A. Penguins

Limits: 1 sec., 256 MiB

Zenyk and Marichka arrived to Antarctica to see some penguins. Well, they could have gone to Lviv for that.

Anyway, there are n penguins, and the i-th penguins is initially located in a point (x_i, y_i) on a plane. The goal of the penguins is to meet in some point on the plane. As we know, penguins aren't really good walkers, so in a second a penguin can go from point (x, y) to either $(x+1, y)$ or $(x, y+1)$. Moreover, at any point of time, at most one penguin can walk.

What is the minimum time needed for all penguins to meet at the same point?

Input

The first line contains a single integer n — the number of penguins. The next n lines describe the initial coordinates of the penguins, which are integers.

Output

In a single line print a single integer — the answer to the problem.

Constraints

$1 \le n \le 10^5$,
$0 \le x_i, y_i \le 10^9$.

Samples

Input (*stdin*)	Output (*stdout*)
2 1 2 2 1	2
3 4 7 10 10 2 2	25

B. Balls

Limits: 1 sec., 256 MiB

Zenyk placed n balls in a row on a table, and the i-th ball is colored in color c_i. Now Marichka is going to play with Zenyk's balls.

In a single turn she can pick a sequence of consecutive balls which has a dominant color. After that all selected balls that are colored in a different color than the dominant will be removed.

Marichka wants to make some number of turns (possibly zero) after which all remaining balls will be colored in the same color. Find out how many different colors could be left at the end.

Color is considered dominant if more than half of the selected balls are colored in it.

Input

The first line contains a single integer n — the number of balls. The second line contains a list of n space-separated integers c_i — the initial colors of the balls in the order they are placed on the table.

Output

In the only line print a single integer — the answer to the problem.

Constraints

$1 \le n \le 10^5$,
$1 \le c_i \le 10^9$.

Samples

Input (*stdin*)	Output (*stdout*)
7 3 1 3 2 1 2 3	2

C. Frog Jumping

Limits: 3 sec., 256 MiB

Marichka and Zenyk like romantic evenings. Today they decided to watch frogs jump over stones.

There are n stones placed in a line and numbered from the left to the right using integers from 1 to n, inclusive. The distance between any two consecutive stones is exactly 1 meter.

There are also m frogs, initially located on the first stone. The objective is to move all frogs to the last (n-th) stone by jumping. Each frog can only jump forward.

The following two condition must be fulfilled:

1. Stones a_1, a_2, ..., a_k must be visited by exactly one of the frogs.
2. All the other stones (except the first one and the last one) must be never visited by any frog.

When the i-th frog jumps more than d meters in a single jump, it costs c_i units of energy. Any smaller jump costs nothing.

Your task is to find the minimum total amount of energy needed for all frogs to get to the last stone.

Input

The first line of the input contains four space-separated integers n, m, k and d. The second line contains m space-separated integers c_i, which are the energy costs of a big jump for the corresponding frogs. The third line contains k space-seperated unique integers a_i, which are the indices of stones that must be visited exactly once.

Output

In the first and only line of the output print a single integer — minimum total energy cost.

Constraints

$3 \leq n \leq 10^9$,
$1 \leq m, k \leq 10^5$,
$1 \leq d, c_i \leq 10^9$,
$2 \leq a_i < n$.

Samples

Input (*stdin*)	Output (*stdout*)
10 2 3 3 4 7 4 8 7	4
10 2 2 3 4 7 9 5	15

D. Best Strategy

Limits: 1 sec., 256 MiB

Today Zenyk and Marichka decide to play a game. They have $2N$ stones in a row. Number A_i is written on i-th stone. Zenyk and Marichka take turns alternately. Marichka moves first. In each turn player takes leftmost or rigthmost stone until there is at least one stone.

Marichka wins if sum of all numbers on her stones is greater than or equal to Zenyk's sum. Otherwise Zenyk wins. Zenyk thinks that he knows the best strategy of this game. He takes a stone with bigger number on each turn. If they are equal Zenyk takes the leftmost one.

Help Marichka to find if she can win this game.

Input

The first line of the input contains one integer N. Second line contains $2N$ integers A_i.

Output

In the first line print `"Marichka"` (without quotes) if Marichka can win in this game, otherwise print `"Zenyk"`. If Marichka can win also print her strategy – N characters, i-th character equals `'L'` if in the i-th turn Marichka should take leftmost stone, otherwise i-th character equals `'R'`. If there exist several possible strategies, print any of them.

Constraints

$1 \le N \le 10^5$,
$1 \le A_i \le 10^9$.

Samples

Input (*stdin*)	Output (*stdout*)
4 7 10 4 0 2 5 4 7	Marichka RLRL
1 4 4	Marichka L

Notes

In the first test sum of Marichka's stones equals 21 and Zenyk's stones equals 18. Another strategies for Marichka exist. Note that Marichka wins if both sums are equal.

