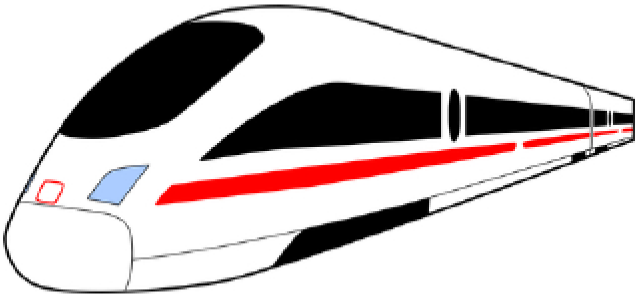
Problem A. Environment-Friendly Travel

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes



Taking holidays, unfortunately, has a carbon footprint. The $\texttt{CO}_2$-cost of a kilometer traveled depends on the mode of transportation. For instance, train travel is less costly than bus travel, which is itself less costly than car travel.

Your objective is to plan a holiday trip from your house, given by 2D coordinates (x_s, y_s) , to your travel destination, given by (x_d, y_d). Being aware of the environmental impact of travel, you want to minimize the $\texttt{CO}_2$-cost of your holiday, but you still want to keep the total number of kilometers traveled within a given budget B.

To aid you in planning, you have access to a map of N stations, possibly linked by T different modes of transportation (airplane, train, etc.) numbered $1, \ldots, T$. Each mode has a $\texttt{CO}_2$-cost per distance unit $C_1, \ldots, C_T$. You can travel by car from your home to the destination, from your home to any station, and from any station to the destination point, at a cost C_0 per distance unit. C_0 is always greater than any of $C_1, \ldots, C_T$. Each of the N stations has coordinates (x_i, y_i) for $i = 0, \ldots, N-1$. Each station may be connected to some other stations via one or several of the T modes. Each connection works both ways, so only one direction has to be listed. There can be multiple modes of transportation available between two stations. You can only travel between two stations via their connections using the available transportation modes (car travel is not allowed between stations).

The distance between two points a and b is the 2D distance between (x_a, y_a) and (x_b, y_b), rounded to the nearest integer above:

$$dist(a, b) = \left\lceil \sqrt{(x-a)^2 + (x-b)^2} \right\rceil ,$$

and the $\texttt{CO}_2$-cost of travel between a and b, using transport mode i is:

$$cost(a, b, i) = C_i \times dist(a, b).$$

Given two source–destination coordinates, a budget B expressed in distance units, a list of transportation modes and their respective $\texttt{CO}_2$ -costs, and the station network, your task is to compute the minimal $\texttt{CO}_2$ -cost possible while traveling at most B kilometers.

Input

The input consists of the following lines:

- Line 1 contains two space-separated integers, x_s and y_s, the coordinates of your house.
- Line 2 contains two space-separated integers, x_d and y_d, the coordinates of your destination.
- Line 3 contains an integer, B, the maximal distance (in kilometers) that you accept to travel.

- Line 4 contains an integer, C_0, the $\texttt{CO}_2$-cost per distance unit of traveling by car.
- Line 5 contains an integer, T, the number of modes of transportation (beside cars).
- Line $i + 5$, for $1 \le i \le T$, contains the integer C_i , the $\texttt{CO}_2$-cost per distance unit of transportation mode i.
- Line $T + 6$ contains the integer N, the number of stations.
- Line $i + T + 7$ describes station i $(0 \le i < N)$ and contains $3 + 2 \times l_i$ space-separated integers. The first three integers are x_i , y_i and l_i. The pair (x_i, y_i) represents the coordinates of station while l_i is the number of links between station i and other stations. The l_i remaining pairs of integers (j, m_j) each describe a link to station j $(0 \le j < N)$ using transportation mode m_j $(1 \le m_j \le T)$. All links are bidirectional.

Limits: All inputs are integers. All coordinates are in $[0, 100] \times [0, 100]$.

- $1 \le T \le 100$;
- $1 \le N \le 1000$;
- $0 \le B \le 100$;
- $1 \le C_1, \ldots, C_T < C_0 \le 100$;
- for each station, there are at most 100 links to other stations.

Output

The output should contain a single line with a single integer representing the minimal feasible $\texttt{CO}_2$-cost or -1 if no feasible cost is found within the kilometer budget.

