International Collegiate Programming Contest

The 2020 Beninese Collegiate Programming Contest

Benin

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(Contest Problems)

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Problem A. Calculator Messages

Input file:	`digits.in`
Output file:	`standard output`
Balloon Color:	`Red`

Alex is a six-year-old boy. He was playing with his sister's calculator and he discovered that when he rotates the calculator, some digits look like characters. This is his list:

$$0 \rightarrow \mathrm{O}$$
$$1 \rightarrow \mathrm{I}$$
$$2 \rightarrow \mathrm{Z}$$
$$3 \rightarrow \mathrm{E}$$
$$5 \rightarrow \mathrm{S}$$
$$7 \rightarrow \mathrm{L}$$
$$8 \rightarrow \mathrm{B}$$
$$9 \rightarrow \mathrm{G}$$

Alex will write some digits for his mother on the calculator and she will need your help to translate them into alphabetical words.

Input

The first line contains N - the number of Alex's words ($1 \leq N \leq 100$).

Each of the N lines contain a string S_i ($1 \leq |S_i| \leq 1000$) and has only digits [0, 1, 2, 3, 5, 7, 8, 9].

$|X|$ is the length of X.

Output

N lines; each has one string with uppercase English letters - the string you will give to Alex's mother.

Example

digits.in	standard output
2 771 002	ILL ZOO

Problem B. Winner

Input file:	`winner.in`
Output file:	`standard output`
Balloon Color:	`Brown`

One day, a famous website made a 1 vs 1 contest. This is a special type of contest, in which 2 contestants compete against each other in a contest that has N problems and the one who solves more problems first wins.

$Mike$ challenged his friend $Jack$ on who will solve more problems first.

Can you help them and tell who solved more problems first, or if there's a tie?

Input

The input consists of 2 lines.

The first line contains an integer N $(1 \leq N \leq 100)$ - the number of problems.

The second line contains N integers a_i $(1 \leq a_i \leq 2)$. If a_i equals 1, this means $Mike$ solved problem number i first. If a_i equals 2, this means $Jack$ solved problem number i first.

Output

Print "Mike" if Mike solved more problems faster than Jack, or print "Jack" if Jack solved more problems faster than Mike. Otherwise, print "Tie".

Examples

winner.in	standard output
6 1 2 1 1 2 1	Mike
5 1 2 2 2 1	Jack
2 1 2	Tie

Problem C. Easy Contest

Input file:	`contest.in`
Output file:	`standard output`
Balloon Color:	`Orange`

The chief judge of some programming contest has N ideas that haven't been used yet, as well as N statement's stories that haven't been used yet too. The i^{th} $(1 \le i \le N)$ idea could be described by two values, a_i which is the difficulty of the idea and b_i the difficulty of the implementation, while the j^{th} $(1 \le j \le N)$ statement story could be described by one value y_j which is the difficulty of understanding it.

It's known that if you used the i^{th} idea and the j^{th} statement story to make problem K, then you can calculate the difficulty of problem K by using the following formula:

$$difficulty_{(k)} = a_i^2 + b_i^2 - y_j \cdot a_i \cdot b_i$$

The total difficulty of the contest is the sum of all difficulties of all problems.

Your task is to match each problem idea with a statement story in some way to create the easiest contest you can create.

You can use the problem idea only once as well as the statement story.

Input

The first line of input contains an integer N $(1 \le N \le 10^3)$, which is the number of the problem ideas as well as the number of the statement stories.

Followed by N lines where the i^{th} line contains two integers a_i and b_i $(1 \le a_i, b_i \le 10^3)$, which are the difficulty of the idea and the difficulty of the implementation of the i^{th} problem, respectively.

Followed by a line that contains N integers y_j $(1 \le y_j \le 10^3)$, which are the difficulty of understanding the j^{th} statement story.

Output

Print the minimum contest's difficulty you can create.

