

## A. And Yet Another Bracket Sequence

time limit per test: 5 seconds  
 memory limit per test: 256 megabytes  
 input: standard input  
 output: standard output

Polycarpus has a finite sequence of opening and closing brackets. In order not to fall asleep in a lecture, Polycarpus is having fun with his sequence. He is able to perform two operations:

- adding any bracket in any position (in the beginning, the end, or between any two existing brackets);
- cyclic shift — moving the last bracket from the end of the sequence to the beginning.

Polycarpus can apply any number of operations to his sequence and adding a cyclic shift in any order. As a result, he wants to get the correct bracket sequence of the minimum possible length. If there are several such sequences, Polycarpus is interested in the lexicographically smallest one. Help him find such a sequence.

A *correct bracket sequence* is a sequence of opening and closing brackets, from which you can get a correct arithmetic expression by adding characters "1" and "+". Each opening bracket must correspond to a closed one. For example, the sequences "(()())", "()", "((()()))" are correct and ")((", "(()" and "((()))(" are not.

The sequence  $a_1 a_2 \dots a_n$  is lexicographically smaller than sequence  $b_1 b_2 \dots b_n$ , if there is such number  $i$  from 1 to  $n$ , that  $a_k = b_k$  for  $1 \leq k < i$  and  $a_i < b_i$ . Consider that "(" < ")".

### Input

The first line contains Polycarpus's sequence consisting of characters "(" and ")". The length of a line is from 1 to 1 000 000.

### Output

Print a correct bracket sequence of the minimum length that Polycarpus can obtain by his operations. If there are multiple such sequences, print the lexicographically minimum one.

### Examples

<b>input</b>
()()
<b>output</b>
(())
<b>input</b>
()(
<b>output</b>
(())

### Note

The sequence in the first example is already correct, but to get the lexicographically minimum answer, you need to perform four cyclic shift operations. In the second example you need to add a closing parenthesis between the second and third brackets and make a cyclic shift. You can first make the shift, and then add the bracket at the end.

## B. Group Photo 2 (online mirror version)

time limit per test: 2 seconds  
memory limit per test: 256 megabytes  
input: standard input  
output: standard output

Many years have passed, and  $n$  friends met at a party again. Technologies have leaped forward since the last meeting, cameras with timer appeared and now it is not obligatory for one of the friends to stand with a camera, and, thus, being absent on the photo.

Simply speaking, the process of photographing can be described as follows. Each friend occupies a rectangle of pixels on the photo: the  $i$ -th of them in a standing state occupies a  $w_i$  pixels wide and a  $h_i$  pixels high rectangle. But also, each person can lie down for the photo, and then he will occupy a  $h_i$  pixels wide and a  $w_i$  pixels high rectangle.

The total photo will have size  $W \times H$ , where  $W$  is the total width of all the people rectangles, and  $H$  is the maximum of the heights. The friends want to determine what minimum area the group photo can they obtain if no more than  $n/2$  of them can lie on the ground (it would be strange if more than  $n/2$  gentlemen lie on the ground together, isn't it?..)

Help them to achieve this goal.

### Input

The first line contains integer  $n$  ( $1 \leq n \leq 1000$ ) — the number of friends.

The next  $n$  lines have two integers  $w_i, h_i$  ( $1 \leq w_i, h_i \leq 1000$ ) each, representing the size of the rectangle, corresponding to the  $i$ -th friend.

### Output

Print a single integer equal to the minimum possible area of the photo containing all friends if no more than  $n/2$  of them can lie on the ground.

### Examples

<b>input</b>
3 10 1 20 2 30 3
<b>output</b>
180
<b>input</b>
3 3 1 2 2 4 3
<b>output</b>
21
<b>input</b>
1 5 10
<b>output</b>
50

## C. Rooks and Rectangles

time limit per test: 2 seconds  
memory limit per test: 256 megabytes  
input: standard input  
output: standard output

Polycarpus has a chessboard of size  $n \times m$ , where  $k$  rooks are placed. Polycarpus hasn't yet invented the rules of the game he will play. However, he has already allocated  $q$  rectangular areas of special strategic importance on the board, they must be protected well. According to Polycarpus, a rectangular area of the board is well protected if all its vacant squares can be beaten by the rooks that stand on this area. The rooks on the rest of the board do not affect the area's defense. The position of the rooks is fixed and cannot be changed. We remind you that the rook beats the squares located on the same vertical or horizontal line with it, if there are no other pieces between the square and the rook. Help Polycarpus determine whether all strategically important areas are protected.

### Input

The first line contains four integers  $n, m, k$  and  $q$  ( $1 \leq n, m \leq 100\,000, 1 \leq k, q \leq 200\,000$ ) — the sizes of the board, the number of rooks and the number of strategically important sites. We will consider that the cells of the board are numbered by integers from  $1$  to  $n$  horizontally and from  $1$  to  $m$  vertically. Next  $k$  lines contain pairs of integers " $x\ y$ ", describing the positions of the rooks ( $1 \leq x \leq n, 1 \leq y \leq m$ ). It is guaranteed that all the rooks are in distinct squares. Next  $q$  lines describe the strategically important areas as groups of four integers " $x_1\ y_1\ x_2\ y_2$ " ( $1 \leq x_1 \leq x_2 \leq n, 1 \leq y_1 \leq y_2 \leq m$ ). The corresponding rectangle area consists of cells  $(x, y)$ , for which  $x_1 \leq x \leq x_2, y_1 \leq y \leq y_2$ . Strategically important areas can intersect or coincide.

### Output

Print  $q$  lines. For each strategically important site print "YES" if it is well defended and "NO" otherwise.