Example

standard input	standard output

1 1
10 2
12
100
2
10
50
3
2 3 2 1 1 2 2
5 5 1 2 1
9 3 0
	850

Note

Sample Explanation

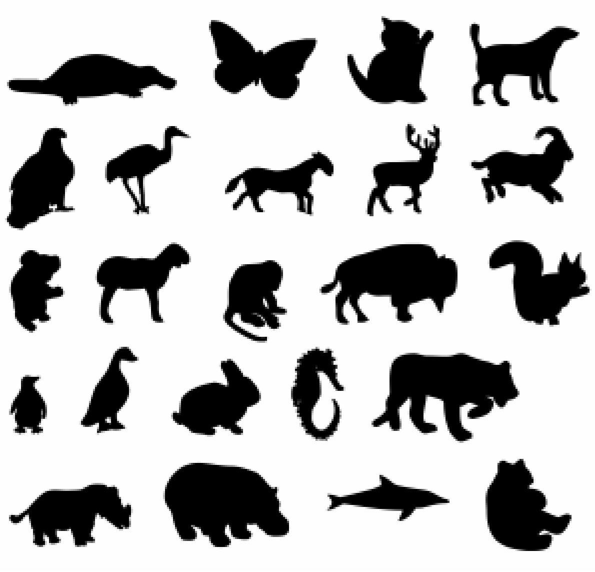
The results corresponds to the $\texttt{CO}_2$-cost of the following route:

1. from home at (1,1) to station 0 at (2,3) by car for a cost of $100 \times \lceil\sqrt{1^2 + 2^2}\rceil = 300$,
2. to station 2 at (9,3) via transportation mode 2 for a cost of $50 \times \lceil\sqrt{7^2 + 0^2}\rceil = 350$,
3. to the destination at (10,2) by car for a cost of $100 \times \lceil\sqrt{1^2 + 1^2}\rceil = 200$ for a total of 850.

This route is valid because the total distance traveled is $3 + 7 + 2 = 12$, within the allowed budget of 12.

Problem B. Biodiversity

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes



Alicia has a huge garden which is the habitat of many animals that she really cares about. After listening to a podcast about biodiversity, she becomes very concerned about the balance between species in her garden. She wants to know if there is a species that could overtake the others. In order to do so, she decides to carry out a census of all animals in the garden, writing down the species of each of them. Can you help her checking if there is strictly more animals from one species than the animals from all other species together?

Input

The input consists of the following lines:

- on the first line: an integer N;
- on each of the next N lines: the species of an animal as a string of length at most 20, containing only ASCII alphanumeric characters.

Limits

- $1 \leq N \leq 2 \times 10^5$.

Output

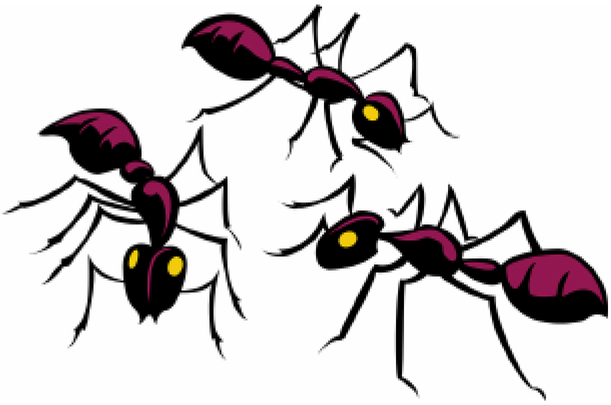
A string that appears a number of times that is greater than the sum of the others, if there is any, or the string “NONE” otherwise.

Examples

standard input	standard output
3 frog fish frog	frog
4 cat mouse mouse cat	NONE

Problem C. Ants

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes



Charles is fascinated by ants. In order to observe a colony of ants over a long period, Charles managed to build a program that uniquely identifies each ant, using image recognition. (Yes, every ant is unique.) Inside the program, each ant is tagged with a unique nonnegative integer. Whenever there is a birth in the colony, the new ant is given a new tag, different from all tags already assigned. Whenever some ant disappears, its tag falls back into the pool of available tags.

Charles's program works as follows. It first scans the whole colony, building the list of tags of the ants that are recognized. Then it assigns fresh tags to the new ants. To do so, the program simply picks the first natural number (i.e., nonnegative integer) that is not currently assigned to any ant, and so on.

Due to some glitches in the image recognition device and in the program, there are sometimes negative or very large numbers that appear in the input list. These are simply ignored by Charles's program.

Your job is to reimplement the part of Charles's program that finds a fresh tag to assign to a new ant.

Input

The input consists of the following lines:

- on the first line: an integer N;
- on the next N lines: some integers $X_1, \ldots, X_N$, one per line.

