i], a[i+1], \dots, a[j]$  is sorted in non-ascending order, output 2.

If the subarray  $a[i], a[i+1], \dots, a[j]$  is sorted in both non-ascending and non-descending order (i.e, if all the elements in the range are equal), output 3.

Any other input "v i j" ( $v \neq 0$ ) should be treated as an update, as follows:

For each element in the subarray  $a[i], a[i+1], \dots, a[j]$ , Sumit has to replace the element  $a[k]$  with  $v-a[k]$ .

Sumit is really tired and does not want to write a program. Can you write a program for Sumit, which responds to Abhishek's instructions?

#### Input

The first line of input contains 2 space separated integers 'n' and 'q'. The second line contains 'n' integers  $a[0], a[1], \dots, a[n-1]$ . Each of the next 'q' lines contain 3 integers 'v', 'i', 'j'.

#### Output

For each query, output a single integer 0, 1, 2 or 3, denoting the answer.

#### Example

**Input :**

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

**Output :**

```
0
1
2
3
```

**Constraints:**

```
1 <= n <= 100000
1 <= q <= 100000
-5000 <= a[i] <= 5000
-5000 <= v <= 5000
```

**Explanation**

Initial array is {3, -2, -5, 1}. After first update, the array will be {3, 3, 6, 0}. Now, from indices '0' to '3', it is unsorted. From indices '0' to '2', it is sorted in non-descending order. From indices '2' to '3', it is sorted in non-ascending order. Between indices '0' and '1', the values are equal.

---

Added by: suhash

Date: 2011-02-26

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Bytecode 2011, NIT Trichy, India

## SPOJ Problem Set (classical)

### 8434. Kolica

#### Problem code: KOLICA

A number of shopping carts filled with explosives are floating in a coordinate system, in one of the four main directions (up, down, left or right). All carts are moving at a speed of one unit per second.

Movement is continuous; for example, in one third of a second, a cart travels one third of a unit.

When two or more carts collide (are at the same place at the same time), there is an explosion and all carts taking part in the collision explode and cease to exist.

Write a program that, given the starting points and directions of all carts, determines which carts never explode.

#### Input

The first line of input contains an integer  $N$  ( $2 \leq N \leq 500$ ), the number of carts.

Each of the following  $N$  lines contains two integers and a string. Each pair of integers describes the starting coordinates of one cart (between 0 and 100 000 000, inclusive), and the string describes the direction in which the cart is moving ("gore" for up, "dolje" for down, "lijevo" for left, or "desno" for right).

No two carts will start at the same coordinates.

#### Output

Output the indices of all carts which never explode, sorted in ascending order, one index per line. The first cart in the input is labeled 1, the second is labeled 2 etc. If no carts survive, output "nema".

#### Example

**Input:**45 5 dolje5 6 lijevo5 7 desno5 8 gore

**Output:**

1234**Input:**53 3 dolje1 1 desno5 1 lijevo100000 500000 desno900000 500000 lijevo**Output:**nema**Input:**310 0 gore0 10 desno15 5 lijevo

**Output:**2

---

Added by: Stjepan Glavina

Date: 2011-02-28

Time limit: 1s-2s

Source limit:50000B

Languages: All

Resource: Croatian Nationals 2007



## SPOJ Problem Set (classical)

### 8442. Problem 3

#### Problem code: NOVICE43

When I first learned backtracking I made a program to find all the permutations of the English alphabets in lexicographically increasing. Filled with elation I showed the program to Rohil. Rohil being someone who likes to do stuff off the league was not impressed and gave me the following variation of the problem help me to solve the problem:

You have to find the number of permutations of length  $N(1 \leq N \leq 12)$  such that at whenever an alphabet say (\$) appears in the permutation all the alphabets smaller than \$ should have appeared before it at least once. An alphabet is smaller than another if it appears before the other in the English alphabet. 'a' being the smallest and 'z' being the largest. For example when  $N=2$  then aa,ab are the only valid permutations and ba,bb is invalid since in ba all the alphabets smaller than b have not appeared at least once before it. See example for further clarification.

When I first learned backtracking I made a program to find all the permutations of the English alphabets in lexicographically increasing. Filled with elation I showed the program to Rohil. Rohil being someone who likes to do stuff off the league was not impressed and gave me the following variation of the problem help me to solve the problem:

You have to find the number of permutations of length  $N(1 \leq N \leq 11)$  such that at whenever an alphabet (say 'c' ) appears in the permutation all the alphabets smaller than 'c' should have appeared before it at least once. An alphabet is smaller than another if it appears before the other in the English alphabet. 'a' being the smallest and 'z' being the largest. For example when  $N=2$  then aa,ab are the only valid permutations and ba,bb is invalid since in ba all the alphabets smaller than b have not appeared at least once before it. See example for further clarification.

#### Input

Line 1: T(no. of test cases)

Line 2: n1

Line 3: n2

...

...

#### Output

Line 1: no. of such permutations of length n1

.....

.....

## Example

**Input :**

2  
2  
3

**Output :**

2  
5

Explanation for N=3, the possible permutations are:

abc  
aba  
abb  
aab  
aaa

---

Added by: Mahesh Chandra Sharma

Date: 2011-03-01

Time limit: 3s

Source limit:50000B

Languages: All

Resource: NSIT Noivce contest #4

## SPOJ Problem Set (classical)

### 8456. PRIMITIVEROOTS

#### Problem code: PROBLEM4

Problem 4: PRIMITIVEROOTS

##### Introduction to Primitive Roots:

a **primitive root modulo  $n$**  is any number  $g$  with the property that any number coprime to  $n$  is congruent to a power of  $g$  modulo  $n$ .

The number 3 is a primitive root modulo 7, because

$$\begin{array}{lclclclclcl} 3^1 & = & 3 & = & 3^0 \times 3 & \equiv & 1 \times 3 & = & 3 \equiv 3 \pmod{7} \\ 3^2 & = & 9 & = & 3^1 \times 3 & \equiv & 3 \times 3 & = & 9 \equiv 2 \pmod{7} \\ 3^3 & = & 27 & = & 3^2 \times 3 & \equiv & 2 \times 3 & = & 6 \equiv 6 \pmod{7} \\ 3^4 & = & 81 & = & 3^3 \times 3 & \equiv & 6 \times 3 & = & 18 \equiv 4 \pmod{7} \\ 3^5 & = & 243 & = & 3^4 \times 3 & \equiv & 4 \times 3 & = & 12 \equiv 5 \pmod{7} \\ 3^6 & = & 729 & = & 3^5 \times 3 & \equiv & 5 \times 3 & = & 15 \equiv 1 \pmod{7} \end{array}$$

##### Problem Statement:

Given a prime number  $n$  as input you've to find the (product all the primitive roots of  $n$ )  $\% n$

##### Input:

The first line consists of  $t$  the number of test cases followed by  $t$  lines. Each line consists of a prime number  $n$ .

##### Output:

For each test case print the test case number followed by ':' followed by (product of all primitive roots of n) % n. If it is not a prime then print "NOTPRIME"

### **Input Specifications**

$1 \leq t \leq 100$

$10000 \geq n \geq 3$

### **Example**

#### **Sample Input**

3

6

7

9

#### **Sample Output**

1:NOTPRIME

2:1

3:NOTPRIME

### **Description for test case #2:**

The primitive roots of 7 are 3 and 5. The product  $3 \cdot 5 = 15 \cdot 7 = 1$

---

Added by: cegprakash

Date: 2011-03-04

Time limit: 3s

Source limit: 50000B

Languages: C C# C++ 4.0.0-8 C++ 4.3.2 JAVA PERL PERL 6 PHP PYTH 2.5

Resource: Edited question from Kurukshetra 2011

## SPOJ Problem Set (classical)

### 8461. Adventure in Moving

#### Problem code: AVDM

To help you move from Waterloo to the big city, you are considering renting a moving truck. Gas prices being so high these days, you want to know how much the gas for such a beast will set you back.

The truck consumes a full litre of gas for each kilometre it travels. It has a 200 litre gas tank. When you rent the truck in Waterloo, the tank is half full. When you return it in the big city, the tank must be at least half full, or you'll get gouged even more for gas by the rental company. You would like to spend as little as possible on gas, but you don't want to run out along the way.

#### Input

Input is all integers. The first integer is the distance in kilometres from Waterloo to the big city, at most 10000. Next comes a set of up to 100 gas station specifications, describing all the gas stations along your route, in non-decreasing order by distance. Each specification consists of the distance in kilometres of the gas station from Waterloo, and the price of a litre of gas at the gas station, in tenths of a cent, at most 2000.

#### Output

Output is the minimum amount of money that you can spend on gas to get you from Waterloo to the big city. If it is not possible to get from Waterloo to the big city subject to the constraints above, print "Impossible".

#### Example

**Input :** 500

100 999  
150 888  
200 777  
300 999  
400 1009  
450 1019  
500 1399

**Output :**

450550

---

Added by: Fendy Kosnatha  
Date: 2011-03-05  
Time limit: 0.125s  
Source limit: 50000B  
Languages: All  
Resource: UVa

## SPOJ Problem Set (classical)

### 8462. Barn Allocation

#### Problem code: BARN

Farmer John recently opened up a new barn and is now accepting stall allocation requests from the cows since some of the stalls have a better view of the pastures.

The barn comprises  $N$  ( $1 \leq N \leq 100,000$ ) stalls conveniently numbered  $1..N$ ; stall  $i$  has capacity  $C_i$  cows ( $1 \leq C_i \leq 100,000$ ). Cow  $i$  may request a contiguous interval of stalls  $(A_i, B_i)$  in which to roam ( $1 \leq A_i \leq N$ ;  $A_i \leq B_i \leq N$ ), i.e., the cow would like to wander among all the stalls in the range  $A_i..B_i$  (and the stalls must always have the capacity for her to wander).

Given  $M$  ( $1 \leq M \leq 100,000$ ) stall requests, determine the maximum number of them that can be satisfied without exceeding stall capacities.

Consider both a barn with 5 stalls that have the capacities shown and a set cow requests:

Stall id:	1	2	3	4	5
	+---+---+---+---+---+				
Capacity:	1	3	2	1	3
	+---+---+---+---+---+				
Cow 1	XXXXXXXXXX				(1, 3)
Cow 2	XXXXXXXXXXXXXXXXXX				(2, 5)
Cow 3	XXXXXXX				(2, 3)
Cow 4	XXXXXXX				(4, 5)

FJ can't satisfy all four cows, since there are too many requests for stalls 3 and 4.

Noting that Cow 2 requests an interval that includes stalls 3 and 4, we test the hypothesis that cows 1, 3, and 4 can have their requested stalls. No capacity is exceeded, so the answer for this set of data is 3 -- three cows (1, 3, and 4) can have their requests satisfied.

#### Input

- \* Line 1: Two space-separated integers:  $N$  and  $M$
- \* Lines  $2..N+1$ : Line  $i+1$  contains a single integer:  $C_i$
- \* Lines  $N+2..N+M+1$ : Line  $i+N+1$  contains two integers:  $A_i$  and  $B_i$

#### Output

- \* Line 1: The maximum number of requests that can be satisfied

## Example

**Input :**

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

**Output :**

```
3
```

---

Added by: Fendy Kosnatha  
Date: 2011-03-05  
Time limit: 2s  
Source limit:50000B  
Languages: All  
Resource: USACO Gold Division

## **SPOJ Problem Set (classical)**

### **8467. GRADE POINT AVERAGE**

#### **Problem code: GPA1**

##### **Problem 1: GRADEPOINTAVERAGE**

##### **Problem Statement:**

Every student of a college has to write 3 internal assessments and 1 final exam on each semester for all the 6 subjects. Each internal assessment mark is out of 20 and the final exam mark is out of 100. The best two of three assessment marks is chosen and those marks are considered to be out off 45. The final exam mark is considered to be out off 50. The rest 5 marks is allotted based on the percentage of attendance of the student.

Attendance mark allotment

Below 51% attendance - 5 marks

Below 61% attendance - 4 marks

Below 71% attendance - 3 marks

Below 81% attendance - 2 marks

Below 91% attendance - 1 mark

else -No mark for those sincere students

Since the attendance mark for the absentees is higher, some students even bunk the assessments. If he bunks then instead of the mark 'ab' symbol is used which denotes "absent". But no one bunks the final exam.

For each subject there'll be some credit allotted by the department based on the importance of the subject.

Total marks in a particular subject = best two out of three assessments(45%)

+ attendance mark(5%) +Final exam  
mark(50%)

##### **Points out off 10:**

%Total mark in a subject Points



>=91  
10

>=81  
9

>=71  
8

>=61  
7

>50  
6

==50  
5

<50  
0

If the student scores 0 point in any of the subjects then he's declared as FAILED else he's declared as PASSED

Mr.Chintumani, a professor of Computer Science department of the college designed a software program to calculate the GRADEPOINTAVERAGE(GPA) of the student and to determine whether the student is "PASSED" or "FAILED"

GPA= sum of (credit\*points) for all the subjects / total number of credits of all the subjects

### **Input:**

The first line consists of an integer n, the number of students in the class. Then n test cases follows, in each test case the first line consists of 6 integers a,b,c,d,e and f, the credits of the 6 subjects. Then for the next 6 lines, each line(each subject) consists of 5 numbers(the first three numbers are the assessment marks out off 20, the fourth is the final exam mark and the fifth is the percentage of attendance).

### **Output:**

Assume you are Prof. Chintumani and print the result and GPA(rounded to two decimal places) per line for each student in the format as given in the example output.

### **Example:**

### **Sample Input:**

1

1 1 1 2 2 3

19 18 20 70 70

17.33 15 16.66 66 70.66

ab ab ab 0 100

ab ab 10 78 78

17 18.33 19.5 64 87

14 8 ab 60 45

### **Sample Output:**

FAILED, 6.30

### **Explanation of the testcase:**

There is only 1 student

In the Subject 0, he got 19,18 and 20 as internal marks, considering best two of three his internals score is 43.875/45.

His final exam score is 35/50

His attendance mark is 3

So the total marks he got in that subject is 81.875 which leads to 9 points.

Similarly he gets

Subject 1: 74.2387 --> 8 points

Subject 2: 0 --> 0 points

Subject 3: 52.25 --> 6 points

Subject 4: 75.5588 --> 8 points

Subject 5: 59.75 --> 6 points

$$\text{Gpa} = (9*1 + 8*1 + 0*1 + 6*2 + 8*2 + 6*3) / (1+1+1+2+2+3) = 6.30$$

Since he got 0 points in atleast one of the subjects he is FAILED

The output format is "RESULT,<space>gpa" without double quotes.

---

Added by: cegprakash  
Date: 2011-03-06  
Time limit: 1s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 8478. Ancient Pocket Calculator

#### Problem code: POCALC1

Adam likes pocket calculators, especially the early ones. As one of his favorite calculators is about 40 years old, he is not sure how long he will be able to use it. So he had the ingenious idea to develop a simulator that behaves exactly like his calculator. This simulator must be able to read a sequence of keystrokes from the calculator's keypad, process the appropriate calculations and print the calculator's output. As Adam needs only basic arithmetic, the following keys will be sufficient: digits 0 to 9, decimal point, operators +, -, x and : (for division), the equal sign for calculating and displaying a result and the [C] key for resetting the calculator and clearing the display, i.e. the display is set to "0.". Calculations are done from left to right without any operator precedence.



You may call Adam's calculator a headstrong contemporary, because of its special behaviour:

There is no invalid sequence of keystrokes. You can press arbitrary keys one after another, the calculator always knows how to handle it. If more than one operator key (including [=]) is pressed directly after another, only the last of these operators will be processed - all previous ones (in that continuous sequence) are ignored.

If more than 8 digit keys are pressed for the input of a single number, only the first 8 digits will be processed - all following digits are ignored. If the actual display value is zero, the typing of the zero key will have no effect, it's just ignored like successive keystrokes of the same operator. If a floating point value is typed in, a leading zero directly before the decimal point may be left out, but will be displayed just the same. If the decimal point key is pressed within a number that already has a decimal point typed in or if the input of a number (as a sequence of digit keys) is terminated by a decimal point, that has no effect.

#### Input

Input starts with a positive integer  $t$  ( $t < 1000$ ) in a single line, the number of testcases. Then  $t$  lines follow, each line giving the description of an arbitrary sequence of keystrokes on the calculator's keypad. Every key is enclosed by square brackets, all keystrokes are separated by a single space. The number of keystrokes per sequence is less than 500 and every sequence will be terminated by [=].

## Output

For each sequence of keystrokes print the result the calculator will show on the display after the complete sequence of keystrokes has been processed. The size of the display is 8 digits plus an optional "-" sign in front of the leftmost digit and a decimal point that will always appear, even if the result is an integer value. If a value has more than 8 decimal digits, it has to be rounded to fit into 8 digits. As the calculator's display is filled from right to left, the output has to be adjusted to the right.

If the absolute value of a number rounded to an integer needs more than 8 digits, scientific notation is used. Same case, if the absolute value of a number is larger than  $10^{100}$ , but rounding to 8 digits would result in displaying zeros only. If the absolute value is not larger than  $10^{100}$ , it results to zero.

In scientific notation a number is expressed as a product of a decimal part and a power of 10. The decimal part has always exactly one non-zero digit before the decimal point, an optional "-" sign in front of the leftmost digit and upto 4 digits after the decimal point, rounded if necessary. If the exponent is negative, a "-" follows, otherwise a space. Then follow two digits representing the exponent; a leading zero is shown in the exponent, if necessary.

Notice that there are two cases, where the calculator will display "Error." instead of showing a result. If a (final or interim) result has a rounded absolute value of at least  $10^{100}$  or if you divide by zero. After an error has occurred, all following keystrokes are ignored unless [C] is pressed.

**For more clarity of the calculator's behaviour and the required input and output format please look at the examples below.**

## Example

### Input :

```
12
[3] [+] [4] [x] [5] [=]
[1] [:] [6] [=]
[4] [.] [8] [-] [x] [+] [-] [+] [x] [-] [.] [=]
[4] [.] [8] [-] [x] [+] [-] [+] [x] [.] [=]
[+] [+] [+] [+] [+] [+] [1] [=] [=] [=]
[9] [8] [C] [-] [7] [6] [5] [4] [3] [2] [1] [0] [1] [2] [3] [4] [=]
[1] [=] [2] [=] [3] [=]
[5] [:] [9] [8] [7] [8] [9] [8] [9] [8] [7] [8] [8] [:] [4] [5] [6] [7] [8] [9] [=]
[-] [9] [9] [9] [9] [9] [9] [9] [9] [-] [-] [-] [-] [8] [8] [8] [8] [8] [8] [=]
[2] [.] [3] [.] [4] [.] [5] [=]
[0] [0] [0] [0] [0] [=]
[.] [:] [.] [=]
```

### Output :

```
35.
0.1666667
4.8
0.
1.
-76543210.
3.
1.108-13
-1.0089 08
2.345
0.
Error.
```

---

Added by: numerix  
Date: 2011-03-06  
Time limit: 2s  
Source limit: 10000B  
Languages: All  
Resource: own problem

## **SPOJ Problem Set (classical)**

### **8491. Messy Phone List**

#### **Problem code: PHONMESS**

Adam has a lot of friends and therefore he stored a lot of phone numbers in his phone database. As his telephone doesn't belong to the latest generation, its database is somewhat simple. In fact, all entries are stored line by line, exactly in the way Adam once typed them in, no matter what format he used. Unfortunately he changed the format from time to time, unable or too lazy to remember how he did it the last time. So, after years have passed (Adam likes his phone and doesn't want to replace it by a modern one), his phone number list has become really messed up and he wants to do some clean up. Your task is to write a program that will do that clean up for him.

Every entry consists of three parts: telefon number, first name and last name of one of Adam's friends. The order of these parts may vary. An entry may start with the phone number, following the name or vice versa, phone number and name always separated by exactly one space. The order of the two parts of the name may also vary. Either it is first name before last name, separated by a space, or it is last name before first name, separated by a comma.

A phone number may contain an optional leading area code, separated by a "-" or a "/" from the local code. If an area code is missing, the area code of Adam's hometown is assumed. Area code and local code both consist of at least three and at most ten digits. There may be additional optional spaces in between for better readability. For the final list the phone numbers have to be normalized. A normalized phone number consists of the area code and the local code, separated by "-" without any spaces.

A name consists of any letters of the English alphabet. Capital letters and small letters may be mixed, as Adam didn't pay attention to that when he typed in the entries. First name and last name each are at least one and at most 20 characters long. For the final list all names have to be normalized. A normalized name consists of only small letters, except the first one being a capital letter. All following explanations refer to normalized numbers and names.

If two different persons have the same phone number, that will be considered as being an error - none of these entries must appear in the final list. If two entries are equal, they must appear only once in the final list. If a person is listed with different phone numbers, this person has changed phone numbers over the years and will only appear with the latest of the listed numbers, that does not have to be removed because of the reason stated above.

#### **Input**

Input starts with a positive integer  $t$  ( $t < 50$ ) in a single line, then  $t$  testcases follow. Every testcase starts with one line containing a positive integer  $n$  ( $n < 1000$ ), the number of phone list entries, and - separated by a space - the area code of Adam's hometown. Then  $n$  lines follow, each line representing one entry in the phone list.

## Output

For each testcase first print the number k of entries in the final list in a single line. Then k lines must follow, the cleaned up phone list. Each line is a single entry that has to look exactly like this: [first name] [last name]: [phone number]. Square brackets only for clarity. The list has to be sorted in alphabetical order according to last names (primary key) and - if necessary - first names (secondary key).

## Example

### Input :

```
2
10 0608
Sastre,Carlos 030/64 736 666
Voigt,Jens 07401-4498
A Winokurow 0289-334405
Jan ULLRICH 089-77 98 00 9
089/779 8009 Ullrich,Jan
LANCE Armstrong 0608 / 220 4 768 86
Jan Ullrich 089/7798 005
02 89 / 33 44 05 Contador,A
ArmStrong,Lance 220476886
Ullrich,JaN 0289 / 334405
5 012
Becker,Franz 1200344
Becker,Boris 034/50005
Boris Becker 012 / 50 005
5000 5 Boris Becker
Franz Beckenbauer 332323
```

### Output :

```
4
Lance Armstrong: 0608-220476886
Carlos Sastre: 030-64736666
Jan Ullrich: 089-7798005
Jens Voigt: 07401-4498
3
Franz Beckenbauer: 012-332323
Boris Becker: 012-50005
Franz Becker: 012-1200344
```

---

Added by: numerix

Date: 2011-03-07

Time limit: 1s-3s

Source limit:10000B

Languages: All

Resource: own problem



## **SPOJ Problem Set (classical)**

### **8495. Maximum Subset of Array**

#### **Problem code: MAXSUB**

Given an array find the sum of the maximum non-empty subset of the array and also give the count of the subset. A subset of an array is a list obtained by striking off some numbers.  
A non-empty subset implies a subset with at least 1 element in it.

Given an array find the sum of the maximum non-empty subset of the array and also give the count of the subset. A subset of an array is a list obtained by striking off some (possibly none) numbers.

A non-empty subset implies a subset with at least 1 element in it.

#### **Input**

First line contains an integer T which is the number of integers. Following this T-cases exist.

Each case starts with a line containing an integer n which is the number of elements in the array.

The next line contains n-integers which contain the value of this subset.

$T \leq 20$

$n \leq 50,000$

Each element in the array  $\leq 1000,000,000$

#### **Output**

For each test case output the value of the maximum subset and the count of the subsets modulo 1000,000,009

#### **Example**

**Input :**

```
2
5
1 -1 1 -1 1
6
-200 -100 -100 -400 -232 -450
```

**Output :**

```
3 1
-100 2
```

---

Added by: ::: Pratik ::.

Date: 2011-03-07

Time limit: 2s-15s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 8496. No Squares Numbers

#### Problem code: NOSQ

A square free number is defined as a number which is not divisible by any square number.

For example,

13, 15, 210 are square free numbers, where as 25 (divisible by  $5*5$ ), 108 (divisible by  $6*6$ ), 18 (divisible by  $3*3$ ) are not square free numbers.

However number 1 is not considered to be a square and is a squarefree number.

Now you must find how many numbers from number a to b, are square free and also have a digit d inside it.

For example for in the range 10 to 40 te squarefree numbers having digit 3 are

13, 23, 30, 31, 33, 34, 35, 37, 38, 39

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For example,

13, 15, 210 are square free numbers, where as 25 (divisible by  $5*5$ ), 108 (divisible by  $6*6$ ), 18 (divisible by  $3*3$ ) are not square free numbers.

However number 1 is not considered to be a square and is a squarefree number.

Now you must find how many numbers from number a to b, are square free and also have a digit d inside it.

For example for in the range 10 to 40 te squarefree numbers having digit 3 are

13, 23, 30, 31, 33, 34, 35, 37, 38, 39

#### Input

The first line contains an integer T, which is the number of test-cases

Then follow T lines, each containing 3 integers a, b and d.

$1 \leq T \leq 20,000$

$1 \leq a \leq b \leq 100,000$

$0 \leq d \leq 9$

### Output

Print one integer which is the required number as described in the problem statement.

### Example

**Input :**

```
3
10 40 3
1 100 4
1 100000 7
```

**Output :**

```
10
9
26318
```

---

Added by: ::: Pratik ::.

Date: 2011-03-07

Time limit: 3s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 8505. Nacci Fear

#### Problem code: NACCI

We all know about the classical fibonaaci series, Fibonacci series is  $F(n)=F(n-1)+F(n-2)$ . For this question we call it a 2-Nacci series as a new element is calculated as the sum of the last 2 terms of the series. For fibonaaci we assume  $F(0)=0$  and  $F(1)=1$ . We define as new series N-Nacci where  $F(n)$  is the sum of the last  $n$  terms and here we assume that  $F(0)=0$ ,  $F(1)=1$ ,  $F(2)=2$ ...  $F(n-1)=(n-1)$ . Your task is to calculate the last  $K$  digits of the  $L$ th term of the N-Nacci series(no leading zeros needed).

Constraints

$$2 \leq N \leq 30$$

$$K \leq 8$$

$$L \leq 1000000000$$

### Input

The first line of the input denotes the number of test cases  $t$ (atmost 10). Each line denotes a test case consisting of  $N, K, L$ .

### Output

For each test case print the last  $K$  digits of the  $L$ th term of the N-Nacci series.

### Example

**Input :**

```
4
2 1 5
3 6 12
4 1 10
4 2 10
```

**Output :**

```
5
778
6
16
```

---

Added by: Saransh Bansal  
Date: 2011-03-09  
Time limit: 1s-4s  
Source limit:50000B  
Languages: All  
Resource: Own problem

## SPOJ Problem Set (classical)

### 8507. Party Switching

#### Problem code: PSWITCH

Seraph is a smart boy who, one day at the time of his birthday he was wearing a lot of lights for the event. The number of lights is installed for as many as  $N$ , which are numbered 1 through  $N$ . lights are connected to a controller that has 4 buttons. Each button functions as follows:

1. if this button is pressed, then all light will change the state from OFF to ON or from ON to OFF
2. if this button is pressed, then the odd-numbered light will change its state
3. if this button is pressed, then the even-numbered light will change its state
4. if this button is pressed, all lights are numbered  $3K + 1$  will change its state

In the controller, there are counter  $C$  that count number of button will be pressed. when the initial state, the state of all the lights are ON and the counter  $C$  is set to 0. After that you will be given information of light at the end of the show, and you have to count how many kinds of configuration according to the information provided.

Seraph is a smart boy who, one day at the time of his birthday he was wearing a lot of lights for the event. The number of lights is installed for as many as  $N$ , which are numbered 1 through  $N$ . lights are connected to a controller that has 4 buttons. Each button functions as follows:

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4. if this button is pressed, all lights are numbered  $3K + 1$  will change its state

In the controller, there are counter  $C$  that count number of button will be pressed. when the initial state, the state of all the lights are ON and the counter  $C$  is set to 0. After that you will be given information of light at the end of the show, and you have to count how many kinds of configuration according to the info

rmation ahdadhprovided.

#### Input

The first line containing  $N$  ( $10 \leq N \leq 100$ ) that indicates number of lamps. The second line is  $C$  ( $1 \leq C \leq 1000$ ) that indicate the final value of counte. The third line is lists the number of ON lights at the end of the show, each number separated by a space and the end of the line given the value -1. The fourth line is lists the number of OFF light at the end of the show, each number separated by a space

and the end of the line given the value -1.

## Output

configurations are possible at the end of the event. There should be no repetitive configuration and output must be in lexicographical. If there is no configuration, print "Impossible".

## Example

### Input :

```
10
1
-1
7 -1
```

### Output :

```
0000000000
0101010101
0110110110
```

### Explanation :

There is 10 lamps in that event and you have to pressed the button once, and at the end of event, lamp number 7 must be OFF.

0 mean that lamp is OFF, 1 mean that lamp is ON

---

Added by: Fendy Kosnatha

Date: 2011-03-10

Time limit: 0.050s-0.5s

Source limit:50000B

Languages: All

Resource: IOI 1998

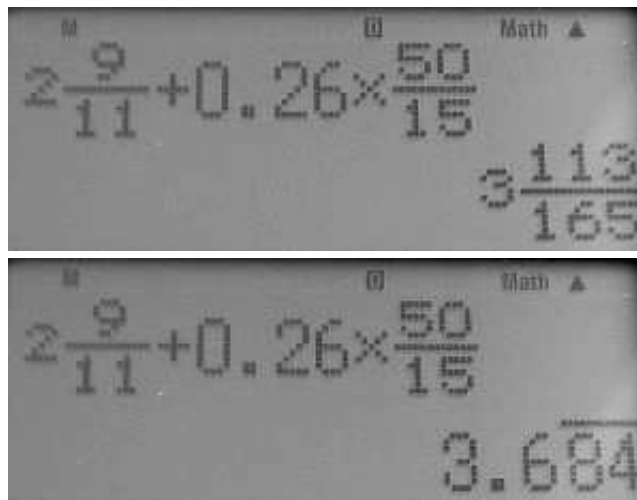


## SPOJ Problem Set (classical)

### 8542. Modern Pocket Calculator

#### Problem code: POCALC2

Adam likes pocket calculators, not only the early ones, but also the modern ones with a two line LCD-display and mathematically correct operator precedence. The upper (input-)line shows the expression you typed in, the (output-)line below shows the result immediately after the [=] key has been pressed. Given the calculator's input-line, the program's task is to produce its output-line. Using the calculator's [S-D] key, the display switches between fractional and decimal representation of the result, so output must contain both representations.



#### Input

Input starts with a positive integer  $t$  ( $t < 1000$ ) in a single line, then  $t$  testcases follow. Every testcase consists of either three lines or a single line, representing the expression in the calculator's input-line, followed by a blank line. An expression contains  $n$  numbers ( $0 < n < 10$ ) with exactly one operator (+, -, x, :) between any two numbers and exactly one space to separate number and operator. There will be no invalid expression and no undefined operation.

A number is given as a decimal, a fraction or a mixed number and will be non-negative. If a number is positive, its decimal value is between  $10^{-9}$  and  $10^9$ , numerator and denominator are also non-negative and not larger than  $10^9$  each, given decimals have at most 9 digits overall. These constraints also hold for all calculations, if done properly. The length of the fraction bar depends on the maximum length of the numerator or the denominator respectively. If lengths of numerator and denominator are different, the shorter one will be centered based on the fraction bar. If centering isn't possible, it is set one digit to the right.

## Output

For each testcase print the result the calculator will display in its output-line: first fractional, then decimal, both representations separated by " [S-D] ". If a result is negative, the negative sign has to be printed directly (i.e. no space) in front of the integer part or the fraction bar.

The fractional representation has to be printed in lowest terms either as a proper fraction or mixed number. If the number has an integer representation, that has to be printed instead. Numerator and denominator have to be placed as described in the input section.

After " [S-D] " the exact(!) decimal representation has to be printed. As the screenshot shows, the calculator is even able to display a repeating decimal in its decimal representation using a vinculum, so that's what the program has to do as well, using underscores in the line above. You can assume that no decimal expansion is longer than 100 digits (it's a calculator with XXL-display).

The number of lines for every output depends on the result. It may be three lines (if fractions appear) or a single line (if result is an integer). Print a blank line after every testcase except the last one. Be careful not to print any trailing spaces.

**For more clarity of input and output format please look at the examples below.**

## Example

Input: 5 9      502-- + 0.26 \* -- 11      15      4      95.88 - -- 1 -      18      53 - 5.1259 \* 14 1      --- \* 0.5100      Output: 113      --- [S-D] 3.484 165 1532      ----- [S-D] 5.75654320987 2025      1-2- [S-D] -2.125 823 [S-D] 23 1---- [S-D] 0.005200

---

Added by: numerix

Date: 2011-03-12

Time limit: 1s

Source limit: 10000B

Languages: All

Resource: own problem

## SPOJ Problem Set (classical)

### 8551. Colours A, B, C, D

#### Problem code: ABCD

Consider a table with 2 rows and  $2N$  columns (a total of  $4N$  cells). Each cell of the first row is coloured by one of the colours A, B, C, D such that there are no two adjacent cells of the same colour. You have to colour the second row using colours A, B, C, D such that:

- \* There are exactly  $N$  cells of each colour (A, B, C and D) in the table.
- \* There are no two adjacent cells of the same colour. (Adjacent cells share a vertical or a horizontal side.)

It is guaranteed that the solution, not necessarily unique, will always exist.

#### Input

[a natural number  $N \leq 50000$ ]

[a string of  $2N$  letters from the set {A, B, C, D}, representing the first row of the table]

#### Output

[a string of  $2N$  letters from the set {A, B, C, D}, representing the second row of the table]

#### Example

Input1CBOutputADInput2ABADOutputBCDC

---

Added by: Adrian Satja Kurdija

Date: 2011-03-13

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: originated from a mathematical problem

## SPOJ Problem Set (classical)

### 8578. Reverse the sequence

#### Problem code: REVSEQ

This is a very ad-hoc problem. Consider a sequence  $(N, N-1, \dots, 2, 1)$ . You have to reverse it, that is, make it become  $(1, 2, \dots, N-1, N)$ . And how do you do this? By making operations of the following kind.

Writing three natural numbers  $A, B, C$  such that  $1 \leq A \leq B < C \leq N$  means that you are swapping the block (block = consecutive subsequence) of elements occupying positions  $A \dots B$  with the block of elements occupying positions  $B+1 \dots C$ . Of course, the order of elements in a particular block does not change.

This means that you can pick any two adjacent blocks (each of an arbitrary length) and swap them. The problem can easily be solved in  $N-1$  operations, but to make it more difficult, you must think of a faster way.

#### Input

A natural number  $1 < N < 100$ .

#### Output

Output at most 50 operations, one per line. Each operation is represented by three numbers as described above.

#### Example

**Input :**

5

**Output :**

2 3 5

1 2 4

2 3 5

**Explanation of the sample output:** (5 4 3 2 1) --> (5 2 1 4 3) --> (1 4 5 2 3) --> (1 2 3 4 5)

---

Added by: Adrian Satja Kurdija

Date: 2011-03-18

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: originated from a mathematical problem

## SPOJ Problem Set (classical)

### 8720. Looks like Nim - but it is not

#### Problem code: GAME2

Goran and Stjepan play an interesting game. On the table between them, there is a sequence of  $N$  skyscrapers made of Lego bricks. All of them are made of equal bricks and each of them has a height, which equals the number of bricks in it.

Goran plays first; then Stjepan, then Goran, then Stjepan and so on. In each move, a player has to find the **highest** skyscraper in the sequence (if there's more than one, he chooses any of them) and reduces its height - that is, takes away an arbitrary (positive) number of bricks from it.

