Problem A. Array for Birthday

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

Vova is going to Lesha's birthday party and wants to give him an array of natural numbers a of length n. However, Vova knows that Lyosha will like the array if it does not contain such a triple of numbers a_i, a_j, a_k $(1 \le i, j, k \le n)$ such that $2 \cdot max(a_i, a_j, a_k) < a_i + a_j + a_k$. With such a request, Vova went to the store, where he found out that the cost of an array is equal to the value of its maximum element. Help Vova calculate the minimum amount he should spend on a gift for Lesha.

Input

The single line contains an integer n — the length of the required array.

$$3 \le n \le 10^{18}$$

Output

Print a single integer — the answer to the problem.

Since the answer can be very large, print it modulo $10^9 + 7$.

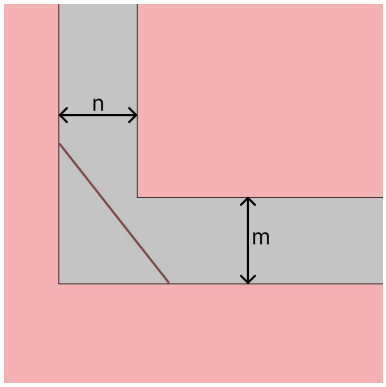
Examples

standard input	standard output
4	3
696969696969	385144833

Problem B. Pipes

Input file:	`standard input`
Output file:	`standard output`
Time limit:	4 seconds
Memory limit:	256 megabytes

Lyosha throws sticks (into the pipeline, of course). However, if the stick gets stuck in the pipeline, Lyosha will have a hard time. So he decided to approach the problem mathematically. He knows that the pipeline consists of t bends. Each bend has a perfectly right angle and is described by two real numbers n and m - the diameter of the incoming pipe and the diameter of the outgoing pipe. Since Lyosha loves anime very much, he also solves the problem in two-dimensional space. You can see an example of how a stick fits into a bend below.



Help Lyosha. Write a program that, for each of the t bends, finds the maximum length of a stick that can float through the bend without getting stuck.

Input

The first input line contains an integer t — the number of bends. Each of the next t lines contains 2 integers n and m separated by a space - a description of the next bend.

$$1 \le t \le 10^5$$

$$1 \le n, m \le 10^9$$

Output

Print t lines, the i-th of which contains a single real number – the maximum length of the stick for the i-th bend.

Your answer will be counted if the relative or absolute error does not exceed 10^{-4}. Formally, if a — is your answer, and b — is the jury's answer, then it will be counted if $\frac{|a-b|}{max(b,1)} \le 10^{-4}$.

Examples

standard input	standard output
1 2 5	9.5823
3 8 1 9 6 10 8	11.1803 21.0704 25.4033

Problem C. Leaf in a box

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

Lesha has a sheet of $n \times m$ cells, and he plays a game. In one move, Lesha draws any line on the sheet, except for vertical and horizontal ones. For each crossed straight side of the cell Lyosha gets a points, for each intersection of the corner of the cell - $2 \cdot a$ points. Lyosha considers XOR points for all the moves he made as the result of the game. Help Lyosha: print the maximum number of points he can get for the game.

Input

The single line contains three integers n, m and a.

$$1 \leq n, m \leq 10^5$$

$$1 \leq a \leq 10^9$$

Output

Print one integer: the maximum number of points that Lyosha can get.

Examples

standard input	standard output
2 11 26	510
6 6 2	30

Problem D. Count zeros

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

Vladimir Yakovlevich — a very strict teacher and is very sensitive to deadlines. So, if the student did not pass the laboratory test on time, the teacher performs the following procedure: he chooses a k-ary number system, asks a classmate of the delinquent to name the number n and counts $n!$ in the chosen number system. As many zeros are put in the student's gradebook as the resulting number contains at the end. However, it is very difficult to calculate it manually. Therefore, Vladimir Yakovlevich asked you, as the most outstanding student, to write a program for such complex calculations. Help Vladimir Yakovlevich.