Limits

The input satisfies $0 \leq N \leq 10^6$. Each integer X_i has less than 100 digits.

Output

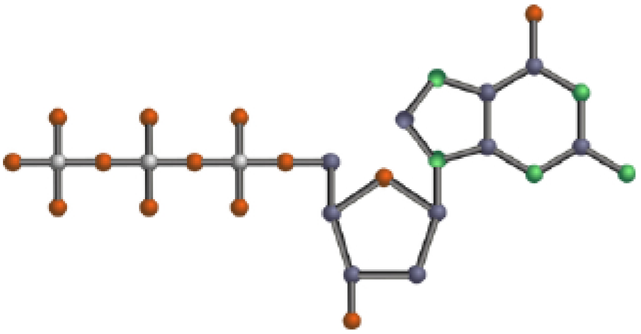
The smallest natural number that does not belong to the set $\{X_1, \ldots, X_N\}$.

Example

standard input	standard output
5 1 -1 0 3 10	2

Problem D. Gnalcats

Input file:	`standard input`
Output file:	`standard output`
Time limit:	0.3 seconds
Memory limit:	256 megabytes



Researchers have discovered a new form of life they have named Gnalcats. Gnalcats have a very strange form of DNA and proteins but the researchers have understood how they work. They are now trying to classify species of Gnalcats by comparing their DNA.

A gene of their DNA is a sequence of bases. These genes operate on proteins, which are extremely long chains of amino-acids ($a - b - c - \ldots$). Amino-acids are either simple or complex (composed of two other amino-acids). Proteins always contain several billions of amino-acids.

Genes operate on proteins in the following way: the seven different bases (**C, D, L, P, R, S, U**) correspond to different transformations on the protein. The result of the operation of a gene on a protein is obtained as the combination of the individual transformations by each base of the gene: the first base of the gene transforms the input protein, the resulting protein is then transformed according to the second base of the gene, and so on. Life is not perfect and thus one of these transformations may fail, in which case the overall transformation fails. If, at any point in the transformation, the protein is reduced to a chain of three or fewer amino-acids (simple or complex) then the transformation fails.

The effect of each base is described in the following table where X denotes the tail of the protein, while a, b, and c are amino-acids (either simple or complex):

base	input protein	output protein
C	$a - X$	$a - a - X$
D	$a - X$	X
L	$a - X$	$\begin{cases} b - X & \text{if } a \text{ is the complex amino-acid } \langle b, c\rangle \\ \text{fail} & \text{if } a \text{ is a simple amino-acid} \end{cases}$
P	$a - b - X$	$c - X$ where c is the complex amino-acid $\langle a, b\rangle$
R	$a - X$	$\begin{cases} c - X & \text{if } a \text{ is the complex amino-acid } \langle b, c\rangle \\ \text{fail} & \text{if } a \text{ is a simple amino-acid} \end{cases}$
S	$a - b - X$	$b - a - X$
U	$a - X$	$\begin{cases} b - c - X & \text{if } a \text{ is the complex amino-acid } \langle b, c\rangle \\ \text{fail} & \text{if } a \text{ is a simple amino-acid} \end{cases}$

For example, the gene **PSDSPCRPSDUL** transforms a protein like this:

- the input protein is $a - b - c - d - e - f - \ldots$
- then applying the rule for the first **P** produces: $\langle a, b\rangle - c - d - e - f - \ldots$

- then applying the rule for **S** produces: $c - \langle a, b\rangle - d - e - f - \dots$
- then **D** gives: $\langle a, b\rangle - d - e - f - \dots$
- then **S** gives: $d - \langle a, b\rangle - e - f - \dots$
- then **P** gives: $\langle d, \langle a, b\rangle\rangle - e - f - \dots$
- then **C** gives: $\langle d, \langle a, b\rangle\rangle - \langle d, \langle a, b\rangle\rangle - e - f - \dots$
- then **R** gives: $\langle a, b\rangle - \langle d, \langle a, b\rangle\rangle - e - f - \dots$
- then **P** gives: $\langle\langle a, b\rangle, \langle d, \langle a, b\rangle\rangle\rangle - e - f - \dots$
- then **S** gives: $e - \langle\langle a, b\rangle, \langle d, \langle a, b\rangle\rangle\rangle - f - \dots$
- then **D** gives: $\langle\langle a, b\rangle, \langle d, \langle a, b\rangle\rangle\rangle - f - \dots$
- then **U** gives: $\langle a, b\rangle - \langle d, \langle a, b\rangle\rangle - f - \dots$
- and finally **L** gives: $a - \langle d, \langle a, b\rangle\rangle - f - \dots$

You are given two genes, and you must decide whether they are equivalent. Two genes are equivalent if for every input protein composed of at least one billion of simple amino-acids, either the application of both genes produces the same output protein, or both applications fail.