The winner of the game is the one who takes away the last brick. Equivalently, the loser of the game is the one who is not able to make a move.

Help Goran and tell him in how many ways he can play his first move, so that he can certainly win (no matter how Stjepan played). If Goran doesn't have a winning strategy at all, the number of ways is zero.

#### Input

In the first line of input, there is an integer  $T \leq 3$ , the number of test cases.

Then follow  $T$  blocks, each of them in two lines:

-  $N \leq 300\,000$ , the number of skyscrapers in the sequence

- a sequence of  $N$  integers in the range  $[0, 10^6]$

#### Output

For each of the  $T$  games, print the required number of ways.

#### Example

Input :

```
3 50 1 0 1 0 30 7 0 51 0 1 0 1
```

Output :

```
0
```

1

3

---

Added by: Adrian Satja Kurdija  
Date: 2011-04-13  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: idea of Goran Zuzic

## SPOJ Problem Set (classical)

### 8728. Hierarchy

#### Problem code: MAKETREE

A group of graduated students decided to establish a company; however, they don't agree on who is going to be who's boss.

Generally, one of the students will be the **main** boss, and each of the other students will have exactly one boss (and that boss, if he is not the main boss, will have a boss of his own too). Every boss will have a strictly greater salary than all of his subordinates - therefore, there are no cycles. Therefore, the hierarchy of the company can be represented as a rooted **tree**.

In order to agree on who is going to be who's boss, they've chosen K most successful students, and each of them has given a statement: I want to be the superior of him, him, and him (they could be successful or unsuccessful). And what does it mean to be a superior? It means to be the boss, or to be one of the boss' superiors (therefore, a superior of a student is not necessary his direct boss).

Help this immature company and create a hierarchy that will satisfy all of the successful students' wishes. A solution, not necessary unique, will exist in all of the test data.

#### Input

In the first line of input, read positive integers N ( $N \leq 100\,000$ ), total number of students, and K ( $K < N$ ), the number of successful students. All students are numbered 1..N, while the successful ones are numbered 1..K.

Then follow K lines. In  $A^{\text{th}}$  of these lines, first read an integer W (the number of wishes of the student A,  $1 \leq W \leq 10$ ), and then W integers from the range [1, N] which denote students which student A wants to be superior to.

#### Output

Output N integers. The  $A^{\text{th}}$  of these integers should be 0 if student A is the main boss, and else it should represent the boss of the student A.

#### Example

**Input :**

```
4 21 32 3 4
```

**Output :**

```
2012
```

**Input :**

```
7 42 2 31 61 72 1 2
```

**Output :**

```
4110423
```

---

Added by: Adrian Satja Kurdija  
Date: 2011-04-15  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: own problem



## SPOJ Problem Set (classical)

### 8732. Best Fit

#### Problem code: BFIT

You are given a sequence of  $N$  random values ( $s_1, s_2, s_3, s_4, \dots, s_N$ )  
You have to find a function  $f(t) = a*t+b$  such that the Euclidean Distance between the given sequence and the function values where  $t$  varies from 1 to  $N$  is minimum.

In effect, you have to minimize

$$\sqrt{\sum_{i=1}^N (a*i + b - s_i)^2}$$

Output the values  $a$  and  $b$  for each test case, rounded up to 4 decimal places.

#### Input

Line 1:  $T$  /\* Number of test cases  $T \leq 1000$  \*/  
Line 2:  $N$  /\* Number of values in first test case  $N \leq 10000$  \*/  
Line 3:  $s_1 s_2 s_3 s_4 \dots s_N$  /\* all values are less than 10000 \*/

.  
.  
.

#### Output

$a$   $b$  /\* Output the values  $a$  and  $b$  rounded up to 4 decimal places for each test case \*/

#### Example

**Input :**

331 1 131 2 331 3 1

**Output :**

0.0000 1.00001.0000 0.00000.0000 1.6667

---

Added by: Shashank Kumar

Date: 2011-04-16

Time limit: 1s

Source limit:50000B

Languages: All

Resource: INSOMNIA 11

## SPOJ Problem Set (classical)

### 8734. Charlie and the Chocolate Factory

#### Problem code: CHARLIE

Charlie works in a magical chocolate factory. Packets of its marzipan are made on conveyor belts. To make marzipan perfect,  $M$  conveyor belts are used, and the process is as follows.

Each of the  $M$  belts has  $N$  cells. Charlie first makes a few initial packets and puts them on the cells of the first belt (there may be zero or more packets in a particular cell).

Then the first belt generates a second belt such that each cell of the second belt, at the same time, counts the packets in some five cells of the first belt and creates that number of packets in itself.

For example, the first cell of the second belt sums the packets in the cells 1, 2, 3, 5, 9 of the first belt, the second cell of the second belt sums the packets in the cells 2, 3, 4, 5, 6 of the first belt and so on.

Then, from the second belt, a third belt is generated in the same manner, then the fourth from the third and so on until the  $M^{\text{th}}$ . Since the number of packets on the belts usually increases, the number of packets in each cell is observed only modulo 10007.

You, as the winner of the golden ticket to the factory, are able to see how the  $M^{\text{th}}$  belt looks like - that is, how many packets of marzipan there is in each cell. Charlie has also explained to you the production process and now you are wondering how first belt looked like.

#### Input

The first line of input contains positive integers  $N$  ( $N \leq 100$ ) and  $M$  ( $M < 2^{31}$ ).

The next  $N$  lines describe the process of generating each new belt. In the  $A^{\text{th}}$  of these lines there are five distinct integers from the interval  $[1, N]$ , denoting the cells of a previous belt from which the packets are added to the  $A^{\text{th}}$  cell of a new belt.

The next line contains  $N$  integers describing the state of the  $M^{\text{th}}$  belt (modulo 10007).

#### Output

Print  $N$  integers describing the state of the first belt (modulo 10007). A unique solution will exist in all of the test data.

#### Example

Input :

```
6 3
1 2 3 4 5
1 2 3 4 6
1 2 3 5 6
1 2 4 5 6
1 3 4 5 6
2 3 4 5 6
```

13 12 12 12 14 12

**Output:**

1 0 0 0 2 0

**Explanation of the sample case:** the process goes like this:

(1 0 0 0 2 0) - (3 1 3 3 3 2) - (13 12 12 12 14 12)

---

Added by: Adrian Satja Kurdija

Date: 2011-04-17

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: own problem

## SPOJ Problem Set (classical)

### 8750. Wordplay

#### Problem code: WORD

Ivana made up a long word of  $N$  letters. Then she wrote down all  $K$ -letter-substrings of that word. For example, if the original word is BANANA and  $K=3$ , Ivana writes down the words BAN, ANA, NAN, ANA. The number of these words is, obviously,  $N-K+1$ .

Ivana sorted these words in lexicographic order (in the given example, that would be ANA, ANA, BAN, NAN).

But the sad thing happened: Ivana forgot the original word! Your task is to reconstruct it. A unique solution will exist in all of the test data.

Constraints:  $3 \leq N \leq 100\,000$ ,  $2 \leq K \leq 15$ ,  $K < N$ .

#### Input

[integers  $N$ ,  $K$ ]

[ $N-K+1$  words in lexicographic order, each consisting of capital English letters]

#### Output

[the required word]

#### Example

**Input :**

```
6 3
ANA
ANA
BAN
NAN
```

**Output :**

```
BANANA
```

---

Added by: Adrian Satja Kurdija

Date: 2011-04-19

Time limit: 3s

Source limit: 50000B

Languages: All

Resource: own problem

## SPOJ Problem Set (classical)

### 8759. Alpine Skiing

#### Problem code: SKIING

Believe it or not, the devices measuring time in alpine ski racing are not perfect. Instead of measuring the exact time, they measure an interval in which the ski racer finished the race (for example 53.42 sec - 53.45 sec).

The probability is distributed evenly on this interval. (More precisely, if we choose any two sub-intervals of equal length, the probability that the ski racer finished the race in each of these sub-intervals is equal. One can also say that each moment in the given interval has equal probability assigned to it, but this in fact says nothing since the probability for each moment is equal to zero (since there are infinitely many moments in the interval) no matter how we distribute the probability.)

And what if there are  $N$  ski racers? Then we have  $N$  intervals. Find the probability that the first ski racer on the list won the race (that is, finished the race with the minimal time).

#### Input

In the first line, there is an integer  $N$  ( $1 \leq N \leq 300$ ).

In the next  $N$  lines, read the intervals assigned to the ski racers: two real numbers  $A_i$  and  $B_i$  in each line, representing the interval  $[A_i, B_i]$  of the  $i$ -th ski racer. ( $0 < A_i < B_i < 1000$ )

#### Output

Print the required probability. The absolute difference between yours and official solution may beat most  $10^{-6}$ .

#### Example

input

```
2
1.000 5.000
2.500 3.000
```

output

```
0.437500
```

input

4  
3.500 17.300  
12.700 21.200  
2.900 15.000  
1.000 20.000

output

0.263541

---

Added by: Adrian Satja Kurdija

Date: 2011-04-21

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Frane Kurtović

## SPOJ Problem Set (classical)

### 8769. String distance

#### Problem code: STRDIST2

Prof.XYZ is an expert in sequence analysis. One such problem he works on is bar-coding DNA sequences. The problem at hand is, given two DNA sequences, find a way to compute their similarity efficiently. Formally a DNA sequence is a string ( $S$ ) of length  $N$  where each character is from a set of symbols derived from a vocabulary  $SUM$ . We define the  $m$ -perturbed set of a string  $S$  to be  $D(S,m)$  which contains the set of all strings  $S'$  obtained by changing atmost  $m$  characters of  $S$  with  $m \leq N$ . In other words,  $D(S,m)$  is the set of all strings  $S'$  such that the hamming distance between  $S$  and  $S'$  (defined by  $H(S,S')$ ) is atmost  $m$ .

Prof.XYZ defines an order  $(m_1, m_2)$  similarity between two  $N$ -length strings  $S_1$  and  $S_2$  to be the number of strings in the intersection of  $D(S_1, m_1)$  and  $D(S_2, m_2)$ . It is easy to see that the number of strings in this intersection only depends on the hamming distance between  $S_1$  and  $S_2$  (rather than the entire original strings  $S_1$  and  $S_2$ ). In other words  $|D(S_1, m_1) \cap D(S_2, m_2)|$  is only a function of  $N$ , the hamming distance  $H(S_1, S_2)$ ,  $m_1$ ,  $m_2$  and the alphabet size  $|SUM|$ . Your objective is to write a program that counts the size of this intersection given  $N$ ,  $m_1$ ,  $m_2$ ,  $H(S_1, S_2)$  and  $|SUM|$ . Since the answer can be very large, output the answer modulo 1000000007.

#### Input

The first line of the input contains the number of test cases  $T$  (atmost 50). Each testcase consists of 5 integers in order

- (1)  $N$  : The length of each of the two strings.  $1 \leq N \leq 1000$
- (2)  $m_1$  : The allowed number of changes in the first string.  $0 \leq m_1 \leq \min(100, N/2)$
- (3)  $m_2$  : The allowed number of changes in the second string.  $0 \leq m_2 \leq \min(100, N/2)$
- (4)  $H(S_1, S_2)$ : The hamming distance between the two strings.  $0 \leq H \leq \min(100, N/2)$
- (5)  $|SUM|$  : The size of the vocabulary.  $2 \leq |SUM| \leq 1000000$

#### Output

For each test-case output the required number of strings in the intersection modulo 1000000007 in a seperate line.

## Example

**Input:** 36 1 2 2 210 2 2 3 520 3 4 5 7 **Output:** 3241925 **Explanation (for the first test case)**

The length of each string is 6. We are allowed to perturb atmost one element from the first string and atmost two elements from the second. Since their hamming distance needs to be two, let  $S1=000000$  be the first string and  $S2=000011$  be the second. The set  $D(S1,1)$  is  $\{000000,000001,000010,000100,001000,010000,100000\}$ . Without enumerating  $D(S2,2)$ , we can see that the only set of strings in  $D(S1,1)$  that can be obtained by perturbing atmost two elements in  $S2$  are  $\{000000,000001,000010\}$ . Thus  $|D(S1,m1) * D(S2,m2)| = 3$ .

---

Added by: Balakrishnan

Date: 2011-04-26

Time limit: 25s

Source limit: 50000B

Languages: All

Resource: The problem was stated in a technical talk.



## SPOJ Problem Set (classical)

### 8785. Cut the Silver Bar

#### Problem code: SILVER

A creditor wants a daily payment during  $n$  days from a poor miner in debt. Since the miner can not pay his daily obligation, he has negotiated with the creditor an alternative way, convenient for both parties, to pay his debt: the miner will give an equivalent of a  $1u$  ( $= 0.001mm$ ) long piece of a silver bar as a guarantee towards the debt. The silver bar owned by the poor miner is initially  $nu$  units long.

By the end of  $n$  days the miner would not have any more silver to give and the creditor would have received an amount of silver equivalent to that of the silver bar initially owned by the miner. By then, the miner expected to have enough money to pay the debt at the next day so that he would have back all his silver.

With this negotiation in mind, the miner has realized that it was not necessary to cut exactly  $1u$  silver piece from the bar everyday. For instance, at the third day he could give the creditor a  $3u$  silver piece, taking back the equivalent of a  $2u$  silver piece which the creditor should already have.

Since cutting the bar was rather laborious and time consuming, the miner wanted to mini-mize the number of cuts he needed to perform on his silver bar in order to make the daily silver deposits during the  $n$  days. Could you help him?

#### Input

Input consists of several cases, each one defined by a line containing a positive integer number  $n$  (representing the length in micras of the silver bar and the number of days of the amortization period). You may assume that  $0 < n < 20000$ . The end of the input is recognized by a line with 0.

#### Output

For each given case, output one line with a single number: the minimum number of cuts in which to cut a silver bar of length  $nu$  to guarantee the debt during  $n$  days.

#### Example

**Input :**  
1530  
**Output :**  
021

---

Added by: John Mario

Date: 2011-04-29

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: XXIV Colombian Programming Contest ACIS REDIS 2010 - ACM ICPC

## SPOJ Problem Set (classical)

### 8786. The Longest Chain of Domino Tiles

#### Problem code: DOMINO1

You are given N domino tiles. Each tile is made of some number of squares (not necessarily two), and each square is coloured either white or black (we use the Croatian letters: B for white and C for black).

Find the longest chain that can be made of these tiles. Each tile can be used at most once and cannot be rotated (for example, BC cannot become CB). The chain is made by a common rule: in adjacent tiles, touching squares must be of the same colour.

#### Input

[N <=100, the number of dominoes]

in the next N lines:

[a string of size between 1 and 100, representing the domino]

#### Output

The length of the longest chain.

#### Example

**Input :**

```
4
CB
BCC
BBCC
BCBBC
```

**Output :**

```
11
```

---

Added by: Adrian Satja Kurdija  
Date: 2011-05-01  
Time limit: 1s  
Source limit:50000B  
Languages: All  
Resource: own problem

## SPOJ Problem Set (classical)

### 8791. Dynamic LCA

#### Problem code: DYNALCA

A forest of rooted trees initially consists of  $N$  ( $1 \leq N \leq 100,000$ ) single-vertex trees. The vertices are numbered from 1 to  $N$ .

You must process the following queries, where ( $1 \leq A, B \leq N$ ) :

- **link**  $A\ B$  : add an edge from vertex  $A$  to  $B$ , making  $A$  a child of  $B$ , where initially  $A$  is a root vertex,  $A$  and  $B$  are in different trees.
- **cut**  $A$  : remove edge from  $A$  to its parent, where initially  $A$  is a non-root vertex.
- **lca**  $A\ B$  : print the lowest common ancestor of  $A$  and  $B$ , where initially  $A$  and  $B$  are in the same tree.

#### Input

The first line of input contains the number of initial single-vertex trees  $N$  and the number of queries  $M$  ( $1 \leq M \leq 100,000$ ). The following  $M$  lines contain queries.

#### Output

For each **lca** query output the lowest common ancestor (vertex number between 1 and  $N$ ).

#### Example

**Input:** 5 9lca 1 1link 1 2link 3 2link 4 3lca 1 4lca 3 4cut 4link 5 3lca 1 5**Output:** 1232

---

Added by: Andrey Naumenko

Date: 2011-05-02

Time limit: 4s

Source limit: 50000B

Languages: All

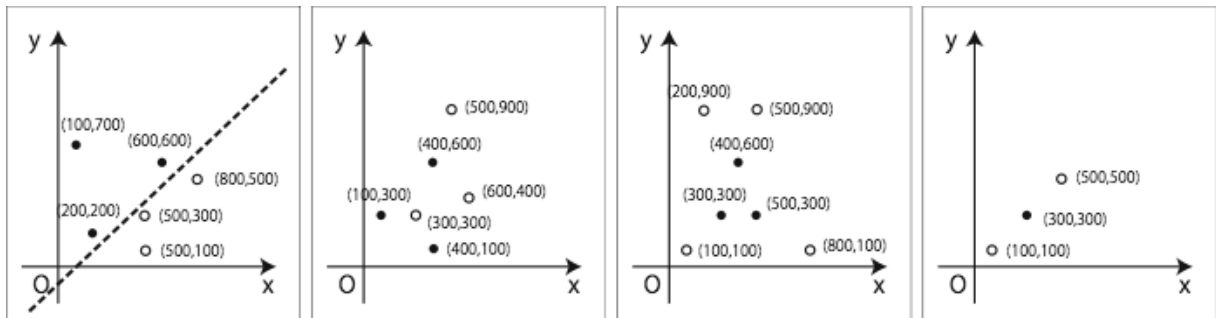
## SPOJ Problem Set (classical)

### 8793. Separate Points

#### Problem code: SPOINTS

Numbers of black and white points are placed on a plane. Let's imagine that a straight line of infinite length is drawn on the plane. When the line does not meet any of the points, the line divides these points into two groups. If the division by such a line results in one group consisting only of black points and the other consisting only of white points, we say that the line "separates black and white points".

Let's see examples in the figure below. In the leftmost example, you can easily find that the black and white points can be perfectly separated by the dashed line according to their colors. In the remaining three examples, there exists no such straight line that gives such a separation.



In this problem, given a set of points with their colors and positions, you are requested to decide whether there exists a straight line that separates black and white points.

#### Input

The input is a sequence of datasets, each of which is formatted as follows.

```
n m
x1 y1
.
.
.
xn yn
xn+1 yn+1
.
.
.
xn+m yn+m
```

The first line contains two positive integers separated by a single space; **n** is the number of black points, and **m** is the number of white points. They are less than or equal to 100. Then **n + m** lines representing the coordinates of points follow. Each line contains two integers  $x_i$  and  $y_i$  separated by a

space, where  $(x_i, y_i)$  represents the x-coordinate and the y-coordinate of the i-th point. The color of the i-th point is black for  $1 \leq i \leq n$ , and is white for  $n + 1 \leq i \leq n + m$ . All the points have integral x- and y-coordinate values between 0 and 10000 inclusive. You can also assume that no two points have the same position.

The end of the input is indicated by a line containing two zeros separated by a space.

## Output

For each dataset, output "YES" if there exists a line satisfying the condition. If not, output "NO". In either case, print it in one line for each input dataset.

## Example

**Input:**  
3 3 100 700 200 200 600 600 500 100 500 300 800 500 3 3 100 300 400 600 400 100 600 400 500 900 300 300 3 4 300 300 500 300 400 600 100 100 200 900 500 900 800 100 1 2 300 300 100 100 500 500 1 1100 100  
200 100 2 2 0 0 500 700 100 1400 1500 2100 2 2 0 0 1000 1000 1000 0 0 1000 3 3 0 100 4399 102 10000 352 5001 102 10000 102 0 101 3 3 100 100 200 100 100 200 0 0 400 0 0 400 3 3 5812 1440 2382 2382 2367 1316 541 3562 9298 3686 7443 7921 0  
**Output:**  
YES NO NO NO YES YES NO NO NO YES

---

Added by: John Mario

Date: 2011-05-03

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: ACM International Collegiate Programming Contest Asia Regional Contest, Tokyo 2009

## SPOJ Problem Set (classical)

### 8794. Swimming Jam

#### Problem code: SWJAM

Despite urging requests of the townspeople, the municipal office cannot afford to improve many of the apparently deficient city amenities under this recession. The city swimming pool is one of the typical examples. It has only two swimming lanes. The Municipal Fitness Agency, under this circumstances, settled usage rules so that the limited facilities can be utilized fully.

Two lanes are to be used for one-way swimming of different directions. Swimmers are requested to start swimming in one of the lanes, from its one end to the other, and then change the lane to swim his/her way back. When he or she reaches the original starting end, he/she should return to his/her initial lane and starts swimming again.

Each swimmer has his/her own natural constant pace. Swimmers, however, are not permitted to pass other swimmers except at the ends of the pool; as the lanes are not wide enough, that might cause accidents. If a swimmer is blocked by a slower swimmer, he/she has to follow the slower swimmer at the slower pace until the end of the lane is reached. Note that the blocking swimmer's natural pace may be faster than the blocked swimmer; the blocking swimmer might also be blocked by another swimmer ahead, whose natural pace is slower than the blocked swimmer. Blocking would have taken place whether or not a faster swimmer was between them.

Swimmers can change their order if they reach the end of the lane simultaneously. They change their order so that ones with faster natural pace swim in front. When a group of two or more swimmers formed by a congestion reaches the end of the lane, they are considered to reach there simultaneously, and thus change their order there. The number of swimmers, their natural paces in times to swim from one end to the other, and the numbers of laps they plan to swim are given. Note that here one "lap" means swimming from one end to the other and then swimming back to the original end. Your task is to calculate

the time required for all the swimmers to finish their plans. All the swimmers start from the same end of the pool at the same time, the faster swimmers in front. In solving this problem, you can ignore the sizes of swimmers' bodies, and also ignore the time required to change the lanes and the order in a group of swimmers at an end of the lanes.

#### Input

The input is a sequence of datasets. Each dataset is formatted as follows.

```
n
t1 c1
...
tn cn
```

$n$  is an integer ( $1 \leq n \leq 50$ ) that represents the number of swimmers.  $t_i$  and  $c_i$  are integers ( $1 \leq t_i \leq 300$ ,  $1 \leq c_i \leq 250$ ) that represent the natural pace in times to swim from one end to the other and the number of planned laps for the  $i$ -th swimmer, respectively.  $t_i$  and  $c_i$  are separated by a space.

The end of the input is indicated by a line containing one zero.

## Output

For each dataset, output the time required for all the swimmers to finish their plans in a line.

No extra characters should occur in the output.

## Example

**Input :**

2 10 30 15 20 2 10 240 15 160 3 2 6 7 2 8 2 4 2 4 7 2 8 2 18 1 0

**Output :**

600 4800 36 40

---

Added by: John Mario

Date: 2011-05-03

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ACM International Collegiate Programming Contest Asia Regional Contest, Tokyo 2009

## SPOJ Problem Set (classical)

### 8795. Twenty Questions

#### Problem code: TWENTYQ

Consider a closed world and a set of features that are defined for all the objects in the world. Each feature can be answered with "yes" or "no". Using those features, we can identify any object from the rest of the objects in the world. In other words, each object can be represented as a fixed-length sequence of booleans. Any object is different from other objects by at least one feature.

You would like to identify an object from others. For this purpose, you can ask a series of questions to someone who knows what the object is. Every question you can ask is about one of the features. He/she immediately answers each question with "yes" or "no" correctly. You can choose the next question after you get the answer to the previous question.

You kindly pay the answerer 100 yen as a tip for each question. Because you don't have surplus money, it is necessary to minimize the number of questions in the worst case. You don't know what is the correct answer, but fortunately know all the objects in the world. Therefore, you can plan an optimal strategy before you start questioning.

The problem you have to solve is: given a set of boolean-encoded objects, minimize the maximum number of questions by which every object in the set is identifiable.

#### Input

The input is a sequence of multiple datasets. Each dataset begins with a line which consists of two integers,  $m$  and  $n$ : the number of features, and the number of objects, respectively. You can assume  $0 < m \leq 11$  and  $0 < n \leq 128$ . It is followed by  $n$  lines, each of which corresponds to an object. Each line includes a binary string of length  $m$  which represent the value ("yes" or "no") of features. There are no two identical objects.

The end of the input is indicated by a line containing two zeros.

#### Output

For each dataset, minimize the maximum number of questions by which every object is identifiable and output the result.

#### Example

---



Added by: John Mario

Date: 2011-05-03

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM International Collegiate Programming Contest Asia Regional Contest, Tokyo 2009

## SPOJ Problem Set (classical)

### 8796. Cubist Artwork

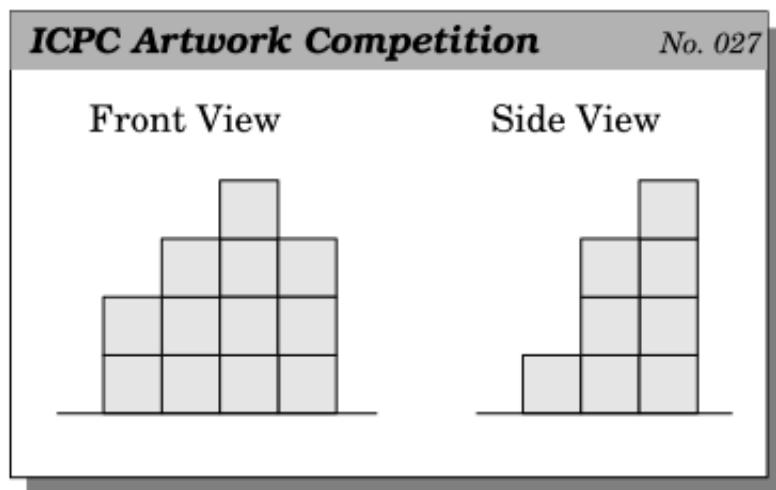
#### Problem code: CUBARTWK

*International Center for Picassonian Cubism* is a Spanish national museum of cubist artworks, dedicated to Pablo Picasso. The center held a competition for an artwork that will be displayed at the facade of the museum building.

The artwork is a collection of cubes that are piled up on the ground and is intended to amuse visitors, who will be curious how the shape of the collection of cubes changes when it is seen from the front and the sides. The artwork is a collection of cubes with edges of 1 foot long and is built on a flat ground that is divided into a grid of unit squares, measuring 1 foot long on each side. Due to some technical reasons, cubes of the artwork must be either put on the ground, fitting into a unit square in the grid, or put on another cube in the way that the bottom face of the upper cube exactly meets the top face of the lower cube. No other way of putting cubes is possible.

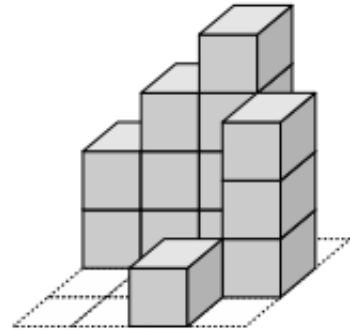
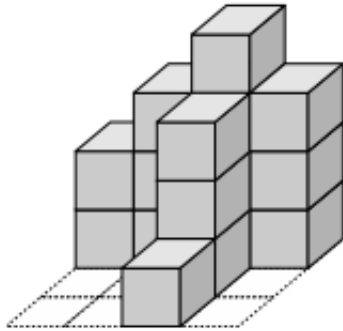
You are a member of the judging committee responsible for selecting one out of a plenty of artwork proposals submitted to the competition. The decision is made primarily based on artistic quality but the cost for installing the artwork is another important factor. Your task is to investigate the installation cost for each proposal. The cost is proportional to the number of cubes, so you have to figure out the minimum number of cubes needed for installation.

Each design proposal of an artwork consists of the front view and the side view (the view seen from the right-hand side), as shown in Figure 1.



The front view (resp., the side view) indicates the maximum heights of piles of cubes for each column line (resp., row line) of the grid.

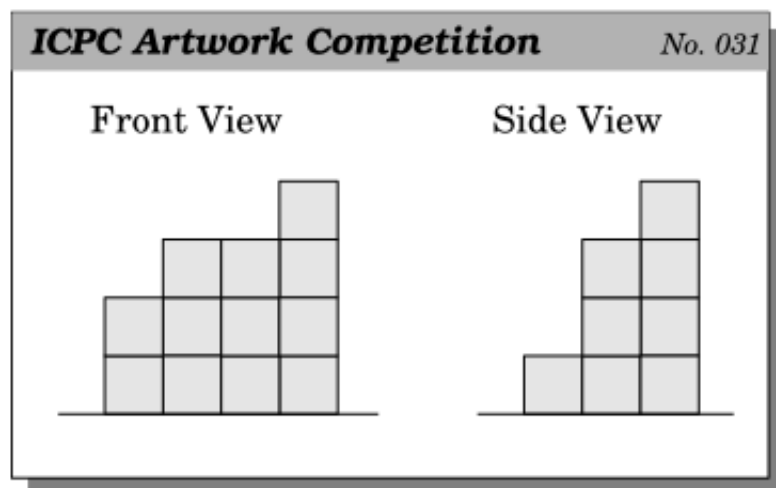
There are several ways to install this proposal of artwork, such as follows.



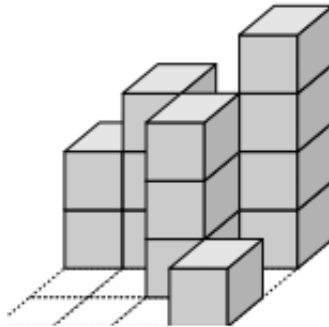
In these figures, the dotted lines on the ground indicate the grid lines. The left figure makes use of 16 cubes, which is not optimal. That is, the artwork can be installed with a fewer number of cubes. Actually, the right one is optimal and only uses 13 cubes.

Notice that swapping columns of cubes does not change the side view. Similarly, swapping rows does not change the front view. Thus, such swaps do not change the costs of building the artworks.

For example, consider the artwork proposal given in Figure 2.



An optimal installation of this proposal of artwork can be achieved with 13 cubes, as shown in the following figure, which can be obtained by exchanging the rightmost two columns of the optimal installation of the artwork of Figure 1.



## Input

The input is a sequence of datasets. The end of the input is indicated by a line containing two zeros separated by a space. Each dataset is formatted as follows.

$$\begin{array}{c} w \ d \\ h_1 \ h_2 \ \dots \ h_w \\ h'_1 \ h'_2 \ \dots \ h'_d \end{array}$$

The integers  $w$  and  $d$  separated by a space are the numbers of columns and rows of the grid, respectively. You may assume  $1 \leq w \leq 10$  and  $1 \leq d \leq 10$ . The integers separated by a space in the second and third lines specify the shape of the artwork. The integers  $h_i$  ( $1 \leq h_i \leq 20$ ,  $1 \leq i \leq w$ ) in the second line give the front view, i.e., the maximum heights of cubes per each column line, ordered from left to right (seen from the front); The integers  $h'_i$  ( $1 \leq h'_i \leq 20$ ,  $1 \leq i \leq d$ ) in the third line give the side view, i.e., the maximum heights of cubes per each row line, ordered from left to right (seen from the right-hand side).

## Output

For each dataset, output a line containing the minimum number of cubes. The output should not contain any other extra characters.

You can assume that for each dataset there is at least one way to install the artwork.

## Example

[illegible]

Added by: John Mario

Date: 2011-05-03

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM International Collegiate Programming Contest Asia Regional Contest, Tokyo 2009

## SPOJ Problem Set (classical)

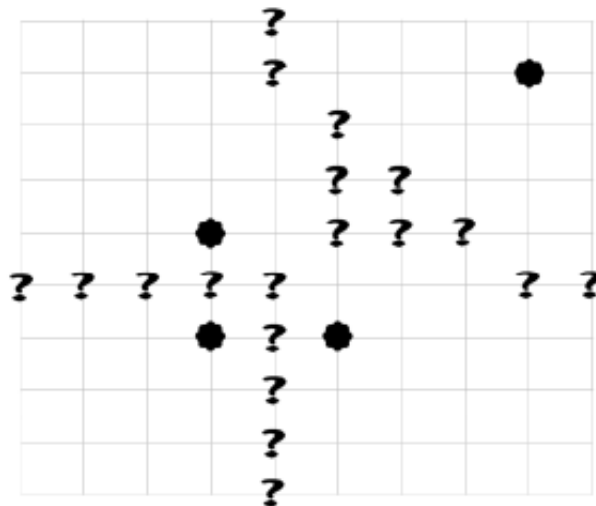
### 8816. Mravograd

#### Problem code: MRAVOGRA

The hard working ants have built a town called Ant Town. They modeled their town after Manhattan, with  $H$  horizontal and  $V$  vertical streets which cross in  $V \times O$  intersections. As ants don't like water, with the first raindrops comes chaos in Ant Town. Town authorities have placed umbrellas under which any number of ants can hide, but only on  $N$  intersections.

When the rain starts, each ant on an intersection starts running, **using streets**, to the nearest intersection with an umbrella. But, if an ant can choose from more than one such intersection, it panics and, not knowing where to go, **stays on its starting intersection** and gets wet. Town authorities use the name "wet intersections" for such starting intersections.

For example, if Ant Town has 10 horizontal and 10 vertical streets, and if there are 4 intersections with umbrellas, then the question marks in the figure represent "wet intersections":



*Picture represents first example. We count streets from left to right from 1 to  $V$  and from down upwards from 1 to  $H$ .*

Write a program which, given the locations of intersections with umbrellas, determines the **number of "wet intersections"** in Ant Town.

#### Input

The first line contains two integers  $H$  and  $V$  ( $1 \leq H, V \leq 30\,000$ ), the numbers of horizontal and vertical streets in Ant Town.

Horizontal streets are numbered 1 to H, vertical streets 1 to V.

The second line contains an integer N ( $1 \leq N \leq 10$ ), the number of intersections with umbrellas.

Each of the following N lines contains two integer h and v, meaning that there is an umbrella on the crossing of horizontal street h and vertical street v. The locations of all umbrellas will be distinct.

## Output

Output the number of "wet intersections" in Ant Town.

## Example

**Input:** 10 10 44 44 66 49 9 **Output:** 19 **Input:** 9 932 25 58 8 **Output:** 36 **Input:** 100 100 250 50 50 51 **Output:** 0

---

Added by: Stjepan Glavina

Date: 2011-05-05

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Croatian National 2007

## SPOJ Problem Set (classical)

### 8820. Okret

#### Problem code: OKRET

There is a text consisting of  $N$  characters. At each step Mirko chooses two numbers  $A$  and  $B$  and then reverses the subsequence consisting of characters between indices  $A$  and  $B$ , inclusive. Indices are 1-based.

Write a program that prints the final text after all operations are made.

#### Input

The first line of input contains the initial text of length  $N$  ( $1 \leq N \leq 2500000$ ). It consists only of lowercase letters of the English alphabet.

The second line contains integer  $M$  ( $1 \leq M \leq 2500$ ), the number of steps.

Each of the following  $M$  lines contain two integer  $A$  and  $B$  ( $1 \leq A \leq B \leq N$ ).

#### Output

In the first and only line output the final text.

#### Example

**Input:** lukakuka31 45 81 8**Output:**kukaluka**Input:**kukulelebodumepcele53 710 122 105 185 15**Output:**kubeeludomepcelluke

---

Added by: Stjepan Glavina

Date: 2011-05-06

Time limit: 1.5s

Source limit:50000B

Languages: All

Resource: Croatian Student 2010



## SPOJ Problem Set (classical)

### 8836. Yet Another Sequence Problem

#### Problem code: SEQ7

We have an infinite non-decreasing sequence A which is created as follows :

- $A[1] = 1$  and  $A[2] = 2$ .
- A number  $i$  occurs  $A[i]$  times in the sequence.

