Problem A
Bicube
Input File: Standard Input

Mary Thomas has a number of sheets of squared paper. Some of squares are painted either in black or some *colorful* color (such as red and blue) on the front side. Cutting off the unpainted part, she will have eight opened-up unit cubes. A unit cube here refers to a cube of which each face consists of one square.

She is going to build those eight unit cubes with the front side exposed and then a *bicube* with them. A bicube is a cube of the size $2 \times 2 \times 2$, consisting of eight unit cubes, that satisfies the following conditions:

- faces of the unit cubes that comes to the inside of the bicube are all black;
- each face of the bicube has a uniform *colorful* color; and
- the faces of the bicube have colors all different.

Your task is to write a program that reads the specification of a sheet of squared paper and decides whether a bicube can be built with the eight unit cubes resulting from it.

Input

The input contains the specification of a sheet. The first line contains two integers H and W, which denote the height and width of the sheet ($3 \le H, W \le 50$). Then H lines follow, each consisting of W characters. These lines show the squares on the front side of the sheet. A character represents the color of a grid: alphabets and digits ('A' to 'Z', 'a' to 'z', '0' to '9') for colorful squares, a hash ('#') for a black square, and a dot ('.') for an unpainted square. Each alphabet or digit denotes a unique color: squares have the same color if and only if they are represented by the same character.

Each component of connected squares forms one opened-up cube. Squares are regarded as connected when they have a common edge; those just with a common vertex are not.

Output

Print "Yes" if a bicube can be built with the given sheet; "No" otherwise.

Sample Input

```
3 40
.a....a....a....a....f....f....f....f...
#bc#.#cd#.#de#.#eb#.#cb#.#dc#.#ed#.#be#.
.#....#....#....#....#....#....#....#...
```

Output for the Sample Input

```
Yes
```

Sample Input

```
5 35
.a....a....a....a....f....f....f...
#bc#.#cd#.#de#.#eb#.#cb#.#dc#.#ed#.
.#..f.#....#....#....#....#....#...
..e##..............................
.b#................................
```

Output for the Sample Input

```
Yes
```

Sample Input

```
3 40
.a....a....a....a....f....f....f....f...
#bc#.#cd#.#de#.#eb#.#cb#.#dc#.#ed#.#eb#.
.#....#....#....#....#....#....#....#...
```

Output for the Sample Input

```
No
```

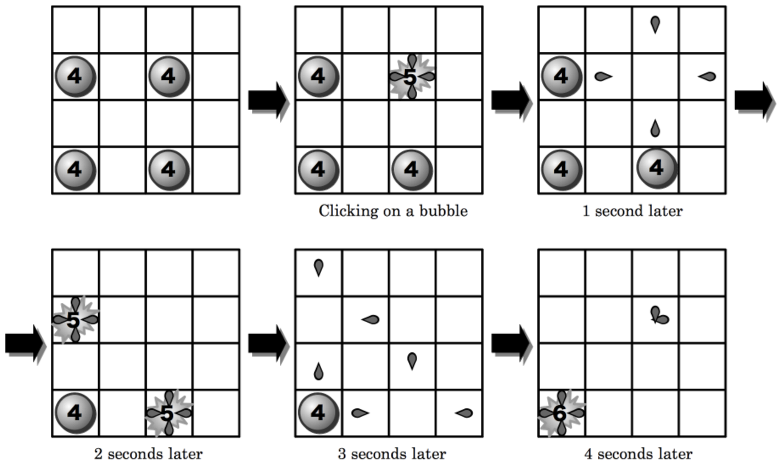
Problem B
Bubble Puzzle
Input File: Standard Input

A browser-based puzzle game called “Bubble Puzzle” is now popular on the Internet.

The puzzle is played on a 4×4 grid, and initially there are several bubbles in the grid squares. Each bubble has a state expressed by a positive integer, and the state changes when the bubble gets stimulated. You can stimulate a bubble by clicking on it, and this will increase the bubble's state by 1. You can also click on an empty square. In this case, a bubble with state 1 is newly created in the square.

When the state of a bubble becomes 5 or higher, the bubble blows up and disappears, and small waterdrops start flying in four directions (up, down, left and right). These waterdrops move one square per second. At the moment when a bubble blows up, 4 waterdrops are in the square the bubble was in, and one second later they are in the adjacent squares, and so on.