Input

The input consists of two lines, each representing a Gnalcats gene.

Limits

Each gene contains at least one base. The sum of the length of the input genes is not greater than 10^4.

Output

The output consists of a single word: “True” if the genes are equivalent, “False” otherwise.

Examples

standard input	standard output
PU SS	True
L R	True
PSPCRSL PS	True
U C	False
PL PR	False

Note

Sample Explanation 1

These genes do nothing: they always transform a protein into the exact same protein.

Sample Explanation 2

These genes always fail because both **L** and **R** bases fail on simple amino acids.

Problem E. Pixels

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes

There are various ways to protect wildlife. One is to make posters that will inspire people, and that is the job of artists. Some of those people that need to be inspired are geeks, and that is why some artists focus on pixel art.

An artist prepared a pixel art drawing for depicting animals in black and white. These drawings should be displayed on a gigantic pixelated, rectangular screen, with K rows (ordered from 0 to $K - 1$, from top to bottom) and L columns (ordered from 0 to $L - 1$, from left to right): displaying drawings on such screens is your job.

When you initialize the screen, it displays only white pixels. Then, its pixels should be controlled individually by switches, and pressing the switch of a pixel P ought to change the color of P, either from black to white or from white to black. However, the screen has a defect: pressing the switch of the pixel P also changes the color of those pixels that have an edge in common with P, i.e., those pixels that are adjacent horizontally or vertically (but not diagonally). Yet, it might still be possible that, by adequately choosing which switches you press, even this defective screen can display the drawing you were handed.

Can you manage to display that drawing? If yes, which set of switches should you press?

Input

- Line 1 contains two integers K and L, separated by spaces.
- For all i such that $0 \leq i < K$, line $i + 2$ contains L symbols "B" or "W", separated by spaces: if the j-th symbol (with $0 \leq j < L$) is a "B", then the pixel that will be displayed on row i and column j should be black; otherwise, it should be a white pixel.

Limits

- $1 \leq K \times L \leq 100000$.

Output

If there is no way to display the desired drawing by pressing switches, your output should contain one line with the word "IMPOSSIBLE" and nothing else. Otherwise, your output should contain K lines, each one containing L symbols "A" or "P" and separated by spaces:

- For all i and j such that $0 \leq i < K$ and $0 \leq j < L$, if the j-th symbol on line $i+1$ is a "P", then you should press the switch associated with the pixel on row i and column j; otherwise, you should avoid that switch.

Examples

standard input	standard output
1 2 B W	IMPOSSIBLE
5 22 B B B W B W W W B W B B B W B B B B W B B B B W W W B W W W B W B W W W B W W B W B W W B B B W B W B W B W B B B W B B B B W B W W W W B W B W B W B W B W W W B W B W W B W W B B B W W B W B W W B B B W B W W B W B B B	A P P A P P A A P A A P P P A A P A P A P A A P P A P A P P A P A P A A A A A P P P A A A P P A P P A A A P P A A P P A A P A P A A A A A A A A P P A P P P A A P A A P P P P A A P A A A A P A P P P A P A P P A P P P A P

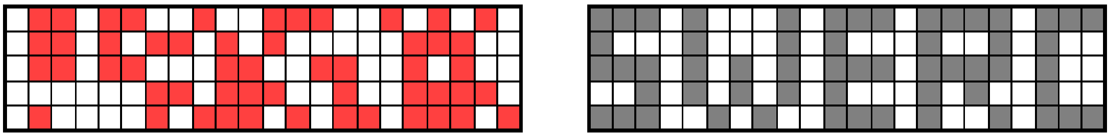
Note

Note that the order in which switches are pressed is not important, and that it is never necessary to press twice the same switch. Thus, a solution can be fully described by the set of switches pressed. There might be several solutions, i.e., several adequate sets of switches. In that case, your output should just represent one such solution.

Sample Explanation 1

Whenever you press a switch, the colors of both pixels changes. Hence, they always have the same color, and the drawing cannot be displayed.

Sample Explanation 2 You can indeed check that, if you press the switches associated to the red pixels of the left picture, you will obtain the picture depicted on the right.



Problem F. Icebergs

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes

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Tania is a marine biologist. Her goal is to measure the impact of climate change on the population of Macaroni penguins. As most species of penguins, Macaroni penguins live in the southern hemisphere, near Antarctica. Tania is primarily focused on the population of Macaroni penguins near the "Îles Nuageuses" (in English, "Cloudy Islands").