First few terms in the sequence are: { 1, 2, 2, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6, 6, 7... }. Note that 3 occurs 2 times in the sequence, (because  $A[3] = 2$ ).

Your task is to find the term  $A[n]$  for any given  $n$ , where  $0 < n \leq 1e13$ .

#### Input

First line contains  $t$ , the number of testcases. Each of the next  $t$  lines contains a number  $n$ .

#### Output

For every case, print the  $n$ th term of the sequence.

#### Example

**Input:**

2  
5  
12

**Output:**

3  
6

---

Added by: Paranoid Android  
Date: 2011-05-09  
Time limit: 1s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 8839. Longest Common Difference Subsequence

#### Problem code: LCDS

Given two sequences of integers, your task is to find the longest common subsequence where every two adjacent values differ the same.

For example, if the sequences are  $A = \{1, 5, 8, 3\}$  and  $B = \{3, 10, 5\}$ , then the common subsequence with adjacent values same are  $A_L = \{1, 8, 3\}$  and  $B_L = \{3, 10, 5\}$  since the differences in  $A_L$  are 7 and -5 which is also the same in  $B_L$ .

#### Input

First line of the input contains  $N_A$  and  $N_B$ , the sizes of the sequences A and B. Then follow two lines, the sequences A and B. ( $1 \leq N_A, N_B \leq 1000$  and all values in the sequence will lie between  $-1e9$  and  $1e9$ ).

#### Output

Print one line, the length of the LCDS as described above.

#### Example

**Input:**

4 3  
1 5 8 3  
3 10 5

**Output:**

3

**Input:**

1 2  
5  
6 8

**Output:**

1

---

Added by: Paranoid Android

Date: 2011-05-09

Time limit: 1s-40s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 8841. Avaricious Maryanna

#### Problem code: AVARY

After Maryanna found the treasure buried by 27 pilots in a secret cave, she wanted to leave there immediately. Unfortunately, finding the door closed because of the overweight treasure she carried, she had to find out the password of the lock. She remembered someone had told her the password is an  $N$ -digit natural decimal integer (without extra leading zeroes), and the  $N$  least significant digits of any positive integral power of that integer is same as itself. She, being a smart girl, came up with all the possible answers within 1 minute. After a few times of tries, she escaped from that cave successfully. To show your intelligence you may solve the same task with your computer within only 10 seconds!

#### Input

The first line contains  $T$  ( $T \leq 1000$ ), the number of test cases.  $T$  lines follow, each contains a single positive integer  $N$  ( $N \leq 500$ ).

#### Output

For each test case, output a single line, which should begin with the case number counting from 1, followed by all the possible passwords sorted in increasing order. If no such passwords exist, output `Impossible` instead. See the sample for more format details.

#### Example

**Input :**

```
2
2
1
```

**Output :**

```
Case #1: 25 76
Case #2: 0 1 5 6
```

---

Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Fudan University Local Contest #2, by Blue Mary

## SPOJ Problem Set (classical)

### 8842. Boring Homework

#### Problem code: BWORK

Professor Z. always gives his students lots of boring homework. Last week, after explaining binary search trees (BSTs), he asked his students to draw a picture of BST according to the list of numbers inserted into the tree sequentially. Maryanna spent so much time playing the game "Starcraft II" that she can't finish her homework in time. She needs your help.

*A binary search tree, which may sometimes also be called ordered or sorted binary tree, is a node-based binary tree data structure which has the following properties:*

*The left subtree of a node contains only nodes with keys less than the node's key.*

*The right subtree of a node contains only nodes with keys greater than the node's key.*

*Both the left and right subtrees must also be binary search trees.*

*--from Wikipedia*

To draw a picture of BST, you may follow the rules listed below:

1. The picture of a 1-node BST, whose size is  $1 \times 1$ , is a single 'o' (15th small Latin letter).
2. If a BST has a non-empty subtree, draw a single 'l' just above the subtree's root, and a single '+' just above previous drawn 'l'. Finally, in the row of '+', use the least number (including 0) of '-'s to connect '+' (denoting the left subtree and right subtree) and 'o' (denoting the parent node of the subtree)
3. The left subtree (if exists) must be drawn on the left side of its parent. Similarly, the right subtree (if exists) must be drawn on the right side of its parent.
4. The column of the BST's root must not contain any character from left subtree or right subtree.
5. Any column containing any characters from BST's left subtree must not contain any characters from BST's right subtree, and vice versa. That is, for a node of the BST, the picture of its left subtree and the picture of its right subtree do not share common columns in the picture of the whole tree.

The sample output may give a clear clarification about the format of the picture.

#### Input

The first line contains **T** ( $T \leq 2500$ ), the number of test cases. T lines follow. Each line contains a positive integer **N** ( $N < 80$ ), followed by N integers - a permutation of 1 to N. The permutation indicates the insert order for the BST.

## Output

For each test case:

Output the case number counting from 1 in the first line. The next lines should be the image described above without any trailing spaces. See the sample for more format details.

*Notice that no trailing whitespaces after the last visible characters of each line are allowed.*

## Example

**Input :**

```
3
3 3 1 2
6 4 5 6 1 3 2
5 3 4 5 2 1
```

**Output :**

Case #1:

```
+--o
|
o+
|
o
```

Case #2:

```
+---o+
|   |
o--+ o+
|   |
+o   o
|
o
```

Case #3:

```
+o+
| |
+o o+
| |
o   o
```

---

Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #2, by Blue Mary

## SPOJ Problem Set (classical)

### 8843. Complete the Set

#### Problem code: COMPLETE

Archaeologists have made a discovery on the Temple of Topology. The temple was once used as a place for ritual ceremony thousands of years ago. Among the relics that were unearthed, a scroll of parchment raised the interest of scientists. The parchment contained many numbers written in ancient symbols.

By decrypting the words carved on a stone, scientists know that these numbers form an interesting set of integers satisfying the following two properties:

1. Bitwise AND any number of integers from the set result in an integer in that set again.
2. Bitwise OR any number of integers from the set result in an integer in that set again.

As the parchment is extremely old, some part of it were broken and the numbers were lost. Now your job is to complete the original set from the remaining integers such that the size of the set is as small as possible.

#### Input

The input contains several test cases. The total number of test cases is less than 1100. Each test case begins with a line containing an integer  $n$  ( $n > 1$ ). The following line contains  $n$  integers  $a_i$  ( $0 \leq a_i < 2^{16}$ ), the remaining integers on the parchment. The integers are distinct.

#### Output

For each test case, output one line containing a single integer, the minimal number of additional integers to make the set complete. If these numbers are already a complete set, print 0.

#### Example

**Input :**

```
4
5
0 1 3 5 7
2
2 4
3
3 7 11
3
1 2 4
```

**Output :**

```
Case #1: 0
Case #2: 2
Case #3: 1
Case #4: 5
```

---

Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #2, by cuiaoxiang

## SPOJ Problem Set (classical)

### 8844. Detection of Extraterrestrial

#### Problem code: DETECT

E.T. Inc. employs Maryanna as alien signal researcher. To identify possible alien signals and background noise, she develops a method to evaluate the signals she has already received. The signal sent by E.T is more likely regularly alternative.

Received signals can be presented by a string of small latin letters 'a' to 'z' whose length is **N**. For each **X** between 1 and **N** inclusive, she wants you to find out the maximum length of the substring which can be written as a concatenation of **X** same strings. For clarification, a substring is a consecutive part of the original string.

#### Input

The first line contains **T**, the number of test cases ( $T \leq 200$ ). Most of the test cases are relatively small. **T** lines follow, each contains a string of only small latin letters 'a' - 'z', whose length **N** is less than 1000, without any leading or trailing whitespaces.

#### Output

For each test case, output a single line, which should begin with the case number counting from 1, followed by **N** integers. The **X**-th (1-based) of them should be the maximum length of the substring which can be written as a concatenation of **X** same strings. If that substring doesn't exist, output 0 instead. See the sample for more format details.

#### Example

**Input :**

```
2
arisetocrat
noonnoonnoon
```

**Output :**

```
Case #1: 11 0 0 0 0 0 0 0 0 0 0
Case #2: 12 8 12 0 0 0 0 0 0 0 0
```

#### Hint

For the second sample, the longest substring which can be written as a concatenation of 2 same strings is "noonnoon", "oonnoonn", "onnooonno", "nnooonnoo", any of those has length 8; the longest substring which can be written as a concatenation of 3 same strings is the string itself. As a result, the second integer in the answer is 8 and the third integer in the answer is 12.

---



Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #2, By Blue Mary

## SPOJ Problem Set (classical)

### 8845. Entertainment

#### Problem code: TENNIS

Maryanna and Lucyanna play tennis every Sunday afternoon since 10 years ago.

A tennis match is determined through 5 sets. Typically the first player to win 3 sets wins the match. A set consists of games, and games, in turn, consist of points.

A game consists of a sequence of points played with the same player serving. A game is won by the first player to have won at least four points in total and at least two points more than the opponent. The running score of each game is described in a manner peculiar to tennis: scores from zero to three points are described as "love", "fifteen", "thirty", and "forty" respectively. If at least three points have been scored by each player, and the scores are equal, the score is "deuce". If at least three points have been scored by each side and a player has one more point than his opponent, the score of the game is "advantage" for the player in the lead. During informal games, "advantage" can also be called "ad in" or "ad out", depending on whether the serving player or receiving player is ahead, respectively.

A set consists of a sequence of games played with service alternating between games, ending when the count of games won meets certain criteria. Typically, a player wins a set by winning at least six games and at least two games more than the opponent.

The first servers of two consecutive sets are different.

Maryanna has found out when she is the server, her winning probability of this point is **M**%; otherwise, **Y**%. She wants to know her winning probability of the whole match if she serves first.

#### Input

The first line contains **T** ( $T \leq 10000$ ), the number of test cases. **T** lines follow. Each line contains two space-separated positive integers **M**, **Y** ( $0 < M, Y < 100$ ).

#### Output

For each test case, output a single line, which should begin with the case number counting from 1, followed by Maryanna's winning percentage accurate to 4 decimal places. See the sample for more format details.

#### Example

**Input :**

```
2
50 50
51 51
```

**Output :**

```
Case #1: 50.0000%
Case #2: 63.5654%
```

---

Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #2, by Blue Mary

## SPOJ Problem Set (classical)

### 8847. Google is Feeling Lucky

#### Problem code: FEELUCK

Google is one of the most famous Internet search engines which hosts and develops a number of Internet-based services and products. On its search engine website, an interesting button "I'm feeling lucky" attracts our eyes. This feature could allow the user skip the search result page and goes directly to the first ranked page. Amazing! It saves a lot of time.

The question is, when one types some keywords and presses "I'm feeling lucky" button, which web page will appear? Google does a lot and comes up with excellent approaches to deal with it. In this simplified problem, let us just consider that Google assigns every web page an integer-valued relevance. The most related page will be chosen. If there is a tie, all the pages with the highest relevance are possible to be chosen.

Your task is simple, given 10 web pages and their relevance. Just pick out all the possible candidates which will be served to the user when "I'm feeling lucky".

#### Input

The input contains multiple test cases. The number of test cases is in the first line of the input file.

For each test case, there are 10 lines, describing the web page and the relevance. Each line contains a character string without any blank characters denoting the URL of this web page and an integer  $V_i$  denoting the relevance of this web page. The length of the URL is between 1 and 100 inclusively. ( $1 \leq V_i \leq 100$ )

#### Output

For each test case, output several lines which are the URLs of the web pages which are possible to be chosen. The order of the URLs is the same as the input.

Please look at the sample output for further information of output format.

#### Example

##### Input :

```
2
www.youtube.com 1
www.google.com 2
www.google.com.hk 3
www.alibaba.com 10
www.taobao.com 5
www.bad.com 10
www.good.com 7
www.fudan.edu.cn 8
www.university.edu.cn 9
acm.university.edu.cn 10
www.youtube.com 1
```

www.google.com 2  
www.google.com.hk 3  
www.alibaba.com 11  
www.taobao.com 5  
www.bad.com 10  
www.good.com 7  
www.fudan.edu.cn 8  
acm.university.edu.cn 9  
acm.university.edu.cn 10

**Output:**

Case #1:

www.alibaba.com

www.bad.com

acm.university.edu.cn

Case #2:

www.alibaba.com

---

Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #2, by g201513

## SPOJ Problem Set (classical)

### 8848. Herbicide

#### Problem code: HERBICID

Professor Z. has a courtyard beside his house. In the past, he loved to clean it and prune the flowers in his yard. However, with the JavaFF class taught by Professor Z. being offered, he indulged in assigning boring homework to the students and had no time for caring his yard. Consequently, weeds begin to grow up and then his yard becomes overgrown.

In the last weekend, after Professor Z. assigned a mass of boring homework again, he suddenly brought his yard to mind. And after he saw the weedy ground, he decided to remove the weeds. But he did not have much time to deal with the garden's problem because of the uncompleted plans of further boring homework in the next JavaFF class. He sprayed herbicide on the ground optionally and, strangely, herbicide was sprayed as several simple polygons on the ground. In order to determine whether he should continue his work or not, Professor Z. needed to know how many weeds were covered by the herbicide. Notice that we assume that the weeds were not killed by the herbicide applied before. In the other words, a single weed can be counted several times in different polygon of herbicide.

It seems that counting this number is quite a tough job. Then he asked Maryanna, one of his students in JavaFF class, for help. But Maryanna has no time because her boring homework had never been finished. Please help her!

#### Input

The very first line of input contains an integer  $T$  ( $T \leq 100$ ) indicating the number of test cases.

The first line of each test case is an integer  $N$  ( $N \leq 1000$ ), which is the number of weeds in Professor Z's yard. In the following  $N$  lines, each line has a pair of integers  $(X_i, Y_i)$  denoting the coordinate of a weed ( $-10000 \leq X_i, Y_i \leq 10000$ ). You can assume all the coordinates are unique. The next line is an integer  $M$  ( $M \leq 1000$ ) which denotes the number of polygons covered by herbicide, all these polygon's vertices are located on one of the  $N$  weeds, then  $M$  polygons descriptions are following. Each polygon  $P_i$  has two lines, the first line of  $i$ th polygon has an integer  $S_i$  ( $3 \leq S_i \leq N$ ) denoting the number of vertices in this polygon. The following line contains  $S_i$  integers, describing the vertices of this polygon in clockwise or counter-clockwise order. In detail, each integer in this line is an index of the coordinates of the  $N$  weeds listed before. Notice that the indexes start from 1. See the sample input for further details.

#### Output:

For each test case, output  $M$  lines, each line has a single integer indicating the number of weeds covered by the corresponding polygon. If a weed lies on the edge of a polygon, then we consider such a weed as being covered.

## Example

### Input :

```
1
6
1 1
3 2
2 3
1 -1
-1 -2
-1 1
3
3
5 4 3
3
1 5 6
5
5 4 2 3 6
```

### Output :

```
Case #1:
4
3
6
```

---

Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 15s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #2, by lcosvse

## SPOJ Problem Set (classical)

### 8849. Imitation

#### Problem code: IMITATE

Iris is a student of ethology studying the animal behavior. She is interested by the imitation behavior of animals. Imitation is an advanced behavior whereby an individual observes and replicates another's.

Iris is such a good researcher that she builds a mathematical model to describe the body figure of animals. She describes the body as a number of joints. And the figure or the status of animal body can be denoted as a set of ordered pairs of two different joints. To study the imitation of the animals, Iris defines the correlation of joints. She defines the correlation as the transitive closure of the ordered pairs of body status with its reflexive pairs eliminated. That is to say, the correlation is an anti-reflexive relation. In this case, we could say that one body status is imitating the other one when the correlations of both body statuses are the same.

For example, for the joint set  $\{J1, J2, J3\}$ . The first body status contains the ordered pair  $(J1, J2)$ ,  $(J2, J3)$ . And the second body status contains the ordered pair  $(J1, J2)$ ,  $(J2, J3)$ ,  $(J1, J3)$ . We could say that the first body status is imitating the other one because both of the correlation sets are  $(J1, J2)$ ,  $(J2, J3)$ ,  $(J1, J3)$  since the definition of the correlation is the transitive closure of body status.

For a given body status, that is, a given set of ordered pairs of joints, Iris want to get another body status, which is imitating the given one. At the same time, the desired body status must contain the minimum number of ordered pairs or the maximum number of ordered pairs. Your task is to calculate the minimum number and the maximum number.

#### Input

There are several test cases. The first line of the input contains a single integer denoting the number of test cases. There are about 100 test cases, but 90% of them are relatively small.

For each test case, the first line contains two integers  $N$  and  $M$  where  $N$  is the number of joints of both the given body status and the desired body status,  $M$  is the number of ordered pairs of the given body status. ( $1 \leq N \leq 1000$ ,  $0 \leq M \leq 10000$ )

Next  $M$  lines, each line denoting an ordered pair  $(X_i, Y_i)$ . The  $X_i$  and  $Y_i$  are integers between 1 and  $N$ . Note that we consider the joints as the number between 1 and  $N$ .

#### Output

For each test case, output two integers denoting the minimum and maximum number of ordered pairs of the desired set. Two integers are separated by a single space.



## Example

### Input :

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

### Output :

```
Case #1: 2 3
Case #2: 3 6
Case #3: 9 18
```

## Hint

In mathematics, the transitive closure of a binary relation  $R$  on a set  $X$  is the transitive relation  $R^+$  on set  $X$  such that  $R^+$  contains  $R$  and  $R^+$  is minimal. If the binary relation itself is transitive, then the transitive closure will be that same binary relation; otherwise, the transitive closure will be a different relation.

A relation  $R$  on a set  $X$  is transitive if, for all  $x, y, z$  in  $X$ , whenever  $x R y$  and  $y R z$  then  $x R z$ . Examples of transitive relations include the equality relation on any set, the "less than or equal" relation on any linearly ordered set, and the relation "x was born before y" on the set of all people. Symbolically, this can be denoted as: if  $x < y$  and  $y < z$  then  $x < z$ .

(From Wikipedia::transitive closure)

---

Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 2s

Source limit: 50000B

Languages: All

Resource: Fudan University Local Contest #2, by g201513

## SPOJ Problem Set (classical)

### 8850. Juice Extractor

#### Problem code: JUICE

Jerry loses himself in the interesting game: Fruit Ninja. Fruit Ninja is a game of iPhone and iPad in which the players cut the fruits coming from the bottom of the screen and gain the bonus from cutting more than two fruits with a single slice. Once a fruit is cut, it breaks into small pieces and cannot be cut any more.

After months of training, he becomes pro of this game. Actually, he can cut all the fruits on the screen at any time. Jerry also has a bad habit that he has no willing to leave some fruits for the future cutting. In the other words, after Jerry cuts the fruits, all the fruits on the screen breaks and no one left. That is why all his friends call him *Juice Extractor*.

Now he only consider about the bonus, when he cuts more than two fruits, he can gain some bonus scores as same as the number of fruits he slice at that time. For example, if Jerry cuts 4 fruits with a single slice, he can get 4 scores from this slice.

After Jerry gets the fruit schedule, he knows the appearing time and the disappearing time for every single fruit. He can only cut a fruit into pieces between its appearing time and disappearing time inclusive. He wants to know the maximum possible bonus scores he can receive.

#### Input

There are several test cases; the first line of the input contains a single integer **T**, denoting the number of the test cases. ( $T \leq 200$ )

For each test case, the first line contains an integer **N**, denoting the total number of fruits. ( $1 \leq N \leq 1000$ )

The next **N** lines, each line describe a fruit. For each line, there are two integers **X<sub>i</sub>** and **Y<sub>i</sub>**, where **X<sub>i</sub>** is the appearing time of the fruit and **Y<sub>i</sub>** is the disappearing time of this fruit. ( $0 \leq X_i \leq Y_i \leq 1000000000$ )

#### Output

For each test case, output a single integer denoting the maximum scores that Jerry could possibly gain. See the sample for further details.

#### Example

**Input :**

```
1
10
1 10
2 11
3 12
4 13
```

13 14  
14 15  
13 19  
20 22  
21 23  
22 24

**Output :**

Case #1: 10

---

Added by: [Trichromatic] XilinX

Date: 2011-05-10

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #2, by g201513

## SPOJ Problem Set (classical)

### 8869. Roti Prata

#### Problem code: PRATA

IEEE is having its AGM next week and the president wants to serve cheese prata after the meeting. The subcommittee members are asked to go to food connection and get  $P(P \leq 1000)$  pratas packed for the function. The stall has  $L$  cooks ( $L \leq 50$ ) and each cook has a rank  $R(1 \leq R \leq 8)$ . A cook with a rank  $R$  can cook 1 prata in the first  $R$  minutes 1 more prata in the next  $2R$  minutes, 1 more prata in  $3R$  minutes and so on (he can only cook a complete prata) ( For example if a cook is ranked 2.. he will cook one prata in 2 minutes one more prata in the next 4 mins an one more in the next 6 minutes hence in total 12 minutes he cooks 3 pratas in 13 minutes also he can cook only 3 pratas as he does not have enough time for the 4th prata). The webmaster wants to know the minimum time to get the order done. Please write a program to help him out.

#### Input

The first line tells the number of test cases. Each test case consist of 2 lines. In the first line of the test case we have  $P$  the number of prata ordered. In the next line the first integer denotes the number of cooks  $L$  and  $L$  integers follow in the same line each denoting the rank of a cook.

#### Output

Print an integer which tells the number of minutes needed to get the order done.

#### Example

**Input :** 3 104 1 2 3 481 188 1 1 1 1 1 1 1 1 **Output :** 12361

---

Added by: Saransh Bansal

Date: 2011-05-14

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Own problem- NTU IEEE codejam 2011

## SPOJ Problem Set (classical)

### 8886. Guess number!

#### Problem code: GNUM

There was an application "Guess number!" in one of the popular social network recently. On each of the levels of this offered game it is necessary to define the secret number with some information provided.

In particular, one of the most difficult levels consists in guessing the rational number  $x$  ( $0 < x < 1$ ). It is known, that the result of multiplication of this number by natural number  $k$  is exactly one alteration: the  $i$ -th and  $j$ -th digits after a decimal point are exchanged by each other.

As the number in front of decimal point isn't changed, the inequality  $0 < kx < 1$  is executed. Initially the numbers after a decimal point can be infinite.

Your problem consists in writing the program which will define value  $x$  on numbers  $i, j, k$ .

#### Input

The first input line contains in one integer  $t$  (about 1000). Each of the following  $t$  lines contains three numbers:  $i, j, k$  ( $1 \leq i < j \leq 1000$ ;  $2 \leq k \leq 10^9$ ).

#### Output

If the required number exists, output consists in two integers -- numerator and denominator of a non-reducible fraction setting required number. Otherwise output is "NO SOLUTION".

#### Example

**Input :**

```
1
1 4 13
```

**Output :**

```
2997 40000
```

---

Added by: Ruslan Sennov

Date: 2011-05-15

Time limit: 5s-15s

Source limit: 50000B

Languages: All

Resource: RCC 2011

## SPOJ Problem Set (classical)

### 8894. Double Time

#### Problem code: DOUTI

In 45 BC a standard calendar was adopted by Julius Caesar - each year would have 365 days, and every fourth year have an extra day - the 29th of February. However this calendar was not quite accurate enough to track the true solar year, and it became noticeable that the onset of the seasons was shifting steadily through the year. In 1582 Pope Gregory XIII ruled that a new style calendar should take effect. From then on, century years would only be leap years if they were divisible by 400. Furthermore the current year needed an adjustment to realign the calendar with the seasons. This new calendar, and the correction required, were adopted immediately by Roman Catholic countries, where the day following Thursday 4 October 1582 was Friday 15 October 1582. The British and Americans (among others) did not follow suit until 1752, when Wednesday 2 September was followed by Thursday 14 September. (Russia did not change until 1918, and Greece waited until 1923.) Thus there was a long period of time when history was recorded in two different styles.

Write a program that will read in a date, determine which style it is in, and then convert it to the other style.

Input will consist of a series of lines, each line containing a day and date (such as Friday 25 December 1992). Dates will be in the range 1 January 1600 to 31 December 2099, although converted dates may lie outside this range. Note that all names of days and months will be in the style shown, that is the first letter will be capitalised with the rest lower case. The file will be terminated by a line containing a single '#'.

Output will consist of a series of lines, one for each line of the input. Each line will consist of a date in the other style. Use the format and spacing shown in the example and described above. Note that there must be exactly one space between each pair of fields. To distinguish between the styles, dates in the old style must have an asterisk ('\*') immediately after the day of the month (with no intervening space). Note that this will not apply to the input.

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Output will consist of a series of lines, one for each line of the input. Each line will consist of a date in the other style. Use the format and spacing shown in the example and described above. Note that there must be exactly one space between each pair of fields. To distinguish between the styles, dates in the old style must have an asterisk ('\*') immediately after the day of the month (with no intervening space). Note that this will not apply to the input.

## Example

### Input :

```
Saturday 29 August 1992
Saturday 16 August 1992
Wednesday 19 December 1991
Monday 1 January 1900
#
```

### Output :

```
Saturday 16* August 1992
Saturday 29 August 1992
Wednesday 1 January 1992
Monday 20* December 1899
```

---

Added by: Andres Tellez

Date: 2011-05-17

Time limit: 10s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 8895. Power Crisis

#### Problem code: POCRI

During the power crisis in New Zealand this winter (caused by a shortage of rain and hence low levels in the hydro dams), a contingency scheme was developed to turn off the power to areas of the country in a systematic, totally fair, manner. The country was divided up into  $N$  regions (Auckland was region number 1, and Wellington number 13). A number,  $m$ , would be picked 'at random', and the power would first be turned off in region 1 (clearly the fairest starting point) and then in every  $m$ 'th region after that, wrapping around to 1 after  $N$ , and ignoring regions already turned off. For example, if  $N = 17$  and  $m = 5$ , power would be turned off to the regions in the order: 1, 6, 11, 16, 5, 12, 2, 9, 17, 10, 4, 15, 14, 3, 8, 13, 7.

The problem is that it is clearly fairest to turn off Wellington last (after all, that is where the Electricity headquarters are), so for a given  $N$ , the 'random' number  $m$  needs to be carefully chosen so that region 13 is the last region selected.

Write a program that will read in the number of regions and then determine the smallest number  $m$  that will ensure that Wellington (region 13) can function while the rest of the country is blacked out.

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The problem is that it is clearly fairest to turn off Wellington last (after all, that is where the Electricity headquarters are), so for a given  $N$ , the 'random' number  $m$  needs to be carefully chosen so that region 13 is the last region selected.

Write a program that will read in the number of regions and then determine the smallest number  $m$  that will ensure that Wellington (region 13) can function while the rest of the country is blacked out.



## Input

Input will consist of a series of lines, each line containing the number of regions (N) with  $13 \leq N < 100$ . The file will be terminated by a line consisting of a single 0.

## Output

Output will consist of a series of lines, one for each line of the input. Each line will consist of the number m according to the above scheme.

## Example

**Input :**

17  
0

**Output :**

7

---

Added by: Andres Tellez

Date: 2011-05-17

Time limit: 10s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 8896. Pattern Matching

#### Problem code: PATT

A regular expression is a string which contains some normal characters and some meta characters.

The meta characters include,

. means any character

[c1 - c2] means any character between c1 and c2 (c1 and c2 are two characters)

[ ^ c1 - c2] means any character not between c1 and c2 (c1 and c2 are two characters)

means the character before it can occur any times

+ means the character before it can occur any times but at least one times

\ means any character follow should be treated as normal character

You are to write a program to find the leftmost substring of a given string, so that the substring can match a given regular expression. If there are many substrings of the given string can match the regular expression, and the left positions of these substrings are same, we prefer the longest one.

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\ means any character follow should be treated as normal character

You are to write a program to find the leftmost substring of a given string, so that the substring can match a given regular expression. If there are many substrings of the given string can match the regular expression, and the left positions of these substrings are same, we prefer the longest one.

#### Input

Every two lines of the input is a pattern-matching problem. The first line is a regular expression, and the second line is the string to be matched. Any line will be no more than 80 character. A line with only an 'e' will terminate the input. nd will terminate the input.

## Output

For each matching problem, you should give an answer in one line. This line contains the string to be matched, but the leftmost substring that can match the regular expression should be bracketed. If no substring matches the regular expression, print the input string.

## Example

**Input :**

```
. *
asdf
f.*d.
sefdfsde
[0-9]+
asd345dsf
[^\*-\\*]
**asdf**fasd
b[a-z]*r[s-u]*
abcdefghijklmnopqrstuvwxy
z
[T-F]
dfkgj
f
end
```

**Output :**

```
(asdf)
se(fdfsde)
asd(345)dsf
**(a)sdf**fasd
a(abcdefghijklmnopqrstu)vwxyz
dfkgj
f
```

---

Added by: Andres Tellez

Date: 2011-05-17

Time limit: 10s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 8910. Probablistic OR

#### Problem code: PROBOR

Everyone knows OR operation. Let us define new operation which we will call Probablistic OR. We will denote this operation as  $\#$ . For given real number  $p$  ( $0 \leq p \leq 1$ ) and two bits  $a$  and  $b$ :

- if  $a = 1$  and  $b = 1$ , then  $\#(a, b) = 1$ ;
- if  $a = 0$  and  $b = 0$ , then  $\#(a, b) = 0$ ;
- else  $\#(a, b) = 0$  with probability  $p$ ,  $\#(a, b) = 1$  with probability  $1-p$ .

Now for two given non-negative integers  $x$  and  $y$  we can define bitwise Probablistic OR operation. The result of this operation is a number received by performing  $\#$  operation for each pair of bits of  $x$  and  $y$  in same positions. For example, for  $p = 0.5$ ,  $x = 2$ , and  $y = 4$ , we will get 0, 2, 4 or 6 each with probability 0.25. You will be given a list of non-negative integers. You have to implement a program which will calculate the expected value of the result of performing bitwise probablistic OR operation on all these numbers given some  $p$ . The numbers will be taken from left to right.

#### Input

Input file starts with real number  $p$  ( $0 \leq p \leq 1$ ) with exactly two digits after the decimal point. Integer  $n$  follows ( $1 \leq n \leq 100$ ). Next line contains  $n$  numbers  $a_i$  in the order they are taking part in the operation ( $0 \leq a_i \leq 10^9$ ).

#### Output

Output the expected value of performing Probablistic OR operation on the given numbers for given  $p$ . Print the result with two digits after the decimal point.

#### Example

**Input :**

```
0.25 4
1 2 3 4
```

**Output :**

```
5.11
```

---

Added by: Spooky

Date: 2011-05-19

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Open All-Ukrainian Collegiate Contest Semi-Final, 2011

## SPOJ Problem Set (classical)

### 8916. Villages by the River

#### Problem code: VILLAGES

In a far away country there is a wide river,  $N$  villages on the left and  $N$  villages on the right side of this river (denoted by  $1..N$  on each side). There are also  $M$  small ships, each of them connecting one village from the left and one village from the right side (in both ways).

You are to organize a film festival in four of these villages: two from the left and two from the right side. Each two of these four villages must be connected by a ship (directly) if they belong to opposite sides of the river.

Help yourself to choose these four villages and first find out; in how many ways can you choose them?

#### Input

In the first line there are integers  $N \leq 1000$  and  $M \leq N^2$ .

In the next  $M$  lines there are two integers from the interval  $[1, N]$  representing the village from the left and the village from the right side connected by this ship.

#### Output

Print the required number of ways to choose villages for the festival.

#### Example

**Input :**

3 51 11 21 32 22 3

**Output :**  
1 (the only possibility is to choose the villages 1, 2 from the left and 2, 3 from the right side)

---

Added by: Adrian Satja Kurdija

Date: 2011-05-21

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Croatian junior team selection test 2011

## SPOJ Problem Set (classical)

### 8917. How Many Plusses

#### Problem code: PLUSEVI

Mirko is a strange boy so he has written down a square matrix full of ones and zeroes. Now he is interested in how many plusses there are in his matrix.

A plus is a square such that its side has an odd length greater than 1 and all of its cells are zero, except for the middle row and the middle column: they must be full of ones. For example, in the matrix below there are two plusses, one inside the other:

```
00100
00100
11111
00100
00100
```

#### Input

In the first line there is an integer  $N \leq 2000$ , dimension of the square matrix.

The next  $N$  lines are the rows of the matrix.

#### Output

Print the number of plusses appearing in the matrix.

#### Example

**Input :**

```
80001000000010000000100001111111100010000000100100001011100010010
```

3

**Output :**

---

Added by: Adrian Satja Kurdija

Date: 2011-05-21

Time limit: 1s-6s

Source limit: 50000B

Languages: All

Resource: Croatian junior team selection test 2011

## SPOJ Problem Set (classical)

### 8930. Party!

#### Problem code: PAAAARTY

Kate is preparing a party. She have bought a very strange garland for it. The garland is a closed chain of bulb. Each bulb can be in one of the following states: N - don't glow, R - glow red, G - glow green, B - glow blue. Each second the state of each bulb changes according to the following table:

	N	R	G	B
N	N	R	G	B
R	R	N	B	G
G	G	B	N	R
B	B	G	R	N

where row is chosen by the current state of the bulb and column is chosen by the state of the bulb on the right. The value at the intersection of the chosen row and column gives the new state of the bulb. For example, if the bulb glows red (R) and the bulb on its right glows green (G) then in the next second the bulb will glow blue (B). And if the bulb and its right neighbour both glow blue then the bulb won't glow at all in the next second. Also all the bulbs change their states simultaneously. Such behaviour should (theoretically) lead to constant twinkling of the garland. Unfortunately it turns out that sometimes eventually the garland goes into such a state that all bulb don't glow. So the garland stops twinkling. Kate is rather worried that this can spoil the party. She is going to set the initial states of each bulb as she like. Help her determine for how long the garland will twinkle starting from this initial state.

### Input

The input file consists of a single string containing characters 'N', 'R', 'G' and 'B', which describes the initial state of the garland. Each character defines the initial state of some bulb. The bulbs are listed from left to right. There is the first bulb on the right of the last one. The length of the string will be no more than 1234567 characters.

### Output

Print the number of seconds during which the garland will twinkle. If the garland won't stop twinkling (at least until the power is turned off) print "Party!" (quotes for clarity).

### Example

**Input :**  
RGBG

**Output :**  
4

## Explanation

The garland will change the state in such a way:

RGBG  
BRRB  
GNGN  
GGGG  
NNNN

---

Added by: Spooky

Date: 2011-05-22

Time limit: 1.5s

Source limit: 50000B

Languages: All

Resource: Open All-Ukrainian Collegiate Contest Semi-Final, 2011

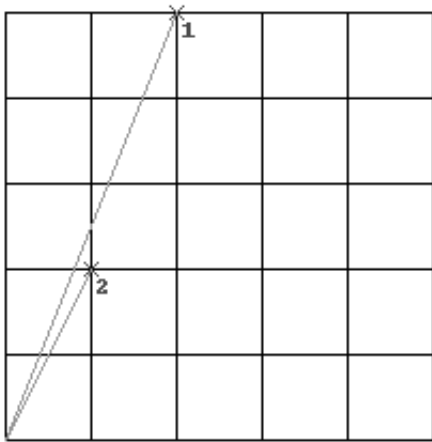


## SPOJ Problem Set (classical)

### 8945. Grid points (speed variation)

#### Problem code: GRIDPNTS

There's a Cartesian lattice with  $0 \leq x, y \leq n$ . Given one point  $(x_1, y_1 > 0)$  in this lattice rotating clockwise as little as possible around the origin find the next point  $(x_2, y_2)$ . The given and searched points mustn't have another point between the origin  $(0, 0)$  and this point itself.  $x_1, y_1, x_2, y_2$  are non-negative integers.