Examples

contest.in	standard output

`2`
`3 3`
`1 1`
`3 1`
	`-8`

`3`
`4 3`
`1 3`
`4 8`
`1 8 3`
	`-180`

Problem D. Largest Number

Input file:	`number.in`
Output file:	`standard output`
Balloon Color:	`Yellow`

One day, *Mike* was attending a lecture at his university, but he got bored so he stopped paying attention to what his professor was saying.

His professor was smart and noticed that *Mike* wasn't paying attention, so he challenged him with a problem.

He wrote N digits on the board and asked him: what is the largest number that you make with these digits?

Input

The first line contains the N ($1 \leq N \leq 10^4$) the number of digits written on the board.

The second contains the N digits: D_i ($1 \leq D_i \leq 9$).

Output

Print the largest number that can be formed by the given digits.

Examples

number.in	standard output
1 5	5
4 1283	8321
4 7813	8731

Problem E. Matrix

Input file:	`matrix.in`
Output file:	`standard output`
Balloon Color:	`Gold`

You are given a grid A that has N rows and N columns.

Count the number of sub-grids of grid A such that the sub-grid has X rows and X columns, and if you rotate this sub-grid 90 degrees to the right, it will remain unchanged.

Input

The first line of input has 2 integers: N and X $(1 \leq N \leq 50)$, $(1 \leq X \leq N)$. The following N lines have N numbers: a_i $(0 \leq a_i \leq 100)$.

Output

Print one integer, the answer to this problem.

Examples

matrix.in	standard output
4 2 1 2 3 1 4 4 4 5 2 2 2 2 2 3 2 2	1
2 2 1 1 1 1	1

Note

Example for Rotation:

Grid A is:

1 2 3

4 5 6

7 8 9

After rotating it 90 degrees to the right, it becomes:

7 4 1

8 5 2

9 6 3

Problem F. Sequence

Input file:	`seq.in`
Output file:	`standard output`
Balloon Color:	`Green`

Nobody really likes long statements, so let's get to the point.

Given a sequence of distinct numbers from 1 to N. There are 4 categories to classify the given sequence:

- **Category 1:** The sequence is increasing.
- **Category 2:** The sequence is decreasing.
- **Category 3:** The sequence is increasing then decreasing.
- **Category 4:** The sequence is decreasing then increasing.

It's guaranteed that the given sequence belongs to one of the above categories.

Input

The first line of input consists one integer N ($2 \leq N \leq 10^3$) - the length of the sequence.

The second line contains all numbers from 1 to N.

Output

Print the number of the category to which the sequence belongs.

Examples

seq.in	standard output
4 1 2 3 4	1
5 5 4 1 2 3	4
4 4 3 2 1	2
4 1 4 3 2	3

Problem G. Painting

Input file:	`paint.in`
Output file:	`standard output`
Balloon Color:	`Blue`

One day, as *George* was on his way back home, he saw a painting in the street. He discovered that it was a magical painting. The painting was divided into rows and columns like a grid. Each cell was initially colored in white.

Here is the magic, when *George* touches a cell in the painting, it's color and the color of its neighbors (if found) changes. If it's black, it changes to white and if it's white it changes to black. The neighbors of a cell are the cells that share a side with it.

Given the cells that *George* touched, you should expect the color of each cell.

Input

The first line contains three integers N, M and Q $(1 \leq N, M \leq 100)$,$(1 \leq Q \leq 1000)$ - the number of rows, number of columns and the number of cells *George* touched, respectively.

The next Q lines contain two integers X and Y $(1 \leq X \leq N, 1 \leq Y \leq M)$ - the row and the column of the cell George touched.

Output

Print the N lines, each line contains M integers separated by single space representing the grid after the operations.

Print 1 if the cell is black and 0 if the cell is white.

Examples

paint.in	standard output
5 8 3 2 2 3 4 5 4	0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0
4 5 2 1 1 4 5	1 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 1 1

Note

If the row and the column of a cell are i and j, its neighbors are $(i-1, j)$, $(i+1, j)$, $(i, j+1)$ and $(i, j-1)$.