During summer, the ice around the islands melt and the islands become too small to host all the birds. Some penguins live on the icebergs floating around. For her study, Tania needs to measure the area of those icebergs.

Using satellite imagery and image recognition, Tania has obtained a map of the icebergs and your goal is to measure their area. The island studied by Tania is quite small and the Earth can locally be approximated as a flat surface. Tania's map thus uses the usual 2D Cartesian coordinate system, and areas are computed in the usual manner. For instance, a rectangle parallel to the axes defined by the equations $x_1 \leq x \leq x_2$ and $y_1 \leq y \leq y_2$ has an area of $(x_2 - x_1) \times (y_2 - y_1)$.

In Tania's representation, an iceberg is a polygon represented by its boundary. For each iceberg, Tania has noted the sequence of points $p_1, \ldots, p_k$ defining the border of the iceberg. The various icebergs never touch each other and they never overlap. Furthermore, the boundary $p_1, \ldots, p_k$ of an iceberg is always a "simple" polygon, i.e. no two segments in $[p_1; p_2], \ldots, [p_k; p_1]$ cross each other.

Input

The input consists of the following lines:

- on the first line, an integer N, describing the number of polygons;
- then N blocks of lines follow, each describing a polygon and composed of:
  - on the first line, an integer P, the number of points defining the polygon border,
  - on the next P lines, two space-separated integers x and y, the coordinates of each border point.

Limits

- The number N of polygons is such that $1 \leq N \leq 1000$.
- Each polygon is described by P points with $3 \leq P \leq 50$.

- All coordinates are such that $0 \leq x, y \leq 10^6$.

Output

The output should contain a single integer: the total area rounded to the nearest integer below. In other words, the output should be a single line containing a single integer I such that the total area A of the polygons described in the input is comprised between I included and $I + 1$ excluded ($I \leq A < I + 1$).

Examples

standard input	standard output

1
4
0 0
1 0
1 1
0 1
	1

2
5
98 35
79 90
21 90
2 36
50 0
3
0 0
20 0
0 20
	6100

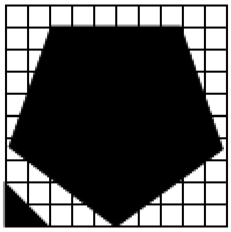
Note

Sample Explanation 1

This sample has a unique iceberg, which is a square of side 1.

Sample Explanation 2

In this sample (depicted below) there are two icebergs, a triangle of area 200 and a pentagon of area 5900.5.



Problem G. Swapping Places

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

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Animals are waiting in a line, in a quarantine zone, before they can enter a hunting-free area, where they will find an easier life.

When entering the quarantine zone, animals have to check in with a guard. The guard writes down the animal species, and then the animal is allowed to join the end of the line, in the last position. At the other end of the line, animals have to check out: when the animal in the first position in the line is finally allowed to enter the hunting-free area, another guard writes down the animal species. Thus, each guard maintains a list of animal species, written down in the chronological order in which the animals have checked in or out. A total of N animals, representing S species, have checked in (and, therefore, checked out).

However, animals may enter the waiting line and leave it in different orders. Indeed, some animal species are friends with each other, and thus two animals from such species, if they occupy adjacent places in the line may accept to switch their places.

You have a list of those pairs of animal species that may accept to switch their places when being in adjacent positions in the line: this list contains L pairs. You were handed out the check-in list maintained by the first guard. Depending on which animals decided to switch places, several check-out lists might be possible. Among all those possible lists, which one comes first in alphabetical order?

Input

The input consists of the following lines:

- Line 1 contains three space-separated integers S, L and N. S is the number of animal species, L is the number of pairs of species that are friends with each other, and N is the number of animals that entered the waiting line.
- Line $i+2$, for $0 \leq i < S$, contains the name of one of the represented species: this name is made of a single word, with uppercase letters between “A” and “Z”, and contains between 1 and 20 letters.

- Line $i + S + 2$, for $0 \leq i < L$, contains two space-separated species names A and B describing that A and B are friends with each other.
- Line $S + L + 2$ represents the check-in list, and it contains N space-separated species names: for all $1 \leq k \leq N$, the kth word is the name of the species of the animal that entered the line in kth position.

Limits

- $1 \leq S \leq 200$;
- $0 \leq L \leq 10000$;
- $1 \leq N \leq 100000$.