#### Input

In the first line the number  $T$  ( $T < 10000$ ) of test cases.  
Then  $T$  lines with the space-separated  $n$  ( $1 \leq n \leq 1000000$ ),  $x_1$  and  $y_1$ .

#### Output

For each test case the space-separated  $x_2$  and  $y_2$ .

#### Example

**Input :**

31 1 15 3 2100 97 98

**Output :**

1 05 398 99

---

Added by: HWK  
Date: 2011-05-24  
Time limit: 1s-10s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 8951. brownie

#### Problem code: XIXO

Bessie has baked a rectangular brownie that can be thought of as an  $R \times C$  grid ( $1 \leq R \leq 500$ ;  $1 \leq C \leq 500$ ) of little brownie squares. The square at row  $i$ , column  $j$  contains  $N_{ij}$  ( $0 \leq N_{ij} \leq 4,000$ ) chocolate chips.

Bessie wants to partition the brownie up into  $A \times B$  chunks ( $1 \leq A \leq R$ ;  $1 \leq B \leq C$ ): one for each of the  $A \times B$  cows. The brownie is cut by first making  $A-1$  horizontal cuts (always along integer coordinates) to divide the brownie into  $A$  strips. Then cut each strip \*independently\* with  $B-1$  vertical cuts, also on integer boundaries. The other  $A \times B - 1$  cows then each choose a brownie piece, leaving the last chunk for Bessie. Being greedy, they leave Bessie the brownie that has the least number of chocolate chips on it.

Determine the maximum number of chocolate chips Bessie can receive, assuming she cuts the brownies optimally.

As an example, consider a 5 row x 4 column brownie with chips distributed like this:

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

Bessie must partition the brownie into 4 horizontal strips, each with two pieces. Bessie can cut the brownie like this:

```
1 2 | 2 1
-----
3 | 1 1 1
-----
2 0 1 | 3
-----
1 1 | 1 1
1 1 | 1 1
```

Thus, when the other greedy cows take their brownie piece, Bessie still gets 3 chocolate chips.

Input

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

## Output

3probm was added from USACO.

---

Added by: nika

Date: 2011-05-25

Time limit: 1s

Source limit:50000B

Languages: All except: BASH C99 strict

Resource: ...

## SPOJ Problem Set (classical)

### 8952. Catapult that ball

#### Problem code: THRBL

Bob has unusual problem. In Byteland we can find a lot of hills and cities. King of Byteland ordered Bob to deliver magic balls from one city to another. Unfortunately, Bob has to deliver many magic balls, so walking with them would take too much time for him. Bob came up with great idea - catapulting them.

Byteland is divided into intervals. Each interval contains city and hill.

Bob can catapult magic ball accurately from city A to city B, if between them there isn't higher hill than A's hill.

#### Input

Every test case contains N and M ( $N \leq 50000$ ) ( $M \leq 50000$ ), number of intervals and number of balls.

In next line there's N numbers  $H$  ( $H \leq 10^9$ ) separated by one space.

In next M lines numbers A and B ( $1 \leq A, B \leq N$ ), number of city from which we want to catapult the ball and number of city to which we want to catapult the ball.

#### Output

Write one number - number of magic balls that Bob can catapult successfully.

#### Example

**Input:** 7 32 3 5 4 2 1 63 52 54 6 **Output:** 2 Bob can catapult ball number 1 and 3.

---

Added by: Krzysztof Lewko

Date: 2011-05-25

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

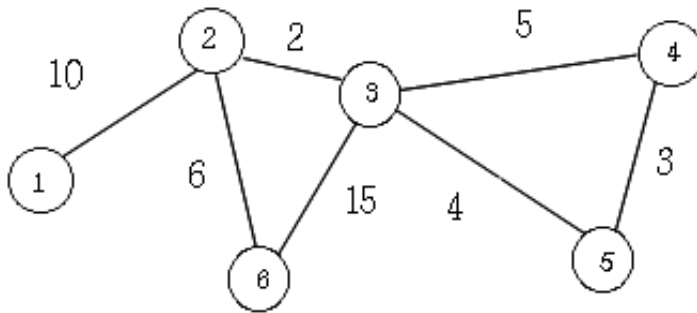
### 8980. Cost

#### Problem code: KOICOST

You are given an undirected graph with  $N$  vertices and  $M$  edges, where the weights are unique.

There is a function  $\text{Cost}(u,v)$ , which is defined as follows:

While there is a path between vertex  $u$  and  $v$ , delete the edge with the smallest weight.  $\text{Cost}(u,v)$  is the sum of the weights of the edges that were deleted in this process.



For example, from the graph above (same as the sample input),  $\text{Cost}(2,6)$  is  $2+3+4+5+6 = 20$ .

Given an undirected graph, your task is to calculate the sum of  $\text{Cost}(u,v)$  for all vertices  $u$  and  $v$ , where  $u < v$ . Since the answer can get large, output the answer modulo  $10^9$ .

#### Input

The first line of the input consists of two integers,  $N$  and  $M$ . ( $1 \leq N \leq 100,000$ ,  $0 \leq M \leq 100,000$ )

The next  $M$  lines consist of three integers,  $u$ ,  $v$ , and  $w$ . This means that there is an edge between vertex  $u$  and  $v$  with weight  $w$ . ( $1 \leq u, v \leq N$ ,  $1 \leq w \leq 100,000$ )

#### Output

Output the sum specified in the problem statement.

#### Example

**Input :**

6 7 1 2 10 2 3 2 4 3 5 6 3 15 3 5 4 4 5 3 2 6 6

**Output :**

256

---

Added by: Joon Young Seo  
Date: 2011-06-01  
Time limit: 1s-5s  
Source limit:50000B  
Languages: All  
Resource: 2011 KOI Regional

## SPOJ Problem Set (classical)

### 8982. Representatives

#### Problem code: KOIREP

There are  $N$  classes in a school, each with  $M$  students. There is going to be a race of 100m dash, and a representative from each class will be chosen to participate in this race. You were assigned a task to choose these representatives. Since you did not want the race to be one sided, you wanted to choose the representatives such that the difference between the ability of the best representative and the worst representative is minimal.

For example, if  $N = 3$  and  $M = 4$ , and each class has students with following abilities:

Class 1: {12,16,67,43}

Class 2: {7,17,68,48}

Class 3: {14,15,77,54}

it is best to choose the student with ability 16 from Class 1, 17 from Class 2, and 15 from Class 3. Thus, the difference in this case would be  $17 - 15 = 2$ .

Your task is to calculate the minimal possible difference you can achieve by choosing a representative from each class.

#### Input

The first line of the input consists of two integers,  $N$  and  $M$ . ( $1 \leq N \leq 1000$ ,  $1 \leq M \leq 1000$ ).

The next  $N$  lines will have  $M$  integers. The  $j$ th element of  $i$ th line is the ability of the  $j$ th student in  $i$ th class. The number is between 0 and  $10^9$ , inclusive.

#### Output

Output the minimal difference one can achieve by choosing the representative from each class.

#### Example

Input :

3 4 12 16 67 43 7 17 68 48 14 15 77 54

Output :

2

Input : 4 310 20 3040 50 6070 80 90100 110 120

Output : 70

---



Added by: Joon Young Seo  
Date: 2011-06-01  
Time limit: 1s-5s  
Source limit:50000B  
Languages: All  
Resource: 2011 KOI regional

## SPOJ Problem Set (classical)

### 8985. Line up

#### Problem code: KOILINE

N people are lined up in a straight line to enter a concert. Each person in this line knows how many people in front have shorter or same heights. Let's call the sequence representing these numbers S. So in other words, S[i] means that there are S[i] people in front of the i-th person who have shorter or same heights than that of person i.

Given the heights of N people and a sequence S, determine the correct order of people lined up. (left is front)

#### Input

The first line of the input is an integer N. ( $1 \leq N \leq 100,000$ )

The next N lines each consists of one integer H. ( $1 \leq H \leq 2 \cdot 10^9$ ) These N integers are the heights of people lined up.

Then, sequence S is given in a single line, separated by a space.

#### Output

Determine the correct ordering of people lined up. Total of N lines should be output. The integer on the i-th line represents the height of the i-th person in the line.

#### Example

**Input :**

```
121201671631721451341821551671201191560 1 0 0 3 2 6 7 4 6 9 4
134167120119156120167182155163172145
```

**Output :**

---

Added by: Joon Young Seo  
Date: 2011-06-02  
Time limit: 1s-5s  
Source limit: 50000B  
Languages: All  
Resource: 2011 KOI Regional

## SPOJ Problem Set (classical)

### 8989. Funny programming contest

#### Problem code: FUPRCO

Bob is trying to solve many problems.

Today he's trying to do his best at "Funny programming contest". In this contest there is  $N$  rounds.

Each round is starting in moment  $A_i$  and ends in moment  $B_i$ . Rounds can overlap on each other. For each round there is one problem to solve. He can't solve more than one problem at once.

Bob knows that problems are very difficult, so he assumed that he will do each round for more than half of time the round lasts.

He knows start and end time for each round.

Help him figuring out if he can spend as much time as he want for each round.

#### Input

First line contains number  $N$  ( $1 \leq N \leq 2 \cdot 10^5$ )

In next  $N$  lines there are three numbers,  $a_i, b_i, c_i$  ( $0 \leq a_i < b_i \leq 10^9$ ,  $(b_i - a_i)/2 < c_i \leq b_i - a_i$ ), time when round  $i$  starts, time when round  $i$  end, and time which Bob wants to spend for round  $i$ .

#### Output

Print "YES" if Bob can spend as much time as he wants for each round, otherwise print "NO"

#### Example

Input:

2

1 5 3

1 2 1

Output:

YES

Input:

2

1 5 3

2 3 1

Output:

NO

---

Added by: Krzysztof Lewko

Date: 2011-06-04

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: <http://oboz.ilo.pl/> <http://main.edu.pl/pl/archive/proserwy>

## SPOJ Problem Set (classical)

### 8991. Number Guessing Game 2

#### Problem code: GUESSLNK

I really enjoy setting problem GUESSING. After three years, I decided to set another "kind of interactive" problem based on it.

Given a link for GUESSING problem, find the server's response

#### Specification

The script runs on server works like this, the URL contains 12 digits, first 6 digits represents **SEED** generated by random number generator, and it won't change during a guessing session. The last 6 digits represents **GUESS**, which is the number user just typed.

The unknown part (for you, of course) is an integer function **f** which is a bijection from  $[0,999999]$  to  $[0,999999]$ .

The server first generate **TARGET** = **f(SEED)**, then it compares **TARGET** and **GUESS** and give response back to user.

for more details on **f**, it's in format  $\text{expr}(x) \% 1000000$ , and  $\text{expr}(x)$  is a expression contains **only** operation add, subtract, multiply, division, modulo, each **exactly once**, and every constants are in  $[0,999999]$ , every variable is  $x$ (of course), brackets are allowed.

for example,  $\text{expr}(x)$  could be  $x/12-34\%(x+1)*56$ , but it's invalid since **f** is not a bijection.

the modulo/division operations here works well if left side is a negative number, for example,  $-2 \% 5 = 3$ ,  $-2 / 5 = -1$ . but it's undefined if the number on the right side is not positive.

#### Input

each line contains a link in format

"<http://www.spoj.pl/problems/GUESSING/XXXXXXXXXXXX>", where XXXXXXXXXX contains exactly 12 digit.

#### Output

The server's response, in format "XAYB".

#### Example

**Input :**

```
http://www.spoj.pl/problems/GUESSING/123456123456/  
http://www.spoj.pl/problems/GUESSING/000000000000/
```

**Output :**

1A3B

1A5B

---

Added by: Bin Jin

Date: 2011-06-06

Time limit: 1s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 8995. CANDY

#### Problem code: LQDCANDY

John had a chocolate bar with the size of  $2^i$ . At his birthday party, he shared this chocolate bar to his friend. But his friend just wanted to taste a piece of this chocolate bar which had the length of  $N$  ( $1 \leq N \leq 10^{18}$ ) so that John had to break this chocolate bar into pieces to get the piece for his friend. Unfortunately, this chocolate bar was so breakable that John just can break it into half each time.

Help him find the smallest length of the chocolate bar that he needs and the minimum times of breaking the chocolate bar to get the piece for his friend.

#### Input

T - the number of test cases

In each of the next T lines, there is one numbers N

#### Output

For every test case, print one line the length of the chocolate bar and the minimum number of times to break the bar.

#### Example

**Input :**

3857

**Output :**

8 08 38 3

---

Added by: TMB

Date: 2011-06-07

Time limit: 0.5s

Source limit: 50000B

Languages: All

Resource: COCI

## **SPOJ Problem Set (classical)**

### **9000. Bob and his new kite factory**

#### **Problem code: KITEPRBL**

Bob, owner of kite factory decided to make some good money.

He has bought new machine to produce kites, but this machine doesn't have any software in it ! He was very sad, oh, so very sad. Every kite is produced from big square sheet of paper.

He didn't want to spend next big sum of money hiring programmers, so he decided to ask you for help.

He wants his machine to :

- cut exactly as much color paper as needed to cover kite and then cover it immediately

- make N very little small holes in the kite ( through which he can put colorful bows and other shiny things )

- at the end he wants his machine to sort convex shape kites and non-convex shapes kites ( he thinks that convex shape kites should be transported to "Biedronka" - shop for poor people, so he doesn't want to mix them with really expensive ones )

#### **Input**

In first line there is number T, number of test cases.

In first line of each test case there is number X( $X < 200$ ), number of vertices of the each kite.

Then X pairs of number,  $x_i$  and  $y_i$ , coords of each vertex.

Left-bottomst corner of paper have (0,0) coords.

In next line number N( $N < 20000$ ), number of holes to make in the kite.

Then N number,  $x_i$  and  $y_i$ , coords of each hole to make in the kite.

Obviously, hole cannot be made on the perimeter of kite.

We can assume that no three points are colinear, also there is no point duplicate. Bob always would give you vertices of kite in clockwise order.

#### **Output**

For each test case print area (  $10^{-3}$  precision ) of paper which was used to produce each kite, holes which were made successfully, and digit 1 if kite is convex shape, otherwise digit 0. Separate each test case with new line

## Example

**Input:**160 05 04 25 40 41 231 11 25 **Output:**32.000 1 0**Explanation:** 32.000 area of paper to cover the kite. Only 1st hole can be made successfully (2nd is on perimeter, 3rd is out the kite)Kite has non-convex shape

---

Added by: Krzysztof Lewko

Date: 2011-06-09

Time limit: 0.5s-1.5s

Source limit:50000B

Languages: All



## SPOJ Problem Set (classical)

### 9030. Bob and his towers

#### Problem code: KVALTWR

Bytie has got a set of wooden blocks for his birthday. The blocks are indistinguishable from one another, as they are all cubes of the same size. Bytie forms piles by putting one block atop another. Soon he had a whole rank of such piles, one next to another in a straight line. Of course, the piles can have different heights.

Bytie's father, Byteasar, gave his son a puzzle. He gave him a number  $k$  and asked to rearrange the blocks in such a way that the number of successive piles of height at least  $k$  is maximised. However, Bytie is only ever allowed to pick the top block from a pile strictly higher than  $k$  and place it atop one of the piles next to it. Further, Bytie is not allowed to form new piles, he can only move blocks between those already existing.

#### Input

In the first line of the standard input there are two integers separated by a single space:  $n$  ( $1 \leq n \leq 1\,000\,000$ ), denoting the number of piles, and  $m$  ( $1 \leq m \leq 50$ ), denoting the number of Byteasar's requests. The piles are numbered from 1 to  $n$ . In the second line there are  $n$  integers  $x_1, x_2, \dots, x_n$  separated by single spaces ( $1 \leq x_i \leq 1\,000\,000\,000$ ). The number  $x_i$  denotes the height of the  $i$ -th pile. The third line holds  $m$  integers  $k_1, k_2, \dots, k_m$  separated by single spaces ( $1 \leq k_i \leq 1\,000\,000\,000$ ). These are the subsequent values of the parameter  $k$  for which the puzzle is to be solved. That is, the largest number of successive piles of height at least  $k$  that can be obtained by allowed moves is to be determined for each given value of the parameter  $k$ .

#### Output

Your program should print out  $m$  integers, separated by single spaces, to the standard output - the  $i$ -th of which should be the answer to the puzzle for the given initial piles set-up and the parameter  $k_i$ .

#### Example

For the input data:

```
5 61 2 1 1 51 2 3 4 5 6 the correct result is: 5 5 2 1 1 0
```

---

Added by: Krzysztof Lewko

Date: 2011-06-14

Time limit: 1s-20s

Source limit:50000B

Languages: All

Resource: XVII POI

## SPOJ Problem Set (classical)

### 9032. Cube Free Numbers

#### Problem code: CUBEFR

A cube free number is a number whose none of the divisor is a cube number( A cube number is a cube of a integer like  $8(2*2*2)$  ,  $27(3*3*3)$  ). So cube free numbers are 1,2,3,4,5,6,7,9,10,11,12,13,14,15,17,18 etc(we will consider 1 as cube free). 8,16,24,27,32 etc are not cube free number. So the position of 1 among the cube free numbers is 1, position of 2 is 2, 3 is 3 and position of 10 is 9. Given a positive number you have to say if its a cube free number and if yes then tell its position among cube free numbers.

#### Input:

First line of the test case will be the number of test case  $T(1 \leq T \leq 100000)$  . Then T lines follows. On each line you will find a integer number  $n(1 \leq n \leq 1000000)$ .

#### Output:

For each input line, print a line containing "Case I: ", where I is the test case number. Then if it is not a cube free number then print "Not Cube Free". Otherwise print its position among the cube free numbers.

#### Sample Input:

```
10
1
2
3
4
5
6
7
8
9
10
```

**Sample Output:**

Case 1: 1

Case 2: 2

Case 3: 3

Case 4: 4

Case 5: 5

Case 6: 6

Case 7: 7

Case 8: Not Cube Free

Case 9: 8

Case 10: 9

---

Added by: Muhammad Ridowan

Date: 2011-06-14

Time limit: 0s-3s

Source limit:50000B

Languages: All

Resource: Own. For alternate thanks Sayef Azad Sakin

## SPOJ Problem Set (classical)

### 9034. Help Tohu

#### Problem code: TOHU

Tohu wants to enter Moscow State University, and he must pass the math exam. He does not know math, and asks you to help him. The problem is to find the sum  $S_n = a_1 + a_2 + \dots + a_n$  of the sequence  $\{a_n\}$  on condition  $\forall k \in \mathbb{N} : a_1 + 2a_2 + \dots + ka_k = \frac{k+1}{k+2}$

#### Input

First line contains single integer  $T \leq 20000$  - the number of test cases.

Each of the next  $T$  lines contains single integer  $1 \leq n \leq 10^9$ .

#### Output

For each  $n$  output the value  $S_n$  with 11 digits after decimal point.

#### Example

**Input :** 225**Output :**  
0.708333333330.73809523810

---

Added by: Efine  
Date: 2011-06-15  
Time limit: 2s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 9040. Tug of War

#### Problem code: TUG

We want to pick a certain number of people from a group of  $N$  people and make them play a game of tug of war!

Then, we would like to split these people into two teams.

Afterwards, an intense game of tug of war would start.

However, when the strength of each team is not equivalent, the game is not very fun. A team's strength is the sum of the strengths of the people in the team.

Since you want the game that is fun, it is necessary to determine if it is possible to pick some people and split them into two teams such that the two teams' strengths are equal.

#### Input

The input consists of a number of test cases.

The first line is the number of test case,  $T$ . ( $1 \leq T \leq 200$ )

Each case starts with  $N$  ( $1 \leq N \leq 100,000$ ), the total number of people.

The next line consists of  $N$  integers, separated by a space. The  $i$ th integer indicates the strength of the  $i$ th person. These integers are less than 100, but larger than 0.

#### Output

For each test case, output "YES" if it is possible to pick some people from the group and separate into two teams of equal strengths. If not, output "NO". Refer to the sample test cases for further clarifications.

#### Example

**Input :**

2410 20 30 40310 18 15  
**Output :**  
YESNO

There are a number of ways to pick teams for the first test case. One example would be {10,20} and {30}.

---

Added by: Joon Young Seo  
Date: 2011-06-16  
Time limit: 1s-20s  
Source limit:50000B  
Languages: All  
Resource: own problem

## SPOJ Problem Set (classical)

### 9050. Tohu again

#### Problem code: TOHU2

Tohu was very tired during the preparation for entrance exams at MSU and Ksjuchi decided to joke on him (of course to cheer). She said him that she is magican and she can read his thoughts To prove that she's prepeared some tables of characters where every character have an unique number more than 0 but less than 100. She shows one of tables to him and asked to make a two-digit integer, subtract from this number the sum of its digits and concentrate on symbol with this number from the table.

Then she calls the character of which he thinks.

Magic, is not it? =)

But Ksjuchi is preparing for the exam in philosophy now, and while she was drowing these tables noxious Socrates mixed up some of the cells.

Now Ksjuchi need to know what tables she can use to surprise Tohu. Help her.

Tohu was very tired during the preparation for entrance exams atMoscow State University and Ksjuchi decided to joke on him (of course to cheer).She said him that she is magican and she can read his thoughts. To prove that she's prepeared some tables of characters whereevery character have an unique number more than 0 but less than 100.She shows one of tables to him and asked to make a two-digit integer,subtract from this number the sum of its digits and concentrate onsymbol with this number from the table.

Then she calls the character of which he thinks.

Magic, is not it? =)

But Ksjuchi is preparing for the exam in philosophy now, and while she was drowing these tables noxious Socrates mixed up some of the cells.Now Ksjuchi need to know what tables she can use to surprise Tohu. Help her

#### Input

First line : number of tests  $T \leq 1000$

Test:

99 lines where every have a type:

i ch where  $i = 1..99$  included and "ch" - 'a'..'z' or 'A'..'Z'



## Output

Print YES if Ksjuchi might uniquely define symbol that Tohu put forth.

Otherwise print NO

## Example

**Input :**

```
1
1 k
2 q
3 J
4 Q
5 P
6 R
7 e
8 G
9 L
10 c
11 g
12 T
13 w
14 v
15 p
16 P
17 X
18 X
19 p
20 I
21 X
22 z
23 L
24 u
25 K
26 F
27 t
28 H
29 Q
30 r
31 V
32 e
33 F
34 V
35 D
36 u
37 c
38 n
39 z
40 w
41 Z
42 K
43 Y
```

44 j  
45 Y  
46 M  
47 u  
48 U  
49 H  
50 i  
51 n  
52 S  
53 k  
54 q  
55 W  
56 o  
57 L  
58 J  
59 O  
60 S  
61 Z  
62 G  
63 m  
64 T  
65 P  
66 k  
67 i  
68 b  
69 J  
70 a  
71 E  
72 g  
73 O  
74 P  
75 M  
76 s  
77 M  
78 A  
79 O  
80 P  
81 g  
82 h  
83 V  
84 U  
85 M  
86 G  
87 Y  
88 u  
89 D  
90 F  
91 h  
92 q  
93 h  
94 a  
95 l  
96 P  
97 d  
98 T  
99 w

**Output :**  
NO

**Hint:Ksjuchi is not a magican. Really.**

---

Added by: Egor  
Date: 2011-06-19  
Time limit: 1s  
Source limit:10000B  
Languages: All  
Resource: own problem

## SPOJ Problem Set (classical)

### 9055. Most Frequent Value

#### Problem code: FREQ2

You are given a sequence of  $n$  integers  $a_0, a_1, \dots, a_{n-1}$ . You are also given several queries consisting of indices  $i$  and  $j$  ( $0 \leq i \leq j \leq n-1$ ). For each query, determine the number of occurrences of the most frequent value among the integers  $a_i, \dots, a_j$ .

#### Input

First line contains two integers  $n$  and  $q$  ( $1 \leq n, q \leq 100000$ ). The next line contains  $n$  integers  $a_0, \dots, a_{n-1}$  ( $0 \leq a_i \leq 100000$ , for each  $i \in \{0, \dots, n-1\}$ ) separated by spaces. The following  $q$  lines contain one query each, consisting of two integers  $i$  and  $j$  ( $0 \leq i \leq j \leq n-1$ ), which indicates the boundary indices for the query.

#### Output

For each query, print one line with one integer: The number of occurrences of the most frequent value within the given range.

#### Example

**Input:** 5 31 2 1 3 30 21 20 4

**Output:**

212NOTE - This problem is similar to a problem Frequent values.

---

Added by: Dominik Gleich

Date: 2011-06-20

Time limit: 1s-5s

Source limit: 50000B

Languages: All

Resource: My own problem.

## SPOJ Problem Set (classical)

### 9067. Đông hồ cát

#### Problem code: DHCAT

Ca?i tie^'n tu+' 1 bài thi UVA.

Đông hồ cát có da.ng 2 tam giác đe^'u chung đi?nh, gồm  $2n-1$  dòng. Lân lu+o+.t mỗi dòng có  $n$  số,  $n-1$  số,...,1,2,...,n số ( $n < 21$ ). Mỗi ô o+? dòng trên chỉ? có the^? đi xuống ô pha?i du+o+'i ( R ) hoặc ô trái du+o+'i ( L ).

YEU câu :

Tim du+o+'ng đi có tro.ng số nho? nhất. Du+o+'ng đi du+o+.c mô ta? la ô xuất phát o+? hang 1 ( các ô du+o+.c đánh số tu+' 0 to+'i  $n-1$  ) và chuỗi LR mô ta? du+o+'ng đi.

Cho số  $S \leq 5000$ , đe^'m số du+o+'ng đi có tro.ng số  $S$  và mô ta? du+o+'ng đi có thu+' tu+. tu+' đie^?n nho? nhất u+'ng vo+'i  $S$ .

#### Input

Dòng đầu tiên là 2 số  $n$  và  $S$ .

$2n-1$  dòng tie^'p theo số a mô ta? đông hồ cát. (  $a \leq 5000$  )

#### Output

Gồm 4 dòng :

Tro.ng số nho? nhất tu+' hang 1 to+'i hang cuối .

Mô ta? du+o+'ng đi u+'ng vo+'i tro.ng số nho? nhất ( ne^'u có nhie^'u du+o+'ng đi, in ra du+o+'ng đi có thu+' tu+. tu+' đie^?n nho? nhất )

Số du+o+'ng đi có tro.ng số là  $S$ . Ne^'u không có du+o+'ng thì in ra -1.

Du+o+'ng đi u+'ng vo+'i tro.ng số  $S$  tho?a man.

#### Example

Input :

3 17

1 2 3

4 5

6

5 4

3 2 1

**Output :**

16

0 RRRR

2

0 RRRL

---

Added by: battieudieu

Date: 2011-06-24

Time limit: 1s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 9070. Lightning Conductor

#### Problem code: LIGHTIN

Progressive climate change has forced the Byteburg authorities to build a huge lightning conductor that would protect all the buildings within the city. These buildings form a row along a single street, and are numbered from  $1$  to  $n$ .

The heights of the buildings and the lightning conductor are non-negative integers. Byteburg's limited funds allow construction of only a single lightning conductor. Moreover, as you would expect, the higher it will be, the more expensive.

The lightning conductor of height  $p$  located on the roof of the building  $i$  (of height  $h_i$ ) protects the building  $j$  (of height  $h_j$ ) if the following inequality holds:

$$h_j \leq h_i + p - \sqrt{|i - j|},$$

where  $|i - j|$  denotes the absolute value of the difference between  $i$  and  $j$ .

Byteasar, the mayor of Byteburg, asks your help. Write a program that, for every building  $i$ , determines the minimum height of a lightning conductor that would protect all the buildings if it were put on top of the building  $i$ .

#### Input

In the first line of the standard input there is a single integer  $n$  ( $1 \leq n \leq 500\,000$ ) that denotes the number of buildings in Byteburg. Each of the following  $n$  lines holds a single integer  $h_i$  ( $0 \leq h_i \leq 1\,000\,000\,000$ ) that denotes the height of the  $i$ -th building.

#### Output

Your program should print out exactly  $n$  lines to the standard output. The  $i$ -th line should give a non-negative integer  $p_i$  denoting the minimum height of the lightning conductor on the  $i$ -th building.

#### Example

For the input data:

```
6
5
3
2
4
2
4
```

the correct result is:

2  
3  
5  
3  
5  
4

---

Added by: Krzysztof Lewko

Date: 2011-06-25

Time limit: 1s-3s

Source limit:50000B

Languages: All

Resource: XVIII POI



## SPOJ Problem Set (classical)

### 9076. Hablu and Bablu

#### Problem code: HABLU

**Hablu** is a hardworking programmer. He solves lots of easy problems everyday :P. **Hablu**'s teammate **Bablu** is busy with studies, so amount of solved by him is smaller than **Hablu**'s.

Their coach **NannaMia** noticed the fact that the number of solved problems by **Hablu** is a multiple of number of solved problems by **Bablu**.

Then **NannaMia** asked **Hablu** a question. Giving a collection of integers S, **NannaMia** said that the number of solved problems by **Bablu** is not a multiple of any integer contained in S (S only contains primes or 1). How many valid integers are there which could be the number of problems solved by **Bablu**.

As **Hablu** solves only easy problems, he is unable to solve this one. So, you need to help him :)

#### Input

The first line contains t, number of test cases ( $t \leq 1500$ ).

Each case starts with an integer H, the number of problems solved by **Hablu** and K, the size of the collection S. The next line contains K space separated integers (the members of S).

Remember that the online judge in which they solve has only(!)  $10^{12}$  problems. So no number will be greater than  $10^{12}$ . And K will be between 0 and 500.

#### Output

Print a line for each test case containing the number of possible integers which can be the number of solved problems by **Bablu**.

#### Example

**Input:** 158 22 3 **Output:** 2 **Note :** May be it's impossible to pass the time limit in several languages.

---

Added by: Bidhan Roy

Date: 2011-06-26

Time limit: 1s-2s

Source limit: 25000B

Languages: All

Resource: Own Problem , Thanks to Muhammad Ridowan for his alternate solution.

## SPOJ Problem Set (classical)

### 9084. Journey to Mars

#### Problem code: JRNTMRS

Byteazar has decided on going to Mars to tour the space stations there being in existence. All marsian space stations lie on a circumference of a circle. Byteazar lands in one of them and then moves around by means of a special vehicle which is powered by an appropriate fuel. A litre of this fuel allows him to travel one meter. However, the provisions of the fuel are meagre, different quantities of it are available in each space station. Byteazar may refuel in the space station he is currently in, though he cannot get more fuel than it is available in that very place (the capacity of his fuel tank is unlimited). This quantity of fuel should allow him to reach the next space station. Byteazar has to decide where to land, so that he can visit all of the space stations. In the end he has to return to the space station in which he has landed. During his journey Byteazar has to travel on the circumference of the circle, constantly in one of the two possible directions.

#### Task

Write a programme which:

- reads from the standard input the number of space stations, distances between them and the amount of fuel available in each of them,
- for each of the space stations checks, whether Byteazar can land there i.e. whether by starting in that very station and travelling in a freely chosen direction he is able to visit all of the space stations and return to his spaceship,
- writes the outcome to the standard output.

#### Input

The first line of the standard input contains a single integer  $N$  ( $3 \leq N \leq 1\,000\,000$ ). It denotes the number of space stations on Mars. The space stations are numbered from 1 to  $N$ . In the next  $N$  lines there is a description of all of the stations and the distances between them. The  $(i+1)$ 'st line contains two integers  $P_i$  and  $d_i$  ( $P_i \leq 0$ ,  $d_i > 0$ ). The first one denotes the amount of fuel (in litres) available in the  $i$ 'th space station. The other denotes the distance (in metres) between the  $i$ 'th and  $(i+1)$ 'st space station (obviously  $d_N$  denotes the distance between the  $N$ 'th and the 1st space station). The total amount of available fuel, as well as the sum of all distances between the space stations does not exceed 2 000 000 000.

#### Output

The programme should write  $N$  lines to the standard output. The  $i$ 'th line should contain the word TAK (i.e. *yes* in Polish), if Byteazar can land in the  $i$ 'th space station or NIE (i.e. *no* in Polish) when it is not possible.

## Example

For the input data:

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

the correct result is:

```
TAK
NIE
TAK
NIE
TAK
```

---

Added by: Krzysztof Lewko  
Date: 2011-06-28  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: XII POI

## SPOJ Problem Set (classical)

### 9085. HIGH

#### Problem code: C11HIGH

Một ngày "đẹp" tro+’i no., Khánh nha ta đēn thách đầ?u team ILS bằng một bài toán rấ?t la... nhu+ sau:

Chie^’u dài củ?a một số tu+. nhiên là số chu+~ số củ?a số đó. Độ cao củ?a một số tu+. nhiên là tổng các chu+~ số củ?a số đó. Cho số tu+. nhiên  $x$  ghi trong he^. đē^’m 10, có chie^’u dài 5. Tìm số tu+. nhiên  $y$  sát sau  $x$  có cùng chie^’u dài, cùng độ cao và cùng he^, đē^’m vo+’i  $x$ .

Tấ?t nhiên, team ILS toan nhu+~ng cao thu? (late hero) nen vie?c gia?i bài toán tren không có gì là khó khăn, ho. đã thách đō? la.i Khánh vo+’i gio+’i ha.n lo+’n ho+n rấ?t nhiē?u : vo+’i he? đē?m  $b$  và số? chu+~ số? là  $10^6$ ???Khánh ma không lam đu+o+.c thì che?t ngu+o+.c vo+’i bo.n nó chu+’ cha? cho+i đầu, các ba.n giúp nhanh vo+’i không Khánh se~ bi. hō?i đō?ng trong 0,5s nu+~a :(

#### Input

- Dòng đầu tiên: hai số tu+. nhiên  $b$  và  $N$ ,  $2 \leq b \leq 10$ ,  $2 \leq N \leq 10^6$ .
- Dòng thu+’ hai: số  $x$

#### Output

Duy nhấ?t số  $y$ . Ne^’u không có nghiē^m ghi ra 0.

#### Example

##### Output:

24089

---

Added by: Nguyē~n Duy Khánh

Date: 2011-06-29

Time limit: 0.5s

Source limit: 50000B

Languages: All

Resource: ILS

## SPOJ Problem Set (classical)

### 9096. Bob and magical scale

#### Problem code: MGCSCLS

Small Bob received scales with magical bricks. They are magical because they can have minus weight.

His mom made L towers on the left arm and P towers on the right arm of the scale. Every tower is made with exactly N bricks.

She asked him how many brick he has to put off from each arm to balance the scale. Obviously Bob can only take bricks from top of the tower and he can't put back taken off bricks. It's too difficult for him. Can you help him solve it in minimum number of moves?

#### Input

In first line number N,L,P . Number of bricks in every tower. Number of towers on left arm and Number of towers on right arm.

In next L lines: construction of towers on the left arm.

In next P lines: construction of towers on the right arm. ( look at picture )

$N \leq 50$

$L \leq 25$

$P \leq 25$

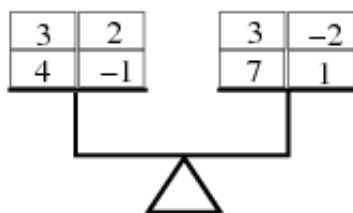
$-50 \leq \text{weight of every brick} \leq 50$

#### Output

Minimal number of moves to balance the scale.

#### Example

```
2 2 2
4 3
-1 2
7 3
1 -2
```



**Output: 2**

I made timelimit so high because i want all correct solutions to get accepted, but not n! solution.