Problem H. Conferences Day

Input file:	`conf.in`
Output file:	`standard output`
Balloon Color:	`Rose`

It's Conferences Day! Every IT Geek from all over Africa will be gathering to attend different speeches concerning multiple IT topics.

The speeches will take place one-by-one (they can't overlap). Each speech has some prerequisite knowledge, which was given in a previous speech (or multiple previous speeches), so that each speech will have a list of other speeches that must be finished before this one can start.

In addition to that, at the beginning of each speech, the speaker will take one extra minute for each of the speeches that have already finished to talk about their content, even the ones that are not part of this speech prerequisites.

Nobody likes long speeches (nor long problem statements), that's why the event organizers decided to arrange the speeches in a way such that the longest speech takes as little time as possible.

Input

The first line contains one integer N $(1 \leq N \leq 4 \cdot 10^5)$ - the number of speeches.

For the next N lines, each line contains:

An integer L_i $(1 \leq L_i \leq 10^6)$ - the length in minutes of the i_{th} speech.

An integer $Need_i$ $(0 \leq Need_i < N)$ - the number of speeches that must be done before the i_{th} speech.

The rest of the line will contain $Need_i$ integers: t_j $(1 \leq j \leq Need_i)$, $(1 \leq t_j \leq N)$ and $(t_j \neq i)$ - the index of the j_{th} speech that must be done before the i_{th} speech.

It is guaranteed that there are no cycles in the speeches dependencies and that the sum of $Need_i$ over all speeches is at most $4 \cdot 10^6$.

Output

Print the answer to the problem, the minimum possible length of the longest of all speeches, if speeches are arranged optimally according to the above rules.

Examples

conf.in	standard output
4 5 0 5 0 5 0 5 0	8
4 8 1 2 10 1 3 11 0 10 0	12

Note

In the first sample, any arrangement of the speeches will give the same answer.

In the second sample, the optimal arrangement is: $4 \rightarrow 3 \rightarrow 2 \rightarrow 1$.

Problem I. Bridges and Trees

Input file:	`graph.in`
Output file:	`standard output`
Balloon Color:	`Violet`

Given a bidirectional graph, you are asked to remove an edge such that graph will become disconnected and the absolute difference between the weight of the minimum spanning tree of one component and the weight of the maximum spanning tree of the other is **minimal**.

Input

The first line of input contains N $(3 \leq N \leq 10^5)$ and M $(2 \leq M \leq 10^5)$ - the number of nodes in the graph and the number of edges, respectively. Nodes are numbered for 1 to N.

The next M lines contains three space separated integers u, v and w where w is the weight of the road between u and v $(1 \leq u, v \leq N)$,$(1 \leq w \leq 10^9)$.

Output

If there's no way to disconnect the graph by removing an edge, print -1. Otherwise, output the absolute difference between the weight of the minimum spanning tree of one component and the weight of the maximum spanning tree of the other.

Example

graph.in	standard output
3 2 1 2 3 2 3 4	3

Problem J. Minimize Me

Input file:	`min.in`
Output file:	`standard output`
Balloon Color:	`White`

Given an array T of length N, you have to choose an integer X such that the following sum is as minimal as possible :

$$S = \sum_{i=1}^{i=N} abs(T_i - (X + i))$$

Input

The first line of the input contains an integer N $(1 \leq N \leq 10^5)$.

The next line contains N integers T_i $(1 \leq T_i \leq 10^9)$.

Output

Print the minimum possible S.

Examples

min.in	standard output
5 2 2 3 5 5	2
9 1 2 3 4 5 6 7 8 9	0

Note

In the first sample :

If we choose $X = 0$, the sum S will be :

$S = abs(2 - (0 + 1)) + abs(2 - (0 + 2)) + abs(3 - (0 + 3)) + abs(5 - (0 + 4)) + abs(5 - (0 + 5)) = 2.$

No other X will give a sum S strictly less than 2.

