

Problem A. GuruGuru

- Time Limit: 2 sec
- Memory Limit: 512 MB

You are playing a game called *Guru Guru Gururin*. In this game, you can move with the vehicle called Gururin. There are two commands you can give to Gururin: 'R' and 'L'. When 'R' is sent, Gururin rotates clockwise by 90 degrees. Otherwise, when 'L' is sent, Gururin rotates counterclockwise by 90 degrees.

During the game, you noticed that Gururin obtains magical power by performing special commands. In short, Gururin obtains magical power every time when it performs one round in the clockwise direction from north to north. In more detail, the conditions under which magical power can be obtained is as follows.

- At the beginning of the special commands, Gururin faces north.
- At the end of special commands, Gururin faces north.
- Except for the beginning and the end of special commands, Gururin does not face north.
- During the special commands, Gururin faces north, east, south, and west one or more times, respectively, after the command of 'R'.

At the beginning of the game, Gururin faces north. For example, if the sequence of commands Gururin received in order is 'RRRR' or 'RRLRRLRR', Gururin can obtain magical power. Otherwise, if the sequence of commands is 'LLLL' or 'RLLR', Gururin cannot obtain magical power.

Your task is to calculate how many times Gururin obtained magical power throughout the game. In other words, given the sequence of the commands Gururin received, calculate how many special commands exists in it.

Input

The input consists of a single test case in the format below.

S

The first line consists of a string S , which represents the sequence of commands Gururin received. S consists of 'L' and 'R'. The length of S is between 1 and 10^3 inclusive.

Output

Print the number of times Gururin obtained magical power throughout the game in one line.

Examples

Input	Output
RRRRLLLLRRRR	2
RLLRLLLLRRRLLRRR	0
LR	0
RRLRRLRRRLRRLRRRLRRLRRRLRRLRR	4

Problem B. Colorful Drink

- Time Limit: 2 sec
- Memory Limit: 512 MB

In the Jambo Amusement Garden (JAG), you sell colorful drinks consisting of multiple color layers. This colorful drink can be made by pouring multiple colored liquids of different density from the bottom in order.

You have already prepared several colored liquids with various colors and densities. You will receive a drink request with specified color layers. The colorful drink that you will serve must satisfy the following conditions.

- You cannot use a mixed colored liquid as a layer. Thus, for instance, you cannot create a new liquid with a new color by mixing two or more different colored liquids, nor create a liquid with a density between two or more liquids with the same color by mixing them.
- Only a colored liquid with strictly less density can be an upper layer of a denser colored liquid in a drink. That is, you can put a layer of a colored liquid with density x directly above the layer of a colored liquid with density y if $x < y$ holds.

Your task is to create a program to determine whether a given request can be fulfilled with the prepared colored liquids under the above conditions or not.

Input

The input consists of a single test case in the format below.

```
N
C1 D1
⋮
CN DN
M
O1
⋮
OM
```

The first line consists of an integer N ($1 \leq N \leq 10^5$), which represents the number of the prepared colored liquids. The following N lines consists of C_i and D_i ($1 \leq i \leq N$). C_i is a string consisting of lowercase alphabets and denotes the color of the i -th prepared colored liquid. The length of C_i is between 1 and 20 inclusive. D_i is an integer and represents the density of the i -th prepared colored liquid. The value of D_i is between 1 and 10^5 inclusive. The $(N + 2)$ -nd line consists of an integer M ($1 \leq M \leq 10^5$), which represents the number of color layers of a drink request. The following M lines consists of O_i ($1 \leq i \leq M$). O_i is a string consisting of lowercase alphabets and denotes the color of the i -th layer from the top of the drink request. The length of O_i is between 1 and 20 inclusive.

Output

If the requested colorful drink can be served by using some of the prepared colored liquids, print 'yes'. Otherwise, print 'no'.

