## Problem A. Rearranging a Sequence

Input file:
Output file:
Time limit:
Memory limit:
standard input
standard output
1 second
512 mebibytes

You are given an ordered sequence of integers, $(1,2,3, \ldots, n)$. Then, a number of requests will be given. Each request specifies an integer in the sequence. You need to move the specified integer to the head of the sequence, leaving the order of the rest untouched. Your task is to find the order of the elements in the sequence after following all the requests successively.

## Input

The input consists of a single test case of the following form. The integer $n$ is the length of the sequence $\left(1 \leq n \leq 2 \cdot 10^{5}\right)$. The integer $m$ is the number of requests $\left(1 \leq m \leq 10^{5}\right)$. The following $m$ lines are the requests, namely $e_{1}, \ldots, e_{m}$, one per line. Each request $e_{i}(1 \leq i \leq m)$ is an integer between 1 and $n$, inclusive, designating the element to move. Note that the integers designate the integers themselves to move, not their positions in the sequence.

## Output

Output the sequence after processing all the requests. Its elements are to be output one per line, in the order in the sequence.

## Examples

| standard input | standard output |
| :--- | :--- |
| 53 | 5 |
| 4 | 2 |
| 2 | 4 |
| 5 | 1 |
| 108 | 3 |
| 1 | 3 |
| 4 | 1 |
| 7 | 10 |
| 3 | 4 |
| 4 | 7 |
| 10 | 2 |
| 1 | 5 |
| 3 | 6 |
|  |  |

## Note

In Sample Input 1, the initial sequence is $(1,2,3,4,5)$. The first request is to move the integer 4 to the head, that is, to change the sequence to $(4,1,2,3,5)$. The next request to move the integer 2 to the head makes the sequence $(2,4,1,3,5)$. Finally, 5 is moved to the head, resulting in $(5,2,4,1,3)$.

## Problem B. Quality of Check Digits

Input file:
Output file:
Time limit:
Memory limit:
standard input
standard output
1 second
512 mebibytes

The small city where you live plans to introduce a new social security number (SSN) system. Each citizen will be identified by a five-digit SSN. Its first four digits indicate the basic ID number (0000-9999) and the last one digit is a check digit for detecting errors.
For computing check digits, the city has decided to use an operation table. An operation table is a $10 \times 10$ table of decimal digits whose diagonal elements are all 0 . Below are two example operation tables.

Operation Table 1

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 0 | 0 | 3 | 1 | 7 | 5 | 9 | 8 | 6 | 4 | 2 |
| 1 | 7 | 0 | 9 | 2 | 1 | 5 | 4 | 8 | 6 | 3 |
| 2 | 4 | 2 | 0 | 6 | 8 | 7 | 1 | 3 | 5 | 9 |
| 3 | 1 | 7 | 5 | 0 | 9 | 8 | 3 | 4 | 2 | 6 |
| 4 | 6 | 1 | 2 | 3 | 0 | 4 | 5 | 9 | 7 | 8 |
| 5 | 3 | 6 | 7 | 4 | 2 | 0 | 9 | 5 | 8 | 1 |
| 6 | 5 | 8 | 6 | 9 | 7 | 2 | 0 | 1 | 3 | 4 |
| 7 | 8 | 9 | 4 | 5 | 3 | 6 | 2 | 0 | 1 | 7 |
| 8 | 9 | 4 | 3 | 8 | 6 | 1 | 7 | 2 | 0 | 5 |
| 9 | 2 | 5 | 8 | 1 | 4 | 3 | 6 | 7 | 9 | 0 |

Operation Table 2

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 2 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 4 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 |
| 5 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 |
| 6 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 |
| 7 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 |
| 8 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 |
| 9 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

Using an operation table, the check digit $e$ for a four-digit basic ID number $a b c d$ is computed by using the following formula. Here, $i \otimes j$ denotes the table element at row $i$ and column $j$.

$$
e=(((0 \otimes a) \otimes b) \otimes c) \otimes d
$$

For example, by using Operation Table 1 the check digit $e$ for a basic ID number $a b c d=2016$ is computed in the following way.

$$
\begin{aligned}
& e=(((0 \otimes 2) \otimes 0) \otimes 1) \otimes 6 \\
& e=((1 \otimes 0) \otimes 1) \otimes 6 \\
& e=(7 \otimes 1) \otimes 6 \\
& e=9 \otimes 6 \\
& e=6
\end{aligned}
$$