A waterdrop disappears either when it hits a bubble or goes outside the grid. When a waterdrop hits a bubble, the state of the bubble gets increased by 1. Similarly, if a bubble is hit by more than one water drop at the same time, its state is increased by the number of the hitting waterdrops. Please note that waterdrops do not collide with each other.



As shown in the figure above, waterdrops created by a blow-up may cause other blow-ups. In other words, one blow-up can trigger a chain reaction. You are not allowed to click on any square while waterdrops are flying (i.e., you have to wait until a chain reaction ends). The goal of this puzzle is to blow up all the bubbles and make all the squares empty as quick as possible.

Your mission is to calculate the minimum number of clicks required to solve the puzzle.

Input

The input consists of 4 lines, each contains 4 nonnegative integers smaller than 5. Each integer describes the initial states of bubbles on grid squares. 0 indicates that the corresponding square is empty.

Output

Output the minimum number of clicks to blow up all the bubbles on the grid in a line. If the answer is bigger than 5, output −1 instead. No extra characters should appear in the output.

Sample Input	Output for the Sample Input
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1

Sample Input	Output for the Sample Input
2 4 4 1 2 4 4 1 2 4 4 1 2 4 4 1	5

Sample Input	Output for the Sample Input
2 4 3 4 2 2 4 4 3 3 2 2 2 3 3 3	3

Problem C
Fair Game
Input File: Standard Input

In an elementary school, children enjoy playing a game.

The game is played by two persons. First, a parameter x and N items are given. The i-th item has a value c_i. Two players take an item in turn.

If a player takes the i-th item in the t-th turn, he earns score of $\sin(x + t + c_i)$ points, where x, t and c_i are interpreted in radian. t is 1 for the first player's first turn, for the second player's first turn t is 2, and so on. Each player's objective is to maximize his total score minus the opponent's total score.

Although the children have been enjoying the game, one day, some of the parents have claimed that the game is unfair because either player may definitely lose no matter how he plays wisely. The parents, as fierce as monsters, requested to make the game fair, i.e. two players get same amount of score when both play optimally.

To satisfy the request, teachers of the elementary school decided to introduce a handicap. Let's consider another parameter w. For the parameters x and w, the following value is added to the first player's score:

$$\left(\frac{2}{1 + \exp(x/w)} - 1\right) \times N$$

Now, for given w and items, is there any x which makes the game fair? Write a program to find x.

Input

The first line of input contains two integers N ($1 \leq N \leq 14$) and w ($1 \leq w \leq 100,000$). N denotes the number of items, and w is a parameter which is described above.

Following N lines describe values for each item. The i-th line stands for integers c_i ($1 \leq c_i \leq 100,000$).

Output

Output x which makes the game fair. If there is no such x, output "impossible" (without quotes) instead.

When there exists such x, your output will be accepted if the absolute value of the difference of two players' scores is no greater than 10^{-3} when they play optimally. If there are multiple answers, any of them will be accepted.

Sample Input	Output for the Sample Input
2 4 1 2	7.004114228712096

Sample Input	Output for the Sample Input
3 12 2 3 5	-0.7128514647179832

Sample Input	Output for the Sample Input
3 5 3 3 6	2.071748850673001

The 2011 35th Annual **acm** International Collegiate
Programming Contest Winter Camp
held by JAG

Problem D
King Slime
Input File: Standard Input

There is a grid of size $W \times H$ surrounded by walls. Some cells in the grid are occupied by slimes. The slimes want to unite with each other and become a "King Slime".

In each move, a slime can move to east, west, south and north direction until it enters a cell occupied by another slime or hit the surrounding wall. If two slimes come together, they unite and become a new slime.

Your task is write a program which calculates the minimum number of moves that all the slimes unite and become a King Slime. Suppose slimes move one by one and they never move simultaneously.

Input

The first line contains three integers N ($2 \leq N \leq 40,000$), W and H ($1 \leq W, H \leq 100,000$), which denote the number of slimes, the width and the height of the grid respectively.