Examples

Input	Output
2 white 20 black 10 2 black white	Yes
2 white 10 black 10 2 black white	No
2 white 20 black 10 2 black orange	No
3 white 10 red 20 white 30 3 white red white	Yes
4 red 3444 red 3018 red 3098 red 3319 4 red red red red	Yes

Problem C. Santa's Gift

- Time Limit: 2 sec
- Memory Limit: 512 MB

Santa is going to pack gifts into a bag for a family. There are N kinds of gifts. The size and the price of the i -th gift ($1 \leq i \leq N$) are s_i and p_i , respectively. The size of the bag is C , thus Santa can pack gifts so that the total size of the gifts does not exceed C . Children are unhappy if they are given multiple items of the same kind gift, so Santa has to choose at most one gift of the same kind per child.

In addition, if a child did not receive a gift that the other children in the same family receive, he/she will complain about that. Hence Santa must distribute gifts fairly to all the children of a family, by giving the same set of gifts to each child. In other words, for a family with k children, Santa must pack zero or k items for each kind of gifts. Santa gives one bag to one family, therefore, the total size of the gifts for each family does not exceed C .

Santa wants to maximize the total price of packed items for a family but does not know the number of children in the family he is going to visit yet. The number seems at most M . To prepare all the possible cases, calculate the maximum total price of items for a family with k children for each $1 \leq k \leq M$.

Input

The input consists of a single test case in the following format.

```
C N M
s1 p1
...
sN pN
```

The first line contains three integers C , N and M , where C ($1 \leq C \leq 10^4$) is the size of the bag, N ($1 \leq N \leq 10^4$) is the number of kinds of the gifts, and M ($1 \leq M \leq 10^4$) is the maximum number of children in the family. The i -th line of the following N lines contains two integers s_i and p_i ($1 \leq s_i, p_i \leq 10^4$), where s_i and p_i are the size and the price of the i -th gift, respectively.

Output

The output should consist of M lines. In the k -th line, print the maximum total price of gifts for a family with k children.

Examples

Input	Output
6 3 2 1 2 2 10 3 5	17 24
200 5 5 31 41 59 26 53 58 97 93 23 84	235 284 375 336 420
1 1 2 1 1	1 0
2 2 2 1 1 2 100	100 2

Problem D. Prefix Suffix Search

- Time Limit: 3 sec
- Memory Limit: 512 MB

As an English learner, sometimes you cannot remember the entire spelling of English words perfectly, but you can only remember their prefixes and suffixes. For example, you may want to use a word which begins with 'appr' and ends with 'iate', but forget the middle part of the word. It may be 'appreciate', 'appropriate', or something like them.

By using an ordinary dictionary, you can look up words beginning with a certain prefix, but it is inconvenient for further filtering words ending with a certain suffix. Thus it is helpful to achieve dictionary functionality which can be used for finding words with a given prefix and suffix. In the beginning, let's count the number of such words instead of explicitly listing them.

More formally, you are given a list of N words. Next, you are given Q queries consisting of two strings. Your task is to write a program which outputs the number of words with the prefix and suffix for each query in the given list.

Input

The input consists of a single test case in the following format.

```
 $N$   $Q$ 
 $w_1$ 
...
 $w_N$ 
 $p_1$   $s_1$ 
...
 $p_Q$   $s_Q$ 
```

The first line contains two integers N and Q , where N ($1 \leq N \leq 10^5$) is the number of words in the list, and Q ($1 \leq Q \leq 10^5$) is the number of queries. The i -th line of the following N lines contains a string w_i . The i -th of the following Q lines contains two strings p_i and s_i , which are a prefix and suffix of words to be searched, respectively.

You can assume the followings:

- All the strings in an input are non-empty and consist only of lowercase English letters.
- The total length of input strings does not exceed 2,500,000.
- Words in the given list are unique: $w_i \neq w_j$ if $i \neq j$.
- Pairs of a prefix and suffix are unique: $(p_i, s_i) \neq (p_j, s_j)$ if $i \neq j$.

Output

For each query, output the number of words with a given prefix and suffix in the given list per a line.