Thus, the SSN is 20166.
Note that the check digit depends on the operation table used. With Operation Table 2, we have $e=3$ for the same basic ID number 2016, and the whole SSN will be 20163.
$\Downarrow+$ check digit using Operation Table 2
20163
$\Downarrow$ human errors

| Altering one single digit |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 00163 | 10163 | 90163 | 21163 | 2216 |  | 20168 | 20169 |
|  |  | Transpo | sing two | adjacent | digits |  |  |
|  |  | 02163 | 21063 | 20613 | 20136 |  |  |

Figure B.1. Two kinds of common human errors

The purpose of adding the check digit is to detect human errors in writing/typing SSNs. The following check function can detect certain human errors. For a five-digit number abcde, the check function is defined as follows.

$$
\operatorname{check}(a b c d e)=((((0 \otimes a) \otimes b) \otimes c) \otimes d) \otimes e
$$

This function returns 0 for a correct SSN. This is because every diagonal element in an operation table is 0 and for a correct SSN we have $e=(((0 \otimes a) \otimes b) \otimes c) \otimes d$ :

$$
\operatorname{check}(a b c d e)=((((0 \otimes a) \otimes b) \otimes c) \otimes d) \otimes e=e \otimes e=0
$$

On the other hand, a non-zero value returned by check indicates that the given number cannot be a correct SSN. Note that, depending on the operation table used, check function may return 0 for an incorrect SSN. Kinds of errors detected depends on the operation table used; the table decides the quality of error detection.

The city authority wants to detect two kinds of common human errors on digit sequences: altering one single digit and transposing two adjacent digits, as shown in Figure B.1.
An operation table is good if it can detect all the common errors of the two kinds on all SSNs made from four-digit basic ID numbers 0000-9999. Note that errors with the check digit, as well as with four basic ID digits, should be detected. For example, Operation Table 1 is good. Operation Table 2 is not good because, for 20613, which is a number obtained by transposing the 3 -rd and the 4 -th digits of a correct SSN 20163, check(20613) is 0 . Actually, among 10000 basic ID numbers, Operation Table 2 cannot detect one or more common errors for as many as 3439 basic ID numbers.
Given an operation table, decide how good it is by counting the number of basic ID numbers for which the given table cannot detect one or more common errors.

## Input

The input describes an operation table with $x_{i j}$ being the decimal digit at row $i$ and column $j$. Each line corresponds to a row of the table, in which elements are separated by a single space. The diagonal elements $x_{i i}(i=0, \ldots, 9)$ are always 0 .

## Output

Output the number of basic ID numbers for which the given table cannot detect one or more common human errors.

## Examples

| standard input | standard output |
| :---: | :---: |
| 0317598642 | 0 |
| 7092154863 |  |
| 4206871359 |  |
| 1750983426 |  |
| 6123045978 |  |
| 3674209581 |  |
| 5869720134 |  |
| 8945362017 |  |
| 9438617205 |  |
| 2581436790 |  |
| 01223456789 | 3439 |
| 9012345678 |  |
| 8901234567 |  |
| 7890123456 |  |
| 6789012345 |  |
| 5678901234 |  |
| 4567890123 |  |
| 3456789012 |  |
| 2345678901 |  |
| 1234567890 |  |
| 0987654321 | 9995 |
| 1098765432 |  |
| 2109876543 |  |
| 32180987654 |  |
| 4321098765 |  |
| 5432109876 |  |
| 65432100987 |  |
| 76543211098 |  |
| 8765432109 |  |
| 9876543210 |  |
| 0000000000 | 10000 |
| 0000000000 |  |
| 0000000000 |  |
| 0000000000 |  |
| 0000000000 |  |
| 0000000000 |  |
| 0000000000 |  |
| 0000000000 |  |
| 0000000000 |  |
| 0000000000 |  |

## Problem C. Distribution Center

Input file:
Output file:
Time limit:
Memory limit:
standard input
standard output
1 second
512 mebibytes

The factory of the Impractically Complicated Products Corporation has many manufacturing lines and the same number of corresponding storage rooms. The same number of conveyor lanes are laid out in parallel to transfer goods from manufacturing lines directly to the corresponding storage rooms. Now, they plan to install a number of robot arms here and there between pairs of adjacent conveyor lanes so that goods in one of the lanes can be picked up and released down on the other, and also in the opposite way. This should allow mixing up goods from different manufacturing lines to the storage rooms.
Depending on the positions of robot arms, the goods from each of the manufacturing lines can only be delivered to some of the storage rooms. Your task is to find the number of manufacturing lines from which goods can be transferred to each of the storage rooms, given the number of conveyor lanes and positions of robot arms.