E. Things

Limits: 1 sec., 256 MiB

Zenyk is a busy man, so he has a lot of things to do. There are n things he has to do, and the i-th thing is going to take time range from l_i to r_i, inclusive. Note that $r_i - l_i$ is an even number, and that the ranges can intersect in any way.

Zenyk decided to makes things easier — for each thing, he will choose either the first half of the time range or the second. But his is afraid that Marichka might notice the change, so for each time moment that he was busy before the change, he must be busy after it as well. Zenyk is considered busy at some point of time if he has at least one thing to do.

You task is to find out whether Zenyk is able make his life easier or not.

Input

The first line contains a single integer n — the number of things. The next n lines describe each time range $[l_i, r_i]$, which are always integer.

Output

In a single line print `YES` if the answer is positive, or `NO` otherwise.

Constraints

$1 \le n \le 200$,
$0 \le l_i < r_i \le 10^9$,
$r_i - l_i$ is even.

Samples

Input (*stdin*)	Output (*stdout*)
4 0 8 4 12 10 12 5 11	YES
3 48 78 2 4 47 77	NO

F. Colorful String

Limits: 3 sec., 256 MiB

Zenyk decided to present Marichka a gift and, of course, decorate it with a beautiful and colorful bow. For that purpose he has got a colorful ribbon n inches long. The ribbon consists of n parts, each one inch long and colored in one of c colors.

But that's not enough for Zenyk because, as they say, four bows are always better than one bow. Hence he decided to cut the ribbon in four parts in such a way that the number of colors that appear in all of the four parts at least k times is maximum possible. (Note that he is only allowed to cut between one inch parts.) And it is your task to help him and find the best cuts.

Input

The first line of the input contains three integers n, c, k – the initial size of the ribbon, the number of colors, the required minimum number of occurrences of a color, respectively. The second line contains n space-separated integers, which denote the colors of the corresponding one inch parts of the ribbon. The colors are numbered using integers between 1 and c, inclusively.

Output

In the first line output a single integer – the maximum number of colors that have at least k occurrences in each of the four parts. In the next line print four space separated integers l_1 l_2 l_3 l_4, which denote the lengths of cutted ribbons, from the left to the right. Please note that the equality $l_1 + l_2 + l_3 + l_4 = n$ must always hold, as well as all l_i should be non-negative.

Constraints

$1 \leq n, k \leq 10^6$,
$1 \leq c \leq 400$.

Samples

Input (*stdin*)	Output (*stdout*)
4 1 1 1 1 1 1	1 1 1 1 1

G. Accommodation Plan

Limits: 4 sec., 256 MiB

The big party will be held at Zenyk and Marichka's home. Their K friends will arrive to them.

Now Zenyk tries to find a way to accommodate all friends. Their house consists of N rooms and $N-1$ hallways. Each hallway connects 2 rooms and has some length. It's possible to reach any room starting from any room via hallways.

Zenyk calls accommodation plan good if

- Each friend lives in some room.
- No 2 friends live in the same room.
- There exist a room (doesn't matter if someone lives there) such that all friends can meet in this room and the distance from it to room of each friend is not bigger than L.

Now Zenyk wants to count the number of good accommodation plans. Two plans are considered different if at least one friend lives in different rooms. As this number can be very big, print it modulo 1000000007.

Input

The first line contains 3 integers – N, K and L. Each of the next $N-1$ lines contain 3 integers – A_i, B_i and C_i, which mean that a hallway connecting A_i and B_i exists with length C_i.

Output

Print one integer – number of good accommodation plans modulo 1000000007.

Constraints

$1 \le K \le N \le 10^5$,
$1 \le A_i, B_i \le N$,
$1 \le C_i, L \le 10^9$.

Samples

Input (*stdin*)	Output (*stdout*)
5 2 7 1 2 4 3 2 8 2 4 2 4 5 6	12

Notes

All good accommodation plans:
$\{1,2\}, \{1,4\}, \{1,5\}, \{2,1\}, \{2,4\}, \{2,5\}, \{4,1\}, \{4,2\}, \{4,5\}, \{5,1\}, \{5,2\}, \{5,4\}$.
A pair of integers represents room indices of the first and the second friend, respectively.

H. Bulls

Limits: 1 sec., 256 MiB

Zenyk and Marichka have a herd of bulls. There are n of bulls, which are placed in a line and numbered from the left to the right. It's known that the i-th bull is a bull of type t_i.

Unfortunately, bulls of the same type don't get along well. Zenyk decided to split the line of the bulls in two so that in each of the new lines there are no pairs of consecutive bulls of the same type. Note that the relative order of bulls in the resulting lines must not change.

Help Zenyk to find the right way to split the bulls.