Input

The only input line contains two integers n and k.

$$1 \le n \le 10^{12}$$

$$2 \le k \le 10^{8}$$

Output

Print a single integer — the number of zeros that Vladimir Yakovlevich will put in the log with such data.

Examples

standard input	standard output
69 42	10
228 69	9
13 4	5

Problem E. Rational teacher

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

Vadim Denisovich, finally graduating from the master's program and becoming a senior lecturer in the Department of Informatics, realized that lecturing — is not such an easy task, but there is nowhere to go.

- Vadim Denisovich teaches a course on programming, consisting of n topics. The topics are ordered and he must read them in the correct order so that the IITP students understand something and can pass the labs.
- Each topic contains a label — one integer from 1 to n inclusive. No two different topics contain the same tag.
- According to the curriculum, the number i in the topic says that Vadim Denisovich should read this topic during the i-th of n equal time intervals into which one lecture is divided. It is guaranteed that Vadim Denisovich will have time to read this topic in one time period. The time intervals that are not occupied by theory on the topic, Vadim Denisovich is obliged to spend on practice.

Vadim Denisovich wants to read the entire course as quickly as possible. However, how many lectures he needs to complete depends on the notes in the course topics. Vadim Denisovich asked you to count the number of possible integers in the topics so that Vadim Denisovich needs exactly k lectures per course if he reads the topics optimally.

Knowing the number of topics n and the natural number k, calculate the number of possible ways of arranging integers on the pages so that Vadim Denisovich needs exactly k lectures to finish reading if he reads optimally. Output the answer modulo $10^9 + 7$.

Input

The single input line contains the numbers n and k — the number of topics and lectures, respectively.

$$1 \le k \le n \le 100\,000$$

Output

A single integer — the number of possible ways to arrange integers by topics so that Vadim Denisovich reads the course in k lectures. Output the answer modulo $10^9 + 7$.

Examples

standard input	standard output
3 2	4
10 5	1310354

Problem F. BSUIR OPEN

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

In honor of the finals of the BSUIR OPEN championship, it was decided to hang up a large TV, on the screen of which the name of the university that hosts this very championship will be written. The screen is a rectangle of size n x m. The upper left corner is at the point $(1, 1)$, and the lower right corner is at the point (n, m).

Vadim, a student of this university, was given a responsible task - to display the name of the university on the screen. As conceived by the organizers, the inscription should look like this:

```
####...###..#...#.###.####.
#...#.#.....#...#..#..#...#
#...#.#.....#...#..#..#...#
####...###..#...#..#..####.
#...#.....#.#...#..#..#.#..
#...#.....#.#...#..#..#..#.
####...###...###..###.#...#
```

But bad luck - Vadim did not sleep all night because of an unknown error: the name was displayed incorrectly. Namely, it was cyclically shifted x rows down and y columns to the right.

In order not to worsen Vadim's condition, you, as his very good friend, sent him home to sleep, and you yourself decided to find this error and eliminate it.

Help Vadim - find x and y.

It is guaranteed that the solution exists and is unique.

Input

The input contains 7 lines of 27 characters each — a description of the name of the university on the screen due to Vadim's mistake.

The character '#' means the outline of a letter.

Output

The output contains two non-negative integers x and y — the shift along the row and column, respectively.

Examples

standard input	standard output
####...###..#...#.###.####. #...#.#.....#...#..#..#...# #...#.#.....#...#..#..#...# ####...###..#...#..#..####. #...#.....#.#...#..#..#.#.. #...#.....#.#...#..#..#..#. ####...###...###..###.#...#	0 0
#..####.####...###..#...#.. #..#.#..#...#.....#.#...#.. #..#..#.#...#.....#.#...#.. ##.#...#####...###...###..# ##.####.####...###..#...#.# #..#...##...#.#.....#...#.. #..#...##...#.#.....#...#..	4 8

Problem G. Tornado

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

Petya bought a summer cottage for himself. It can be described as a rectangle in the plane, where the lower left corner has coordinates (ax, ay) and the upper right corner has coordinates (bx, by).