## Input

The input consists of a single test case, formatted as follows. An integer $n\left(2 \leq n \leq 2 \cdot 10^{5}\right)$ in the first line is the number of conveyor lanes. The lanes are numbered from 1 to $n$, and two lanes with their numbers differing by 1 are adjacent. All of them start from the position $x=0$ and end at $x=10^{5}$. The other integer $m\left(1 \leq m<10^{5}\right)$ is the number of robot arms.
The following $m$ lines indicate the positions of the robot arms by two integers $x_{i}\left(0<x_{i}<10^{5}\right)$ and $y_{i}$ $\left(1 \leq y_{i}<n\right)$. Here, $x_{i}$ is the $x$-coordinate of the $i$-th robot arm, which can pick goods on either the lane $y_{i}$ or the lane $y_{i}+1$ at position $x=x_{i}$, and then release them on the other at the same $x$-coordinate.
You can assume that positions of no two robot arms have the same $x$-coordinate, that is, $x_{i} \neq x_{j}$ for any $i \neq j$.

## Output

Output $n$ integers separated by a space in one line. The $i$-th integer is the number of the manufacturing lines from which the storage room connected to the conveyor lane $i$ can accept goods.

## Examples

|  | standard input | standard output |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :---: |
| 43 | 2444 |  |  |  |  |
| 1000 | 1 |  |  |  |  |
| 2000 | 2 |  |  |  |  |
| 3000 | 3 |  | 2442 |  |  |
| 4 | 3 |  |  |  |  |
| 1 | 1 |  |  |  |  |
| 3 | 2 |  |  |  |  |
| 2 | 3 |  |  |  |  |



## Problem D. Hidden Anagrams

Input file:
Output file:
Time limit:
Memory limit:
standard input
standard output
20 seconds
512 mebibytes

An anagram is a word or a phrase that is formed by rearranging the letters of another. For instance, by rearranging the letters of "William Shakespeare," we can have its anagrams "I am a weakish speller," " I 'll make a wise phrase," and so on. Note that when $A$ is an anagram of $B, B$ is an anagram of $A$.
In the above examples, differences in letter cases are ignored, and word spaces and punctuation symbols are freely inserted and/or removed. These rules are common but not applied here; only exact matching of the letters is considered.

For two strings $s_{1}$ and $s_{2}$ of letters, if a substring $s_{1}^{\prime}$ of $s_{1}$ is an anagram of a substring $s_{2}^{\prime}$ of $s_{2}$, we call $s_{1}^{\prime}$ a hidden anagram of the two strings, $s_{1}$ and $s_{2}$. Of course, $s_{2}^{\prime}$ is also a hidden anagram of them.
Your task is to write a program that, for given two strings, computes the length of the longest hidden anagrams of them.
Suppose, for instance, that "anagram" and "grandmother" are given. Their substrings "nagr" and "gran" are hidden anagrams since by moving letters you can have one from the other. They are the longest since any substrings of "grandmother" of lengths five or more must contain ' $d$ ' or ' $o$ ' that "anagram" does not. In this case, therefore, the length of the longest hidden anagrams is four. Note that a substring must be a sequence of letters occurring consecutively in the original string and so "nagrm" and "granm" are not hidden anagrams.

## Input

Input consists of two strings $s_{1}$ and $s_{2}$ consisting of lowercase letters ('a' through ' $z$ ') and their lengths are between 1 and 4000, inclusive.

## Output

Output the length of the longest hidden anagrams of $s_{1}$ and $s_{2}$. If there are no hidden anagrams, print a zero.