The following N lines describe the initial coordinates of the slimes. The i-th line contains two integers x_i ($1 \leq x_i \leq W$) and y_i ($1 \leq y_i \leq H$), which indicate the coordinates of the i-th slime . All the coordinates are 1-based.

You may assume that each cell is occupied by at most one slime initially.

Output

Output the minimum number of moves that all the slimes unite and become a King Slime.

Sample Input	Output for the Sample Input
4 3 3 1 1 1 3 3 1 3 3	3

Sample Input	Output for the Sample Input
2 3 3 2 2 3 3	2

Sample Input	Output for the Sample Input
2 4 4 2 2 3 3	3

Sample Input	Output for the Sample Input
2 4 4 2 2 2 3	1

The 2011 35th Annual **acm** International Collegiate

Programming Contest Winter Camp

held by JAG

Problem E

Rabbit Game Playing

Input File: Standard Input

Honestly, a rabbit does not matter.

There is a rabbit playing a stage system action game. In this game, every stage has a difficulty level. The rabbit, which always needs challenges, basically wants to play more difficult stages than he has ever played. However, he sometimes needs rest too. So, to compromise, he admitted to play T or less levels easier stages than the preceding one.

How many ways are there to play all the stages at once, while honoring the convention above? Maybe the answer will be a large number. So, let me know the answer modulo $1,000,000,007$.

Input

The first line of input contains two integers N and T ($1 \leq N \leq 10,000$, $1 \leq T \leq 10,000$). N is the number of stages, and T is the compromise level.

The following N lines describe the difficulty levels of each stage. The i-th line contains one integer D_i ($1 \leq D_i \leq 10,000$), which is the difficulty level of the i-th stage.

Output

Calculate how many ways to play all the stages at once there are. Print the answer modulo $1,000,000,007$ in a line.

Sample Input	Output for the Sample Input
3 1 1 2 3	4

Sample Input	Output for the Sample Input
5 3 9 2 6 8 8	24

Sample Input	Output for the Sample Input
5 7 9 9 9 1 5	48

Problem F
Rabbit Jumping
Input File: Standard Input

There are K rabbits playing on rocks floating in a river. They got tired of playing on the rocks on which they are standing currently, and they decided to move to other rocks. This seemed an easy task initially, but there are so many constraints that they got totally confused.

First of all, by one leap, they can only move to a rock within R meters from the current rock. Also, they can never leap over rocks. That is, when they leap in some direction, they should land on the nearest rock in that direction. Furthermore, since they always want to show off that they are courageous, they will never leap to rocks downriver. Finally, since they never want to admit they have been defeated, they never land on a rock if the rock is already visited by other rabbits.

In this situation, is it possible for them to move to their destination rocks? If possible, please minimize the sum of their moving distance.

Input

The first line contains two integers N ($1 \leq N \leq 100$), K ($1 \leq K \leq 3$) and a real number R ($0 \leq R \leq 10^4$), which denote the number of rocks, the number of rabbits, and the maximum distance a rabbit can leap, respectively. The second line contains K numbers $s_1, \ldots, s_K$ where s_i denote the rock where the i-th rabbit is standing. Similarly, the third line contains K numbers $t_1, \ldots, t_K$ where t_i denote the destination rock for the i-th rabbit. $s_1, \ldots, s_K$ are distinct, and $t_1, \ldots, t_K$ are distinct. A destination rock of a rabbit is always different from the rock he/she is standing currently.

Then the following N lines describe the positions of the rocks. The i-th line in this block contains two integers x_i and y_i ($0 \leq x_i, y_i \leq 10,000$), which indicate the coordinates of the i-th rock. The river flows along Y-axis, toward the direction where Y-coordinate decreases. No pair of rocks has identical coordinates.

You may assume that the answer do not change even if you increase R by up to 10^{-5}.

Output

If all the rabbits can move to their destination rocks, print the minimum total distance they need to leap. If not, print "-1" (without quotes). Your answer may contain at most 10^{-6} of absolute error.

Sample Input	Output for the Sample Input
6 3 1.0 1 2 3 4 5 6 0 0 1 0 2 0 0 1 1 1 2 1	3

Problem G
Shelter
Input File: Standard Input

Taro lives in a town with N shelters. The shape of the town is a convex polygon.