Problem K. Mango

Input file:	`mango.in`
Output file:	`standard output`
Balloon Color:	`Pink`

"I wrote the word **Mango**, mom!"

"Oh, that's impressive baby girl."

Little Lama is learning the English alphabet, that's why her parents decided to order her magnetic alphabet so she can stick them on the fridge. To order the alphabet, Lama's parents first tell the store how much they want from the letter "a", how much they want from letter "b", how much they want from letter "c"... and so on until letter "z".

Lama wants to write down the string S, can you help her count how much they need from every letter of the alphabet?

Also, can you sort the word S for Lama to make it easier for her to write?

Input

The first -and only- line of input has the string S ($1 \leq |S| \leq 10^5$) - the word Lama wants to write.

Output

The first line should have 26 space-separated integers, each representing how much Lama needs from each letter of the alphabet [a, b, c, d, e .... y, z] to write the word S.

The second line of the output should have the string S_2 - which is the sorted version of string S.

Example

mango.in	standard output
`dcbc`	`0 1 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0` `bccd`

Problem L. A Little Trick

Input file:	`trick.in`
Output file:	`standard output`
Balloon Color:	`Black`

Homos is a big boy now and he knows that his younger sister: Shambo, has just learnt about mathematical operations. He decided to test her understanding using a little trick. Homos will give Shambo two numbers: X and Y. He is going to let Shambo choose the number N, where:

$$N = X + Y \text{ or } N = X * Y \text{ or } N = X - Y$$

Then, Homos will give Shambo exactly N cookies. Shambo loves cookies so much, so she wants to have the maximum number of cookies she can get.

Help Shambo determine the value N.

Input

The first -and only- line of input has two integers: X and Y, $(-10^9 \leq X, Y \leq 10^9)$ - the two numbers Homos will give to Shambo.

Output

Output a single number N - the maximum number of cookies Shambo can get.

Examples

trick.in	standard output
3 5	15
-3 4	7

Problem M. New Year and Problems Robbers

Input file:	`thieves.in`
Output file:	`standard output`
Balloon Color:	`Cyan`

Some thieves managed to steal the problems of this contest. Fortunately, they didn't leave the contest floor yet, so you will try to catch them.

The contest floor is a grid of size $N \times M$. The thieves will try to get away with the problems by moving from a cell to an adjacent cell **(diagonal movements are not allowed)**, until they reach one of the 4 borders of the grid (contest floor).

In order to stop them, you can block some cells in the grid (so that the thieves can't go through them). Each grid cell has a specific type and each type has a blocking cost, other cells cannot be blocked at all.

Find the cheapest set of grid cells to block, which guarantees that the thieves won't escape with the problems, or report that it's impossible to catch them.

Input

The first line of the input contain three integers N, M and T ($1 \leq N, M \leq 30$ *and* $1 \leq T \leq 26$) - the dimensions of the contest floor and number of types of cells.

Each of the next N lines contain M characters, representing the grid.

- Character 'R' is where the robbers currently are (appears exactly once in the grid).
- Characters 'a' through 'z' represent the different types of cells. Only the first T alphabets.
- A dot ('.') represents a grid cell that cannot be blocked.

The last line contains T integers $Cost_i$ ($1 \leq Cost_i \leq 10^5$) - the cost of blocking a single grid cell of type 'a', 'b', and so on.

Note that the initial position of the thieves cannot be blocked.

Output

Print the minimum total cost of a blocking plan that guarantees no escape for the thieves.

If there is no way to prevent the thieves from escaping, print -1 instead.

Examples

thieves.in	standard output
5 5 1 aaaaa a...a a.R.a a...a aaaaa 1	12
1 2 1 aR 1	-1

Note

In the first example, the best plan is to block the central three cells on each side for a total cost of 12.

In the second example, since the thieves are already on the border, and we cannot block their initial position, there is no way to prevent them from escaping the contest floor.