## Examples

| standard input | standard output |
| :--- | :--- |
| anagram <br> grandmother | 4 |
| williamshakespeare <br> iamaweakishspeller | 18 |
| aaaaaaabbbbbbbb <br> xxxxxabababxxxxxabab | 6 |
| abababacdcdcd <br> efefefghghghghgh | 0 |

## Problem E. Infallibly Crack Perplexing Cryptarithm

Input file:
Output file:
Time limit:
Memory limit:
standard input
standard output
1 second
512 mebibytes

You are asked to crack an encrypted equation over binary numbers.
The original equation consists only of binary digits (' 0 ' and ' 1 '), operator symbols ('+', ' - ', and ' $*$ '), parentheses ('('and ')'), and an equal sign (' $=$ '). The encryption replaces some occurrences of characters in an original arithmetic equation by letters. Occurrences of one character are replaced, if ever, by the same letter. Occurrences of two different characters are never replaced by the same letter. Note that the encryption does not always replace all the occurrences of the same character; some of its occurrences may be replaced while others may be left as they are. Some characters may be left unreplaced. Any character in the English alphabet, in either lowercase or uppercase, may be used as a replacement letter. Note that cases are significant, that is, ' $a$ ' and ' $A$ ' are different letters. Note that not only digits but also operator symbols, parentheses and even the equality sign are possibly replaced.
The arithmetic equation is derived from the start symbol of $Q$ of the following context-free grammar.

$$
\begin{aligned}
Q & ::=E=E \\
E & ::=T|E+T| E-T \\
T & ::=F \mid T * F \\
F & ::=N|-F|(E) \\
N & ::=0 \mid 1 B \\
B & ::=\varepsilon|0 B| 1 B
\end{aligned}
$$

Here, $\varepsilon$ means empty.
As shown in this grammar, the arithmetic equation should have one equal sign. Each side of the equation is an expression consisting of numbers, additions, subtractions, multiplications, and negations. Multiplication has precedence over both addition and subtraction, while negation precedes multiplication. Multiplication, addition and subtraction are left associative. For example, $x-y+z$ means $(x-y)+z$, not $x-(y+z)$. Numbers are in binary notation, represented by a sequence of binary digits, 0 and 1 . Multi-digit numbers always start with 1. Parentheses and negations may appear redundantly in the equation, as in $((--x+y))+z$.
Write a program that, for a given encrypted equation, counts the number of different possible original correct equations. Here, an equation should conform to the grammar, and it is correct when the computed values of the both sides are equal.
For Sample Input 1, C must be '=' because any equation has one ' $=$ ' between two expressions. Then, because A and M should be different, although there are equations conforming to the grammar, none of them can be correct.
For Sample Input 2 , the only possible correct equation is " $-0=0$ ".
For Sample Input 3 ("B-A-Y-L-zero-R"), there are three different correct equations, " $0=-(0) ", " 0=(-0)$ ", and " $-0=(0)$ ". Note that one of the two occurrences of zero is not replaced with a letter in the encrypted equation.

## Input

The input consists of a single test case which is a string of English alphabet characters, binary digits, operator symbols, parentheses and equal signs. The input string has at most 31 characters.

## Output

Print in a line the number of correct equations that can be encrypted into the input string.

## Examples

| standard input | standard output |
| :--- | :--- |
| ACM | 0 |
| icpc | 1 |
| BAYLOR | 3 |
| - AB+AC-A | 1 |
| abcdefghi | 0 |
| $111-10=1+10 * 10$ | 1 |
| $0=10-1$ | 0 |

## Problem F. Three Kingdoms of Bourdelot

Input file:
Output file:
Time limit:
Memory limit: $\quad 512$ mebibytes

You are an archaeologist at the Institute for Cryptic Pedigree Charts, specialized in the study of the ancient Three Kingdoms of Bourdelot. One day, you found a number of documents on the dynasties of the Three Kingdoms of Bourdelot during excavation of an ancient ruin. Since the early days of the Kingdoms of Bourdelot are veiled in mystery and even the names of many kings and queens are lost in history, the documents are expected to reveal the blood relationship of the ancient dynasties.
The documents have lines, each of which consists of a pair of names, presumably of ancient royal family members. An example of a document with two lines follows.

## Alice Bob

Bob Clare
Lines should have been complete sentences, but the documents are heavily damaged and therefore you can read only two names per line. At first, you thought that all of those lines described the true ancestor relations, but you found that would lead to contradiction. Later, you found that some documents should be interpreted negatively in order to understand the ancestor relations without contradiction. Formally, a document should be interpreted either as a positive document or as a negative document.