---

Added by: Krzysztof Lewko

Date: 2011-07-01

Time limit: 1s-15s

Source limit: 50000B

Languages: All

Resource: III POIG

## SPOJ Problem Set (classical)

### 9097. Derangements HARD

#### Problem code: NOVICE65

A derangement of  $n$  numbers is a permutation of those numbers in which none of the numbers appears in its original place. For example, the numbers  $\{1,2,3\}$  can be deranged into  $\{2,3,1\}$  and  $\{3,1,2\}$ . We can modify this slightly for  $n$  numbers that are not necessarily distinct by saying that no number in the derangement can be in the place that a number of the same value was in in the original ordering. So the numbers  $\{1,1,2,2,3\}$  could be deranged into  $\{2,2,1,3,1\}$ ,  $\{2,2,3,1,1\}$ ,  $\{2,3,1,1,2\}$ , and  $\{3,2,1,1,2\}$ .

#### Input

First line contains  $T$  ( $1 \leq T \leq 100$ ) the number of test cases. Each test case contains two lines. First line contains an integer  $N$  ( $1 \leq N \leq 15$ ) denoting total number of elements in the array. Second line contains a space separated list of  $N$  integers  $A_i$  such that  $0 \leq A_i < N$ .

#### Output

For each test case output an integer, the total number of derangements of the array.

#### Example

**Input :**

```
2
5
1 1 2 2 3
6
0 0 0 1 1 1
```

**Output :**

```
4
1
```

---

Added by: amit karmakar

Date: 2011-07-01

Time limit: 2s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 9098. Long Common Subsequence

#### Problem code: LCS3

Given a sequence of  $N$  ( $1 \leq N \leq 1000000$ ) numbers range from 0 to 10000 and several other sequence of  $M$  ( $0 \leq M \leq 5$ ) numbers, you have to compute the Longest Common Subsequence of this sequences with the main sequence.

Given a main sequence of  $N$  ( $1 \leq N \leq 1000000$ ) numbers range from 0 to 10000 and several other sequence of  $M$  ( $0 \leq M \leq 5$ ) numbers, you have to compute the Longest Common Subsequence of this sequences with the main sequence.

#### Input

First line of the input will be  $N$  the number of elements of the main sequence. After that line there will be  $N$  numbers in one or more lines. Each of this number will be between 0 to 10000(inclusive). Then there will be  $Q$  ( $1 \leq Q \leq 5000$ ) the number of query. Then following  $Q$  lines will be queries. In each query, start with a number  $M$  ( $0 \leq M \leq 5$ ), followed by  $M$  numbers also between 0 to 10000(inclusive).

#### Output

For each query first print the number of elements in the longest common subsequence of the main and query sequences. Then print the subsequence. If there is more than one then print the lexicographically smallest.

#### Example

**Input :**

10

5 1 4 3 2 6 5 5 0 7

5

1 5

1 10



4 5 0 4 7

5 4 1 2 3 5

5 2 6 5 0 7

**Output :**

1 5

0

3 5 0 7

3 1 2 5

5 2 6 5 0 7

**Huge Test Case (Almost 5MB)**

---

Added by: Muhammad Ridowan

Date: 2011-07-02

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Own. Thanks msh\_shiplu and zobayer for alternate

## SPOJ Problem Set (classical)

### 9104. Match the words

#### Problem code: NOVICE62

You may have come across questions like, Match-The-Following words with their synonyms in the second column and alike. Ted also stumbled upon one such question. Being weak at english, he tried guessing the answers. While he guessed, he thought about how unlucky he was at guessing.

Being also weak at math, he needs help from you for a slightly different task. Find the total number of ways of completing the solution to this question in which he gets none of the matches correct.

**Note:** In the match-the-following problem, there are two columns of words. Each column contains N words. Words in the first column have to be matched with words in the second column. A valid solution to this question requires every word in the first column to be matched with only one word in the second column and vice-versa.

#### Input

First line contains a single integer T ( $1 \leq T \leq 1000$ ) denoting the total number of test cases. Each test case contains a single integer N ( $1 \leq N \leq 1000000$ ).

#### Output

For each test case, print a single integer the required number of ways modulo 1000000007

#### Example

**Input :**

3  
1  
2  
7

**Output :**

0  
1  
1854

---

Added by: amit karmakar  
Date: 2011-07-02  
Time limit: 1s-2s  
Source limit: 50000B  
Languages: All  
Resource: own problem.....

## SPOJ Problem Set (classical)

### 9118. Genetic Fraud

#### Problem code: GCPC11B

Computer Scientists have a rough life. Due to the shortage of bright young minds like yourself, good programmers are mostly like famous movie stars. It's just like everyone wants to get their hands on your hard earned cash. The situation got so out of hand that you are faced by a lawsuit nearly every day of the year. Each lawsuit is filed by someone claiming alimonies for your alleged child. Luckily for you, you know pretty much about genetic sequences. You know that the human DNA sequence can be represented by a possibly  $N$  characters long string, containing only characters 'a' to 'z'. And you know that a similarity test of the DNA strings of the alleged child to your own can prove your innocence.

The only problem is that this does not only happen to you. As all labs are busy, testing needs at least a year. Still, not all hope is lost. You managed to get the information from one of the DNA labs on how to compute the probability of a genetic relationship between two DNA strings. If you could only help the DNA labs to test two DNA strings for a genetic relationship really fast, you could get the evidence you need for your own lawsuits.

A genetic relationship test, or GRT, requires some heavy computation on the DNA strings. They first acquire all similar regions within two DNA strings. We understand a region within a DNA string to be a consecutive interval within the DNA string. Regions  $a[i..i+l]$  ( $0 \leq i < N-l$ ) and  $b[j..j+l]$  ( $0 \leq j < N-l$ ) of DNA strings  $a$ ,  $b$  are similar to each other, if  $|a[i+k] - b[j+k]| \leq 1$  for  $0 \leq k \leq l$ . A GRT between two DNA sequences is positive, whenever the two DNA sequences have a similar region of at least one half the length of the DNA sequences.

#### Input

The first line of the input gives the number of test cases  $C$  ( $0 < C \leq 1000$ ). The first line of each such test case holds an integer  $N$  ( $1 \leq N \leq 1000$ ), denoting the length of the two DNA strings to be tested. The following two lines contain a string of  $N$  lower-case letters each, giving the two DNA substrings of the two persons to test.

#### Output

For each test case print one line. If the GRT is positive, print out **POSITIVE**. Print **NEGATIVE**, if the test fails.

#### Example

Input :

```
3
4
aaaa
bbcc
8
iacdefgh
abeaaaaa
```

8  
iacdefgh  
abeafaaa

**Output :**

POSITIVE  
NEGATIVE  
NEGATIVE

---

Added by: Adrian Kuegel

Date: 2011-07-05

Time limit: 30s

Source limit:50000B

Languages: All

Resource: German Collegiate Programming Contest 2011 (Author: Moritz Kobitzsch)

## SPOJ Problem Set (classical)

### 9120. Magic Star

#### Problem code: GCPC11D

A magic star consists of all the numbers from 1 to 12 arranged in the shape of a hexagram:

example image

The magic comes from the fact that in each line of 4 numbers, the sum of the numbers is 26. In the example given above, the six lines consist of the following numbers:

- $1 + 4 + 10 + 11$
- $11 + 5 + 3 + 7$
- $7 + 6 + 12 + 1$
- $2 + 10 + 5 + 9$
- $9 + 3 + 6 + 8$
- $8 + 12 + 4 + 2$

There are several possible ways to arrange the numbers to get a magic star. Given a partially labelled star, your task is to extend the solution such that a magic star is formed.

#### Input

The input consists of a visualization of the star; the unlabelled fields of the star will be represented by an 'x' character, and labelled fields will contain a letter between 'A' and 'L', where the  $i$ -th letter in the alphabet represents number  $i$ . The character '.' is used to align the fields of the star in the shape of a hexagram. You may assume that each input will use the same alignment of the fields as the one in the sample input.

#### Output

Print the lexicographically smallest extension of the given partial solution which is a magic star (lexicographically smallest means that the concatenation of the rows should result in a string which is lexicographically smaller than other potential solutions). You may assume that there is always a solution for the given input.

#### Example

**Input :**

```
....x....
.A.I.D.x.
..x...x..
.x.x.x.x.
....x....
```

**Output :**

```
....F....
```

.A.I.D.L.  
..H...E..  
.C.J.B.K.  
....G....

---

Added by: Adrian Kuegel

Date: 2011-07-05

Time limit: 1s

Source limit:50000B

Languages: All

Resource: German Collegiate Programming Contest 2011 (Author: Adrian Kuegel)

## SPOJ Problem Set (classical)

### 9121. Magical Crafting

#### Problem code: GCPC11E

One of the recent hypes in terms of independent games has been Minecraft, a cute little game in which you mine some materials and are able to craft a lot of stuff using these materials. Since you already mastered the Minecraft universe, you decide to write your own little mod for the game to add magical crafting.

Given some magic stone  $m_1$ , by adding a specific amount of diamonds you can transform it into two magic stones  $m_2$  and  $m_3$ , where  $m_1$ ,  $m_2$  and  $m_3$  are upper-case letters. This is called a crafting recipe.

There is also a default transformation which transforms a magic stone into its matching lighting effect; the matching lighting effect for a magic stone labelled with an upper-case letter is the corresponding lower-case letter, e. g. the magic stone 'A' can be transformed into the lighting effect 'a'. This transformation always costs exactly 1 diamond. The default transformation is used whenever you do not use a magic stone for another crafting recipe. The lighting effects will show in a certain order. For each used crafting recipe  $m_1 \rightarrow m_2 m_3$ , the lighting effects which are derived from the magic stone  $m_2$  will show before the lighting effects derived from the magic stone  $m_3$ .

You want to be able to craft wonderful magic lights for your own world. But as you are aware of the rareness of the precious diamonds, and also very picky about the lighting effect sequences you want to achieve, you have to test your crafting recipes. The question arises if your set of crafting recipes allows you to create all your desired lighting effect sequences if you only have the magic stone 'A' to start with, and the minimum number of diamonds you will need for the transformations.

#### Input

The first line of the input gives the number of test cases  $C$  ( $0 < C \leq 100$ ). Each test case starts with two integers  $0 \leq R \leq 30$ ,  $0 \leq L \leq 10$  on a single line, denoting the set of recipes and the number of lighting effect sequences. The next  $R$  lines contain the set of recipes. Each crafting recipe is given on a single line by the magic stones  $m_1$ ,  $m_2$ , and  $m_3$  as well as the number  $d$  ( $0 \leq d \leq 1000$ ) of diamonds necessary for the transformation. The next  $L$  lines contain the lighting effect sequences you want to create. Each of these lines contains an integer  $l$  ( $1 \leq l \leq 100$ ), which represents the length of the lighting effect sequence. The line completes with a single string of length  $l$ , consisting only of lower case characters 'a' to 'z', which represents the sequence of lighting effects you want to create.

#### Output

For every test case print **CASE #** followed by the number of the test case, starting with 1, on a single line. For each lighting effect sequence print a single line. If the effect is possible print **POSSIBLE WITH X DIAMONDS**, with  $X$  representing the number of diamonds you will need to achieve the lighting effect sequence. In the case the lighting effect sequence cannot be crafted, print **IMPOSSIBLE**.

## Example

### Input :

```
2
1 4
A A A 2
3 aaa
8 aaaaaaaa
5 ababa
1 a
3 1
A B C 1
C P C 7
B I C 11
4 icpc
```

### Output :

```
CASE #1
POSSIBLE WITH 7 DIAMONDS
POSSIBLE WITH 22 DIAMONDS
IMPOSSIBLE
POSSIBLE WITH 1 DIAMONDS
CASE #2
POSSIBLE WITH 23 DIAMONDS
```

---

Added by: Adrian Kuegel

Date: 2011-07-05

Time limit: 35s

Source limit:50000B

Languages: All

Resource: German Collegiate Programming Contest 2011 (Author: Moritz Kobitzsch)



## SPOJ Problem Set (classical)

### 9122. Diary

#### Problem code: GCPC11F

Nowadays, people who want to communicate in a secure way use asymmetric encryption algorithms such as RSA. However, my older brother uses another, simpler encryption method for his diary entries. He uses a substitution cipher where each letter in the plaintext is substituted by another letter from the alphabet. The distance between the plaintext letter and the encrypted letter is fixed. If we would define this fixed distance  $d$  to 5, A would be replaced by F, B by G, C by H, ..., Y by D, Z by E.

With a fixed and known distance  $d$  the decryption would be somewhat simple. But my brother uses random distances for each of his diary entries. To decrypt his diary I have to guess the distance  $d$  for each entry. Thus, I use the well known phenomenon that the letter E is used more often in English words than other letters. Can you write a program for me that calculates the distance  $d$  based on the fact that the most used letter in the encrypted text corresponds to the letter E in plaintext? Of course, I am interested in the decrypted text, too.

#### Input

The input consists of several test cases  $c$  that follow ( $1 \leq c \leq 100$ ). Each test case is given in exactly one line containing one diary entry. Diary entries only use upper case letters (A-Z) and spaces. Each diary entry consists of at most 1000 encrypted letters (including spaces).

#### Output

For each test case, print one line containing the smallest possible distance  $d$  ( $0 \leq d \leq 25$ ) and the decrypted text. If the decryption is not possible because there are multiple distances conforming to the rules above, print **NOT POSSIBLE** instead. Spaces are not encrypted.

#### Example

##### Input :

4

```
RD TQIJW GWTYMWX INFWD JSYWNJX ZXJ F XNRUQJ JSHWDUYNTS YJHMSNVZJ
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
XVIDRE TFCCVXZRKV GIFXIRDDZEX TFEKVJK UVTIPGKZFE
XVIDRE TFCCVXZRKV GIFXIRDDZEX TFEKVJK
```

##### Output :

```
5 MY OLDER BROTHERS DIARY ENTRIES USE A SIMPLE ENCRYPTION TECHNIQUE
10 JXU GKYSR RHEMD VEN ZKCFI ELUH JXU BQPO TEW
17 GERMAN COLLEGIATE PROGRAMMING CONTEST DECRYPTION
NOT POSSIBLE
```

---

Added by: Adrian Kuegel

Date: 2011-07-05

Time limit: 2s

Source limit:50000B

Languages: All

Resource: German Collegiate Programming Contest 2011 (Author: Tobias Werth)

## SPOJ Problem Set (classical)

### 9123. Security Zone

#### Problem code: GCPC11G

The manager of a large security company has to build a new surveillance system for different sites. A site consists of  $N$  objects where each object has its own security circle. At the border of the surveillance system a high voltage fence has to be installed. The security zone inside of the fence has to be connected. Furthermore, all objects and their security circles should be inside the security zone. The security circles of different objects will never overlap or touch. Now the manager needs your help. He asks you for the minimal needed fence length.

example image example image

#### Input

The first line of the input gives the number of test cases  $C$  ( $0 \leq C \leq 100$ ). The first line of each such test case holds the integer  $N$ : the number of objects in the current site ( $0 < N \leq 25$ ). Each of the following  $N$  lines holds three integers  $x_i$ ,  $y_i$ , and  $r_i$  that describe an object. The coordinates of the  $i$ -th object and the radius for the needed security circle for this object. ( $|x_i|, |y_i| \leq 100$ ,  $0 < r_i \leq 100$ ) (The center of the security circle around an object is the position of the object itself.)

#### Output

For each test case print one line containing the minimal fence length for this case. Your output should have an absolute or relative error of at most  $10^{-7}$ .

#### Example

##### Input :

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

##### Output :

```
22.2831853072
17.6761051635
25.4247779608
```

---

Added by: Adrian Kuegel

Date: 2011-07-05

Time limit: 10s

Source limit:50000B

Languages: All

Resource: German Collegiate Programming Contest 2011 (Author: Alexander Rass)

## SPOJ Problem Set (classical)

### 9124. Sightseeing

#### Problem code: GCPC11H

As a computer science student you are of course very outdoorsie, so you decided to go hiking. For your vacation this year, you located an island full of nice places to visit. You already identified a number of very promising tracks, but are still left with some problems. The number of choices is so overwhelming, that you had to select only a "small" subset of at most  $10^5$  sights.

And if that is not enough, you are very picky about the order in which you want to visit the sights. So you have already decided on an order in which you want to visit the preselected tracks. The problem you are left with is to decide in which direction to travel along each single track, and whether you may have to reduce your choice of tracks even further. After identifying the travel time between the endpoints of different tracks, you decide to write a program to figure out if you can make all your trips within the time you have planned for your vacation. Since you also do not want to waste any precious time, you only care about an optimal solution to your problem. Furthermore, the tracks can get pretty challenging. That's why you do not want to hike along a track more than once.

#### Input

The first line of the input gives the number of test cases  $C$  ( $0 < C \leq 100$ ). The first line of each such test case holds two integers  $N$ ,  $T$  the number of tracks of the current hiker ( $1 \leq N \leq 10^5$ ) and the maximal time spent hiking throughout the vacation ( $0 \leq T \leq 10^6$ ). Each of the following  $N$  lines holds five integers  $c_p$ ,  $c_{bb}$ ,  $c_{be}$ ,  $c_{eb}$  and  $c_{ee}$  that describe a track (in order of importance).  $c_p$  gives the length of the track in minutes.  $c_{xy}$  gives the travel time of the official **begin** or **end** of a track to the **beginning** or **end** of the next most important track, where  $x$  and  $y$  are either  $b$  or  $e$ . All values given are non-negative integers not greater than  $10^6$ . Since you have to get back to your car, the list is circular. Furthermore, we will ignore the time it takes you to get to the start of your trip with your car.

#### Output

For each test case print one line. The output should contain a list of either **F** or **B** for every track (in order) indicating whether you have to hike the track in forward direction or backward direction. If you cannot make the full trip within the planned time  $T$ , you should print **IMPOSSIBLE** to indicate that these trips are just too much hiking. You can assume that the optimal solution is always unique.

#### Example

**Input :**

```
3
2 100
4 7 8 2 3
1 4 6 1 2
2 20
4 2 3 7 8
1 1 2 4 6
3 5
1 2 2 2 1
```

1 1 2 2 2  
1 2 2 1 2

**Output :**

FF

BB

IMPOSSIBLE

---

Added by: Adrian Kuegel

Date: 2011-07-05

Time limit: 30s

Source limit:50000B

Languages: All

Resource: German Collegiate Programming Contest 2011 (Author: Moritz Kobitzsch)

## SPOJ Problem Set (classical)

### 9125. Suiting Weavers

**Problem code: GCPC11I**



Willy the Weaver is in desperate hope to get married to the most beautiful and delightful female weaver Wilmar. Of course, Willy is not the only weaver interested in Wilmar.

In order to impress the females, weavers build elaborately woven nests using leaf fibers. Tomorrow is the big day on which Wilmar will inspect all nests. There is a heavy storm at the moment, and no weaver can leave his nest within the hours before sunrise. However, the storm will produce many piles of leaf fibers, so that all weavers will have a chance to improve their nests. Therefore, Willy is curious if he can succeed weaving the most impressive nest, so that Wilmar will finally decide on getting married to him. Since size matters, Willy tries to figure out how large his nest and the ones of his rivals may become.

For this purpose, Willy takes into consideration all known places offering leaf fibers suitable for nest construction. Since weavers do not like to leave their known territory, many of these places can be accessed by a subset of all weavers only, and some might even not be reachable by any weaver.

To reduce complexity, Willy does not want to set up a flight plan. This implies that he does not consider any particular strategy of his rivals nor does he make any assumptions on how many fibers they can carry at a time or how quick and when they fly. It is therefore possible that a weaver succeeds in picking up all fibers in his territory. Finally, Willy assumes that all weavers are as integer as he is:

they do not steal fibers from nests of their rivals.

Is there any chance that no weaver will have a larger nest (number of fibers) than Willy after all leaf fibers have been picked up?

## Input

The first line contains the number of testcases  $T$  ( $1 \leq T \leq 100$ ). Each test case starts with a line containing two integers. The first integer  $W$  ( $1 \leq W \leq 100$ ) is the number of weavers (including Willy); the second one  $P$  ( $1 \leq P \leq 400$ ) is the number of places with leaf fibers.

Next come  $W$  lines describing the nest of each weaver with four integers  $x, y, f$ , and  $r$  ( $0 \leq x, y, r \leq 10000, 1 \leq f \leq 10000$ ):  $x$  and  $y$  define the position of the nest,  $f$  is the size of the nest in number of fibers, and  $r$  is the radius of the territory in which the owner of the nest will search for additional fibers. The first of these  $W$  lines describes Willy's nest.

Thereafter follow  $P$  lines defining the places with available leaf fibers with three integers  $x, y$ , and  $f$  ( $0 \leq x, y \leq 10000, 1 \leq f \leq 10000$ ):  $x$  and  $y$  define the position of the place, and  $f$  is the number of available leaf fibers.

## Output

For each test case print one single line containing the string **Suiting Success**, if Willy has a chance to marry Wilmar after all fibers have been picked up (a tie in nest size is sufficient); else print **Lonesome Willy**.

## Example

**Input :**

```
2
3 2
0 0 1 10
10 0 1 10
20 0 1 10
5 0 2
15 0 4
3 2
0 0 1 10
10 0 1 10
20 0 1 10
5 0 2
15 0 5
```

**Output :**

```
Suiting Success
Lonesome Willy
```

---



Added by: Adrian Kuegel

Date: 2011-07-05

Time limit: 10s

Source  
limit: 50000B

Languages: All

Resource: German Collegiate Programming Contest 2011 (Authors: Christian Renner and Christoph Weyer)

## SPOJ Problem Set (classical)

### 9126. Time to live

#### Problem code: GCPC11J

As you might know, most computer networks are organized in a tree-like fashion, i.e. each computer is reachable by each other computer but only over one, unique path.

The so-called *Time to live* (TTL) specifies after how many hops a network packet is dropped if it has not reached its destination yet. The purpose of the TTL is to avoid situations in which a packet circulates through the network caused by errors in the routing tables.

The placement of a router that connects the network to another network is optimal when the maximal needed TTL for packets that are sent from this router to any other computer within the same network is minimal. Given a network as specified above, you should calculate the maximal needed TTL in this network if you can select the computer that should be used as router.

#### Input

The first line of the input consists of the number of test cases  $c$  that follow ( $1 \leq c \leq 100$ ). Each test case starts with a line specifying  $N$ , the number of computers in this network ( $1 < N \leq 10^5$ ). Computers are numbered from  $0$  to  $N-1$ . Then follow  $N-1$  lines, each specifying a network connection by two numbers  $a$  and  $b$  which means that computer  $a$  is connected to computer  $b$  and vice versa, of course ( $0 \leq a, b < N$ ).

#### Output

For each test case in the input, print one line containing the optimal TTL as specified above.

#### Example

Input :

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

**Output :**

1  
1  
2

---

Added by: Adrian Kuegel

Date: 2011-07-05

Time limit: 15s

Source limit:50000B

Languages: All

Resource: German Collegiate Programming Contest 2011 (Author: Tobias Werth)

## SPOJ Problem Set (classical)

### 9334. Point in tetrahedron

#### Problem code: TETRAHED

There're given 5 points in 3D coordinates (integers  $0 \leq x, y, z < 100$ ). Their order is arbitrary. 4 of them are the vertices of a tetrahedron whose edges can be of different size. One is lying in this tetrahedron. Find its index (1-5) in the array of points.

#### Input

In the first line the number T ( $T < 1000$ ) of test cases.

Then for each test case 5 lines with the space separated x-, y- and z-coordinates of the 5 points.

#### Output

For each test case a line with the index of that point which is lying in the tetrahedron formed of the 4 other points.

#### Example

**Input :**

15 72 6692 23 6860 60 4974 78 3367 76 27

**Output :**

3

---

Added by: HWK

Date: 2011-08-07

Time limit: 10s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 9397. Memoria

#### Problem code: PS11F

You might have played the game called Memoria. In this game, there is a board consisting of  $N$  rows containing  $M$  cells each. Each of the cells has a symbol on its back. Each symbol occurs on exactly two cells on the board.

A move means turning a pair of cells *one by one* to see the symbols behind them. When the symbols differ, both of the cells are turned on their faces, thus hiding the symbols again. The player should remember the symbols. If the symbols on the backs of the turned cells coincide, the cells stay that way, i.e., don't turn back again. The player takes the last cell on the board, and declare to be the winner.

Alice and Bob are play Memoria on the ground, after several times, Alice found that for some  $N, M$ , this game isn't fair, Cause Alice Can't calculate the ??, she asks Bob for help. But Bob can't solve this either.

So now is your turns. ..

#### Input

There is only one line contains two integers  $N$  and  $M$  as above ...

#### Output

Output the ?? for Alice , note that because Alice is a girl, so she always move first.

#### Example

**Input 1:**

2 2

**Output 1:**

1/3

**Input 2:**

3 2

**Output 1:**

2/3

---

Added by: xiaodao

Date: 2011-08-16

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 9458. Ghosts having fun

#### Problem code: GHOSTS

Ghost are living in big castle with K rooms.

As they have around few hundred years and very tired, they decided to buy teleports. Every teleport can work only in one way ( to prevent collision ). Ghosts have decided which teleports they want to build and in which order they should be built.

King of ghosts, Bob, asked you to check list of teleports and decide which of them do not build. He don't want ghosts having fun in infinite ride with teleports.

#### Input

In first line - number  $K \leq 1000$ , amount of rooms in castle.

In next line - number  $T \leq 300000$  of teleports.

In next T lines  $a, b \leq K$

Rooms are numbered 1..K

#### Output

Print teleports which should not be built. End test case with 0 0

#### Example

**Input :**

```
452 44 33 21 23 1
```

**Output :**

```
3 23 10 0
```

---

Added by: Krzysztof Lewko

Date: 2011-08-25

Time limit: 1s-3s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 9494. Just Add It

#### Problem code: ZSUM

For two given integers  $n$  and  $k$  find  $(Z_n + Z_{n-1} - 2Z_{n-2}) \bmod 10000007$ , where  $Z_n = S_n + P_n$  and  $S_n = 1^k + 2^k + 3^k + \dots + n^k$  and  $P_n = 1^1 + 2^2 + 3^3 + \dots + n^n$ .

#### Input

There are several test cases [  $\leq 10000$  ]. In each case two space separated positive integers  $n$  and  $k$  are given.

For last test case  $n$  and  $k$  are given as 0 0, which is not to be processed.

$1 < n < 200000000$ ,  $0 < k < 1000000$ .

#### Output

For each case print the asked value in separate line.

#### Example

**Input :**

10 39 3183 175 20 0

**Output :**

4835897211876222852753694

---

Added by: Manohar Singh

Date: 2011-09-04

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: Manohar Singh

## SPOJ Problem Set (classical)

### 9503. Working in Beijing

#### Problem code: WORKB

Mr. M is an undergraduate student of FDU. He finds an intern position in Beijing, so that he cannot attend all the college activities. But in some conditions, he must come back to Shanghai on certain date. We can assume the important activities that Mr. M must attend are occupy a whole day. Mr. M must take flight to Shanghai before that day and leave after that day. On the other hand, Mr. M is absent in Beijing and he will lose his salary for his absent.

Sometimes the cost of flight is much higher than the loss of salary, so to save the cost on the travel, Mr. M can stay in Shanghai to wait for another important date before he back to Beijing.

Now, Mr. M knows all of the important date in the next year. Help him schedule his travel to optimize the cost.

#### Input

The input contains several test cases. The first line of single integer indicates the number of test cases.

For each test case, the first line contains three integers: **n**, **a** and **b**, denoting the number of important events, the cost of a single flight from Beijing to Shanghai or Shanghai to Beijing and the salary for a single day stay in Beijing. ( $1 \leq n \leq 100000$ ,  $1 \leq a \leq 1000000000$ ,  $1 \leq b \leq 100$ )

Next line contains **n** integers  $t_i$ , denoting the time of the important events. You can assume the  $t_i$  are in increasing order and they are different from each other. ( $0 \leq t_i \leq 100000000$ )

#### Output

For each test case, output a single integer indicating the minimum cost for this year.

#### Example

**Input :**

```
2
1 10 10
5
5 10 2
5 10 15 65 70
```

**Output :**

```
Case #1: 30
Case #2: 74
```

**Warning: large input/output data, be careful with certain languages**

---



Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 6s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #3, by lcosvse

## SPOJ Problem Set (classical)

### 9504. Paint on a Wall

#### Problem code: PAINTWAL

Annie wants to paint her wall to an expected pattern. The wall can be represented as a  $2 \times n$  grid and each grid will be painted only one color. Annie has a brush which could paint a rectangular area of the wall at a single step. The paint could be overlap and the newly painted color will replace the older one.

For a given pattern of the wall, your task is to help Annie find out the minimum possible number of painting steps. You can assume that the wall remains unpainted until Annie paint some colors on it.

#### Input

There are multiple test cases in the input. The first line contains the number of test cases.

For each test case, the first line contains the only integer  $n$  indicating the length of the wall. ( $1 \leq n \leq 8$ )

Two lines follow, denoting the expected pattern of the wall. The color is represented by a single capital letter.

See the sample input for further details.

#### Output

For each test case, output only one integer denoting the minimum number of steps.

#### Example

**Input :**

```
3
3
ABA
CBC
3
BAA
CCB
3
BBB
BAB
```

**Output :**

```
Case #1: 3
Case #2: 3
Case #3: 2
```

**The time limit is somewhat tight for this problem.**

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 23s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #3, by g201513

## SPOJ Problem Set (classical)

### 9505. Distinct Subtrees

#### Problem code: DSUBTREE

Given an unrooted tree, the subtree is defined as a connected component of the given tree. Two subtrees are considered the same if there exists a map from nodes of one tree to another so that the edges of both trees are corresponding the same pair of nodes after mapping.

Your task is to find out how many distinct subtrees for a given unrooted tree.

#### Input

The input consists of multiple test cases. The first line of input contains an integer denoting the number of test cases.

For each test case, the first line contains one integer  $n$  denoting the number of nodes of the given tree. ( $1 \leq n \leq 15$ )

Then  $n-1$  lines follow, each line contains two integers denoting an edge of the tree. The index of the node counts from 1.

#### Output

For each test case, output the number of distinct subtrees for the given tree.

#### Example

**Input :**

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

**Output :**

```
Case #1: 3
Case #2: 21
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 9s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #3, by g201513

## SPOJ Problem Set (classical)

### 9506. Jimmy's Travel Plan

#### Problem code: DIST2

Jimmy lives in a huge kingdom which contains lots of beautiful cities. He also loves traveling very much, and even would like to visit each city in the country. Jaddy, his secretary, is now helping him to plan the routes, however, Jaddy suddenly find that is quite a tough task because it is possible for Jimmy to ask route's information toward any city. What was worse is that Jaddy has to response for queries about the distance information nearly between any pair of cities due to the undeterminable starting city which Jimmy is living in when he raises a query. Because of the large scale of the whole country, Jaddy feels hopeless to archive such an impossible job, however, in order to gratify his manager, Jaddy is now looking forward to your assistance.

There might be good news about Jaddy's work: since Jimmy is very lazy and would not like to travel to a destination whose distance between the original city is larger than TWO. That means only one intermediate city among the route is acceptable (Apparently, all the connecting paths between any two cities, if exists, have the same length as ONE). But don't be fooled: Jimmy also needs to know that how many alternative different routes are available so that he can have more options. In particular two routes were named as different if and only if there is at least one path in the two routes is distinguishable, moreover, if more than one paths exist between a particular pair of cities, they are considered as distinct.

#### Input

Input has multiple test cases. The first line of the input has a single integer indicating the number of test cases, then each test case follows. For each test case, the first line contains two integers **N** and **M** indicating the number of cities and paths in the country. Then **M** lines are following, each line contains a pair of integers **A** and **B**, separated by space, denoting an undirected path between city **A** and city **B**. All the cities are numbered from 1 to **N**. Then a new line contains a single integer **Q**, which means there are **Q** queries following. Each query contains a couple of integers **A** and **B** which means querying the distance and number of shortest routes between city **A** and **B**, each query occupies a single line separately.

All the test cases are separated by a single blank line.

You can assume that **N**, **Q** <= 100000, **M** <= 200000.

#### Output

For each test case, firstly output a single line contains the case number, then **Q** lines for the response to queries with the same order in the input. For each query, if there exists at least one routes with length no longer than TWO, then output two integer separated by a single space, the former is the distance (shortest) of routes and the later means how many different shortest routes Jimmy can choose; otherwise, output a single line contains "The pair of cities are not connected or too far away." (quotes for clarifying). See the sample data carefully for further details.

## Example

### Input :

```
2
5 7
1 2
2 3
3 4
4 5
2 5
2 4
1 2
4
1 4
1 2
5 3
5 4

2 0
2
1 1
1 2
```

### Output :

Case #1:

```
2 2
1 2
2 2
1 1
```

Case #2:

```
0 1
```

The pair of cities are not connected or too far away.

**Warning: large input/output data, be careful with certain languages**

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 9s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #3, by lcosvse

## SPOJ Problem Set (classical)

### 9507. Mario and Mushrooms

#### Problem code: MARIO2

Mario usually relaxes himself by walking along the shady track near the Mushroom Kingdom. The evil King Koopa noticed that and placed a lot of mushroom on the road. There are two types of mushrooms, max mushrooms and bad mushrooms. The bad mushrooms will decrease Mario's HP by  $m$  points, on the other hand, max mushrooms will increase Mario's HP by one point. The mushrooms are randomly placed on the track and Mario will receive them one by one. Once Mario's HP becomes zero or below after he received a mushroom, he will die.

Notice that Mario begins with HP zero, so if the first mushroom is bad, Mario will die immediately. Fortunately, if Mario receives all the mushrooms, he will be alive with HP 1. In the other words, if there are  $k$  bad mushrooms on the way, there will also be  $m*k+1$  max mushrooms.

Princess Peach wants to know the possibility for Mario staying alive. Please help her to calculate it out.

#### Input

There are several test cases. The first line contains only one integer denoting the number of test cases.

For each test case, there is only one line including two integers:  $m$  and  $k$ , denoting the amount of points of HP the Mario will decrease if he receives a bad mushroom, and the number of bad mushrooms on the track. ( $1 \leq m \leq 1000$ ,  $1 \leq k \leq 1000$ )

#### Output

For each test case, output only real number denoting the possibility that Mario will survive if he receives all the randomly placed mushrooms one by one. The answer should be rounded to eight digits after the decimal point.

The judge is "ignoring extra white spaces".

#### Example

**Input :**

```
2
1 1
60 80
```

**Output :**

```
Case #1: 0.33333333
Case #2: 0.00020488
```

---



Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 1s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #3, by g201513

## SPOJ Problem Set (classical)

### 9508. Magic Bitwise AND Operation

#### Problem code: AND

Given  $n$  integers, your task is to pick  $k$  out of them so that the picked number are minimum when do bitwise AND among all of them.

#### Input

There are multiple test cases for this problem. The first line of the input contains an integer denoting the number of test cases.

For each test case, there are two integers in the first line:  $n$  and  $k$ , denoting the number of given integers and the number of integers you are asked to pick out. ( $1 \leq n \leq 40$ ,  $1 \leq k \leq n$ )

The second line contains the  $n$  integers. You may assume that all integers are smaller than  $2^{60}$ .

*Note: There are about one thousand randomly generated test cases. Fortunately 90% of them are relatively small.*

#### Output

For each test case, output only one integer - the smallest possible value.

#### Example

**Input :**

```
2
3 2
5 6 7
8 2
238 153 223 247 111 252 253 247
```

**Output :**

```
Case #1: 4
Case #2: 9
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 23s

Source limit: 50000B

Languages: All

Resource: Fudan University Local Contest #3, by g201513

## SPOJ Problem Set (classical)

### 9510. Ads Proposal

#### Problem code: ADSPROP

There are  $N$  customers set their  $M$  different advertisements on Baidu. Each advertisement is owned by single customer. The ads system of Baidu records the number of clicks of each advertisement this year. The proposal system wants to analysis the advertisements about the relativity of the description length and the number of clicks of the advertisements. During the analysis, it is very important to do such a query to ask the total length of the advertisements with top  $K$  clicking times for each customer. You may assume the clicks of all advertisements are distinct.