Output

The output should contain a single line containing N words $w_0, \ldots, w_{N-1}$, separated by spaces: the list $w_0, \ldots, w_{N-1}$ must be, among all the possible check-out lists, the one that comes first in alphabetical order.

Example

standard input	standard output
3 2 6 ANTILOPE CAT ANT CAT ANTILOPE ANTILOPE ANT ANT CAT CAT ANTILOPE CAT ANT	ANT ANTILOPE CAT CAT CAT ANT

Note

Sample Explanation

The six possible orderings at check-out, sorted in (increasing) alphabetical order, are:

1. ANT ANTILOPE CAT CAT CAT ANT
2. ANT CAT ANTILOPE CAT CAT ANT
3. ANT CAT CAT ANTILOPE CAT ANT
4. ANT CAT CAT CAT ANT ANTILOPE
5. ANT CAT CAT CAT ANTILOPE ANT
6. ANTILOPE ANT CAT CAT CAT ANT

Problem H. Pseudo-Random Number Generator

Input file:	`standard input`
Output file:	`standard output`
Time limit:	0.3 seconds
Memory limit:	256 megabytes

Donald loves nature. Being a programmer, Donald writes programs to simulate the growth of trees or to build realistic 3D landscapes. For this purpose, Donald needs a good pseudo-random number generator. He devises the following method to produce an infinite sequence of 40-bit unsigned integers (the lines in the right are comments).

$$\begin{aligned} M &:= 1 \ll 40 && // = 2^{40} = 1099511627776 \\ S(0) &:= 0x600\text{DCAFE} && // = 1611516670 \\ S(n+1) &:= (S(n) + (S(n) \gg 20) + 12345)\% M \end{aligned}$$

On the last line, $x \gg 20$ denotes the quotient of the Euclidean division of x by 2^{20} and $x\%M$ denotes the remainder of the Euclidean division of x by M.

As a very first test to decide if this is indeed a good pseudo-random number generator, Donald wishes to count the number of even values produced by this sequence, in order to check whether this is close enough to 50%. Your help will be welcome.

Input

The input consists of a single line, containing an integer N.

Limits

The input satisfies $0 \leq N < 2^{63}$.

Output

The output should contain a single line with a single integer corresponding to the number of even values in the sequence $S(0), S(1), \ldots, S(N-1)$.

Examples

standard input	standard output
3	2
500000000	250065867

Problem I. Rats

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

To celebrate the Lunar New Year of the Rat, Douglas decides to count the number of rats living in his area. It is impossible for him to find all rats, as they tend to be well hidden. However, on the first day of the new year, Douglas manages to capture n_1 rats and marks each of them with an ear tag before releasing them. On the second day of the new year, Douglas captures n_2 rats and observes that n_{12} of them had been marked during the first day.

Douglas is asking for your help to estimate the total number of rats in his area. Looking up in your statistics textbook, you propose using the Chapman estimator $\widehat{N}$, given by:

$$\widehat{N} = \left\lfloor \frac{(n_1+1)(n_2+1)}{n_{12}+1} - 1 \right\rfloor$$

where $\lfloor x \rfloor$ is the floor of a real number x, i.e., the closest integer less than or equal to x.

Input

The input consists of a single line, with three space-separated integers: n_1, n_2, n_{12}, in that order.

Limits

- $0 \leq n_1, n_2 \leq 10000$;
- $0 \leq n_{12} \leq \min(n_1, n_2)$.

Output

The output should contain a single line with the single integer $\widehat{N}$.

Example

standard input	standard output
15 18 11	24

Problem J. Counting Trees

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Your friend Darwin is a very famous naturalist and tells you that he is currently trying to count the number of varieties of a very particular species of trees he discovered two years ago.

He tells you that these trees are very peculiar. First, they are flat: one of their sides is facing south and the other is facing north. Second, when one of their branches splits, it splits in exactly two sub-branches, which go in two opposite directions: one goes towards the west and the other goes towards the east. All in all, such a tree can be very easily represented as a binary tree such as computer scientists are used to. (Mathematically, a binary tree is either the empty tree or an internal node with exactly two children, which are themselves binary trees.)

As a great programmer, you get excited as soon as you hear about binary trees. Darwin continues his explanations: in such a tree, branches are either horizontal or go up. Still obsessed by binary trees, you figure out that this corresponds to saying that, in the binary tree representation, if internal nodes are labelled by the elevation (distance from the ground) of the corresponding branch split, then the label of a non-root node is always larger than or equal to the label of its parent. Empty trees are not labelled.