He'll escape to the nearest shelter in case of emergency. Given the current location, the cost of escape is defined as the square of the distance to the nearest shelter. Because emergency occurs unpredictably, Taro can be at any point inside the town with the same probability. Calculate the expected cost of his escape.

Input

The first line contains two integers M and N ($3 \le M \le 100, 1 \le N \le 100$), which denote the number of vertices of the town and the number of shelters respectively.

The following M lines describe the coordinates of the vertices of the town in the conunter-clockwise order. The i-th line contains two integers x_i and y_i ($-1000 \le x_i, y_i \le 1000$), which indicate the coordinates of the i-th vertex. You may assume the polygon is always simple, that is, the edges do not touch or cross each other except for the end points.

Then the following N lines describe the coordinates of the shelters. The i-th line contains two integers x_i and y_i, which indicate the coordinates of the i-th shelter. You may assume that every shelter is strictly inside the town and any two shelters do not have same coordinates.

Output

Output the expected cost in a line. The answer with an absolute error of less than or equal to 10^{-4} is considered to be correct.

Sample Input	Output for the Sample Input
4 1 0 0 3 0 3 3 0 3 1 1	2.0000000000

Sample Input	Output for the Sample Input
5 2 2 0 2 2 0 2 -2 0 0 -2 0 0 1 1	1.0000000000

Sample Input	Output for the Sample Input
4 3 0 0 3 0 3 3 0 3 1 1 1 2 2 2	0.7500000000

Problem H
Sightseeing Tour
Input File: Standard Input

KM city has N sightseeing areas. Currently every pair of area is connected by a bidirectional road.

However for some reason, Mr. KM, the mayor of this city, decided to make all of these roads one-way . It costs $C_{i,j}$ dollars to renovate the road between area i and area j to a one-way road from area i to area j. Of course, Mr. KM is economic and wants to minimize the total cost of the renovation.

On the other hand, because tourism is the most important industry for KM city, there must exists a tour that goes through all the sightseeing areas, visiting each area exactly once. The first and last area of the path need not to be the same. Can you calculate the minimum total cost required for the renovation, given this situation?

Input

The first line contains the number of sightseeing area N ($1 \leq N \leq 100$). Next N lines describe the integer matrix C, where the j-th element of the i-th row of the input describes $C_{i,j}$ ($0 \leq C_{i,j} \leq 1,000,000$). For each i, you can assume $C_{i,i}$ is always zero.

Output

Output the minimum cost in a line.

Sample Input	Output for the Sample Input
3 0 2 7 2 0 4 5 8 0	11

The 2011 35th Annual **acm** International Collegiate

Programming Contest Winter Camp

held by JAG

Problem I

Tampopo Machine

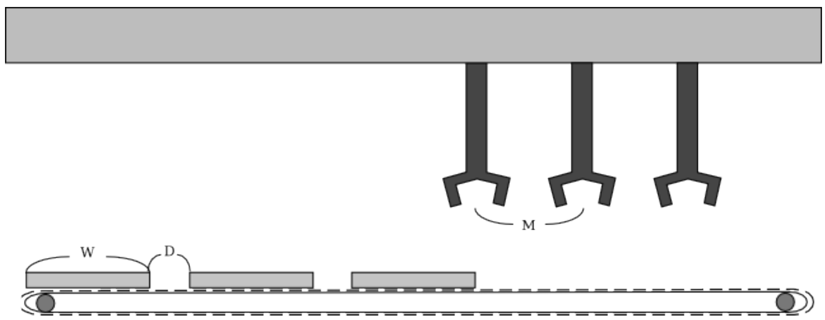
Input File: Standard Input

"Today is another day of endless, tedious work to put a tampopo on sashimi..."

Yaruo works in a sashimi (sliced raw fish) factory. His job is to put tampopos on sashimi packages everyday. Tired of this menial job, he decided to develop a tampopo machine to do the job instead of him.

The tampopo machine has the following properties. Sashimi packages are put on a conveyor belt and move from left to right. The width of a package is W and the interval between two adjacent packages is D. The machine has N magic hands placed above the conveyor belt at regular intervals of M. These magic hands put tampopos every T seconds.