Your task is to help Baidu to design this little toolkit.

#### Input

The input consist multiple test cases. The number of test cases is given in the first line of the input.

For each test case, the first line contains three integers  $N$ ,  $M$  and  $Q$ , denoting the number customer, the number of advertisement instances and the number of queries. ( $N \leq 100000$ ,  $M \leq 500000$ ,  $Q \leq 100000$ )

Then  $M$  lines follow, each line contains three numbers,  $U$ ,  $C$  and  $L$ , indicating the owner of this advertisement, the clicks for this advertisement and the length.

Finally  $Q$  lines come. Each line contains only one integer  $K$ , representing the query for top  $K$  clicking advertisements for each customer.

All input numbers will be positive and less than 1000000000.

#### Output

For each test case, output  $Q$  lines, each line contains only one integer, denoting the sum of total length of the top  $K$  number of clicks for each customer.

#### Example

**Input :**

```
2
2 4 3
1 12 13
2 23 41
1 21 46
1 22 31
1
2
3
6 15 3
5 2677139 731358928
2 347112028 239095183
```

```
6 27407970 85994789
6 767687908 734935764
6 255454855 110193353
3 39860954 813158671
5 617524049 55413590
3 338773814 7907652
6 810348880 736644178
2 777664288 63811422
6 590330120 616490361
5 552407488 136492190
1 416295130 448298060
5 811513162 232437061
4 43273262 874901209
4
9
13
```

**Output:**

Case #1:

```
72
118
131
```

Case #2:

```
5801137622
5887132411
5887132411
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 9s

Source limit:50000B

Languages: All

Resource: Fudan University Local Contest #3, by Blue Mary

## SPOJ Problem Set (classical)

### 9511. 24-Puzzle

#### Problem code: PUZZLE24

Daniel likes to play a special board game, called 24 puzzle. 24 puzzle is such a game that there are tiles with the number 1 to 23 in a play board like the follows:

```
#  #
#####
####
####
#####
#  #
```

The '#' denotes the positions that the tiles may be placed on. There are 24 possible positions in total, so one of them is not occupied with the tile. We denote the empty position by zero.

Daniel could move the tiles adjacent to the empty position to it. In this way Daniel can reorder the number tiles of the game. He plays with this game by setting up a target states initially, and then trying to do some move to achieve the target. Soon he finds that not all target states can be achieved by the move.

He asks for your help, to determine whether he set up an impossible target or not.

#### Input

The first line of input contains an integer denoting the number of test cases.

For each test case, the first line contains 24 integers denoting the initial states of the game board. The numbers describes the tiles from top to bottom, left to right. And the empty position is indicated by zero. You can assume that the number of each tiles are different, and there must be exactly one empty position. The second line of test case also contains 24 integers denoting the target states.

#### Output

For each test case, if the target is impossible to achieve, output **Y** in a single line, otherwise, output **N**.

#### Example

**Input :**

```
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
3 1 2 0 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
3 0 2 1 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
```

**Output :**

```
N
Y
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 1s

Source limit:50000B

Languages: All

Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary, by Blue Mary

## SPOJ Problem Set (classical)

### 9512. Bombing

#### Problem code: BOMB2

It's a cruel war which kills millions of people and series of cities were ruined. In order to stop it, let's bomb the opponent's base.

It seems to be not a hard work in circumstances of street battles, however, you'll be encountered a much more difficult instance: recounting exploits of the military. In the bombing action, the commander will dispatch a group of bombers with weapons having the huge destructive power to destroy all the targets in a line. Thanks to the outstanding work of our spy, the positions of all opponents' bases had been detected and marked on the map, consequently, the bombing plan will be sent to you.

Specifically, the map is expressed as a 2D-plane with some positions of enemy's bases marked on. The bombers are dispatched orderly and each of them will bomb a vertical or horizontal line on the map. Then your commanded wants you to report that how many bases will be destroyed by each bomber. Notice that a ruined base will not be taken into account when calculating the exploits of later bombers.

#### Input

Multiple test cases. Each test cases starts with two non-negative integer  $N$  ( $N \leq 100,000$ ) and  $M$  ( $M \leq 100,000$ ) denoting the number of target bases and the number of scheduled bombers respectively. In the following  $N$  line, there is a pair of integers separated by single space indicating the coordinate of position of each opponent's base. The following  $M$  lines describe the bombers, each of them contains two integers  $c$  and  $d$  ( $0 \leq c \leq 1$ ,  $-1,000,000,000 \leq d \leq 1,000,000,000$ ).  $c = 0$  means this bomber will bomb the line  $x = d$ ,  $c = 1$  means this bomber will bomb the line  $y = d$ .

The input ends with  $N = M = 0$ .

#### Output

For each test case, output  $M$  lines, the  $i$ -th line contains a single integer denoting the number of bases that were destroyed by the corresponding bomber in the input. Output a blank line after each test case.

#### Example

**Input :**

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

**Output :**

```
2
1
```

**Warning: large input/output data, be careful with certain languages**

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 5s

Source limit:50000B

Languages: All

Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary



## SPOJ Problem Set (classical)

### 9513. Game

#### Problem code: TETRISGM

Alice and Bob are playing game with each other. They play the game on a 2D board. Alice has many vertical 1\*2 tiles while Bob has many horizontal 2\*1 tiles. They take turn to place their own tiles on the board. Considering about that the tiles cannot overlap each other, the player cannot do the placement any more loses. Since this is such a complex game that they could not find optimal method to play that, Alice decide to simplify this game by replace the large 2D board by some small ones. Alice set up a lot of Tetris tiles instead of the original 2D board. In the other words, the player can only place their own vertical or horizontal tiles on the Tetris-like board. Each player can choose one possible place on any Tetris tiles to place its own tiles. In fact, there are following 15 types of Tetris playground.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
#	####	##	##	#	#	#	#	###	###	###	#	#	#	##
#		##	##	##	##	#	#	#	#	#	##	##	###	##
#				#	#	##	##				#	#		
#														

The playground cannot be transformed in any ways, including reflection and rotation.

Given the number of each type of tiles, you are asked to determine who will win the game if Alice plays first and both players are playing optimal.

#### Input

There are multiple test cases; the first line of input contains a single integer denoting the number of test cases.

For each test case, there are only one line contains 15 integers denoting the number of Tetris tiles of the above 15 types. All the numbers are no greater than 100.

#### Output

For each test cases, output **Alice** if Alice will win the game and both player plays optimally, **Bob** otherwise.

#### Example

Input :

```
3
5 4 0 0 0 0 0 0 0 0 0 0 0 0 0
5 5 0 0 0 0 0 0 0 0 0 0 0 0 0
100 100 0 0 0 0 0 0 0 0 0 0 2 1 0 0
```

**Output:**

Case #1: Alice  
Case #2: Bob  
Case #3: Alice

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 1s

Source limit: 50000B

Languages: All

Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary, by g201513

## SPOJ Problem Set (classical)

### 9515. Dwarven Sniper's Hunting

#### Problem code: HUNT1

Now the hunting starts in the world named DOTA, a stupid PC game which cannot play with others together.

Among the individuals in the game, there are two heroes named Dwarven Sniper and Lycanthrope. Lycanthrope wants to escape from being captured; however, our Dwarven Sniper won't let him go! He will use the Silver Bullet to kill the Lycanthrope by only one shot! Yes, that's enough.

Lycanthrope is running on a line in the map with a constant speed. The weapon range of the Silver Bullet is limited by  $L$  meters. Dwarven Sniper can run for a while freely, and then shoot Lycanthrope. In order to show his excellent shooting skill, Dwarven Sniper wants the Silver Bullet flying as far as possible. But don't forget the flying time of the Silver Bullet due to considerable weight of the bullet. And Dwarven Sniper wants to stop the hunting as quickly as possible. So if there is more than one way to show his excellent skill, he would choose the fastest way. In this problem we consider the Silver Bullet and Lycanthrope as two points.

Now Dwarven Sniper wants to know the maximum length that the Silver Bullet can fly, and (under this condition) the shortest time that the hunting lasts. Specifically, the total hunting time is defined as the time interval from the start of hunting to the moment that the bullet hit Lycanthrope. Can you help him?

#### Input

There are several test cases. Each of them contains only one line which consist of 9 real numbers, that are  $X1, Y1, X2, Y2, Lx, Ly, vD, vB$  and  $L$  ( $-10000 \leq X1, Y1, X2, Y2, Lx, Ly \leq 10000, 0 \leq vD, vB, L \leq 100000$ ). The pair  $(X1, Y1)$  is the starting position of the Lycanthrope while  $(X2, Y2)$  is the starting position of Dwarven Sniper, while  $(Lx, Ly)$  is the moving vector per second of the Lycanthrope,  $vD$  is the speed of the Dwarven Sniper,  $vB$  is the speed of the Silver Bullet,  $L$  is the maximum possible flying distance of the bullet.

All units are meters/second.

It is guaranteed that  $(Lx^2 + Ly^2) < vD^2 < vB^2$ , and Dwarven Sniper's starting position is different from Lycanthrope's position. The input ends with a line containing all zeros.

#### Output

For each test case, output two real numbers  $S$  and  $T$  in a line separated by a single space denoting that the Silver bullet flies  $S$  meters before hitting Lycanthrope and the hunting lasts for  $T$  seconds, both with 3 numbers after the decimal point.

You may assume that Dwarven Sniper can finish his hunting within no more than  $1e+9$  seconds.

**Note: The judge is "ignoring extra white spaces".**

## **Example**

**Input :**

```
-1 0 0 10 1 0 2 10 10
0 0 0 5 0 1 2 6 6
0 0 0 0 0 0 0 0 0
```

**Output :**

```
10.000 1.000
6.000 3.000
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 3s

Source limit:50000B

Languages: All

Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary

## SPOJ Problem Set (classical)

### 9516. XOR Equations

#### Problem code: XOREQ

Recently, Jimmy is learning about linear algebra from Blue Mary while having the course of Boolean algebra in class offered by Prof. Z. Since Jimmy has been thoroughly bored by the boring homework assigned by two teachers, evil Jimmy plans to set a hard question to baffle them as revenge for their heavy tasks. As a result, Jimmy comes up with an idea that merging the knowledge from both the two classes and constructs a complicate problem: the XOR equation system.

Let's consider the following equations:

$$\begin{aligned}(a_{11} \cdot x_1) \wedge (a_{12} \cdot x_2) \wedge \dots \wedge (a_{1m} \cdot x_m) &= 0 \\(a_{21} \cdot x_1) \wedge (a_{22} \cdot x_2) \wedge \dots \wedge (a_{2m} \cdot x_m) &= 0 \\&\dots \\(a_{n1} \cdot x_1) \wedge (a_{n2} \cdot x_2) \wedge \dots \wedge (a_{nm} \cdot x_m) &= 0\end{aligned}$$

which satisfies the following conditions:

1.  $a_{ij} \in \{0,1\}$  for  $1 \leq i \leq n$  and  $1 \leq j \leq m$ ;
2.  $x_i \in S_i$  where  $S_i$  is a subset of  $\{0,1,2,3\}$ ,  $1 \leq i \leq m$ ;
3.  $|S_i| \leq 3$ ,  $1 \leq i \leq m$ ;
4.  $1 \leq n \leq 30$ ,  $1 \leq m \leq 22$ .

In the system of equations, operation  $\cdot$  denotes the multiplication operation while  $\wedge$  is for bitwise XOR. Moreover, the bitwise XOR takes two bit patterns of equal length and performs the logical XOR operation on each pair of corresponding bits. The result in each position is 1 if the two bits are different, and 0 if they are the same.

Rather than expecting a solution of a specified equation system, Jimmy would like to ask the teachers to calculate that how many distinct solutions can satisfy a given equation system. What a confusing puzzle! Help Jimmy's teachers please!

#### Input

There are several test cases. The first line of input is a single positive integer ( $\leq 15$ ) indicating the number of test cases, the test cases follow.

For each test case, the first line contains two integers **N** and **M** giving the two dimensions of the equation system respectively where **N** is the number of rows and **M** for columns. Then **N** lines are following, each line contains **M** integers. Item at line  $i$  and column  $j$  represents  $a_{ij}$ . The next **M** lines are descriptions of  $S_i$  that the leading integer **K** denotes the number of elements in  $S_i$  and the following **K** integers represent elements.

## Output

For each test case, output one line containing a single integer which represents the answer of this case.

## Example

**Input :**

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

**Output :**

```
1
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 9s

Source limit: 50000B

Languages: All

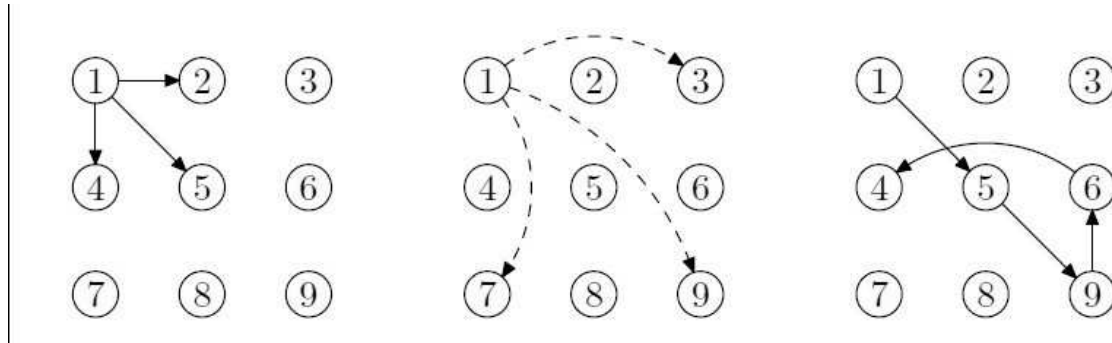
Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary

## SPOJ Problem Set (classical)

### 9517. Unlock the Cellphone

#### Problem code: UNLOCK

Modern high-tech cell phones use unlock patterns to unlock the system. The pattern is usually a 3\*3 dot array. By moving your finger over there dots, you can generate your personal unlock pattern. More specifically, press your finger over any starting dot, then slide all the way to the next dot, touch it, and so on. Jumping is not allowed. For example, starting from dot 1, you can slide to touch dot 2, dot 4 and dot 5, but sliding directly to dot 3, dot 7 or dot 9 are not allowed. Note that sliding from 1 to 6 and 8 is also allowed because they are not considered as jumping over any dot. However, you can jump a dot if it has been touched before. For example, starting with 1-5-9-6, you can slide directly to dot 4.



Here is a very particular cell phone. It has a dot array of size  $n*m$ . Some of the dots are ordinary ones: you can touch, and slide over them when touched before; some are forbidden ones: you cannot touch or slide over them; some are inactive ones: you cannot touch them, but can slide over them. Each dot can only be touched once. You are required to calculate how many different unlock patterns passing through all the ordinary dots.

#### Input

The input contains several test cases. Each test case begins with a line containing two integers  $n$  and  $m$  ( $1 \leq n, m \leq 5$ ), indicating the row and column number of the lock keypad. The following  $n$  lines each contains  $m$  integers  $K_{i,j}$  indicating the properties of each key,  $K_{i,j}=0$  stands for an ordinary key,  $K_{i,j}=1$  stands for a forbidden key; and  $K_{i,j}=2$  stands for an inactive key. The number of ordinary keys is greater than zero and no more than 16.

Input terminates by EOF.

#### Output

For each test, output an integer indicating the number of different lock patterns.

## Example

**Input :**

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

**Output :**

```
24
2140
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 7s

Source limit:50000B

Languages: All

Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary, by cuiaoxiang



## SPOJ Problem Set (classical)

### 9518. The Time of Day

#### Problem code: LCM

There are no days and nights on byte island, so the residents here can hardly determine the length of a single day. Fortunately, they have invented a clock with several pointers. They have  $N$  pointers which can move round the clock. Every pointer ticks per second, and the  $i$ -th pointer move to the start position after  $i$  times of ticks. The wise of the byte island decide to define a day as the time interval between the start time and the first time when all the pointers moves to the position exactly the same as the start time. The wise of the island decide to choose some of the  $N$  pointers to make the length of the day are greater than or equal to a given seconds  $M$ . They want to know how many different ways to make it possible.

#### Input

There are a lot of test cases, the number of test cases are in the first line of input.

For each test cases, there are only one line contains two integers  $N$  and  $M$ , indicating the number of pointers and the lower bound for seconds of a day. ( $1 \leq N \leq 40$ ,  $1 \leq M \leq 2^{63}-1$ )

#### Output

For each test case, output a single integer denoting the number of ways.

#### Example

**Input :**

```
3
5 5
10 1
10 128
```

**Output :**

```
Case #1: 22
Case #2: 1023
Case #3: 586
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 2s

Source limit:50000B

Languages: All

Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary, by g201513

## SPOJ Problem Set (classical)

### 9519. Distinct Submatrices

#### Problem code: DSUBMTR

Consider an matrix of capital letters. By selecting consecutive columns and rows, we can define the sub-matrix as the elements on chosen columns and rows.

Two sub-matrices should be regarded the same if and only if they have the same detentions and characters (which, of course, are capital letters) on corresponding position. It is your task to find the number of distinct sub-matrices of a given letter matrix.

#### Input

The input contains a lot of test cases. The first line of input contains exactly one integer, indicating the number of test cases.

For each of the test case, the first line contains two integers **N** and **M**, denoting the number of rows and columns of the given matrix. ( $1 \leq N, M \leq 128$ )

The next **N** lines contain only capital letters, indicating the given matrix.

#### Output

For each test case, output a single integer denoting the number of distinct sub-matrices.

#### Example

**Input :**

```
2
2 2
AB
BA
3 3
ABA
BAA
AAA
```

**Output :**

```
Case #1: 7
Case #2: 22
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 9s

Source limit: 50000B

Languages: All

Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary, by g201513

## SPOJ Problem Set (classical)

### 9520. Tanks

#### Problem code: TANKS

Surprisingly, the king of the Quadruple Island Kingdom suddenly declares war on its neighbor country, the Utopia Land. After that, the King dispatches a large number of tanks for first attack. You, as the Defense Minister of Utopia Land, are certainly under mass of pressure. In order to defense the enemy, you decide to use the new secret weapon: laser cannon. This kind of weapon is so powerful that can easily destroy any thing at a line in a moment, or course, including tanks.

However, Because of some designing flaw, you can use such weapon just once during the war. The only hope is that you can choose a good moment and right way to use it so that as many tanks as possible can be destroyed.

A tank can be described as a point whose coordinate is  $(X_i, Y_i)$  on a 2D-plane with speed vector  $(VX_i, VY_i)$  per second. Starting at time 0, you can use your laser cannon at any position and in any direction at any INTEGER number of seconds after time 0. It is possible that some tanks will meet at the same point while moving, and they will not influence each other anyway.

#### Input

Multiple test cases. The number of test cases is no more than 10. For each test cases, The first line contains a single integer  $N$  ( $1 \leq N \leq 100$ ) indicating the number of tanks. Then  $N$  lines are following that describing the tanks respectively. Each of them consists of four nonzero integer  $X_i, Y_i, VX_i, VY_i$  separated by single spaces where  $|X_i|, |Y_i| \leq 100,000,000$  and  $|VX_i|, |VY_i| \leq 100$  denoting the initial position of a tank and the speed vector. Input ends with  $N = 0$ .

#### Output

For each test case, output one line with a single integer indicating the largest number of tanks which can be destroyed by the laser cannon.

Note: Be careful when handling floating point errors.

#### Example

**Input :**

```
4
10 10 -1 -1
3 1 4 6
2 8 5 -1
1 3 1 4
0
```

**Output :**

```
3
```

---

Added by: [Trichromatic] XilinX

Date: 2011-09-08

Time limit: 9s

Source limit:50000B

Languages: All

Resource: ACM/ICPC Regionals, Shanghai 2011 Preliminary

## SPOJ Problem Set (classical)

### 9525. Cipher

#### Problem code: CIPHERJ

Bob and Alice started to use a brand-new encoding scheme. Surprisingly it is not a Public Key Cryptosystem, but their encoding and decoding is based on secret keys. They chose the secret key at their last meeting in Philadelphia on February 16th, 1996. They chose as a secret key a sequence of  $n$  distinct integers,  $a_1, \dots, a_n$ , greater than zero and less or equal to  $n$ . The encoding is based

on the following principle. The message is written down below the key, so that characters in the message and numbers in the key are correspondingly aligned. Character in the message at the position  $i$  is written in the encoded message at the position  $a_i$  where  $i$  is the corresponding

number in the key. And then the encoded message is encoded in the same way. This process is repeated  $k$  times. After  $k$ th encoding they exchange their message.

The length of the message is always less or equal than  $n$ . If the message is shorter than  $n$ , then spaces are added to the end of the message to get the message with the length  $n$ .

Help Alice and Bob and write program which reads the key and then a sequence of pairs consisting of  $k$  and message to be encoded  $k$  times and produces a list of encoded messages.

#### Input

The input file consists of several blocks. Each block has a number  $0 < n \leq 200$  in the first line.

The next line contains a sequence of  $n$  numbers pairwise distinct and each greater than zero and less or equal than  $n$ . Next lines contain integer number  $k$  and one message of ascii characters separated by one space. The lines are ended with eol, this eol does not belong to the message. The block ends with the separate line with the number 0. After the last block there is in separate line the number 0.

#### Output

Output is divided into blocks corresponding to the input blocks. Each block contains the encoded input messages in the same order as in input file. Each encoded message in the output file has the length  $n$ . After each block there is one empty line.

#### Sample Input

```
10
4 5 3 7 2 8 1 6 10 9
1 Hello Bob
1995 CERC
0
0
```

## Sample Output

```
BolHeol  b  
C RCE
```

---

Added by: Andres Tellez

Date: 2011-09-12

Time limit: 3s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 9527. Department

#### Problem code: DEPARTJ

The Department of Security has a new headquarters building. The building has several floors, and on each floor there are rooms numbered  $xxyy$  where  $yy$  stands for the room number and  $xx$  for the floor number,  $0 < xx, yy < 10$ .

The building has "pater-noster" elevator, i.e. elevator build up from several cabins running all around. From time to time the agents must visit the headquarters. During their visit they want to visit several rooms and in each room they want to stay for some time. Due to the security reasons, there can be only one agent in the same room at the same time. The same rule applies to the elevators.

The visits are planned in the way ensuring they can be accomplished within one day. Each agent visits the headquarters at most once a day.

Each agent enters the building at the 1st floor, passes the reception and then starts to visit the rooms according to his/her list. Agents always visit the rooms by the increasing room numbers. The agents form a linear hierarchy according to which they have assigned their one letter personal codes. The agents with higher seniority have lexicographically smaller codes. No two agents have the same code.

If more than one agent want to enter a room, or an elevator, the agents have to form a queue. In each queue, they always stand according to their codes. The higher the seniority of the agent, the closer to the top of the queue he stands. Every 5 s (seconds) the first agent in the queue in front of the elevator enters the elevator. After visiting the last room in the headquarters each agent uses if necessary elevator to the first floor and exits the building.

The times necessary to move from a certain point in the headquarters to another are set as follows: Entering the building, i.e. passing the reception and reaching the elevator, or a room on the first floor takes 30 s. Exiting the building, i.e. stepping out of the elevator or a room on the first floor and passing the reception takes also 30 s. On the same floor, the transfer from the elevator to the room (or to the queue in front of the room), or from the room to the elevator (or to the queue in front of the elevator), or from one room to another (or to the queue in front of the room) takes 10 s. The transfer from one floor to the next floor above or below in an elevator takes 30 s. Write a program that determines time course of agent's visits in the headquarters.

## Input

The input file contains the descriptions of  $n \geq 0$  visits of different agents. The first line of the description of each visit consists of agent's one character code  $C$ ,  $C=A, \dots, Z$ , and the time when the agent enters the headquarters. The time is in the format HH:MM:SS (hours, minutes, seconds). The next lines (there will be at least one) contain the room number, and the length of time intended to stay in the room, time is in seconds. Each room is in a separate line. The list of rooms is sorted according to the increasing room number. The list of rooms ends by the line containing 0. The

list of the descriptions of visits ends by the line containing the character dot.

## Output

The output contains detailed records of each agent's visit in the headquarters. For each agent, there will be a block. Blocks are ordered in the order of increasing agent's codes. The first line of a block contains the code of agent. Next lines contain the starting and ending time (in format HH:MM:SS) and the descriptions of his/her activity. Time data will be separated by one blank character. Description will be separated from time by one blank character. Description will have a form Entry, Exit or Message. The Message can be one of the following: Waiting in elevator queue, Waiting in front of room *RoomNumber*, Transfer from room *RoomNumber* to room *RoomNumber*, Transfer from elevator to room *RoomNumber*, transfer from *RoomNumber* to elevator, Stay in room *RoomNumber*, Stay in elevator. Print a blank line after each block.

## Sample Input

```
A 10:00:00
0101 100
0110 50
0202 90
0205 50
0
B 10:01:00
0105 100
0201 5
0205 200
0
.
```

## Sample Output

```
A
10:00:00 10:00:30 Entry
10:00:30 10:02:10 Stay in room 0101
10:02:10 10:02:20 Transfer from room 0101 to room 0110
10:02:20 10:03:10 Stay in room 0110
10:03:10 10:03:20 Transfer from room 0110 to elevator
10:03:20 10:03:50 Stay in elevator
10:03:50 10:04:00 Transfer from elevator to room 0202
10:04:00 10:05:30 Stay in room 0202
10:05:30 10:05:40 Transfer from room 0202 to room 0205
10:05:40 10:07:40 Waiting in front of room 0205
10:07:40 10:08:30 Stay in room 0205
10:08:30 10:08:40 Transfer from room 0205 to elevator
10:08:40 10:09:10 Stay in elevator
10:09:10 10:09:40 Exit
```

B



10:01:00 10:01:30 Entry  
10:01:30 10:03:10 Stay in room 0105  
10:03:10 10:03:20 Transfer from room 0105 to elevator  
10:03:20 10:03:25 Waiting in elevator queue  
10:03:25 10:03:55 Stay in elevator  
10:03:55 10:04:05 Transfer from elevator to room 0201  
10:04:05 10:04:10 Stay in room 0201  
10:04:10 10:04:20 Transfer from room 0201 to room 0205  
10:04:20 10:07:40 Stay in room 0205  
10:07:40 10:07:50 Transfer from room 0205 to elevator  
10:07:50 10:08:20 Stay in elevator  
10:08:20 10:08:50 Exit

---

Added by: Andres Tellez

Date: 2011-09-12

Time limit: 1s-3s

Source limit:50000B

Languages: All

## SPOJ Problem Set (classical)

### 9528. Johns Trip

#### Problem code: JTRIP

Little Johnny has got a new car. He decided to drive around the town to visit his friends. Johnny wanted to visit all his friends, but there was many of them. In each street he had one friend. He started thinking how to make his trip as short as possible. Very soon he realized that the best way to do it was to travel through each street of town only once. Naturally, he wanted to finish his trip at the same place he started, at his parents' house.

The streets in Johnny's town were named by integer numbers from 1 to  $n$ ,  $n < 1995$ . The junctions were independently named by integer numbers from 1 to  $m$ ,  $m \leq 44$ . All junctions in the town had

different numbers. Each street was connecting exactly two (not necessarily different) junctions. No two streets in the town had the same number. He immediately started to plan his round trip. If there was more than one such round trip, he would have chosen the one which, when written down as a sequence of street numbers is lexicographically the smallest.

But Johnny was not able to find even one such round trip. Help Johnny and write a program which finds the desired shortest round trip. If the round trip does not exist the program should write a message. Assume that Johnny lives at the junction ending the 1st street input with smaller number. All streets in the town are two way. There exists a way from each street to another street in the town. The streets in the town are very narrow and there is no possibility to turn back the car once he is in the street.

## Input

Input file consists of several blocks. Each block describes one town. Each line in the block contains three integers  $x, y, z$ , where  $x > 0$  and  $y > 0$  are the numbers of junctions which are connected by the street number  $z$ . The end of the block is marked by the line containing  $x=y=0$ . At the end of the input file there is an empty block,  $x=y=0$ .

## Output

The output file consists of 2 line blocks corresponding to the blocks of the input file. The first line of each block contains the sequence of street numbers (single members of the sequence are separated by space) describing Johnny's round trip. If the round trip cannot be found the corresponding output block contains the message "Round trip does not exist.". The second line of each block is empty.

## Sample Input

```
1 2 1
2 3 2
3 1 6
1 2 5
2 3 3
3 1 4
0 0
1 2 1
2 3 2
1 3 3
2 4 4
0 0
0 0
```

## Sample Output

```
1 2 3 5 4 6
```

```
Round trip does not exist.
```

---

Added by: Andres Tellez  
Date: 2011-09-12  
Time limit: 3s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 9529. Maya Calendar

#### Problem code: MAYCA

During his last sabbatical, professor M. A. Ya made a surprising discovery about the old Maya calendar. From an old knotted message, professor discovered that the Maya civilization used a 365 day long year, called *Haab*, which had 19 months. Each of the first 18 months was 20 days long, and the names of the months were *pop*, *no*, *zip*, *zotz*, *tzec*, *xul*, *yoxkin*, *mol*, *chen*, *yax*, *zac*, *ceh*, *mac*, *kankin*, *muan*, *pax*, *koyab*, *cumhu*. Instead of having names, the days of the months were denoted by numbers starting from 0 to 19. The last month of Haab was called *uayet* and had 5 days denoted by numbers 0, 1, 2, 3, 4. The Maya believed that this month was unlucky, the court of justice was not in session, the trade stopped, people did not even sweep the floor.

For religious purposes, the Maya used another calendar in which the year was called *Tzolkin* (holly year). The year was divided into thirteen periods, each 20 days long. Each day was denoted by a pair consisting of a number and the name of the day. They used 20 names: *imix*, *ik*, *akbal*, *kan*, *chicchan*, *cimi*, *manik*, *lamat*, *muluk*, *ok*, *chuen*, *eb*, *ben*, *ix*, *mem*, *cib*, *caban*, *eznab*, *canac*, *ahau* and 13 numbers; both in cycles.

Notice that each day has an unambiguous description. For example, at the beginning of the year the days were described as follows:

*1 imix, 2 ik, 3 akbal, 4 kan, 5 chicchan, 6 cimi, 7 manik, 8 lamat, 9 muluk, 10 ok, 11 chuen, 12 eb, 13 ben, 1 ix, 2 mem, 3 cib, 4 caban, 5 eznab, 6 canac, 7 ahau*, and again in the next period *8 imix, 9 ik, 10 akbal...*

Years (both Haab and Tzolkin) were denoted by numbers 0, 1, ..., where the number 0 was the beginning of the world. Thus, the first day was:

Haab: 0 . pop 0

Tzolkin: 1 imix 0

Help professor M. A. Ya and write a program for him to convert the dates from the Haab calendar to the Tzolkin calendar.

## Input

The date in Haab is given in the following format:

*NumberOfTheDay. Month Year*

The first line of the input file contains the number of the input dates in the file. The next  $n$  lines contain  $n$  dates in the Haab calendar format, each in separate line. The year is smaller then 5000.

## Output

The date in Tzolkin should be in the following format:

*Number NameOfTheDay Year*

The first line of the output file contains the number of the output dates. In the next  $n$  lines, there are dates in the Tzolkin calendar format, in the order corresponding to the input dates.

### Sample Input

```
3
10. zac 0
0. pop 0
10. zac 1995
```

### Sample Output

```
3
3 chuen 0
1 imix 0
9 cimi 2801
```

---

Added by: Andres Tellez

Date: 2011-09-12

Time limit: 3s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 9532. Transportation

#### Problem code: TRANSJ

Ruratania is just entering capitalism and is establishing new enterprising activities in many fields including transport. The transportation company TransRuratania is starting a new express train from city A to city B with several stops in the stations on the way. The stations are successively numbered, city A station has number 0, city B station number  $m$ . The company runs an experiment in order to improve passenger transportation capacity and thus to increase its earnings. The train has a maximum capacity  $n$  passengers. The price of the train ticket is equal to the number of stops (stations) between the starting station and the destination station (including the destination station). Before the train starts its route from the city A, ticket orders are collected from all onroute stations. The ticket order from the station  $S$  means all reservations of tickets from  $S$  to a fixed destination station. In case the company cannot accept all orders because of the passenger capacity limitations, its rejection policy is that it either completely accept or completely reject single orders from single stations.

Write a program which for the given list of orders from single stations on the way from A to B determines the biggest possible total earning of the TransRuratania company. The earning from one accepted order is the product of the number of passengers included in the order and the price of their train tickets. The total earning is the sum of the earnings from all accepted orders.

### Input

The input file is divided into blocks. The first line in each block contains three integers: passenger capacity  $n$  of the train, the number of the city B station and the number of ticket orders from all stations. The next lines contain the ticket orders. Each ticket order consists of three integers: starting station, destination station, number of passengers. In one block there can be maximum 22 orders. The number of the city B station will be at most 7. The block where all three numbers in the first line are equal to zero denotes the end of the input file.

### Output

The output file consists of lines corresponding to the blocks of the input file except the terminating block. Each such line contains the biggest possible total earning.

## Sample Input

```
10 3 4
0 2 1
1 3 5
1 2 7
2 3 10
10 5 4
3 5 10
2 4 9
0 2 5
2 5 8
0 0 0
```

## Sample Output

```
19
34
```

---

Added by: Andres Tellez  
Date: 2011-09-12  
Time limit: 3s  
Source limit: 50000B  
Languages: All

## SPOJ Problem Set (classical)

### 9533. Kindergarten Counting Game

#### Problem code: KINDJ

Everybody sit down in a circle. Ok. Listen to me carefully.

“Woooooo, you scewwy wabbit!”

Now, could someone tell me how many words I just said?

#### Input and Output

Input to your program will consist of a series of lines, each line containing multiple words (at least one). A “word” is defined as a consecutive sequence of letters (upper and/or lower case).

Your program should output a word count for each line of input. Each word count should be printed on a separate line.

#### Sample Input

```
Meep Meep!  
I tot I taw a putty tat.  
I did! I did! I did taw a putty tat.  
Shsssssssssh ... I am hunting wabbits. Heh Heh Heh Heh ...
```

#### Sample Output

```
2  
7  
10  
9
```

---

Added by: Andres Tellez

Date: 2011-09-12

Time limit: 3s

Source limit: 50000B

Languages: All



## SPOJ Problem Set (classical)

### 9534. Turn on the lights

#### Problem code: JZPLIT

Recently Zippy received a puzzle. It is an  $n*m$  matrix. In each cell of the matrix, there is a switch and a light. Once he flips the switch in a cell, lights in the same column or the same row as the cell (including itself) change to its opposite state (which means: on->off off->on). Zippy wants to turn on all the lights. Please help him to solve the puzzle.

#### Input

First line,  $n, m$ .

The following  $n$  lines, each line is a  $m$ -length string, representing the original state. (0 means on and 1 means off)

$1 \leq n, m \leq 1000$

First line,  $n, m$ .

The following  $n$  lines, each line is a  $m$ -length string, representing the original state. (0 means on and 1 means off)

$1 \leq n, m \leq 100$

#### Output

$n$  lines, each line is a  $m$ -length string. It's obvious that if a valid solution exists, there exists a solution that every switch is flipped no more than once. So 1 means the switch is flipped once and 0 means the switch remains unflipped.

It's guaranteed that there always exists a solution. If there are multiple solutions, output any of them.

#### Example

**Input :**