Examples

Input	Output
6 7 appreciate appropriate acceptance ace acm acetylene appr iate a e a a ac ce ace e acceptance acceptance no match	2 5 0 2 2 1 0
5 5 d dd ddd dddd ddddd d d dd dd ddd ddd d dddd ddddd dd	5 4 3 2 1
7 4 connected disconnected graph directed diameter distance minor c ed di ed dis ed dis e	1 2 1 1

Problem E. Magic Triangles

- Time Limit: 2 sec
- Memory Limit: 512 MB

Fallen angel Yohane plans to draw a magic symbol composed of triangles on the earth. By casting some magic spell on the symbol, she will obtain magic power; this is the purpose for which she will draw a magic symbol. The magic power yielded from the magic symbol is determined only by the common area of all the triangles. Suppose the earth is a two-dimensional plane and the vertices of the triangles are points on the plane. Yohane has already had a design of the magic symbol, i.e. the positions, sizes, shapes of the triangles. However, she does not know how much magic power will be obtained from the symbol. Your task as a familiar of the fallen angel is to write a program calculating the common area of given triangles on a two-dimensional plane.

Input

The input consists of a single test case in the following format.

```
N
x1,1 y1,1 x1,2 y1,2 x1,3 y1,3
...
xN,1 yN,1 xN,2 yN,2 xN,3 yN,3
```

The first line contains an integer N , which is the number of triangles ($1 \leq N \leq 10^5$). The i -th line of the following N lines contains six integers $x_{i,1}, y_{i,1}, x_{i,2}, y_{i,2}, x_{i,3},$ and $y_{i,3}$, where $(x_{i,j}, y_{i,j})$ is the coordinate of the j -th vertex of the i -th triangle ($-1,000 \leq x_{i,j}, y_{i,j} \leq 1,000$).

You can assume the followings:

- Every triangle has a positive area.
- The vertices of every triangle are in the counter-clockwise order.

Output

Output the common area of given triangles in a line. The output can contain an absolute or relative error no more than 10^{-6} .

Examples

Input	Output
2 0 0 2 0 0 2 0 1 2 1 0 3	0.5
2 0 0 100 0 50 100 50 -50 100 50 0 50	3125
5 0 0 1 0 0 1 0 0 2 0 0 2 0 0 3 0 0 3 0 0 4 0 0 4 0 0 5 0 0 5	0.5

Problem F. Nim without Zero

- Time Limit: 2 sec
- Memory Limit: 512 MB

Alice: "Hi, Bob! Let's play Nim!"

Bob: "Are you serious? I don't want to play it. I know how to win the game."

Alice: "Right, there is an algorithm to calculate the optimal move using XOR. How about changing the rule so that a player loses a game if he or she makes the XOR to 0?"

Bob: "It sounds much better now, but I suspect you know the surefire way to win."

Alice: "Do you wanna test me?"

This game is defined as follows.

1. The game starts with N heaps where the i -th of them consists of a_i stones.
2. A player takes any positive number of stones from any single one of the heaps in one move.
3. Alice moves first. The two players alternately move.
4. If the XOR sum, $a_1 \text{ XOR } a_2 \text{ XOR } \dots \text{ XOR } a_N$, of the numbers of remaining stones of these heaps becomes 0 as a result of a player's move, the player loses.

Your task is to find which player will win if they do the best move.

Input

The input consists of a single test case in the format below.

$$\begin{array}{c} N \\ a_1 \\ \vdots \\ a_N \end{array}$$

The first line contains an integer N which is the number of the heaps ($1 \leq N \leq 10^5$). Each of the following N lines gives the number of stones in each heap ($1 \leq a_i \leq 10^9$).

Output

Output the winner, Alice or Bob, when they do the best move.

Examples

Input	Output
2 1 1	Alice
5 1 2 3 4 5	Bob
10 1 2 3 4 5 6 7 8 9 10	Alice

In the first example, the XOR sum is 0 in the initial state, but the game is going because nobody moves yet. First Alice takes a stone and the XOR sum becomes 1, then Bob takes the last stone and the XOR sum becomes 0. Therefore, Alice will win, and Bob will lose.