In initial state, the right end of the first package is under the leftmost magic hand. The magic hands start putting a tampopo as soon as he turns on the power of the machine. The conveyor belt moves one unit length per one second.



Unfortunately, after building the machine, Yaruo noticed that there exist some packages with no tampopos. Calculate the ratio of packages with no tampopos for him.

When a magic hand puts a tampopo on the left or right end of a package, you can assume that the tampopo is on the package.

Input

The input consists of 5 integers, W, D, N, M and T which are described in the problem statement.
$(1 \le W, D, N, M, T \le 1,000,000,000)$

Output

Output the ratio of packages with no tampopos in a line. The absolute error should be less than or equal to 10^{-9}.

Sample Input	Output for the Sample Input
1 1 1 1 1	0.000000000000

Sample Input	Output for the Sample Input
1 2 3 4 5	0.200000000000

Sample Input	Output for the Sample Input
3 2 2 1 6	0.166666666667

Problem J
Top of the Hill
Input File: Standard Input

You are participating in a radio control car race. The car is so easy to operate that you can navigate the car wherever you want it to go.

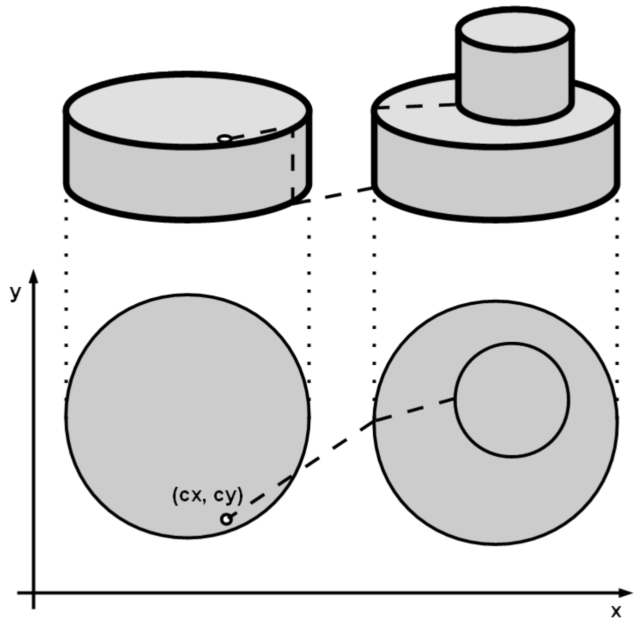
In the race, the contestants drive their cars on a large, flat stage with N cylindrical discs on it. Some discs are lying on another disc but no disc runs off the edge of the disc underneath. All cylindrical discs has the same height (or, “thickness”.) All edges of discs never touch or intersect each other.

The car is secure enough that it can get off a disc by just falling down vertically from any point on its edge, but it has to use elevator to get on a disc. There are four elevators at north, south, east and west side of each disc.

Initially, the car is at (cx, cy), and a goal is the highest point on the stage. If there are many points, you can choose any one of them.

You really want to win the race, so you decided to write a program to calculate the shortest distance your car has to run from the start to the goal. The car is not running while the car is getting on or off the discs, so you don’t have to sum up the height of discs.

The figure below shows an example of the shortest path from the start to the goal.



Note that the car is small enough that you can ignore its width.

Input

The first line of the input contains one integer $N (1 \leq N \leq 30)$, the number of cylindrical discs. The next line contains two integers $cx, cy (|cx|, |cy| \leq 100)$ which describe the initial coordinates of a radio control car. Then each of the following N lines consists of three integers $x_i, y_i, r_i (|x_i|, |y_i| \leq 100, 1 \leq r_i \leq 100)$, where (x_i, y_i) is the coordinates of the center of the i-th disc and r_i is its radius respectively. You can assume that the initial point of the radio control car is not on boundaries of any discs.

Output

Output the shortest distance the car should run. The absolute error should be less than or equal to 10^{-6}.

Sample Input	Output for the Sample Input
1 0 0 10 10 10	10.0

Sample Input	Output for the Sample Input
3 5 5 0 0 1 0 0 2 3 3 2	7.242640687

Sample Input	Output for the Sample Input
3 30 10 25 15 10 50 15 10 52 17 2	21.378378914