### Examples

input
4 3 3 3 1 1 3 2 2 3 2 3 2 3 2 1 3 3 1 2 2 3
output
YES YES NO

### Note

Picture to the sample:



For the last area the answer is "NO", because cell  $(1, 2)$  cannot be hit by a rook.

## D. Social Network

time limit per test: 2 seconds  
memory limit per test: 256 megabytes  
input: standard input  
output: standard output

Polycarpus got an internship in one well-known social network. His test task is to count the number of unique users who have visited a social network during the day. Polycarpus was provided with information on all user requests for this time period. For each query, we know its time... and nothing else, because Polycarpus has already accidentally removed the user IDs corresponding to the requests from the database. Thus, it is now impossible to determine whether any two requests are made by the same person or by different people.

But wait, something is still known, because that day a record was achieved —  $M$  simultaneous users online! In addition, Polycarpus believes that if a user made a request at second  $S$ , then he was online for  $T$  seconds after that, that is, at seconds  $S, S + 1, S + 2, \dots, S + T - 1$ . So, the user's time online can be calculated as the union of time intervals of the form  $[S, S + T - 1]$  over all times  $S$  of requests from him.

Guided by these thoughts, Polycarpus wants to assign a user ID to each request so that:

- the number of different users online did not exceed  $M$  at any moment,
- at some second the number of distinct users online reached value  $M$ ,
- the total number of users (the number of distinct identifiers) was as much as possible.

Help Polycarpus cope with the test.

### Input

The first line contains three integers  $n, M$  and  $T$  ( $1 \leq n, M \leq 20\,000, 1 \leq T \leq 86400$ ) — the number of queries, the record number of online users and the time when the user was online after a query was sent. Next  $n$  lines contain the times of the queries in the format "hh:mm:ss", where hh are hours, mm are minutes, ss are seconds. The times of the queries follow in the non-decreasing order, some of them can coincide. It is guaranteed that all the times and even all the segments of type  $[S, S + T - 1]$  are within one 24-hour range (from 00:00:00 to 23:59:59).

### Output

In the first line print number  $R$  — the largest possible number of distinct users. The following  $n$  lines should contain the user IDs for requests in the same order in which the requests are given in the input. User IDs must be integers from  $1$  to  $R$ . The requests of the same user must correspond to the same identifiers, the requests of distinct users must correspond to distinct identifiers. If there are multiple solutions, print any of them. If there is no solution, print "No solution" (without the quotes).

### Examples

input
4 2 10 17:05:53 17:05:58 17:06:01 22:39:47
output
3 1 2 2 3

input
1 2 86400 00:00:00
output
No solution

### Note

Consider the first sample. The user who sent the first request was online from 17:05:53 to 17:06:02, the user who sent the second request was online from 17:05:58 to 17:06:07, the user who sent the third request, was online from 17:06:01 to 17:06:10. Thus, these IDs cannot belong to three distinct users, because in that case all these users would be online, for example, at 17:06:01. That is impossible, because  $M = 2$ . That means that some two of these queries belonged to the same user. One of the correct variants is given in the answer to the sample. For it user **1** was online from 17:05:53 to 17:06:02, user **2** — from 17:05:58 to 17:06:10 (he sent the second and third queries), user **3** — from 22:39:47 to 22:39:56.

In the second sample there is only one query. So, only one user visited the network within the 24-hour period and there couldn't be two users online on the network simultaneously. (The time the user spent online is the union of time intervals for requests, so users who didn't send requests could not be online in the network.)

## E. The Art of Dealing with ATM

time limit per test: 2 seconds

memory limit per test: 256 megabytes

input: standard input

output: standard output

ATMs of a well-known bank of a small country are arranged so that they can not give any amount of money requested by the user. Due to the limited size of the bill dispenser (the device that is directly giving money from an ATM) and some peculiarities of the ATM structure, you can get at most  $k$  bills from it, and the bills may be of at most two distinct denominations.

For example, if a country uses bills with denominations 10, 50, 100, 500, 1000 and 5000 burles, then at  $k = 20$  such ATM can give sums 100 000 burles and 96 000 burles, but it cannot give sums 99 000 and 101 000 burles.

Let's suppose that the country uses bills of  $n$  distinct denominations, and the ATM that you are using has an unlimited number of bills of each type. You know that during the day you will need to withdraw a certain amount of cash  $q$  times. You know that when the ATM has multiple ways to give money, it chooses the one which requires the minimum number of bills, or displays an error message if it cannot be done. Determine the result of each of the  $q$  of requests for cash withdrawal.

### Input

The first line contains two integers  $n, k$  ( $1 \leq n \leq 5000, 1 \leq k \leq 20$ ).

The next line contains  $n$  space-separated integers  $a_i$  ( $1 \leq a_i \leq 10^7$ ) — the denominations of the bills that are used in the country. Numbers  $a_i$  follow in the strictly increasing order.

The next line contains integer  $q$  ( $1 \leq q \leq 20$ ) — the number of requests for cash withdrawal that you will make.

The next  $q$  lines contain numbers  $x_i$  ( $1 \leq x_i \leq 2 \cdot 10^8$ ) — the sums of money in burles that you are going to withdraw from the ATM.

### Output

For each request for cash withdrawal print on a single line the minimum number of bills it can be done, or print -1, if it is impossible to get the corresponding sum.

### Examples

input
6 20 10 50 100 500 1000 5000 8 4200 100000 95000 96000 99000 10100 2015 9950
output
6 20 19 20 -1 3 -1 -1

input
5 2 1 2 3 5 8 8 1 3 5 7 9 11 13 15
output
1 1 1 2 2 2