```
2 3
010
010
```

**Output :**

```
010
101
```

---

Added by: sevenkplus

Date: 2011-09-12

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 9535. Turn on the lights 2

#### Problem code: JZPLIT2

Recently Zippy received a puzzle. It is an  $n*m$  matrix. In most cells of the matrix, there is a light with a switch. However, some cells do not contain a light with a switch, and they are called "blocks". Once he flips the switch in a cell, lights in visible cells from it (including itself) change to its opposite state (which means: on  $\rightarrow$  off off  $\rightarrow$  on). One cell is visible from another, iff they are in the same row or the same column, and there aren't any blocks between them (and of course the two cells should not be blocks). Zippy wants to turn on all the lights. Please help him to solve the puzzle.

#### Input

First line,  $n, m$ .

The following  $n$  lines, each line is a  $m$ -length string, representing the original state. (0 means on, 1 means off and 2 means a block)

$1 \leq n, m \leq 300$

number of blocks  $\leq \max(n, m)$

#### Output

$n$  lines, each line is a  $m$ -length string. It's obvious that if a valid solution exists, there exists a solution that every switch is flipped no more than once. So 1 means the switch is flipped once and 0 means the switch remains unflipped. Of course, a block do not contain a switch, so for the cell, you should always output 0.

It's guaranteed that there always exists a solution. If there are multiple solutions, output any of them.

Firstline,  $n, m$ .

The following  $n$  lines, each line is a  $m$ -length string, representing the original state. (0 means on, 1 means off and 2 means a block)

#### Example

**Input :**

```
2 3
011
121
```

**Output :**

```
001
100
```

---

Added by: sevenkplus  
Date: 2011-09-12  
Time limit: 1s-5s  
Source limit:50000B  
Languages: All

## SPOJ Problem Set (classical)

### 9543. Dynamic Congruence Equation System

#### Problem code: DCES

Consider the congruence equation system as the following form:

$$x[1] = k_1 x[p_1] + b_1 \pmod{10007}$$

$$x[2] = k_2 x[p_2] + b_2 \pmod{10007}$$

...

$$x[n] = k_n x[p_n] + b_n \pmod{10007}$$

We will ask you to achieve some instructions as the following form:

- A i: Ask the current  $x[i]$ 's value. (or "-1" for no solution, "-2" for multiply solution.)
- C i k p b: Modify the  $i$ th congruence equation to a new one.

#### Input

The first two lines are N and Q.

Than following Q lines are the query above.

(..  $N \leq 30,000$ ,  $Q \leq 100,000$  ..)

#### Output

For each query, print the result.

#### Example

**Input 1:** 52 2 12 3 22 4 32 5 42 3 55A 1A 2C 5 3 1 1A 4A 5

**Output 1:** 4276714142562126**Input 2:** 40 1 01 3 01 4 01 2 06A 1A 2A 3A 4C 1 1 5 1A 1**Output 2:** 0-2-2-2-1

---

Added by: xiaodao

Date: 2011-09-14

Time limit: 1s-5s

Source limit: 50000B

Languages: All except: C++ 4.0.0-8

Resource: FHQ's query

## SPOJ Problem Set (classical)

### 9547. Counting d-pairs

#### Problem code: DPAIR

You're given a sequence  $A$  of  $N$  non-negative integers. Answer  $Q$  queries, where each query consists of two integers:  $a, b$ . The answer is number of pairs of integers  $i$  and  $j$  that satisfy these conditions:

$$1 \leq i \leq j \leq N$$

$$a \leq j-i+1 \leq b$$

all elements of  $A$  with indices from range  $[i, j]$  are mutually distinct. (indexing starts with 1)

#### Constraints :

$$1 \leq N \leq 8 \cdot 10^5$$

$$1 \leq Q \leq 2 \cdot 10^5$$

$$0 \leq A[k] \leq 10^6, \text{ for every integer } k \text{ between } 1 \text{ and } N, \text{ inclusive}$$

$$1 \leq a \leq b \leq N$$

#### Input

First line of input contains integer  $N$ . Second line contains  $N$  integers representing sequence  $A$ . Third line is integer  $Q$ , number of queries. Next  $Q$  lines has 2 integers,  $a$  and  $b$ .

#### Output

In the  $i$ -th line output the answer for  $i$ -th query.

#### Example

**Input:** 51 2 3 4 511 1**Output:** 5**NOTE: IO is huge**

---

Added by: Buda

Date: 2011-09-16

Time limit: 0.800s

Source limit: 50000B

Languages: All

Resource: own problem, thanks to lpp

## SPOJ Problem Set (classical)

### 9569. Sum of Pairwise Products

#### Problem code: PAIRSUM

Given  $N$  non negative numbers, the task is to answer  $M$  queries.

Each query is as follows:

Given  $u, v$  you need to find the pairwise product sum ( $u$  and  $v$  are zero indexed)

$$a_u a_u + a_{u+1} a_{u+1} + a_{u+1} a_u + a_{u+2} a_{u+2} + a_{u+2} a_{u+1} + a_{u+2} a_u + \dots + a_v a_v + a_v a_{v-1} + \dots + a_v a_u$$

#### Input

$\langle N \rangle$

$\langle a_0 \rangle \langle a_1 \rangle \dots \langle a_{N-1} \rangle$

$\langle M \rangle$

$\langle u_1 \rangle \langle v_1 \rangle$

$\langle u_2 \rangle \langle v_2 \rangle$

...

$\langle u_M \rangle \langle v_M \rangle$

#### Output

Print the answer for each query in a separate line.

#### Example

**Input :**

5

2 0 1 3 3

3

0 2

1 2

3 4

**Output :**

7

1

27

**Constraints**

$u \geq 0, u < N$

$v \geq 0, v < N$

$u \leq v$

$N \leq 100000$

$M \leq 100000$

$0 \leq a_i \leq 1000000$

---

Added by: Manukranth

Date: 2011-09-20

Time limit: 1s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 9570. Counting binary strings

#### Problem code: STRCOUNT

Let  $f(n,k)$  is the number of length  $n$  binary strings for which the length of the longest substring of ones is equal to  $k$ . You have to build a table of these values.

#### Input

None.

#### Output

63 lines - the  $n$ -th of them consists of  $n+1$  values:  $f(n,0)$   $f(n,1)$  ...  $f(n,n)$ .

#### Example

```
1 1
1 2 1
1 4 2 1
1 7 5 2 1
```

...

---

Added by: Noszály Csaba  
Date: 2011-09-20  
Time limit: 1s  
Source limit: 3333B  
Languages: All  
Resource: folklore



## SPOJ Problem Set (classical)

### 9577. Dynamic Tree Connectivity

#### Problem code: DYNACON1

A forest of unrooted trees initially consists of  $N$  ( $1 \leq N \leq 100,000$ ) single-vertex trees. The vertices are numbered from 1 to  $N$ .

Your task is to maintain that forest and answer connectivity queries.

All edges in the problem are **undirected**.

You will receive the following queries, where ( $1 \leq A, B \leq N$ ) :

- **add** A B : add an edge between vertices A and B, where initially there is no path between A and B.
- **rem** A B : remove edge between vertices A and B, where initially there is an edge between A and B.
- **conn** A B : print **YES** if there is a path between A and B and **NO** otherwise, where initially A and B are different.

#### Input

The first line of input contains the number of initial single-vertex trees  $N$  and the number of queries  $M$  ( $1 \leq M \leq 100,000$ ). The following  $M$  lines contain queries.

#### Output

For each **conn** query output **YES** or **NO**. Pay attention to letter case.

#### Example

**Input:** 5 11 conn 1 5 add 1 2 add 1 3 add 3 4 add 5 4 conn 1 5 rem 4 5 conn 1 5 rem 3 4 add 3 5 conn 1 5 **Output:** NO YES NO YES This example will be the first test case.

---

Added by: Andrey Naumenko

Date: 2011-09-23

Time limit: 30s

Source limit: 50000B

Languages: All

## SPOJ Problem Set (classical)

### 9587. The Prime conjecture

#### Problem code: PRIMEZUK

Euclid may have been the first to prove that there are infinitely many primes. Let's walk through his proof, as even today, it's regarded as an excellent model of reasoning.

Let us assume the converse, that there only a finite number of primes:  $p_1, p_2, \dots, p_n$ . Let  $m = 1 + \prod_{i=1}^n p_i$ , i.e. the product of all of these primes plus one. Since this number is bigger than any of the primes on our list,  $m$  must be composite. Therefore, some prime must divide it. But which prime? In fact,  $m$  leaves a remainder of 1 when divided by any prime  $p_i$ , for  $1 \leq i \leq n$ . Thus,  $p_1, p_2, \dots, p_n$  cannot be the complete list of primes, because if so  $m$  must also be a prime. Since this contradicts the assumption it means there cannot exist such a complete list of primes; therefore the number of primes must be infinite!

Your mathematician friend Wannabe\_Fermat has come up with a conjecture which he keeps telling to anyone who is willing to lend an ear: "The number  $m$  that we come up with when multiplying any  $n$  distinct prime numbers and adding 1 to this result is also a prime". You as Wannabe\_Zuckerburg, are becoming jealous as your friend's conjecture is gaining popularity and decide to come up with a program that finds counter-examples to shut him up forever.

#### Input

The first line contains  $T$ , the number of test-cases. Each test-case consists of two lines, the first line containing the number  $n$ - the number of primes in our list, and second line containing  $n$  space-separated prime numbers. Moreover, following things can be safely assumed:

$1 \leq T \leq 10$

$n$  will be at most 9 and  $m$  can be contained in 32-bits.

#### Output

For each input case  $x$ , the output is of the format "Case #x:  $y$ ", where  $y = m$  if  $m$  is a prime, else  $y$  is the largest prime factor of  $m$ .

#### Example

**Input :**

232 3 542 7 5 11

**Output :**

Case #1: 31 Case #2: 257

**Explanation:** Case #1 - 31 is a prime number Case #2 -  $2 \cdot 5 \cdot 7 \cdot 11 + 1 = 771$ , which can be written as  $3 \cdot 257$ .

---

Added by: Siddharth Kothari  
Date: 2011-09-25  
Time limit: 3s  
Source limit:50000B  
Languages: All  
Resource: own

## SPOJ Problem Set (classical)

### 9636. A Canvas Building

#### Problem code: ACANVAS

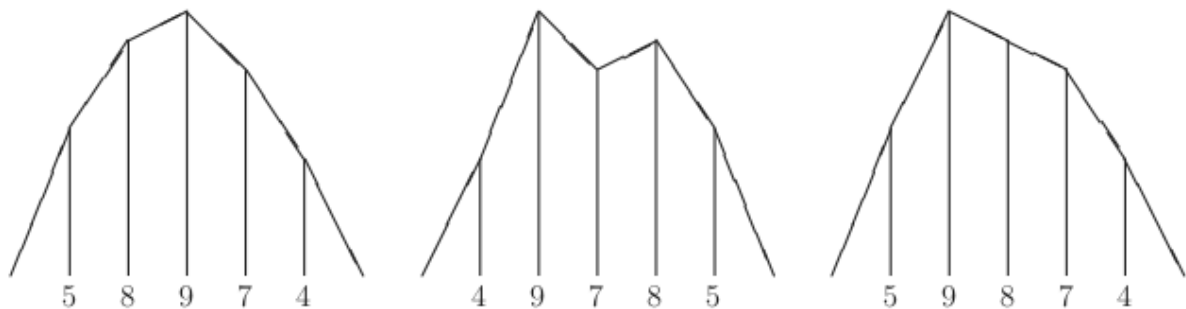
Original statement in spanish at

<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>

The International Canvas Preparation Committee (ICPC) has a peculiar procedure for setting up its canvases. The procedure depends on a bidimensional view of the canvases.

A given canvas is set up using  $N$  poles of different heights. To set up the canvases, the ICPC uses the following procedure. First,  $N+2$  points are marked on the floor, all on the same line, so that two consecutive points are always separated by a distance of exactly two feet. Afterwards, a pole is placed vertically over each of the  $N$  central points. Finally, the canvas is extended over the poles, joining the upper end of each pole with the upper end of neighboring poles. The first and last poles are joined with the free points on the floor.

The next figure shows 3 possible ways of setting up a canvas using the instructions mentioned before, with pole heights of 4, 5, 7, 8 and 9.



After years of hard work, the ICPC came to the conclusion that in order to obtain useful and sturdy canvases, it is necessary that the angle formed by two consecutive patches of canvas at the end of a pole, measured towards the inside, is *strictly* less than 180 degrees. In the figure shown, only the canvas on the left satisfies this condition. The canvas in the middle has an angle greater than 180 degrees at poles of heights 4 and 7, while the canvas on the right has an angle of exactly 180 degrees at the pole of height 8. We say a canvas is valid when it adheres to the ICPC recommendation.

Of course, given the number of poles and their heights, there are a lot of different ways of placing them, some of which will produce valid canvases and some of which will not. The task at hand is to, given this data, count the number of different valid canvases which can be set up. Two valid canvases are considered different if the sequence of heights of the poles in one of them, read from left to right, is different from the sequence of heights of the other one, read in the same way.

## Input

The input contains several test cases. Each test case is described on two consecutive lines. The first line contains one integer  $N$  which indicates the number of poles ( $1 \leq N \leq 60$ ). The second line contains  $N$  integers  $H_i$  representing the heights of the poles in feet ( $1 \leq H_i \leq 10^9$  for  $1 \leq i \leq N$ ). The last line of the input contains a single -1 and should not be processed as a test case.

## Output

For each test case output a single line with an integer representing the number of different valid canvases which can be set up using the given poles.

## Example

### Input:

```
5
4 5 7 8 9
7
33 65 57 64 63 61 49
1
1000000000
3
2 2 3
3
1 3 1
4
2 2 2 2
-1
```

### Output:

```
2
16
1
1
0
0
```

---

Added by: Pablo Ariel Heiber

Date: 2011-10-04

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: Argentinian Programming Tournament 2011

## SPOJ Problem Set (classical)

### 9637. Black and White

#### Problem code: BANDW

*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

The famous game Black and White is a solitaire which is played using a set of identical chips. Each chip has two faces with different colors. Surprisingly enough, those colors are black and white.

The game starts by placing  $N$  chips forming a single line. There exists an objective pattern which is a given sequence of  $N$  colors black or white. In a single move, the player can choose a group of consecutive chips and invert their color, in other words, for each chip in the group, the color which was facing up, is facing down and the one which was facing down is facing up. The game finishes when the facing up colors of the chips are equal to the objective pattern.

Barby has just discovered this game and soon she realized that you can always won by inverting each chip individually if needed. To make this game more challenging to her, she wanted to win in the least possible number of moves. Note that Barby just cares about how many moves she makes, and it doesn't matter how many chips are inverted in each move. To know how well is Barby playing, she asked you to make a program that given the chip's initial position and the objective pattern, shows the least possible number of moves to win the game. Are you going to say no?

#### Input

The input contains several test cases. Each test case is described in a single line that contains two non-empty words  $S$  and  $T$  of equal size and at most 500 letters each.  $S$  indicates the chip's initial position while  $T$  represents the objective pattern. Both words only contain uppercase letters "B" and "N", representing respectively White and Black. The last line of the input contains two asterisks separated by a single space and should not be processed as a test case.

#### Output

For each test case output a single line with an integer representing the least possible number of moves such that you can change the chip's which are initially positioned as described in  $S$  to form the pattern given by  $T$ .

#### Example

##### Input:

```
BBNBBNBBBB NNNNNBBNNB
BNBNB NBNBN
BNBN NBNB
B B
* *
```

**Output:**

3  
1  
1  
0

---

Added by: Pablo Ariel Heiber

Date: 2011-10-04

Time limit: 2s

Source limit:50000B

Languages: All

Resource: Argentinian Programming Tournament 2011

## SPOJ Problem Set (classical)

### 9638. Circuits

#### Problem code: CIRCUITS

*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

Everyone is aware of the existence of the well known Nordenskjold Archipelago, located in the Arctic Ocean and belonging to the Krasnoyarsk Krai of Russia. This archipelago consists of a groups of  $N$  islands and  $M$  aquatic routes between some pairs of islands. Each route connects a pair of islands and for each pair there is at most one route connecting them.

Considering the popularity of Nordenskjold Archipelago, Krasnoyarsk's authorities are concerned about its touristic value. The touristic value of the archipelago is given by the total number of islands that belong to at least one "touristic circuit". A touristic circuit is a path starting and ending in the same island that visits at least three different islands, never visits the same island more than once and uses just aquatic routes to go from one island to the next one.

Krasnoyarsk's authorities want to know the minimum number of additional aquatic routes that must be built so that every island belongs to at least one touristic circuit. Your task is to write a program that answers this question.

#### Input

The input contains several test cases. Each test case is described in several lines. The first line contains two integer numbers  $N$  and  $M$  ( $3 \leq N \leq 100$ ,  $1 \leq M \leq 1000$ ) which indicate the number of islands and the number of aquatic routes, respectively. Each island is identified by a number between 1 and  $N$ . Each of the next  $M$  lines contains two integers  $U$  and  $V$  ( $1 \leq U < V \leq N$ ), indicating that there is an aquatic route connecting islands  $U$  and  $V$ . You may assume that in each test case there is at most one aquatic route connecting the same pair of islands. The last line of the input contains the number -1 twice and should not be processed as a test case.

#### Output

For each test case output a single line with an integer representing the minimum number of additional aquatic routes that must be built so that every island belongs to at least one touristic circuit.

#### Example

**Input:**

```
3 1
1 3
9 10
1 2
2 3
1 3
7 9
```



5 9  
5 7  
6 8  
4 6  
4 8  
8 9  
4 4  
1 2  
1 4  
1 3  
2 3  
12 9  
1 7  
2 6  
4 9  
9 10  
8 12  
1 5  
1 8  
8 11  
4 10  
-1 -1

**Output:**

2  
0  
1  
4

---

Added by: Pablo Ariel Heiber

Date: 2011-10-04

Time limit: 3s

Source limit:50000B

Languages: All

Resource: Argentinian Programming Tournament 2011

## SPOJ Problem Set (classical)

### 9639. Doing Nothing

#### Problem code: DONOTHIN

*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

A young couple uses to make their time as productive as possible. This activity is quite stressful, so they decided to "waste" some time watching their favorite TV series.

The series has  $N$  seasons, and each season has a possibly different number of chapters according to its success, actors availability, production time and other external factors. Each chapter has a duration of exactly  $M$  minutes.

To keep up with the plot, before watching each new season, they watch, without any rest, all the chapters of all the previous seasons. This has just made them concern about how much time they will be spending with this hobby, which should keep them calm. They need your help so they don't get back to the stressful situation they had.

#### Input

The input contains several test cases. Each test case is described in two lines. The first line has two integers  $N$  and  $M$  representing respectively how many seasons the series has and the duration in minutes of each chapter ( $1 \leq N \leq 10^5$ ,  $1 \leq M \leq 10^6$ ). The next line has  $N$  integers  $C_i$  representing how many chapters each season has sorted chronologically. ( $1 \leq C_i \leq 100$  for  $1 \leq i \leq N$ ). The last line of the input contains the number -1 twice and should not be processed as a test case.

#### Output

For each test case output a single line with an integer representing the number of minutes the couple spends in watching the whole series.

#### Example

##### Input:

```
6 20
24 23 15 22 24 17
1 100
100
10 1000000
99 99 99 99 99 99 99 99 99 99
-1 -1
```

##### Output:

9000  
10000  
5445000000

---

Added by: Pablo Ariel Heiber  
Date: 2011-10-04  
Time limit: 4s  
Source limit:50000B  
Languages: All  
Resource: Argentinian Programming Tournament 2011

## SPOJ Problem Set (classical)

### 9640. Equilibrium

#### Problem code: EQUI

*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

The mean and the median usually confuse the students because of their similar spelling, but they are quite different concepts. In this problem we are going to work with the mean and the median of a set consisting of  $N$  pairwise distinct integers, where  $N$  is odd. The mean of such set is defined, as usual, as the sum of the numbers divided by  $N$ , while the median is the unique element in the set that is greater than  $(N-1)/2$  of its elements, and less than the other  $(N-1)/2$  elements in the set. For instance, if the set is  $\{0, 2, 6, 4, 13\}$ , then the mean is 5 while the median is 4.

We aim to make student's lives easier by generating "balanced" sets, that is, sets consisting of an odd number of pairwise distinct integers where the mean and the median coincide. For example, the set  $\{0, 2, 6, 4, -2\}$  is balanced, since it has  $N=5$  different integers, and the mean and the median are both equal to 2.

The following procedure has been suggested in order to obtain balanced sets. A set with an even number of distinct integers is chosen, and an extra integer distinct from every element in the set is added to it, in such a way that the resulting set is balanced. We want you to check if the given procedure works. Therefore your task is, given  $N-1$  distinct integers, with odd  $N$ , count the number of balanced sets that can be formed by following the described procedure.

#### Input

The input contains several test cases. Each test case is described with two lines. The first line contains a single odd positive integer  $N$  that indicates the number of elements the balanced set must have ( $3 \leq N \leq 499$ ). The second line contains  $N-1$  distinct integers  $Z_i$  that represent the given elements of the set ( $-10^{14} \leq Z_i \leq 10^{14}$  for  $1 \leq i \leq N-1$ ). The last line of the input contains the number -1, and should not be processed as a test case.

#### Output

For each test case, output a single line with an integer representing the total number of different balanced sets that can be obtained by adding an integer to the given set, as explained in the problem description.

#### Example

**Input:**

```
5
0 2 6 4
7
1 2 3 4 5 8
3
-1000000000000000 1000000000000000
-1
```

**Output:**

```
3
1
3
```

---

Added by: Pablo Ariel Heiber  
Date: 2011-10-04  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Argentinian Programming Tournament 2011

## SPOJ Problem Set (classical)

### 9641. Factory of Bridges

#### Problem code: FBRIDGES

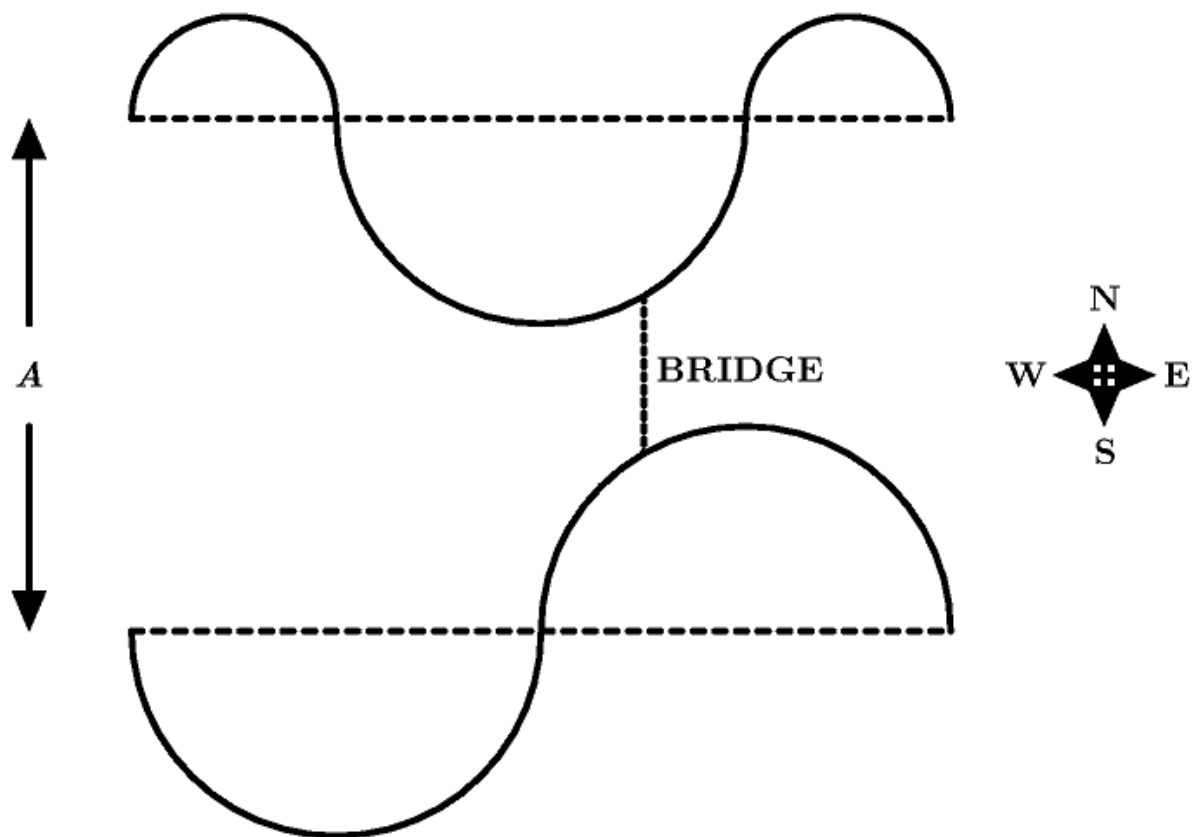
*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

In the Central Area of Macedonia there is a river following the East-West direction. The region's inhabitants want to build a bridge that crosses the river in the North-South direction, a task for which they have contracted the cheapest bridge factory they know, the Short Bridge Construction Company. As shown by its name, this construction company specializes in building the shortest possible bridges for each river.

The first thing that the company does is to model the river's shores (Northern and Southern). Each of these is considered as being formed by semicircles of varying radii, alternatively oriented to one side or the other, with all their centers collinear. The two lines that are defined by the centers of the semicircles of each shore have the East-West direction, and are separated by a distance **A** one from the other. The value **A** is called the width of the river. Note that both shores are aligned, that is, the Northern shore neither begins nor ends further to the West or to the East than the Southern shore.

In the following figure you can see the model of a certain river. In the Northern shore the semicircle furthest to the West is oriented to the North, whereas in the Southern shore the semicircle furthest to the West is oriented to the South. In each shore the orientations of the following semicircles alternate. The shortest possible bridge in the North-South direction is the one shown.



Your task is to help the construction company finding the length of the shortest possible bridge connecting both shores of the river in the North-South direction.

## Input

The input contains several test cases. Each test case is described by three lines. The first line contains an integer number  $A$ , denoting the width of the river in meters ( $3 \leq A \leq 10^4$ ). The second line describes the Northern shore of the river, while the third line describes its Southern shore.

The description of each shore begins with an integer number  $C$  giving the number of semicircles that are used to model that shore ( $1 \leq C \leq 1000$ ). This is followed by a character "N" or "S", meaning that the semicircle furthest to the West in this shore is oriented to the North or to the South, respectively. The description ends with  $C$  integer numbers  $R_i$ , representing the radii in meters of the semicircles that form the shore ( $1 \leq R_i < A/2$  for  $1 \leq i \leq C$ ). The semicircles are given in order, from the one furthest to the West (radius  $R_1$ ) to the one furthest to the East (radius  $R_C$ ). The orientations of the semicircles alternate between North and South after the first semicircle, whose orientation is given as described above. Assume that in each test case both shores are aligned, which implies that the sum of the radii of the semicircles forming each shore is the same.

The end of the input is denoted by a line containing the number -1.

## Output

For each test case, print a single line containing a rational number representing the length in meters of the shortest bridge that connects both shores of the given river in the North-South direction. Round the result to the nearest rational number with 2 decimal digits. In case of ties, round up. Note that you should always print 2 digits after the dot, even if this means ending with a zero.

## Example

### Input:

```
5
3 N 1 2 1
2 S 2 2
3
1 N 1
1 S 1
3
1 S 1
1 N 1
-1
```

### Output:

```
1.54
3.00
1.00
```

---

Added by: Pablo Ariel Heiber

Date: 2011-10-04

Time limit: 10s

Source limit: 50000B

Languages: All

Resource: Argentinian Programming Tournament 2011



## SPOJ Problem Set (classical)

### 9642. Getting There Fast

#### Problem code: GETFAST

*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

Gabriela drives a school bus. Being one of the few women who have that job, she is always mocked by the male drivers. To improve her status, she decided that besides driving responsibly she is going to drive more efficiently. Her idea is to finish her route spending as little time as possible, without violating any traffic rule.

The bus Gabriela drives has a very modern driving system that allows her to adjust the acceleration to any real number instantly. Hence, the acceleration is constant by intervals, jumping to another acceleration whenever Gabriela decides so. If  $v$  is the bus' speed at a given instant of time, and  $a$  its acceleration that remains constant over a period of time  $t$ , then the speed at the end of that period will be  $v + at$ . Moreover, the bus will move a distance of  $at^2/2 + vt$  during that period of time.

The traffic rules prevent vehicles from using an acceleration greater than  $A$ , or a deceleration less than  $D$ , i.e. the acceleration  $a$  at any time must satisfy  $-D \leq a \leq A$ . Moreover, there are check points along the route of the bus where the speed must lie within a certain given interval.

Gabriela knows in advance the location of the check points, the total length of the route, and the constants  $A$  and  $D$ . At the beginning of the route the speed and acceleration of the bus are both 0. There are no additional restrictions regarding the speed or the acceleration the bus must have at the end of the route (in particular, it is not necessary to stop in the end). Your job is to use this data to determine the minimum time that Gabriela needs in order to finish the route without violating the rules.

#### Input

The input contains several test cases. Each test case is described using several lines. The first line of each test case contains four integers  $N$ ,  $L$ ,  $A$  and  $D$ .  $N$  represents the total number of check points that are present in Gabriela's route ( $1 \leq N \leq 10^5$ ).  $L$  indicates the length of the route in meters ( $2 \leq L \leq 10^7$ ).  $A$  and  $D$  represent, respectively, the maximum allowed acceleration and deceleration for the bus ( $1 \leq A, D \leq 100$ ). Each of the following  $N$  lines describe a different check point using three integers  $X$ ,  $V$  and  $W$  that represent, respectively, the distance between the check point and the starting point of the route ( $1 \leq X \leq L-1$ ), the minimum speed, and the maximum speed allowed for the bus at the time it passes by that check point ( $1 \leq V, W \leq 100$ ). Assume that in each test case the check points are given in ascending order of distance from the start point of the route, and no two check points are at the same distance from the start point. In this problem, the length is expressed in m (meters), the speed in m/s, and the acceleration in  $\text{m/s}^2$ . The end of the input is indicated by a line containing the number -1 four times, and should not be processed as a test case.

## Output

For each test case, output a single line containing a rational that represents the minimum time (in seconds) needed for Gabriela to finish her route without violating any traffic rule, or an asterisk if it is impossible to do that. Round the answer to the nearest rational with two decimal digits. In case of a tie, round up. Print exactly two digits after the decimal point, even if that means ending the number with 0's.

## Example

### Input:

```
1 40 10 1
20 21 21
1 40 10 5
20 20 20
1 20 10 50
10 14 15
5 1000 2 5
400 30 80
600 35 50
700 10 30
900 30 40
950 10 30
-1 -1 -1 -1
```

### Output:

```
*
2.83
2.00
35.96
```

---

Added by: Pablo Ariel Heiber

Date: 2011-10-04

Time limit: 10s

Source limit: 50000B

Languages: All

Resource: Argentinian Programming Tournament 2011

## SPOJ Problem Set (classical)

### 9643. He is Lazy

#### Problem code: HEISLAZY

*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

As we all know, Humberto is really lazy. He is so lazy that he sticks his nose out of the window so that the wind will blow it for him. Obviously, he hasn't worked at all in his whole life. However, he got lucky and won a lot of money in the lottery. With some of that money he bought an empty field, and made build several houses inside of it, where he moved with his family and friends. Thus, Humberto can go in a straight line from any point in his field to any other, without having to make detours because of urban design (for the sake of simplicity, we consider the objects in Humberto's field as dots, so they don't interfere in Humberto's way).

Sadly, that was not enough for Humberto, so in order to walk even less he decided to have installed some catapults in strategic points of his field. Each catapult can send him from the point where it is installed, to any point at a certain fixed distance (that depends on the range of the catapult).

But, in spite of simplifying his life, the catapults made the task of choosing a way in the field a real headache, because Humberto wants to walk as less as possible. As tired as he is of all his problems, he decided to use the rest of his money to hire you to tell him the minimum distance he has to walk to move from a given point in the field to another.

#### Input

The input contains several test cases. Each test case is described in several lines. The first line contains five integers  $N$ ,  $P_X$ ,  $P_Y$ ,  $L_X$  and  $L_Y$ .  $N$  represents the number of catapults in the field ( $1 \leq N \leq 100$ ). The pair  $(P_X, P_Y)$  indicates the coordinates in the  $XY$  plane of the starting point for Humberto, while the pair  $(L_X, L_Y)$  indicates analogously the destination point ( $1 \leq P_X, P_Y, L_X, L_Y \leq 10^9$ ). Each of the next  $N$  lines describes a different catapult, using three integers  $C_X$ ,  $C_Y$  and  $F$ , that indicate the point  $(C_X, C_Y)$  where the catapult of strength  $F$  is installed. This means that Humberto may move, without walking, from the point  $(C_X, C_Y)$  to any point in the plane that is at a distance of *exactly*  $F$  from  $(C_X, C_Y)$ . Assume that in each test case all the points given in the plane are different. The end of the input is indicated by a single line containing the number -1 five times, and it should not be processed as a test case.

#### Output

For each test case, output a single line containing a rational number that represents the minimum distance Humberto has to walk in order to get from the starting point to the destination point, using some or none of the catapults. Round the answer to the nearest rational with two decimal digits. In case of a tie, round up. Print exactly two digits after the decimal point, even if that means ending the number with 0's.

## Example

### Input:

```
1 10 10 20 10
11 10 9
1 20 10 10 10
11 10 9
2 1 1 12 1
3 1 6
8 1 5
1 12 12 1 1
6 6 9
5 10 10 1 1
3 3 7
8 3 7
8 8 7
3 8 7
5 5 5
-1 -1 -1 -1 -1
```

### Output:

