Problem A. Another Copy Of Polygon

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

You are given a convex polygon consisting of n vertices on the plane and a vector d. Calculate the perimeter of the union of the polygon with its copy translated by the vector d.

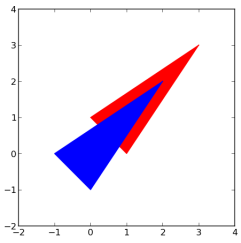
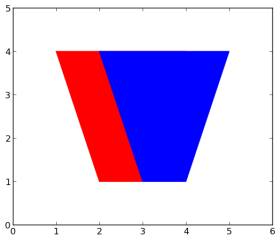
Input

The first line of the input contains one integer n ($3 \le n \le 10^5$) — the number of vertices of the polygon. Each of the next n lines contains two integers between 0 and 10^9 — coordinates of the respective vertex. The vertices are listed in clockwise order. The last line of the input contains two integers d_x and d_y ($-10^9 \le d_x, d_y \le 10^9$) — coordinates of the translation vector.

Output

Print the perimeter of the union of the polygon with the translated copy with absolute error 10^{-3} or better.

Examples

standard input	standard output	Notes
3 3 3 1 0 0 1 -1 -1	12.07544	
4 1 4 4 4 3 1 2 1 1 0	12.32456	

Problem B. Byteland Routes

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

There are n cities in Byteland. The cities are connected with $n-1$ bidirectional roads so that any two cities are connected directly or indirectly via the road network. Each road has length 1.

Byteland has two main cities with numbers 1 and 2. Other cities are numbered 3 through n.

Byteazar was given the task to reorganize the bus routes in Byteland. There is a single route between each pair of distinct cities, connecting them via the shortest path in the network. To calculate efficiency of existing routes, Byteazar defined *importance* of a city as the distance (that is, the length of the shortest path) to the nearest main city, and importance of a route as the **minimum** importance among all cities on this route.

Given the configuration of Bytelandian roads, calculate the sum of importances of all $n \cdot (n-1)/2$ existing routes.

Input

The first line contains an integer n ($2 \le n \le 10^5$) — the number of cities. Each of the next $n-1$ lines contains two distinct integers a and b ($1 \le a, b \le n$) — endpoints of the respective road.

Output

Print one integer — total importance of all routes.

Examples

standard input	standard output
7 7 2 7 3 7 4 2 5 3 6 4 1	7

Problem C. Complete Graph

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

You are given a complete graph with n vertices, where n is odd. Find any coloring of edges of this graph in $(n-1)/2$ colors such that for each color all edges of this color form a single cycle connecting all n vertices.

Input

The first line of the input contains one integer n ($1 \le n \le 2000$, n is odd) — the number of vertices of the graph.

Output

Print $(n-1)/2$ lines. On the i-th line, print the corresponding cycle as a sequence of vertices connected by the edges of the i-th color. Vertices are indexed 1 through n. If there are several correct solutions, print any of them.

Example

standard input	standard output
5	1 2 4 3 5 2 3 1 4 5
7	1 2 3 4 5 6 7 1 3 5 7 2 4 6 1 4 7 3 6 2 5

Problem D. Day For Picnic

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2.5 seconds
Memory limit:	512 mebibytes

Lisa is going on a picnic today. She wants to make a blanket in the shape of a quadrilateral.

There are n flowers growing on the lawn. Lisa loves flowers very much. When she puts her blanket on the lawn, she wants each vertex of the quadrilateral to be placed at a point that contains a flower.

Lisa has l square meters of canvas available, hence she is able to produce any blanket with area at most l. Under this constraint, Lisa wants to make the area covered by the blanket as big as possible. Note that the quadrilateral is allowed to be either convex or concave, as well as to contain collinear vertices. However, the border of the quadrilateral must pass through each point at most once, and all vertices of the quadrilateral must be distinct.

Input

The first line of the input contains two integers n and l ($4 \le n \le 300$, $1 \le l \le 10^9$) — the number of flowers and the area of canvas available for Lisa. Each of next n lines contains two integers x and y ($-10^4 \le x, y \le 10^4$) — coordinates of the respective flower in meters. No two flowers occupy the same point.

Output

Print the maximum possible area of the blanket with absolute error 10^{-2} or better. If it is impossible to create a blanket of area at most l with all four vertices at points containing flowers, print 0.