As usual, Petya looked at the weather forecast, but this time he was very surprised. The forecast contained information about an impending tornado. In addition, the exact trajectory of its movement was indicated.

A tornado can be described as a convex polygon consisting of n vertices with coordinates (x_i, y_i). The movement of a tornado can be described as a pair (dx_i, dy_i), where dx_i — movement of the tornado along the x coordinate, and dy_i — movement along the y coordinate relative to the previous position. When moving, the polygon describing the tornado does not change or rotate. In total, the tornado will make m smooth movements without sharp jerks.

Petya installed a fence around the perimeter of his site. But he's worried that a tornado might damage part of the fence (or the entire fence), so he needs to know how long the fence needs to be repaired. The tornado will only damage the parts of the fence that fall inside the tornado area at any time.

Help Petya determine the length of the fence that will have to be restored.

Input

The first line contains four integers ax, ay, bx, by ($ax < bx$, $ay < by$) — the coordinates of the lower left and upper right corners, respectively.

The second line contains an integer n — the number of corners in the polygon.

The next n lines contain two integers x_i and y_i — the coordinates of the corners of the convex polygon in counterclockwise order.

The next line contains an integer m — the number of times the tornado moves.

The next m lines contain two integers dx_i and dy_i — changes in the tornado coordinates.

$$3 \le n \le 10^5$$
$$0 \le m \le 10^5$$
$$-10^8 \le ax, ay, bx, by \le 10^8$$
$$-10^8 \le x_i, y_i \le 10^8$$
$$-10^3 \le dx_i, dy_i \le 10^3$$

Output

Print a single real number — the length of the fence to be restored.

Your answer will be counted if the relative or absolute error does not exceed 10^{-9}. Formally, if a — is your answer, and b — is the jury's answer, then it will be counted if $\frac{|a-b|}{max(b,1)} \le 10^{-9}$.

Example

standard input	standard output
1 1 5 5 4 0 0 -2 0 -2 -2 0 -2 4 2 2 2 0 0 2 3 0	6.0

Problem H. Ignition of the flame

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

Darkness has enveloped the whole world in which Vadim lives. Vadim's world is represented as a matrix of size $n \times m$, where the rows are numbered from 1 to n from top to bottom, and the columns are numbered from 1 to m from left to right. Each cell is either free or impassable. Free cells are marked with '.' (dot). Vadim can move to a horizontally or vertically adjacent cell only if this cell is free and lies within the table. Vadim himself is in the cell marked with 'S'.

To defeat the Darkness, Vadim needs to light **all** the candles in his world. Candles are marked with an 'E'. Being at the point (x, y), Vadim can launch a beam of fire in one of four directions. The beam will fly until it goes beyond the matrix boundary, or hits a wall, denoted by the '#' symbol, or a candle. **Note that a maximum of one candle can be set on fire per beam.**

For convenience, Vadim's world contains mirrors, denoted by the symbols '/' and '\'. Consider the case when a ray hits one of two types of mirrors from either side: when it hits a mirror of the '/' type from the left, the ray goes up and flies further until a certain moment, described above. The rest of the cases are handled similarly.

Because Vadim is busy with other things, namely, preparing for the celebration of the victory over Darkness, then he asks you to help him determine if it is possible to light all the candles?

Input

The first line contains two integers n and m — the number of rows and columns of the matrix, respectively.

The next n lines contain m characters in each line - a description of Vadim's world.

It is guaranteed that there is exactly one cell with the character 'S'. It is also guaranteed that the number of characters 'E' **is not less than 1 and not more than 8**.

$$1 \leq n \times m \leq 10^5$$

Output

Print "`Yes`" (without quotes) if Vadim manages to light all the candles, otherwise "`No`".