```
1.00
10.00
4.00
10.41
5.11
```

---

Added by: Pablo Ariel Heiber

Date: 2011-10-04

Time limit: 15s

Source limit:50000B

Languages: All

Resource: Argentinian Programming Tournament 2011

## SPOJ Problem Set (classical)

### 9644. Imperialism

#### Problem code: IMPER

*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

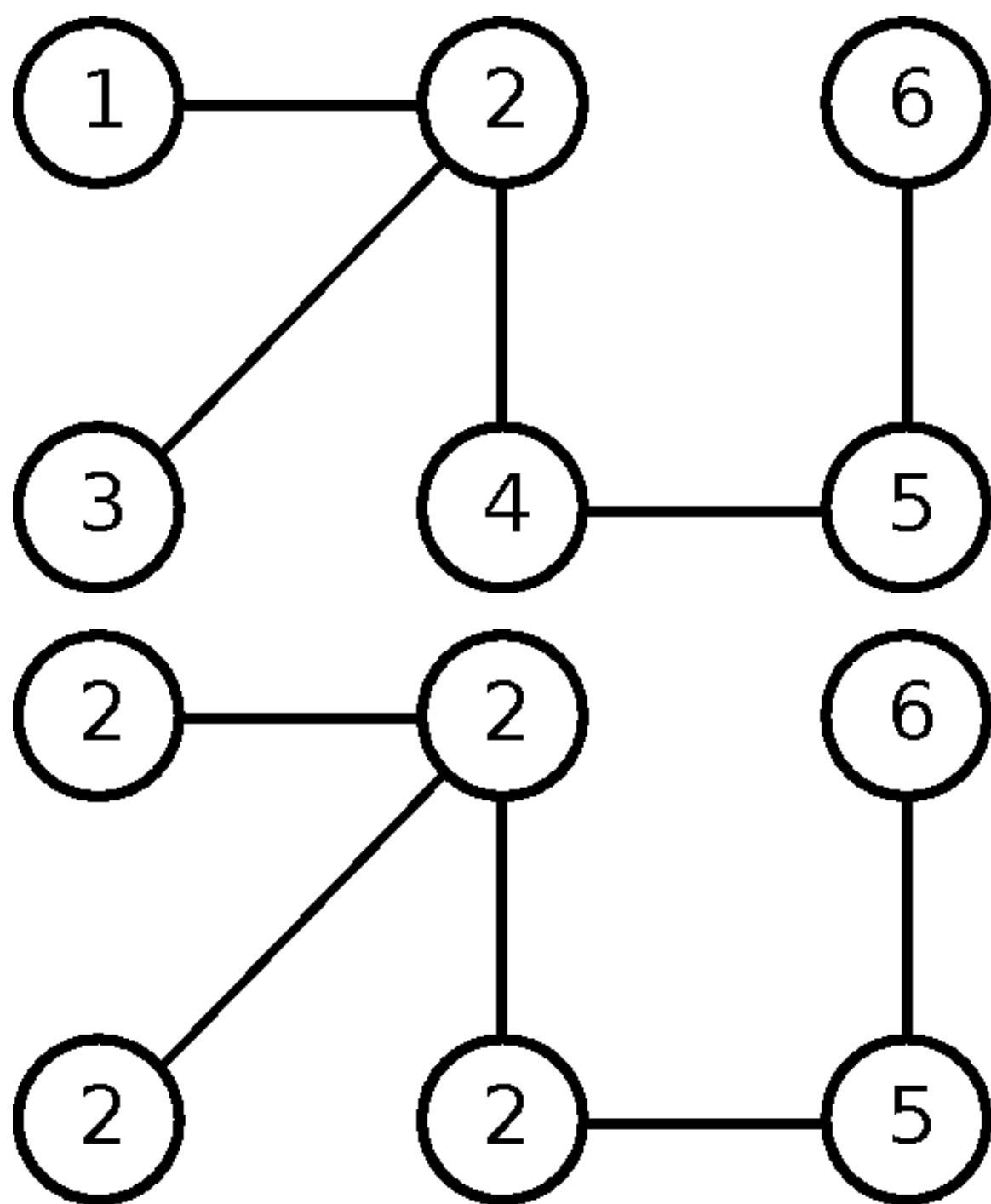
The ambition of conquest and expansion is a very well known disease in planet Earth... and also in the entire universe.

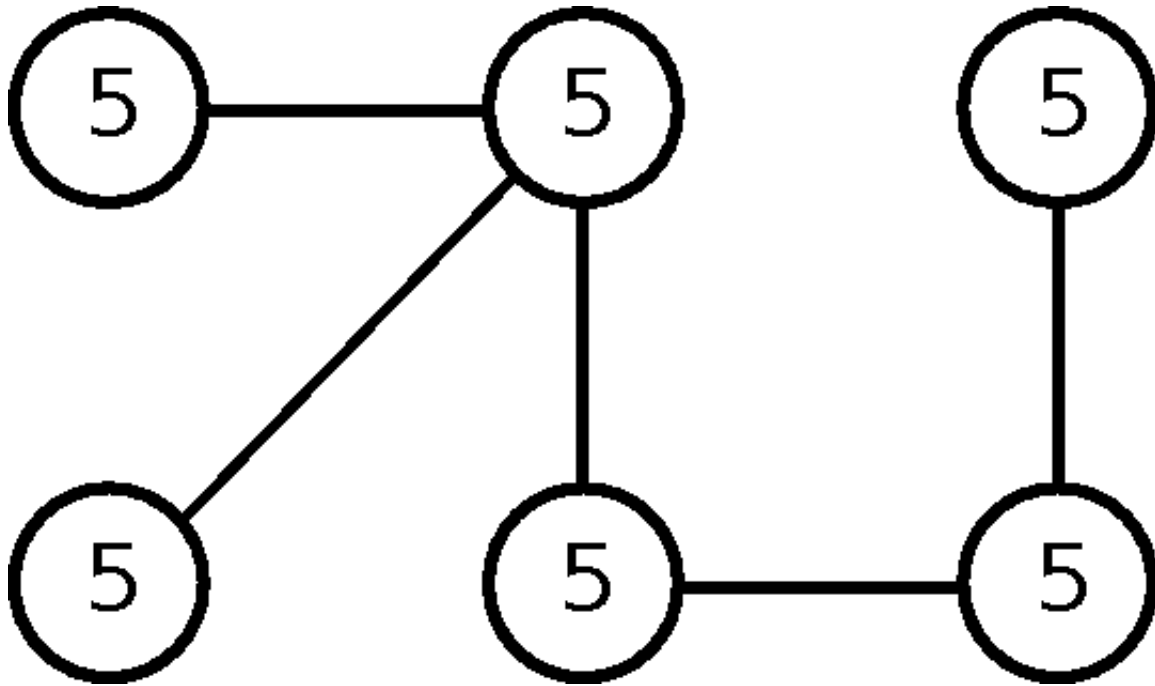
In planet "Imperius" several fortresses have been built one at a time and each one of them but the first was connected at the moment of its construction to a previously built fortress by a direct path, for commercial purposes.

Imperius was becoming one of the most peaceful and prosperous planet in the universe, until they built no more fortresses. At that moment,  $N$  different empires emerged (numbered from 1 to  $N$ ), each one of them dominating a different fortress. And the thirst of conquest took Imperius. Thus, every year, exactly one of the living empires conquers every neighbor empire, and dominates every fortress belonging to them. Two empires are considered neighbors if there exist two fortresses joined by a path, each one dominated by one different empire of these two.

Eventually a single empire will dominate every fortress. Your task is to find the minimum number of years such that this can happen.

As an example, on the left side of the figure below a possible scenario in which six fortresses are initially dominated by six different empires is shown. Each fortress is tagged with the identification number of the empire dominating it. If empire 2 conquered every neighbor on the first year, the the situation would be as in the central figure. Finally, if empire 5 conquered his neighbor empires, it would end up dominating every fortress, as seen on the right side of the figure.





## Input

The input contains several test cases. Each test case is described in two lines. The first line contains an integer  $N$  ( $2 \leq N \leq 10^4$ ) representing the number of fortresses in planet Imperius. The next line contains  $N-1$  integers  $P_i$  indicating that the fortress  $i+1$  was connected to fortress  $P_i$  ( $1 \leq P_i \leq i$  for  $1 \leq i \leq N-1$ ). The last line of the input contains a single -1 and should not be processed as a test case.

## Output

For each test case output a single line with an integer representing the minimum number of years such that a single empire may dominate every fortress.

## Example

### Input:

```

6
1 2 2 4 5
7
1 1 3 3 4 4
6
1 2 2 2 2
-1

```

### Output:

```

2
2
1

```

---

Added by: Pablo Ariel Heiber  
Date: 2011-10-04  
Time limit: 3s  
Source limit: 50000B  
Languages: All  
Resource: Argentinian Programming Tournament 2011



## SPOJ Problem Set (classical)

### 9645. Joy of CompuTennis

#### Problem code: JOCTENIS

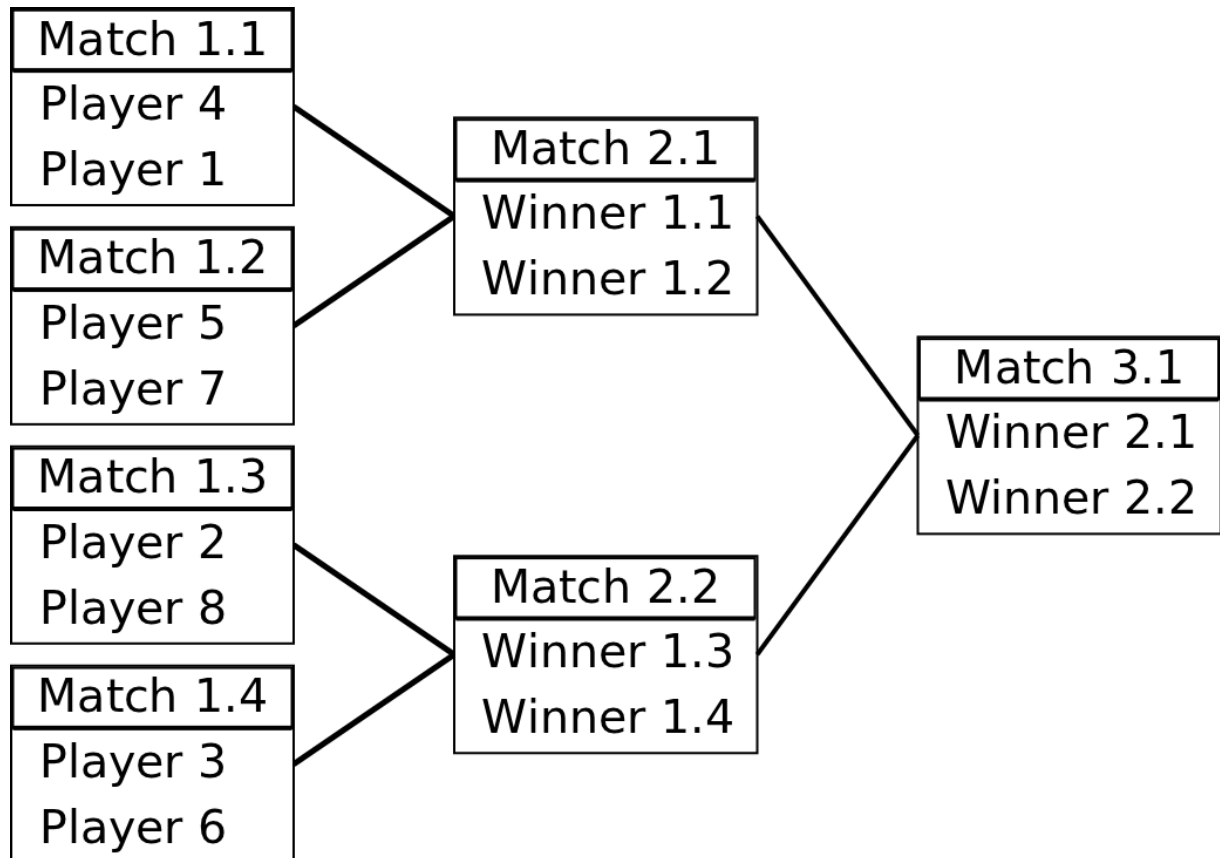
*Original statement in spanish at*

*<http://www.dc.uba.ar/events/icpc/download/problems/taip2011-problems.pdf>*

The Modern Club Association organizes every year a tournament of CompuTennis, which is a sport specially adapted to a public without any mensurable physical qualities. The rules of CompuTennis are very complex (suffices to say that they involve coding with your elbow glued to your ear), but fortunately it is not necessary to know them in detail to solve this problem. You just need to know that in a CompuTennis match two players oppose each other, and the match is won by the player that first wins **S** sets; in turn, each set is composed of several games, and to win a set a player must win at least **J** games, with a difference of at least **D** more games won than the opponent.

The tournament has **K** rounds, and there are  $N = 2^K$  players in it, who all participate in the first round. In each round each of the remaining participating players is paired with another participating player, in order to play a single match. The winning player of each of these matches advances to the next round, whereas the losing player is automatically disqualified from the tournament. The winner of the only match of round **K** is thus the winner of the tournament.

It is desirable to make the tournament as long as possible, considering that the matches are broadcast on television and the Association is paid for every minute on air. Given any pair of different players, the Association knows the probability for one of them to win a game against the other. You are a member of the organizing committee, and your task is to prepare the fixture for the matches of each round in order to maximize the expected number of games played in the tournament. Doing this involves deciding which pairs of players will play a match in the first round, and then for each of the following rounds deciding which pair of matches from the previous round will provide the winning players for each match in that round. Note that this can only depend on the identification of the matches in the previous round. The following figure shows a possible fixture for  $K = 3$  rounds and  $N = 2^3 = 8$  players.



For the moment, the Association only wants to estimate their earnings, so it is sufficient to tell them the maximum expected number of games that can be played in the tournament.

## Input

The input contains several test cases. Each test case is described using several lines. The first line contains four integer numbers, **K**, **S**, **J** and **D**. The value **K** denotes the number of rounds in the tournament ( $1 \leq K \leq 3$ ). The value **S** denotes the number of sets that a player must win to win a match ( $1 \leq S \leq 10$ ). The value **J** denotes the minimum number of games that a player must win in order to win a set, whereas **D** indicates that a player should win **D** more games than its opponent for him to win the set ( $1 \leq D \leq J \leq 100$ ). The players are identified by different integer numbers from 1 to  $N = 2^K$ . Each of the following **N** lines contains **N** values. In the **i**-th line, the **j**-th value is an integer number **P<sub>ij</sub>** such that  $p_{ij} = P_{ij}/100$  is the probability that player number **i** wins a game against player number **j** ( $0 \leq P_{ij} \leq 100$  for  $1 \leq i, j \leq N$ ). You may assume that **P<sub>ii</sub>** = 0 (no player opposes himself) and that **P<sub>ij</sub>** + **P<sub>ji</sub>** = 100 for **i** and **j** different.

The end of the input is denoted by a line containing four times the number -1.

## Output

For each test case, you should print a line containing a rational number representing the maximum expected number of games that the given tournament can have. The result should be rounded to the nearest rational number with 2 decimal digits. In case of ties, round up. Note that you should always print 2 digits after the dot, even if this means ending with a zero.

## Example

### Input:

```
1 1 2 2
0 50
50 0
3 3 6 2
0 88 2 76 71 24 50 4
12 0 54 37 84 95 88 98
98 46 0 66 36 13 33 33
24 63 34 0 29 21 96 63
29 16 64 71 0 0 47 13
76 5 87 79 100 0 56 89
50 12 67 4 53 44 0 23
96 2 67 37 87 11 77 0
-1 -1 -1 -1
```

### Output:

```
4.00
224.08
```

---

Added by: Pablo Ariel Heiber

Date: 2011-10-04

Time limit: 30s

Source limit: 50000B

Languages: All

Resource: Argentinian Programming Tournament 2011

## SPOJ Problem Set (classical)

### 9650. Mega Inversions

#### Problem code: TRIPINV

The  $n^2$  upper bound for any sorting algorithm is easy to obtain: just take two elements that are misplaced with respect to each other and swap them. Conrad conceived an algorithm that proceeds by taking not two, but three misplaced elements. That is, take three elements  $a_i > a_j > a_k$  with  $i < j < k$  and place them in order  $a_k; a_j; a_i$ . Now if for the original algorithm the steps are bounded by the maximum number of inversions  $n(n-1)/2$ , Conrad is at his wits' end as to the upper bound for such triples in a given sequence. He asks you to write a program that counts the number of such triples.

#### Input

The first line of the input is the length of the sequence,  $1 \leq n \leq 10^5$ .  
The next line contains the integer sequence  $a_1; a_2 \dots a_n$ .  
You can assume that all  $a_i$  belongs  $[1; n]$ .

#### Output

Output the number of inverted triples.

#### Example

**Input :**  
43 3 2 1  
**Output :**  
2

---

Added by: Krzysztof Lewko  
Date: 2011-10-05  
Time limit: 1s-5s  
Source limit: 50000B  
Languages: All  
Resource: Nordic programming contest

## SPOJ Problem Set (classical)

### 9652. Robots on a grid

#### Problem code: ROBOTGRI

You have recently made a grid traversing robot that can find its way from the top left corner of a grid to the bottom right corner. However, you had forgotten all your AI programming skills, so you only programmed your robot to go rightwards and downwards (that's after all where the goal is). You have placed your robot on a grid with some obstacles, and you sit and observe. However, after a while you get tired of observing it getting stuck, and ask yourself "How many paths are there from the start position to the goal position?", and "If there are none, could the robot have made it to the goal if it could walk upwards and leftwards?" So you decide to write a program that, given a grid of size  $n \times n$  with some obstacles marked on it where the robot cannot walk, counts the different ways the robot could go from the top left corner  $s$  to the bottom right  $t$ , and if none, tests if it were possible if it could walk up and left as well. However, your program does not handle very large numbers, so the answer should be given modulo  $2^{31} - 1$ .

#### Input

On the first line is one integer,  $1 < n \leq 1000$ . Then follows  $n$  lines, each with  $n$  characters, where each character is one of '.' and '#', where '.' is to be interpreted as a walkable tile and '#' as a non-walkable tile. There will never be a wall at  $s$ , and there will never be a wall at  $t$ .

#### Output

Output one line with the number of different paths starting in  $s$  and ending in  $t$  (modulo  $2^{31} - 1$ ) or THE GAME IS A LIE if you cannot go from  $s$  to  $t$  going only rightwards and downwards but you can if you are allowed to go left and up as well, or INCONCEIVABLE if there simply is no path from  $s$  to  $t$ .

#### Example

Input :

5.....#...#.#...#.....#.....

Output :

6

---

Added by: Krzysztof Lewko  
Date: 2011-10-05  
Time limit: 1s-5s  
Source limit:50000B  
Languages: All  
Resource: Nordic programming contest

## SPOJ Problem Set (classical)

### 9655. Elevator Trouble

#### Problem code: ELEVTRBL

You are on your way to your first job interview as a program tester, and you are already late. The interview is in a skyscraper and you are currently in floor  $s$ , where you see an elevator. Upon entering the elevator, you learn that it has only two buttons, marked "UP  $u$ " and "DOWN  $d$ ". You conclude that the UP-button takes the elevator  $u$  floors up (if there aren't enough floors, pressing the UP-button does nothing, or at least so you assume), whereas the DOWN-button takes you  $d$  stories down (or none if there aren't enough). Knowing that the interview is at floor  $g$ , and that there are only  $f$  floors in the building, you quickly decide to write a program that gives you the amount of button pushes you need to perform. If you simply cannot reach the correct floor, your program halts with the message "use the stairs". Given input  $f, s, g, u$  and  $d$  (floors, start, goal, up, down), find the shortest sequence of button presses you must press in order to get from  $s$  to  $g$ , given a building of floors, or output "use the stairs" if you cannot get from  $s$  to  $g$  by the given elevator.

#### Input

The input will consist of one line, namely  $f\ s\ g\ u\ d$ , where  $1 \leq s; g \leq f \leq 1000000$  and  $0 \leq u; d \leq 1000000$ . The floors are one-indexed, i.e. if there are 10 stories,  $s$  and  $g$  be in  $[1; 10]$ .

#### Output

You must reply with the minimum numbers of pushes you must make in order to get from  $s$  to  $g$ , or output use the stairs if it is impossible given the configuration of the elevator.

#### Example

Input :  
10 1 10 2 1  
Output :  
6

---

Added by: Krzysztof Lewko  
Date: 2011-10-06  
Time limit: 1s  
Source limit: 50000B  
Languages: All  
Resource: Nordic programming contest



## SPOJ Problem Set (classical)

### 9682. Bí hie^?m

#### Problem code: RIDDLE

Ba cu?a Ellenora thu+o+‘ng ra cho cháu gái mình nhu+~ng bài toán đố mà Elly coi là bí hie^?m. Buổi tối vu+‘a rồi ba đố Elly bài toán sau:

"O+? cu+?a hàng ca.nh nhà ta có  $k$  mặt hàng vớ+‘i giá khác nhau tu+‘ 1 đê^?n  $k$ . Ba có  $n$  đồng tie^?n me^?nh giá  $a_1, a_2, \dots, a_n$ . Ba đi.nh sang bên đây mua một mặt hàng nào đó, tra? đúng giá cu?a nó mà không pha?i nhân la.i tie^?n thu+‘a. Nhu+ng ba đã già quá rồi. Ba không muôn mang tất cả? tie^?n cu?a mình đi, có the^? lân hoặc rớ+‘i mất, vì vậy ba chỉ? mang theo **một số đồng đầu tiên**. Vậy ba pha?i mang theo **ít nhất** bao nhiêu đồng tie^?n đê^? mua đũ+o+.c mặt hàng bất kỳ?"

Chỉ? mất vài giây Elly đã đũ+o+ ra đũ+o+.c câu tra? lo+‘i và nghĩ thâm trong bu.ng: "Ôi, ba o+‘i, la.i nhu+~ng bài toán già?i thuật quá chuân!".

Ba.n có the^? đũa tại vớ+‘i Elly bằng cách vie^?t chu+o+ng trình già?i bài toán này đũ+o+.c không?

**Du+~ lie^?u:** Vào tu+‘ file văn bản RIDDLE.INP:

- Dòng đầu tiên chu+‘a số nguyên  $T$  - số lu+o+.ng tests trong file,
- Mỗi test cho trên 2 dòng:
  - Dòng thu+‘ nhất chu+‘a 2 số nguyên  $n$  và  $k$  ( $1 \leq n \leq 10^5$ ,  $1 \leq k \leq 10^6$ ),
  - Dòng thu+‘ 2 chu+‘a  $n$  số nguyên  $a_1, a_2, \dots, a_n$ , ( $0 < a_i \leq 10^5$ , " $i = 1 \div n$ ").

**Ke^?t qua?:** Đũa ra file văn bản RIDDLE.OUT, ke^?t qua? mỗi test đũa ra trên một dòng đũ+o+‘i đa.ng số nguyên. Ne^?u không có cách mang thì đũa ra số -1.

**Ví dụ.:**

RIDDLE.INP	RIDDLE.OUT
3	4
7 10	3
1 2 3 4 5 6 7	-1
3 3	
2 4 1	
3 6	
3 1 4	

Added by: Nguyễn Duy Khánh  
Date: 2011-10-09  
Time limit: 1s  
Source limit: 50000B  
Languages: All

```
(function() { var po = document.createElement('script'); po.type = 'text/javascript'; po.async = true;
po.src = 'https://apis.google.com/js/plusone.js'; var s =
document.getElementsByTagName('script')[0]; s.parentNode.insertBefore(po, s); })();
```

## SPOJ Problem Set (classical)

### 10070. Trick or Treat

#### Problem code: TRICKTRT

Johnny and his friends have decided to spend Halloween night doing the usual candy collection from the households of their village. As the village is too big for a single group to collect the candy from all houses sequentially, Johnny and his friends have decided to split up so that each of them goes to a different house, collects the candy (or wreaks havoc if the residents don't give out candy), and returns to a meeting point arranged in advance.

There are  $n$  houses in the village, the positions of which can be identified with their Cartesian coordinates on the Euclidean plane. Johnny's gang is also made up of  $n$  people (including Johnny himself). They have decided to distribute the candy after everybody comes back with their booty. The houses might be far away, but Johnny's interest is in eating the candy as soon as possible.

Keeping in mind that, because of their response to the hospitality of some villagers, some children might be wanted by the local authorities, they have agreed to fix the meeting point by the river running through the village, which is the line  $y = 0$ . Note that there may be houses on both sides of the river, and some of the houses may be houseboats ( $y = 0$ ). The walking speed of every child is 1 meter per second, and they can move along any direction on the plane.

At exactly midnight, each child will knock on the door of the house he has chosen, collect the candy instantaneously, and walk back along the shortest route to the meeting point. Tell Johnny at what time he will be able to start eating the candy.

#### Input

Each test case starts with a line indicating the number  $n$  of houses ( $1 \leq n \leq 50000$ ). The next  $n$  lines describe the positions of the houses; each of these lines contains two floating point numbers  $x$  and  $y$  ( $-200000 \leq x, y \leq 200000$ ), the coordinates of a house in meters. All houses are at different positions.

A blank line follows each case. A line with  $n = 0$  indicates the end of the input; do not write any output for this case.

#### Output

For each test case, print two numbers in a line separated by a space: the coordinate  $x$  of the meeting point on the line  $y = 0$  that minimizes the time the last child arrives, and this time itself (measured in seconds after midnight). Your answer should be accurate to within an absolute or relative error of  $10^{-5}$ .

### Sample Input

```
2
1.5 1.5
3 0
```

```
1
0 0
```

```
4
1 4
4 4
-3 3
2 4
```

```
5
4 7
-4 0
7 -6
-2 4
8 -5
```

```
0
```

### Sample Output

```
1.500000000 1.500000000
0.000000000 0.000000000
1.000000000 5.000000000
3.136363636 7.136363636
```

---

*Problemsetter: Javier Gómez Serrano*

---

Added by: David García Soriano

Date: 2011-11-23

Time limit: 2s-3s

Source limit:50000B

Languages: All

Resource: Southwestern Europe Regional, SWERC 2009

```
(function() { var po = document.createElement('script'); po.type = 'text/javascript'; po.async = true;
po.src = 'https://apis.google.com/js/plusone.js'; var s =
document.getElementsByTagName('script')[0]; s.parentNode.insertBefore(po, s); })();
```

## SPOJ Problem Set (classical)

### 10198. Tro cho+i 0 1

#### Problem code: QTBIT

Cho một dãy nhị phân độ dài  $N$  nguyên ( $1 \leq N \leq 1000$ ). Xét tro cho+i giu+~a hai ngu+o+'i nhu+ sau: đē^'n lu+o+.t minh, ngu+o+'i cho+i xóa  $K$  số 1 liên tiếp nhau trong dãy ( $1 \leq k \leq 10$ ). Tro cho+i ke^'t thúc khi có một ngu+o+'i không the^? xóa đū+o+.c nu+~a, đó là ngu+o+'i thua cuộc.

Lu+u ý:Ne^'u nhu+ ngay ta.i bu+o+'c đâu ngu+o+'i cho+i số 1 đã không xóa đū+o+.c thì xem nhu+ là ngu+o+'i thua cuộc và tro cho+i ke^'t thúc.

Yêu cầu:Xác đī.nh xem ai chắc chắn là ngu+o+'i thắng cuộc. Bie^'t mō.i nu+o+'c đi đē^'u là tôi u+u.

#### Input

Dòng đầu tiên là số nguyên đū+o+.ng  $T$  - số test ( $1 \leq T \leq 100$ ).

$T$  cặp dòng tiếp theo gồm :

- Dòng thu+' nhāt là số  $K$ .
- Dòng thu+' hai là xâu biē^?u die^~n dãy nhị phân.

#### Output

Gồm  $T$  dòng mỗi dòng ghi ra ngu+o+'i chie^'n thắng (1 hoặc 2) cu?a test đó.

#### Example

**Input :**

2

2

0011101101

1

1111111111

**Output :**

2

Added by: l0i.....tran đie^?m

Date: 2011-12-12

Time limit: 1s

Source limit:50000B

Languages: C C# C++ 4.0.0-8 C++ 4.3.2 JAR JAVA PAS gpc PAS fpc

Resource: Trần Tú Nam - Khóa 8

```
(function() { var po = document.createElement('script'); po.type = 'text/javascript'; po.async = true;
po.src = 'https://apis.google.com/js/plusone.js'; var s =
document.getElementsByTagName('script')[0]; s.parentNode.insertBefore(po, s); })();
```

## SPOJ Problem Set (classical)

### 10210. After Party Transfers

#### Problem code: TRANSFER

You've been to a potluck party (party where each person contributes food), but some people are angry that they spent more money preparing their dish than the others. Now they want you (they span the bottle) to figure out how the participants of the party can, in the *fewest* amount of transfers, become even.

To clarify, you are free to transfer money between them in any way you like, but eventually the money they spent on their dishes, plus the money they received, minus the money they sent, must be equal for all participants.

#### Input

The first line contains  $C$  ( $- [0..10]$ ) - the number of test cases.

For each test case, the first line contains the number  $N$  ( $- [0..20]$ ) - the number of people at the party.

The following  $N$  lines contain an integer  $x_i$  ( $- [0, 10^6]$ ) representing the amount of money the  $i$ th person's dish cost.

#### Output

For each testcase:

The first line should be the minimal amount of transfers needed to even out the party budget.

The following lines should be on the form " $a \rightarrow b: t$ ", where  $a, b$  ( $- [0..N]$ ) and represent that person ' $a$ ' must transfer ' $t$ ' money to person ' $b$ '.  $t$  is here a floating point number of at least 6 digits precision. (Notice: that is 6 digits precision after adding together your in and out flows)

In case of multiple best solutions exists, print any.

#### Example

**Input :**

```
2
6
2
4
1
5
0
6
```

3  
9  
16  
25

**Output:**

3  
0 -> 1: 1.0  
2 -> 3: 2.0  
4 -> 5: 3.0  
2  
0 -> 1: 7.66666666666667  
1 -> 2: 8.3333333333333

**Explanation:**

In the first case, 3 is the minimal amount of transfers. An alternative transfer pattern would be "0 -> 3: 1 1 -> 3: 2 2 -> 4: 2 2 -> 5: 1". That would have made everyone even, but would have taken one more transfer (4).

In the second case, after the transfers, each person is down 16.666.

---

Added by: Thomas Dybdahl Ahle  
Date: 2011-12-13  
Time limit: 5s-15s  
Source limit: 50000B  
Languages: All



```
(function() { var po = document.createElement('script'); po.type = 'text/javascript'; po.async = true;
po.src = 'https://apis.google.com/js/plusone.js'; var s =
document.getElementsByTagName('script')[0]; s.parentNode.insertBefore(po, s); })();
```

## **SPOJ Problem Set (classical)**

### **10239. Between the Mountains**

#### **Problem code: ACPC11B**

Did you try to ride a telepherique (cable car)? It is a lot of fun. Our company is trying to build a new telepherique line between two high mountains and you will be invited for a free ride. The trick to get your free ride is to help the company in building the telepherique line. The company wants to build two platforms, one on each mountain. The line will extend between these two platforms. The suitable points for holding a platform in each mountain were determined, and the altitudes of these points were reported.

One of the talented engineers suggested that the company can save a lot of energy if the two stations have the same altitude or at least have altitudes which are as close to each other as possible. Your job is to select two points, one at each mountain, from those suitable points, so that the altitude difference between the two points is as little as possible.

#### **Input**

Your program will be tested on one or more test cases. The first line of the input will be a single integer  $T$ , the number of test cases ( $1 \leq T \leq 100$ ). Follows  $2T$  lines containing the test cases, each on a pair of lines.

Each of the two lines in a case describe the altitudes of suitable points to build a platform on one mountain. Each line starts with an integer  $N$ , the number of reported altitudes ( $1 \leq N \leq 1,000$ ), followed by  $N$  integers, which represent the altitudes reported from this mountain. Any altitude value will be between 1 and 1,000,000, inclusive.

#### **Output**

For each test case, output, on a single line, a single number representing the minimum altitude difference between two suitable platform points, one at each mountain.

Did you try to ride a telepherique (cable car)? It is a lot of fun. Our company is trying to build a new telepherique line between two high mountains and you will be invited for a free ride. The trick to get your free ride is to help the company in building the telepherique line.

The company wants to build two platforms, one on each mountain. The line will extend between these two platforms. The suitable points for holding a platform in each mountain were determined, and the altitudes of these points were reported.

One of the talented engineers suggested that the company can save a lot of energy if the two stations have the same altitude or at least have altitudes which are as close to each other as possible. Your job is to select two points, one at each mountain, from those suitable points, so that the altitude difference between the two points is as little as possible.

## Input

Your program will be tested on one or more test cases. The first line of the input will be a single integer  $T$ , the number of test cases ( $1 \leq T \leq 100$ ). Follows  $2T$  lines containing the test cases, each on a pair of lines.

Each of the two lines in a case describe the altitudes of suitable points to build a platform on one mountain. Each line starts with an integer  $N$ , the number of reported altitudes ( $1 \leq N \leq 1,000$ ), followed by  $N$  integers, which represent the altitudes reported from this mountain. Any altitude value will be between 1 and 1,000,000, inclusive.

## Output

For each test case, output, on a single line, a single number representing the minimum altitude difference between two suitable platform points, one at each mountain.

## Example

### Input :

```
2
8 1 3 5 7 9 7 3 1
8 2 4 6 8 10 8 6 2
8 2 3 5 10 9 3 2 1
7 1 2 6 12 13 3 2
```

### Output :

```
1
0
```

---

Added by: WahbA  
Date: 2011-12-15  
Time limit: 1s-5s  
Source limit: 50000B  
Languages: All  
Resource: Arab Collegiate Programming Contest

```
(function() { var po = document.createElement('script'); po.type = 'text/javascript'; po.async = true;
po.src = 'https://apis.google.com/js/plusone.js'; var s =
document.getElementsByTagName('script')[0]; s.parentNode.insertBefore(po, s); })();
```

## **SPOJ Problem Set (classical)**

### **10240. Circleland**

#### **Problem code: ACPC11C**

You are visiting circleland, and you have long waited to visit their famous art exhibition. The exhibition has  $N$  rooms arranged in a cycle. In every room, there are some artistic pieces. The rooms are named  $R_1, R_2, \dots, R_N$ . There are also  $N$  corridors, named  $C_1, C_2, \dots, C_N$ , of lengths  $L_1, L_2, \dots, L_N$ , respectively. Each corridor  $C_i$  connects the two rooms  $R_i$  and  $R_{i+1}$ , except  $C_N$  which connects  $R_N$  and  $R_1$ . Thus, the whole exhibition forms a cycle. You can walk in both directions in every corridor. There is a single entrance to the exhibition in room  $R_1$ , but there are exits in every room. As there is nothing interesting to see in the corridors, you would like to spend the least effort walking through corridors in the exhibition. Compute the minimum total distance you need to walk in corridors such that you enter from the entrance, exit from any exit and visit all rooms.

You are visiting circleland, and you have long waited to visit their famous art exhibition. The exhibition has  $N$  rooms arranged in a cycle. In every room, there are some artistic pieces. The rooms are named  $R_1, R_2, \dots, R_N$ . There are also  $N$  corridors, named  $C_1, C_2, \dots, C_N$ , of lengths  $L_1, L_2, \dots, L_N$ , respectively. Each corridor  $C_i$  connects the two rooms  $R_i$  and  $R_{i+1}$ , except  $C_N$  which connects  $R_N$  and  $R_1$ . Thus, the whole exhibition forms a cycle. You can walk in both directions in every corridor.

There is a single entrance to the exhibition in room  $R_1$ , but there are exits in every room. As there is nothing interesting to see in the corridors, you would like to spend the least effort walking through corridors in the exhibition. Compute the minimum total distance you need to walk in corridors such that you enter from the entrance, exit from any exit and visit all rooms.

#### **Input**

Your program will be tested on one or more test cases. The first line of the input will be a single integer  $T$ , the number of test cases ( $1 \leq T \leq 100$ ). Next  $T$  lines contain the testcases, each on a single line.

Each case starts with an integer  $N$  , the number of rooms in the exhibition ( $2 \leq N \leq 100,000$ ), followed by  $N$  numbers, the lengths of the corridors,  $L_1$  ,  $L_2$  , ...,  $L_N$  , in this order ( $1 \leq L_i \leq 1,000,000$ ).

The sum of the lengths of all corridors will not exceed 1,000,000,000.

## Output

For each test case, output, on a single line, a single number representing the minimum total distance you have to walk in corridors such that you visit all rooms.

## Example

**Input :**

```
2
5 1 1 1 1 1
7 100 15 20 42 33 15 24
```

**Output :**

```
4
149
```

---

Added by: WahbA

Date: 2011-12-15

Time limit: 5s

Source limit: 50000B

Languages: All

Resource: Arab Collegiate Programming Contest