Example

standard input	standard output
4 7 -1 -1 -1 1 1 1 1 -1	4.00
7 21 -4 -2 -1 2 -5 -1 7 5 2 3 -10 1 1 -2	21.00
4 9837 -100 -100 -100 100 100 100 100 -100	0.00

Problem E. Easy Guessing Game

Input file:	*standard input*
Output file:	*standard output*
Time limit:	8 seconds
Memory limit:	512 mebibytes

This is an interactive problem.

Petya and Vasya are playing a game. The game consists of several rounds. At the beginning of each round Petya secretly chooses a number x from 1 to n (n is independent of the round number). Then Vasya can name a number y from 1 to n and Petya tells if y is less than x. Each round Vasya can name as many numbers as he wants. After that Vasya must name the number x. Vasya's goal is to guess the number correctly while making as few guesses as possible.

Help Vasya write a program that plays the game.

It is guaranteed that Petya won't change the chosen number during the round. However, at the beginning of a new round he can choose the number based on Vasya's behaviour during the past rounds.

Input

The first line contains two integers: maximal number n that can be guessed by Petya and the number of rounds k ($1 \le n \le 10^9$, $k = 10^4$).

After that each query is followed by Petya's answer. Each answer is «`<`» is Petya's number is less than the number in the query, or «`>=`» otherwise.

No response follows an attempt to guess the number.

Output

You should process all k rounds. Each line of output should contain exactly one query of form

`c x`

`c` — a single character describing the query type: `'?'` for a question, and `'='` for a guess attempt.

`x` — an integer from 1 to n.

Total number of `?`-queries should not exceed $k(\log_2(n+1) + 0.1)$.

Examples

standard input	standard output

4 2
 	
`<`
 	
`>=`
 	
`>=`
 	
`>=`
	
	`? 3`
	
	`? 2`
	
	`= 2`
	`? 3`
	
	`? 4`
	
	`= 4`

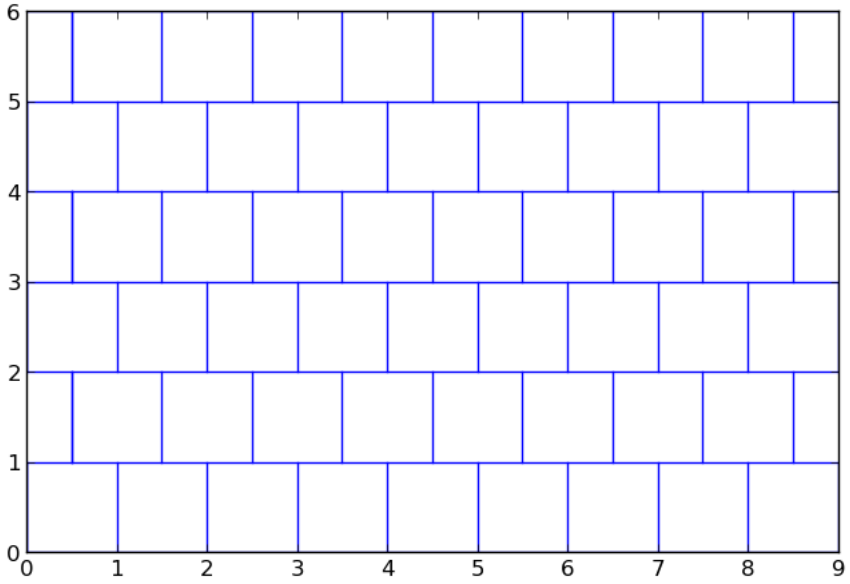
Note

Note that the sample test case is invalid since $k \neq 10^4$. Instead, the first test case will be this: `4 10000`

Problem F. Fred's Parquet

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

The parquet floor in Fred's house consists of square tiles 1×1 which are arranged in the following way:



The image shows only a part of a parquet, though you may assume it is actually so big that it covers the entire plane.

Fred's friend Sam once drew a thin red rectangular contour on the floor. Calculate the number of tiles that have at least one red point on them (inside or on the border).

Input

The first line of the input contains two real numbers x_1, y_1 — the coordinates of the lower left vertex of the red rectangle. The second line contains two real numbers x_2, y_2 — the coordinates of the upper right vertice of the rectangle ($0 < x_1 < x_2 \le 10^9$, $0 < y_1 < y_2 \le 10^9$). Coordinates are given with no more than one digit after decimal point.