- In a positive document, the person on the left in each line is an ancestor of the person on the right in the line. If the document above is a positive document, it should be interpreted as "Alice is an ancestor of Bob, and Bob is an ancestor of Clare".
- In a negative document, the person on the left in each line is NOT an ancestor of the person on the right in the line. If the document above is a negative document, it should be interpreted as "Alice is NOT an ancestor of Bob, and Bob is NOT an ancestor of Clare".

A single document can never be a mixture of positive and negative parts. The document above can never read "Alice is an ancestor of Bob, and Bob is NOT an ancestor of Clare".
You also found that there can be ancestor-descendant pairs that didnt directly appear in the documents but can be inferred by the following rule: For any persons $x, y$ and $z$, if $x$ is an ancestor of $y$ and $y$ is an ancestor of $z$, then $x$ is an ancestor of $z$. For example, if the document above is a positive document, then the ancestor-descendant pair of "Alice Clare" is inferred.
You are interested in the ancestry relationship of two royal family members. Unfortunately, the interpretation of the documents, that is, which are positive and which are negative, is unknown. Given a set of documents and two distinct names $p$ and $q$, your task is to find an interpretation of the documents that does not contradict the hypothesis that $p$ is an ancestor of $q$. An interpretation of the documents contradicts the hypothesis if and only if there exist persons $x$ and $y$ such that we can infer from the interpretation of the documents and the hypothesis that

- $x$ is an ancestor of $y$ and $y$ is an ancestor of $x$, or
- $x$ is an ancestor of $y$ and $x$ is not an ancestor of $y$.

We are sure that every person mentioned in the documents had a unique single name, that is, no two persons have the same name and one person is never mentioned with different names. When a person $A$ is an ancestor of another person $B$, the person $A$ can be a parent, a grandparent, a great-grandparent, or so on, of the person $B$. Also, there can be persons or ancestor-descendant pairs that do not appear in the documents. For example, for a family tree shown in Figure F.1, there can be a positive document:

A H
B H
D H
F H
E I
where persons $C$ and $G$ do not appear, and the ancestor-descendant


Figure F.1. A Family Tree pairs such as " $A E$ ", " $D F$ ", and " $C I$ " do not appear.

## Input

The first line of input consists of two distinct names, $p$ and $q$, separated by a space. The second line of consists of a single integer $n$ that indicates the number of documents. Then the descriptions of $n$ documents follow.
The description of the $i$-th document $c_{i}$ is formatted as follows: the first line consists of a single integer $m_{i}$ that indicates the number of pairs of names in the document. Each of the following $m_{i}$ lines consists of a pair of distinct names $x_{i, j}$ and $y_{i, j}\left(1 \leq j \leq m_{i}\right)$, separated by a space. Each name consists of lowercase or uppercase letters and its length is between 1 and 5 , inclusive. Each test satisfies the following constraints: $1 \leq n \leq 1000,1 \leq m_{i}, \sum_{i=1}^{n} m_{i} \leq 10^{5}$, that is, the total number of pairs of names in the documents does not exceed $10^{5}$. The number of distinct names that appear in a test case does not exceed 300 .

## Output

Output "Yes" (without quotes) in a single line if there exists an interpretation of the documents that does not contradict the hypothesis that $p$ is an ancestor of $q$. Output "No" otherwise.

## Examples

| standard input | standard output |
| :--- | :--- |
| Alice Bob | No |
| 3 |  |
| 2 |  |
| Alice Bob Clare |  |
| 2 |  |
| Bob Clare |  |
| Clare David |  |
| 2 |  |
| Clare David |  |
| David Alice |  |
| Alice David |  |
| 3 |  |
| 2 |  |
| Alice Bob |  |
| Bob Clare |  |
| 2 |  |
| Bob Clare |  |
| Clare David |  |
| 2 | Yes |
| Clare David |  |
| David Alice |  |
| Alice Bob |  |
| David Clare |  |

## Problem G. Placing Medals on Binary Tree

Input file:
Output file:
Time limit:
Memory limit:
standard input
standard output
5 seconds
512 mebibytes

You have drawn a chart of a perfect binary tree, like one shown in Figure G.1. The figure shows a finite tree, but, if needed, you can add more nodes beneath the leaves, making the tree arbitrarily deeper.