Problem G. Additions

- Time Limit: 2 sec
- Memory Limit: 512 MB

You are given an integer N and a string consisting of '+' and digits. You are asked to transform the string into a valid formula whose calculation result is smaller than or equal to N by modifying some characters. Here, you replace one character with another character any number of times, and the converted string should still consist of '+' and digits. Note that leading zeros and unary positive are prohibited.

For instance, '0123+456' is assumed as invalid because leading zero is prohibited. Similarly, '+1+2' and '2++3' are also invalid as they each contain a unary expression. On the other hand, '12345', '0+1+2' and '1234+0+0' are all valid.

Your task is to find the minimum number of the replaced characters. If there is no way to make a valid formula smaller than or equal to N , output -1 instead of the number of the replaced characters.

Input

The input consists of a single test case in the following format.

N
 S

The first line contains an integer N , which is the upper limit of the formula ($1 \leq N \leq 10^9$). The second line contains a string S , which consists of '+' and digits and whose length is between 1 and 1,000, inclusive. Note that it is **not** guaranteed that initially S is a valid formula.

Output

Output the minimized number of the replaced characters. If there is no way to replace, output -1 instead.

Examples

Input	Output
100 +123	2
10 +123	4
1 +123	-1
10 ++1+	2
2000 1234++7890	2

In the first example, you can modify the first two characters and make a formula '1+23', for instance. In the second example, you should make '0+10' or '10+0' by replacing all the characters. In the third example, you cannot make any valid formula less than or equal to 1.

Problem H. Enlarge Circles

- Time Limit: 2 sec
- Memory Limit: 512 MB

You are given N distinct points on the 2-D plane. For each point, you are going to make a single circle whose center is located at the point. Your task is to maximize the sum of perimeters of these N circles so that circles do not overlap each other. Here, "overlap" means that two circles have a common point which is not on the circumference of at least either of them. Therefore, the circumferences can be touched. Note that you are allowed to make a circle with radius 0.

Input

The input consists of a single test case in the following format.

```

N
x1 y1
⋮
xN yN

```

The first line contains an integer N , which is the number of points ($2 \leq N \leq 200$). Each of the following N lines gives the coordinates of a point. Integers x_i and y_i ($-100 \leq x_i, y_i \leq 100$) in the i -th line of them give the x - and y -coordinates, respectively, of the i -th point. These points are distinct, in other words, $(x_i, y_i) \neq (x_j, y_j)$ is satisfied if i and j are different.

Output

Output the maximized sum of perimeters. The output can contain an absolute or a relative error no more than 10^{-6} .

Examples

Input	Output
<pre> 3 0 0 3 0 5 0 </pre>	31.415926535
<pre> 3 0 0 5 0 0 5 </pre>	53.630341225
<pre> 9 91 -18 13 93 73 -34 15 2 -46 0 69 -42 -23 -13 -87 41 38 68 </pre>	1049.191683488

Problem I. Sum of QQ

- Time Limit: 2 sec
- Memory Limit: 512 MB

You received a card with an integer S and a *multiplication table* of infinite size. All the elements in the table are integers, and an integer at the i -th row from the top and the j -th column from the left is $A_{i,j} = i \times j$ ($i, j \geq 1$). The table has infinite size, i.e., the number of the rows and the number of the columns are infinite.

You love rectangular regions of the table in which the sum of numbers is S . Your task is to count the number of integer tuples (a, b, c, d) that satisfies $1 \leq a \leq b, 1 \leq c \leq d$ and $\sum_{i=a}^b \sum_{j=c}^d A_{i,j} = S$.

Input

The input consists of a single test case of the following form.

S

The first line consists of one integer S ($1 \leq S \leq 10^5$), representing the summation of rectangular regions you have to find.

Output

Print the number of rectangular regions whose summation is S in one line.

Examples

Input	Output
25	10
1	1
5	4
83160	5120

Problem J. Prime Routing

- Time Limit: 2 sec
- Memory Limit: 512 MB

Fox Jiro is one of the staffs of the ACM-ICPC 2018 Asia Yokohama Regional Contest and is responsible for designing the network for the venue of the contest. His network consists of N computers, which are connected by M cables. The i -th cable connects the a_i -th computer and the b_i -th computer, and it carries data in both directions. Your team will use the S -th computer in the contest, and a judge server is the T -th computer.