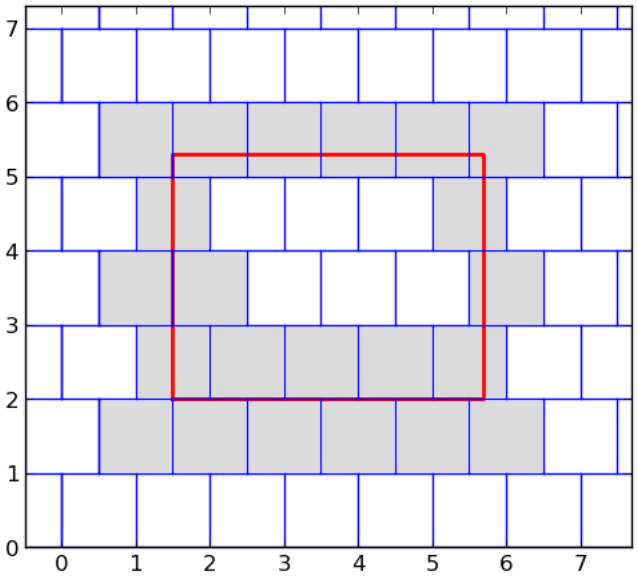
Output

Print one integer — the number of tiles that have at least one common point with the red rectangle.

Example

standard input	standard output
1.5 2 5.7 5.3	22

Note



Problem G. Game With Mirroring

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Alice thinks of some integer x and tells Bob the integer z, which is the sum of x and *mirrored* x (i.e. integer which is obtained by reading the decimal representation of x backwards and eliminating possible leading zeroes).

Before trying to guess x, Bob wants to know the number of possible x for a given z. Help him to calculate this number.

Input

The first line of the input contains one integer t — the number of test cases ($1 \le t \le 500$). Each test case contains one integer — the value of z ($1 \le z \le 10^{18}$).

Output

For each test case print one integer — number of different x such as z is equal to sum of x and mirrored x.

Example

standard input	standard output
4 10 11 121 109	1 1 9 0

Problem H. How Long Till Connection?

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

You are given a bipartite graph. The left half contains n vertices indexed from 0 to $n-1$, and the right half contains m vertices indexed from 0 to $m-1$. Initially there are k edges. On i-th step (counting from 0-th step) an edge between the vertex $(i \bmod n)$ in the left half and the vertex $(i \bmod m)$ is added.

How many steps will pass before the graph becomes connected?

Input

The first line contains three numbers n, m and k ($1 \le n, m \le 10^9$, $0 \le k \le 10^5$).

i-th of the next k lines contains two integers u_i и v_i — indices of vertices of left and right half connected by i-th edge ($0 \le u_i < n$, $0 \le v_i < m$).

Multiple edges are allowed.

Output

Print the answer to the problem. If the graph never becomes connected, print -1 instead.

Examples

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

Problem I. Imoaix

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	512 mebibytes

Vasya bought a new smart vacuum cleaner Imoaix. To test how intelligent it is, Vasya splits the room into $(n+1)$ rows and columns numbered from 0 to n. Imoaix is placed into cell $(0,0)$. In each corners of the room (cells $(0,0)$, $(0,n)$, (n,n) and $(n,0)$) Mirko placed some gold coins, while in other cells he placed some silver coins (no more than 10^4 coins per cell).

Each second Imoaix moves in one of eight main directions. In other words, from the current cell Imoaix can move to any cell that shares a side or a vertex with it. Vasya ordered Imoaix to collect all the gold coins and return to the starting cell in exactly $4n$ seconds.

Now Imoaix wonders, what is the maximum number of silver coins it can collect while completing the task.

Input

The first line of the input contains the integer n ($1 \le n \le 500$). Each of the next $n+1$ lines contains $n+1$ integers, representing the number of silver coins in each cell. Number of coins in each cell will not exceed 10^4.

Output

Print the maximum number of silver coins Imoaix can gather, while picking up all gold coins and returning back in $4n$ seconds.

Example

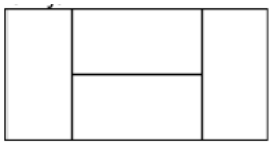
standard input	standard output
2 1 1 1 1 10 1 1 1 1	17
3 1 2 3 4 2 3 4 5 3 4 5 6 4 5 6 7	51

Problem J. Journey Of Cat

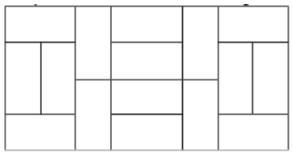
Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Byteazar had just paved his kitchen in a very interesting way.