Examples

standard input	standard output
1 6 S..E.E	No
4 4 S..\ .#.. .E.. ...E	Yes
4 4 /\/\ .\/. ./S# \/#E	No

Problem I. Soldering hut

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

There are N microprocessors on the board, numbered from 1 to N. Microprocessor 1 is the central one. Each microprocessor has a capacity, and the initial performance value of the ith ($1 \le i \le N$) microprocessor is C_i.

Tracks on the board can carry a signal in two directions. Initially, there are no tracks on the board. You are instructed to lay $N-1$ tracks. Each j-th ($1 \le j \le N-1$) track is laid according to the following conditions:

- Two microprocessors A_j and B_j are selected, so that the signal from microprocessor 1 can reach microprocessor A_j and cannot reach microprocessor B_j, passing only along the tracks that exist at the moment.
- You connect microprocessors A_j and B_j with a trace. The cost of this connection is equal to the number of pairs of microprocessors (s, t) that satisfy the following conditions:

  Microprocessor s and microprocessor t lie on the shortest path between main microprocessor 1 and microprocessor A_j, and when the signal goes from the pins of microprocessor 1 to microprocessor A_j, it goes to microprocessor s earlier than microprocessor t, and the performance value of microprocessor s is strictly greater than the performance of microprocessor t.

  Here microprocessors lying on the path between microprocessors 1 and A_j include microprocessors 1 and A_j. Note that the shortest path between microprocessor 1 and microprocessor A_j is unique.

- The performance values of all microprocessors lying on the path between microprocessor 1 and A_j are changed to the performance value of microprocessor B_j.

You need to display the cost of running each track.

Input

The first line contains an integer N — the number of microprocessors ($1 \le N \le 100\,000$).

The second line contains N integers C_i — the performance of each processor ($1 \le C_i \le 1\,000\,000\,000$).

The next $N-1$ lines contain 2 numbers A_j and B_j, denoting the microprocessors to be connected by the jth track ($1 \le j \le N-1$).

Output

Print $N-1$ lines, each of which indicates the cost of running the track.

Examples

standard input	standard output
5 1 2 3 4 5 1 2 2 3 2 4 3 5	0 0 0 2
10 1 7 3 4 8 6 2 9 10 5 1 2 1 3 2 4 3 5 2 6 3 7 4 8 5 9 6 10	0 0 0 1 1 0 1 2 3

Problem J. Garden

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

Vladimir Yakovlevich loves to spend his summer holidays in the garden. This year, he bought a small plot of land from a neighbor and decided to install an automatic irrigation system there.

Let's represent Vladimir Yakovlevich's plot as a field of $n \times m$ cells. The system consists of k watering points, i-th point is located in a cell with coordinates x_i, y_i and waters the garden for q cells vertically **or** horizontally. The direction of watering Vladimir Yakovlevich chooses himself. That is, water from one point waters a maximum of $2 \cdot q + 1$ cell (including the one where it is installed).

However, Vladimir Yakovlevich is an experienced gardener, and he knows that the land on his plot holds moisture well, and there will be no harvest if one cell of the garden is watered by two or more equally directed sources (but a cell can be irrigated by one horizontally directed and one vertically directed source). In turn, water may not enter at all into some cell, and this is permissible: Vladimir Yakovlevich will plant cacti in such cells. Determine if Vladimir Yakovlevich can turn the located irrigation sources so that not a single cell of the garden receives an excess of water?

Input

The first line contains 4 integers n, m, k, q.

Next k lines contain 2 space-separated integers x_i and y_i — coordinates of irrigation sources.

$$1 \le n, m, q \le 1000$$

$$1 \le k \le n \cdot m$$

$$1 \le x_i \le n$$

$$1 \le y_i \le m$$

Output

Print "`YES`" (without quotes) if Vladimir Yakovlevich can set up an irrigation system to get a crop, and "`NO`" otherwise

Examples

standard input	standard output
2 5 6 1 1 1 1 2 1 4 1 5 2 1 2 4	YES
8 6 15 5 1 3 2 5 3 4 3 6 4 5 5 1 5 4 5 5 5 6 6 4 6 5 7 3 7 4 7 6 8 4	NO