He decided to adjust the routing algorithm of the network to maximize the performance of the contestants through the magical power of prime numbers. In this algorithm, a packet (a unit of data carried by the network) is sent from your computer to the judge server passing through the cables a prime number of times if possible. If it is impossible, the contestants cannot benefit by the magical power of prime numbers. To accomplish this target, a packet is allowed to pass through the same cable multiple times.

You decided to write a program to calculate the minimum number of times a packet from S to T needed to pass through the cables. If the number of times a packet passes through the cables cannot be a prime number, print -1 .

Input

The input consists of a single test case, formatted as follows.

```

N M S T
a1 b1
⋮
aM bM

```

The first line consists of four integers N , M , S , and T ($2 \leq N \leq 10^5$, $1 \leq M \leq 10^5$, $1 \leq S, T \leq N$, $S \neq T$). The i -th line of the following M lines consists of two integers a_i and b_i ($1 \leq a_i < b_i \leq N$), which means the i -th cables connects the a_i -th computer and the b_i -th computer in the network. You can assume that the network satisfies the following conditions.

- The network has no multi-edge, i.e., $(a_i, b_i) \neq (a_j, b_j)$ for all i, j ($1 \leq i < j \leq M$).
- The packets from N computers are reachable to T by passing through some number of cables. The number is not necessarily a prime.

Output

If there are ways such that the number of times a packet sent from S to T passes through the cables is a prime number, print the minimum prime number of times in one line. Otherwise, print -1 .

Examples

Input	Output
<pre> 5 5 1 5 1 2 1 4 2 3 3 4 3 5 </pre>	3
<pre> 5 4 1 5 1 2 2 3 3 4 4 5 </pre>	-1
<pre> 2 1 1 2 1 2 </pre>	3
<pre> 3 3 1 2 1 2 1 3 2 3 </pre>	2

Problem K. Rough Sorting

- Time Limit: 2 sec
- Memory Limit: 512 MB

For skilled programmers, it is very easy to implement a sorting function. Moreover, they often avoid full sorting to reduce computation time if it is not necessary. Here, we consider "rough sorting" which sorts an array except for some pairs of elements. More formally, we define an array is " K -roughly sorted" if an array is sorted except that **at most** K pairs are in reversed order. For example, '1 3 2 4' is 1-roughly sorted because (3,2) is only the reversed pair. In the same way, '1 4 2 3' is 2-roughly sorted because (4,2) and (4,3) are reversed.

Considering rough sorting by exchanging adjacent elements repeatedly, you need less number of swaps than full sorting. For example, '4 1 2 3' needs three exchanges for full sorting, but you only need to exchange once for 2-rough sorting.

Given an array and an integer K , your task is to find the result of the K -rough sorting with a minimum number of exchanges. If there are several possible results, you should output the lexicographically minimum result. Here, the lexicographical order is defined by the order of the first different elements.

Input

The input consists of a single test case in the following format.

```

N K
x1
⋮
xN

```

The first line contains two integers N and K . The integer N is the number of the elements of the array ($1 \leq N \leq 10^5$). The integer K gives how many reversed pairs are allowed ($1 \leq K \leq 10^9$). Each of the following N lines gives the element of the array. The array consists of the permutation of 1 to N , therefore $1 \leq x_i \leq N$ and $x_i \neq x_j$ ($i \neq j$) are satisfied.

Output

The output should contain N lines. The i -th line should be the i -th element of the result of the K -rough sorting. If there are several possible results, you should output the minimum result with the lexicographical order.

Examples

Input	Output
3 1 3 2 1	1 3 2
3 100 3 2 1	3 2 1
5 3 5 3 2 1 4	1 3 5 2 4
5 3 1 2 3 4 5	1 2 3 4 5

In the last example, the input array is already sorted, which means the input is already a 3-roughly sorted array and no swapping is needed.