Figure G.1. A Perfect Binary Tree Chart

Tree nodes are associated with their depths, defined recursively. The root has the depth of zero, and the child nodes of a node of depth $d$ have their depths $d+1$.

You also have a pile of a certain number of medals, each engraved with some number. You want to know whether the medals can be placed on the tree chart satisfying the following conditions.

- A medal engraved with $d$ should be on a node of depth $d$.
- One tree node can accommodate at most one medal.
- The path to the root from a node with a medal should not pass through another node with a medal.

You have to place medals satisfying the above conditions, one by one, starting from the top of the pile down to its bottom. If there exists no placement of a medal satisfying the conditions, you have to throw it away and simply proceed to the next medal.
You may have choices to place medals on different nodes. You want to find the best placement. When there are two or more placements satisfying the rule, one that places a medal higher in the pile is better. For example, when there are two placements of four medals, one that places only the top and the 2nd medal, and the other that places the top, the 3rd, and the 4th medal, the former placement is better.
In Sample Input 1, you have a pile of six medals engraved with $2,3,1,1,4$, and 2 again respectively, from top to bottom.

- The first medal engraved with 2 can be placed as shown in Figure G. 2 (A).
- Then the second medal engraved with 3 may be placed as shown in Figure G. 2 (B).
- The third medal engraved with 1 cannot be placed if the second medal were placed as stated above, because both of the two nodes of depth 1 are along the path to the root from nodes already with a medal. Replacing the second medal satisfying the placement conditions, however, enables a placement shown in Figure G. 2 (C).
- The fourth medal, again engraved with 1, cannot be placed with any replacements of the three medals already placed satisfying the conditions. This medal is thus thrown away.
- The fifth medal engraved with 4 can be placed as shown in of Figure G. 2 (D).
- The last medal engraved with 2 cannot be placed on any of the nodes with whatever replacements.



## Input

The first line of the input has $n$, an integer representing the number of medals $\left(1 \leq n \leq 5 \times 10^{5}\right)$. The following $n$ lines represent the positive integers engraved on the medals. The $i$-th of these lines has an integer $x_{i}\left(1 \leq x_{i} \leq 10^{9}\right)$ engraved on the $i$-th medal of the pile from the top.

## Output

When the best placement is chosen, for each $i$ from 1 through $n$, output "Yes" in a line if the $i$-th medal is placed; otherwise, output "No" in a line.

## Examples

| standard input | standard output |
| :--- | :--- |
| 6 | Yes |
| 2 | Yes |
| 3 | Yes |
| 1 | No |
| 1 | Yes |
| 4 | No |
| 2 |  |
| 10 | Yes |
| 4 | Yes |
| 4 | Yes |
| 4 | Yes |
| 4 | Yes |
| 4 | Yes |
| 4 | Yes |
| 1 | Yes |
| 4 | Yes |

## Problem H. Animal Companion in Maze

Input file:
Output file:
Time limit:
Memory limit
standard input
standard output
3 seconds
512 mebibytes

George, your pet monkey, has escaped, slipping the leash!
George is hopping around in a maze-like building with many rooms. The doors of the rooms, if any, lead directly to an adjacent room, not through corridors. Some of the doors, however, are one-way: they can be opened only from one of their two sides.
He repeats randomly picking a door he can open and moving to the room through it. You are chasing him but he is so quick that you cannot catch him easily. He never returns immediately to the room he just has come from through the same door, believing that you are behind him. If any other doors lead to the room he has just left, however, he may pick that door and go back. If he cannot open any doors except the one through which he came from, voilà, you can catch him there eventually.
You know how rooms of the building are connected with doors, but you don't know in which room George currently is.
It takes one unit of time for George to move to an adjacent room through a door. Write a program that computes how long it may take before George will be confined in a room. You have to find the longest time, considering all the possibilities of the room George is in initially, and all the possibilities of his choices of doors to go through.
Note that, depending on the room organization, George may have possibilities to continue hopping around forever without being caught. Doors may be on the ceilings or the floors of rooms; the connection of the rooms may not be drawn as a planar graph.