While you find this property rather boring and not very interesting, Darwin goes on and tells you a really astonishing and subtle fact he recently discovered about his favorite species of trees. After a lengthy discussion with Darwin, you finally understand that this property can be simply expressed in the binary tree representation. Namely, if one does an inorder traversal of the labeled binary tree of any tree of that species, the resulting sequence of elevations is always the same! (The inorder traversal of the empty tree is the empty sequence and, if a tree is not empty, its inorder traversal is the concatenation of the inorder traversal of the left sub-tree, followed by the label of the top node, followed by the inorder traversal of the right sub-tree.)

After having heard the impressive research results of your friend, you urge him to elaborate on the methodology he uses to count the varieties of this particularly surprising species. This leads him to reveal the hypothesis he is currently working on: every tree of a given variety is represented by the same binary tree, which uniquely identifies that variety. Moreover, every labeled binary tree verifying the conditions above indeed corresponds to an existing variety. Darwin believes that some kind of mathematical tool could then be used to count the varieties, but he has not enough mathematical background to do so.

Now that you are really impressed by Darwin's work, it is your turn: impress him by writing a program that counts the number of varieties of that species.

Input

The input consists of the following lines:

- on the first line: the number N of elements of the sequence of elevations produced by the inorder traversal of any tree of the species;
- the N following lines represent the sequence of elevations, in millimeters, with one integer per line.

Limits

Both N and the elevations are greater than or equal to 0 and less than or equal to 1000000.

Output

A single line with a single integer, the number of varieties of trees in the species, modulo 1000000007.

Examples

standard input	standard output
6 3 1 6 2 4 5	1
6 1 1 1 1 1 1	132

Problem K. Birdwatching

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes

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Kiara studies an odd species of birds that travel in a very peculiar way. Their movements are best explained using the language of graphs: there exists a directed graph $\mathcal{G}$ where the nodes are trees, and a bird can only fly from a tree T_a to T_b when (T_a, T_b) is an edge of $\mathcal{G}$.

Kiara does not know the real graph $\mathcal{G}$ governing the flight of these birds but, in her previous field study, Kiara has collected data from the journey of many birds. Using this, she has devised a graph $\mathcal{P}$ explaining how they move. Kiara has spent so much time watching them that she is confident that if a bird can fly directly from a to b, then she has witnessed at least one such occurrence. However, it is possible that a bird flew from a to b to c but she only witnessed the stops a and c and then added (a, c) to $\mathcal{P}$. It is also possible that a bird flew from a to b to c to d and she only witnessed a and d, and added (a, d) to $\mathcal{P}$, etc. To sum up, she knows that $\mathcal{P}$ contains all the edges of $\mathcal{G}$ and that $\mathcal{P}$ might contain some other edges (a, b) for which there is a path from a to b in $\mathcal{G}$ (note that $\mathcal{P}$ might not contain all such edges).

For her next field study, Kiara has decided to install her base next to a given tree T. To be warned of the arrival of birds on T, she would also like to install detectors on the trees where the birds can come from (i.e. the trees T' such that there is an edge (T', T) in $\mathcal{G}$). As detectors are not cheap, she only wants to install detectors on the trees T' for which she is sure that (T', T) belongs to $\mathcal{G}$.

Kiara is sure that an edge (a, b) belongs to $\mathcal{G}$ when (a, b) is an edge of $\mathcal{P}$ and all the paths in $\mathcal{P}$ starting from a and ending in b use the edge (a, b). Kiara asks you to compute the set $S(T)$ of trees T' for which she is sure that (T', T) is an edge of $\mathcal{G}$.

Input

The input describes the graph $\mathcal{P}$. The first line contains three space-separated integers N, M, and T: N is the number of nodes of $\mathcal{P}$, M is the number of edges of P and T is the node corresponding to the tree on which Kiara will install her base.

The next M lines describe the edges of the graph $\mathcal{P}$. Each contains two space-separated integers a and b ($0 \leq a$, $b < N$ and $a \neq b$) stating that $(a, b) \in \mathcal{P}$. It is guaranteed that the same pair (a, b) will not appear twice.

Limits

- $1 \leq N, M \leq 100000$;
- $0 \leq T < N$.

Output

Your output should describe the set $S(T)$. The first line should contain an integer L, which is the number of nodes in $S(T)$, followed by L lines, each containing a different element of $S(T)$. The elements of $S(T)$ should be printed in increasing order, with one element per line.