Input

The first line contains a single integer n. The next line contains n integers t_i, which describe the types of the bulls in order.

Output

If there's no way to split the bulls in the way Zenyk wants, print a single integer `-1`.

Otherwise, in the first line print the number of bulls in the first group, and in the second line print the sorted list of indices of selected bulls. In the next two lines describe the second group in the same way. If multiple answers exist, you can output any one of them. Note that it's allowed for one of the groups to be empty.

Constraints

$1 \le n \le 10^6$,
$1 \le t_i \le 10^9$.

Samples

Input (*stdin*)	Output (*stdout*)
8 1 2 2 4 7 2 2 3	4 1 2 4 6 4 3 5 7 8
4 7 7 7 4	-1

I. Time to Seed Flowers

Limits: 3 sec., 256 MiB

It's spring time! A perfect time for Marichka to seed flowers. Her garden consists of n rows, and each rows has exactly m slots to seed flowers. In each of the $n \times m$ slots she wants to have flowers of single type seeded.

It is known that Marichka seeded flowers of type a_{ij} in the slot with coordinates (i, j) last year. This year she would like to have some dominating type of flowers, which means that there should be a type that is seeded in at least $\frac{nm}{2}$ slots. She decided that in a day she will pick any row, throw away all flowers that are already seeded there and seed flowers of arbitrary types in all slots of the row.

It is quite clear that Zenyk is not going to help her with the garden work. But he anyway would like to minimize the number of days she spends working. And it is your task to help him.

Input

The first line of the input contains pair of integers n and m – the number of rows and the number of slots in a row, respectively. The next n lines contain m integers each, which denote the initial types of flowers seeded on the corresponding slots. The flower types are numbered using positive integers.

Output

In the only line of the output print the minimum number of days it will take to reach the Marichka's goal.

Constraints

$1 \leq n, m \leq 1000$,
$1 \leq a_{ij} \leq 10^9$.

Samples

Input (*stdin*)	Output (*stdout*)
4 3 1 1 2 2 4 2 2 1 1 4 3 7	1

J. Cut the Cake

Limits: 1 sec., 256 MiB

It is Marichka's k^2-th birthday today! Zenyk bought a big cake for this occasion and now he wants to cut it.

For the sake of simplicity, consider the cake as rectangular matrix with n rows and m columns. There are exactly k^2 candles on it, each of them located in a unique cell of the matrix. Zenyk wants to cut the cake with $k-1$ horizontal and $k-1$ vertical cuts. (Note that he's only allowed to cut between cells.) After the cutting, each of k^2 parts must contain a single candle.

You task is to find and output any valid cutting, or indicate that it's impossible to achive the goal.

Input

The first line contains three integers n, m and k. The following n lines contain a string of m characters each. Character `"1"` represents a cell with a candle on it, while `"0"` respresents a cell without candle.

It's guaranteed that there are exactly k^2 candles on the cake.

Output

In the first line print `"YES"` if it's possible to cut the cake the way Zenyk wants, otherwise print `"NO"`.

In case of positive answer the second line must contain $k-1$ unique valid indices of the horizontal cuts, and the third line must contain $k-1$ unique valid indices of the vertical cuts. A cut between rows (or columns) i and $i+1$ has index i (1-based).

Constraints

$2 \le k \le n, m \le 200$.

Samples

Input (*stdin*)	Output (*stdout*)
4 4 2 1000 0001 0010 0001	YES 2 3
3 4 2 1110 0000 0100	NO

K. Message

Limits: 3 sec., 256 MiB

One evening Zenyk decided to send some nice message to Marichka to congratulate her on the start of spring. Initially, he entered message s on his phone, but after a moment he realized, that it would be much better to enter message t.

Unfortunately, it's not so easy to change the message now – the only thing Zenyk is able to do is to remove the first or the last occurrence of any letter. Please note that he is able to perform this operation any number of times. Moreover, the letters are not removed instantly. It takes w_i seconds to remove character that was initially placed on i-th position in string s.

Help Zenyk to calculate the minumum number of seconds it takes to transform message s into t using the described operations. If it's impossible to do that, print a single line ``You better start from scratch man...'' (without quotes).

Input

The first line of the input contains string s, the second – string t. The third line contains $|s|$ space-separated integers, each of which denotes the number of seconds it takes to remove the corresponding character.

Output

If Zenyk is able to transform s into t, print the minimum number of seconds required to do that. Otherwise, print ``You better start from scratch man...'' (without quotes).

Constraints

$1 \le |s|, |t| \le 200000$,
$1 \le w_i \le 10^9$,
Strings s and t consist only of the lower case latin letters a-z.

Samples

Input (*stdin*)	Output (*stdout*)
ababccb abc 7 2 2 4 3 2 1	7
babab baab 2 1 3 2 4	You better start from scratch man...