## Input

The first line of the input contains two integers $n\left(2 \leq n \leq 10^{5}\right)$ and $m\left(1 \leq m \leq 10^{5}\right)$, the number of rooms and doors, respectively. Next $m$ lines describe the doors. The $i$-th of these lines contains three integers $x_{i}, y_{i}$ and $w_{i}\left(1 \leq x_{i} \leq n, 1 \leq y_{i} \leq n, x_{i} \neq y_{i}, w_{i}=1\right.$ or 2$)$, meaning that the $i$-th door connects two rooms numbered $x_{i}$ and $y_{i}$, and it is one-way from $x_{i}$ to $y_{i}$ if $w_{i}=1$, two-way if $w_{i}=2$.

## Output

Output the maximum number of time units after which George will be confined in a room. If George has possibilities to continue hopping around forever, output "Infinite".

## Examples

| standard input | standard output |
| :---: | :---: |
| $\begin{array}{lll} 2 & 1 & \\ 1 & 2 & 2 \end{array}$ | 1 |
| $\begin{array}{lll} \hline 2 & 2 & \\ 1 & 2 & 1 \\ 2 & 1 & 1 \end{array}$ | Infinite |
| $\begin{array}{lll} 6 & 7 & \\ 1 & 3 & 2 \\ 3 & 2 & 1 \\ 3 & 5 & 1 \\ 3 & 6 & 2 \\ 4 & 3 & 1 \\ 4 & 6 & 1 \\ 5 & 2 & 1 \end{array}$ | 4 |
| $\begin{array}{lll} \hline 3 & 2 & \\ 1 & 3 & 1 \\ 1 & 3 & 1 \end{array}$ | 1 |

## Problem I. Skinny Polygon

Input file:
Output file: standard output
Time limit: $\quad 3$ seconds
Memory limit: $\quad 512$ mebibytes

You are asked to find a polygon that satisfies all the following conditions, given two integers, $x_{b b}$ and $y_{b b}$.

- The number of vertices is either 3 or 4 .
- Edges of the polygon do not intersect nor overlap with other edges, that is, they do not share any points with other edges except for their endpoints.
- The $x$ - and $y$-coordinates of each vertex are integers.
- The $x$-coordinate of each vertex is between 0 and $x_{b b}$, inclusive. Similarly, the $y$-coordinate is between 0 and $y_{b b}$, inclusive.
- At least one vertex has its $x$-coordinate 0 .
- At least one vertex has its $x$-coordinate $x_{b b}$.
- At least one vertex has its $y$-coordinate 0 .
- At least one vertex has its $y$-coordinate $y_{b b}$.
- The area of the polygon does not exceed 25000 .

The polygon may be non-convex.

## Input

The input consists of multiple test cases. The first line of the input contains an integer $n$, which is the number of the test cases $\left(1 \leq n \leq 10^{5}\right)$. Each of the following $n$ lines contains a test case containing two integers $x_{b b}$ and $y_{b b}\left(2 \leq x_{b b} \leq 10^{9}, 2 \leq y_{b b} \leq 10^{9}\right)$, stated above.

## Output

For each test case, output description of one polygon satisfying the conditions stated above, in the following format. In the first line print the number of vertices $v$, each of next $v$ lines must contain the coordinates of the $i$-th vertex $\left(x_{i}, y_{i}\right)$. The first vertex $\left(x_{1}, y_{1}\right)$ can be chosen arbitrarily, and the rest should be listed either in clockwise or in counterclockwise order.

When more than one polygon satisfies the conditions, any one of them is acceptable. One can prove that, with the input values ranging as stated above, there is at least one polygon satisfying the conditions.

## Example

|  | standard input | standard output |  |
| :--- | :--- | :--- | :---: |
| 2 | 4 |  |  |
| 56 | 5 | 6 |  |
| 10000000002 | 0 | 6 |  |
|  | 0 | 0 |  |
|  | 5 | 0 |  |
|  | 3 |  |  |
|  | 1000000000 | 0 |  |
|  | 0 | 2 |  |
|  | 999999999 | 0 |  |

## Problem J. Cover the Polygon with Your Disk

Input file: standard input
Output file: standard output
Time limit: 3 seconds
Memory limit: 512 mebibytes
A convex polygon is drawn on a flat paper sheet. You are trying to place a disk in your hands to cover as large area of the polygon as possible. In other words, the intersection area of the polygon and the disk should be maximized.