Examples

standard input	standard output

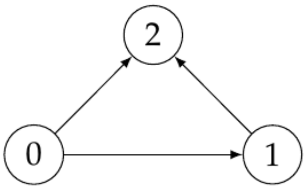
3 3 2
0 1
0 2
1 2
	1
	1

6 8 2
0 1
0 2
1 2
2 0
2 3
3 4
4 2
2 5
	2
	1
	4

Note

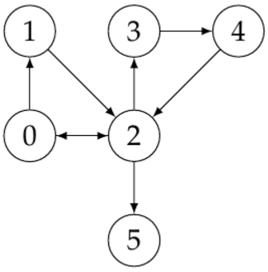
Sample Explanation 1

The graph corresponding to this example is depicted below. The node 1 belongs to $S(2)$ because the (only) path from 1 to 2 uses (1, 2). The node 0 does not belong to $S(2)$ because the path $0 \to 1 \to 2$ does not use the edge (0, 2).



Sample Explanation 2

The graph corresponding to this example is depicted below. For the same reason as in Sample 1, the node 0 does not belong to $S(2)$ while 1 does. The nodes 3 and 5 do not belong to $S(2)$ because we do not have edges (3, 2) or (5, 2). Finally 4 belongs to $S(2)$ because all paths from 4 to 2 use the edge (4, 2).



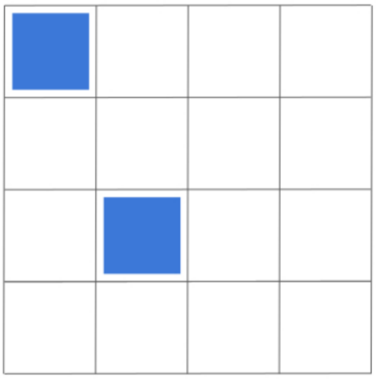
Problem L. River Game

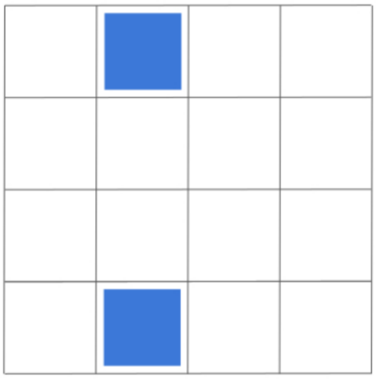
Input file:	`standard input`
Output file:	`standard output`
Time limit:	0.5 seconds
Memory limit:	256 megabytes

Together with an ornithologist friend, you are spending hours bird-watching in wetlands, waiting for a rare bird that you want to take a picture of.

In order to kill time, you devised a little game. The wetland is represented by an $N \times N$ grid made of 3 types of squares: firm ground, wet zone, and protected zone.

Connected wet zone squares form wet areas, which are maximal sets of wet zone squares such that we can go from any square of the area to any other square of the area by a path of connected wet zone squares. Two squares are considered connected when they share one edge, so that squares not on the border of the grid are connected to 4 other squares. Each wet area must be connected to both the left and right sides of the grid, and does not contain more than $2N$ wet zone squares. Two wet zone squares that belong to two different wet areas will always be at distance at least 3 from each other, the distance being counted by moving horizontally or vertically on the grid. For example, in the two examples below, the blue squares are at distance 3 from one another.





One after the other, you and your friend will each take turns placing a camera on the wetland with the following constraints:

- The camera must be on a firm ground square.
- The camera must be adjacent to a wet zone square so that you can take bird photos.

- The camera must not be on a protected zone square.
- There cannot be two cameras on the same square.
- No two cameras adjacent to the same wet area can be adjacent (again, the notion of adjacency means sharing an edge).

The first player who cannot place a camera anymore loses the game. Assuming both players play optimally, will the first player win or lose?

Input

The input consists of the following lines:

- on the first line, the integer N;
- on the next N lines, a string representing a row of the grid: "*" represents a wet zone square, "." represents a firm ground square and "x" represents a protected square.

Limits

The input satisfies $1 \leq N \leq 10$.

Output

The four words "First player will win" if the first player wins the game provided both players play optimally, or "Second player will win" otherwise.

Examples

standard input	standard output

`3`
`...`
`...`
`***`
	`First player will win`

`10`
`**********`
`*.x.*.....`
`*...*.....`
`*****.....`
`..........`
`..........`
`xx******..`
`***x...*..`
`..*...x*.x`
`..********`
	`Second player will win`

Note

Sample Explanation 1

The first player can place a camera in three possible places: if he places a camera in the left or right position, then the second player can place one in the other position and wins the game. On the other hand, if the first player places a camera in the middle, the second player cannot place another camera and loses.