At the beginning of the process the floor in the kitchen was paved by one rectangle $2^n \times 2^{n+1}$. Then, Byteazar took n turns of replacing each of the rectangles with four smaller rectangles as it is shown on the picture:



After two turns the kitchen floor looked as follows:



After all n turns were done, the floor consisted of 1×2 unit cells tiles. The cell at the **upper left** corner has coordinates $(1, 1)$, while the cell at the **bottom right** corner has coordinates $(2^n, 2^{n+1})$.

Byteazar's cat starts her walk at the cell (r, c). Each second the cat moves in one of four directions: left, right, up or down.

Given the sequence of the cat's movement, determine for each step in the sequence whether the cat moved between two distinct tiles or not during this particular move.

Input

The first line of the input contains one integer n ($0 \le n \le 20$) — the number of steps in the paving process. The second line contains two integers r and c ($1 \le r \le 2^n$, $1 \le c \le 2^{n+1}$) — the row and column indices of the cat's starting position.

The third line contains one non-empty string of at most 10^5 capital English letters 'L', 'R', 'U' and 'D' — directions of the cat's movement (corresponding to left, right, up and down, respectively). You may assume that the cat never left the kitchen floor while moving.

Output

Print one string. The i-th character of this string should be 'Y' if the cat moved between two different tiles during the i-th step, or 'N' otherwise.

Example

standard input	standard output
2 2 3 URRRDLDRRRU	NYNYNYYYYYN

Note

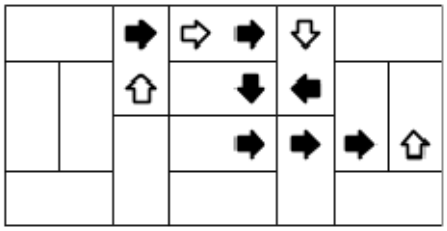


Illustration to the sample. Black arrows denote that the cat moved between two tiles.

Problem K. King Size

Input file:	*standard input*
Output file:	*standard output*
Time limit:	4 seconds
Memory limit:	512 mebibytes

You are given a king size table $r \times c$, each cell of this table contains exactly one decimal digit (an integer from 0 to 9). You have to process q queries, each asking for the sum of digits in some rectangle.

The trick is that r and c might be large, so the table is given in the compressed form. For each of r rows you are given some string that provides the period of this row. The row can be reconstructed by repeating its period multiple times and taking first c characters of the resulting infinite string.

Input

The first line of the input consists of integers r and c ($1 \le r, c \le 10^5$) — the number of rows and columns in the table respectively.

Each of the next r lines contains the period of the corresponding rows. Each period is a string of at most $min(c, 100)$ decimal digits.

The next line contains one integer q ($1 \le q \le 10^5$) — the number of queries.

Each of the following lines contains four integers x_1, y_1, x_2, y_2 ($1 \le x_1 \le x_2 \le r$, $1 \le y_1 \le y_2 \le c$) — coordinates of the upper left and the lower right corners of the rectangle to calculate the sum in.

Numeration of rows and columns starts from 1.

Output

For each question print one integer — the sum of the digits in the given rectangle.

Example

standard input	standard output
4 10 1 04 123 98 1 1 1 4 10	134
4 3 5 0 330 405 2 1 1 4 1 1 1 3 1	12 8

Note

In the first sample, the decompressed table will look as follows:

```
1111111111
0404040404
1231231231
9898989898
```

Problem L. Laura's Function

Input file:	*standard input*
Output file:	*standard output*
Time limit:	4 seconds
Memory limit:	512 mebibytes

Young Laura enjoys playing with square matrices. She invented a new function called $Lr(A)$.

$Lr(A)$, where A is a square matrix of size $n \times n$, is calculated as the sum of absolute values of differences for all n^4 ordered pairs of numbers in the matrix.

Given a matrix B of size $n \times m$, compute the sum of $Lr(X)$ for all submatrices of size $k \times k$ of matrix B modulo $10^4 + 7$.

Input

The first line of the input contains three integers n, m and k ($1 \le n, m, k \le 500$). Each of the next n lines contains m integers A_{ij} ($1 \le A_{ij} \le 10^9$). It is guaranteed that all A_{ij} are pairwise distinct.

Output

Print one integer — the sum of $Lr(X)$ for all submatrices $k \times k$ modulo $10^4 + 7$

Examples

standard input	standard output
3 3 2 1 2 3 4 5 6 7 8 9	112
2 5 2 17 1 2 3 10 18 4 5 6 11	240