## Input

The input consists of a single test case, formatted as follows. The first line contains $n$, the number of vertices of the polygon $(3 \leq n \leq 10)$, and $r$, the radius of the disk $(1 \leq r \leq 100)$. Then follow $n$ lines with $x_{i}$ and $y_{i}$ which give the coordinate values of the $i$-th vertex of the polygon $(1 \leq i \leq n)$. Coordinate values satisfy $0 \leq x_{i} \leq 100$ and $0 \leq y_{i} \leq 100$.
The vertices are given in counterclockwise order. As stated above, the given polygon is convex. In other words, interior angles at all of its vertices are less than 180 degrees. Note that the border of a convex polygon never crosses or touches itself.

## Output

Output the largest possible intersection area of the polygon and the disk. The answer should not have an absolute error greater than $0.0001\left(10^{-4}\right)$.

## Examples

| standard input | standard output |
| :---: | :---: |
| $\begin{array}{ll} \hline 4 & 4 \\ 0 & 0 \\ 6 & 0 \\ 6 & 6 \\ 0 & 6 \end{array}$ | 35.759506 |
| $\begin{array}{ll} 3 & 1 \\ 0 & 0 \\ 2 & 1 \\ 1 & 3 \end{array}$ | 2.113100 |
| $\begin{array}{lll} 3 & 1 \\ 0 & 0 \\ 100 & 1 \\ 99 & 1 \end{array}$ | 0.019798 |
| $\begin{array}{lll} 4 & 1 & \\ 0 & 0 & \\ 100 & 10 \\ 100 & 12 \\ 0 & 1 & \end{array}$ | 3.137569 |
| 10 10 <br> 0 0 <br> 10 0 <br> 20 1 <br> 30 3 <br> 40 6 <br> 50 10 <br> 60 15 <br> 70 21 <br> 80 28 <br> 90 36 | 177.728187 |
| 10 49 <br> 50 0 <br> 79 10 <br> 96 32 <br> 96 68 <br> 79 90 <br> 50 100 <br> 21 90 <br> 4 68 <br> 4 32 <br> 21 10 | 7181.603297 |

## Problem K. Black and White Boxes

| Input file: | standard input |
| :--- | :--- |
| Output file: | standard output |
| Time limit: | 5 seconds |
| Memory limit: | 512 mebibytes |

Alice and Bob play the following game.

1. There are a number of straight piles of boxes. The boxes have the same size and are painted either black or white.
2. Two players, namely Alice and Bob, take their turns alternately. Who plays first is decided by a fair random draw.
3. In Alice's turn, she selects a black box in one of the piles, and removes the box together with all the boxes above it, if any. If no black box to remove is left, she loses the game.
4. In Bob's turn, he selects a white box in one of the piles, and removes the box together with all the boxes above it, if any. If no white box to remove is left, he loses the game.
Given an initial configuration of piles and who plays first, the game is a definite perfect information game. In such a game, one of the players has sure win provided he or she plays best. The draw for the first player, thus, essentially decides the winner.
In fact, this seemingly boring property is common with many popular games, such as chess. The chess game, however, is complicated enough to prevent thorough analyses, even by supercomputers, which leaves us room to enjoy playing.
This game of box piles, however, is not as complicated. The best plays may be more easily found. Thus, initial configurations should be fair, that is, giving both players chances to win. A configuration in which one player can always win, regardless of who plays first, is undesirable. You are asked to arrange an initial configuration for this game by picking a number of piles from the given candidate set. As more complicated configuration makes the game more enjoyable, you are expected to find the fair configuration with the maximum possible number of boxes.

## Input

The input consists of a single test case, formatted as follows. A positive integer $n(n \leq 40)$ is the number of candidate piles. Each of the next $n$ lines contains $p_{i}$ : a string of characters ' B ' and ' W ', representing the $i$-th candidate pile. Here, 'B' and 'W' mean black and white boxes, respectively. The boxes appear in the order in the pile, from bottom to top. The number of boxes in a candidate pile does not exceed 40.

## Output

Output in a line the maximum possible number of boxes in a fair initial configuration consisting of some of the candidate piles. If only the empty configuration is fair, output a zero.

## Examples

| standard input | standard output |
| :--- | :--- |
| 4 | 5 |
| B |  |
| W |  |
| WB |  |
| WB | 10 |
| B |  |
| W |  |
| WB |  |
| WB |  |
| BWW |  |

