Problem A. Experiments with Gorlum

Input file:	`expgorl.in`
Output file:	`expgorl.out`
Time limit:	1 second
Memory limit:	64 megabytes

Recently Yerzhan invented a new type of laser that is capable of measuring distance to distant objects. As any invention, laser needs testing and Yerzhan wants to test it on a moving animate creature (don't ask the final purpose of this laser). Since using mouses is too mainstream, Yerzhan went to the Forbidden Forest in search of a right creature.

The story of Yerzhan catching Gorlum is quite fascinating, but it would be inappropriate to tell it right now. What is more important is that he found the subject of his experiments. The creature's name is Gorlum and, despite Yerzhan's efforts, Gorlum, being a pretty dumb creature, only learned to strictly perform 5 types of commands, denoted by Latin symbols for convenience:

- "L" — Gorlum takes one step to its left — transition from point (x, y) to point $(x - 1, y)$.
- "R" — Gorlum takes one step to its right — transition from point (x, y) to point $(x + 1, y)$.
- "F" — Gorlum takes one step forward — transition from point (x, y) to point $(x, y + 1)$.
- "B" — Gorlum takes one step backwards — transition from point (x, y) to point $(x, y - 1)$.
- "I" — Gorlum takes a shiny ring with glowing texts out of his pocket and doesn't move at all.

For experiment purposes Yerzhan located his laser in point with coordinates $(Laser_x, Laser_y)$ on a plane in Euclidean space. Yerzhan also taught Gorlum to understand and perform a list T of these 5 commands, where T is a string containing the commands in the order Gorlum must perform them. Gorlum starts at point $(Gorlum_x, Gorlum_y)$.

Your task is to output the minimal and maximal distances to Gorlum detected by the laser. Your answer will be considered correct if the absolute or relative errors of the two numbers don't exceed 10^{-9}.

Input

First two lines of input contain a natural number $K \le 10^5$ and a string S ($|S| \le 10^4$), consisting of symbols "LRFBI". To obtain the list of commands T, simply concatenate S K-times to itself (in other words $T = S^K$).

The last two lines contain two pairs of numbers: coordinates of location of the laser $(Laser_x, Laser_y)$ and of Gorlum $(Gorlum_x, Gorlum_y)$.

All coordinates are integer numbers, not exceeding 10^4.

Output

Two real numbers — minimal and maximal detected distances. Absolute or relative errors of the numbers must not exceed 10^{-9}.

Examples

expgorl.in	expgorl.out
100000 LRFBI 10000 10000 10000 10000	0.000000000000 1.000000000000

Note

In 40% of testcases $|S| \le 2 \times 10^3$, $K \le 2 \times 10^4$.

Problem B. Riddick's Cube

Input file:	`riddicks.in`
Output file:	`riddicks.out`
Time limit:	2 seconds
Memory limit:	64 megabytes

It is well known, that the most sold toy in history is Rubik's Cube. In mere 40 years 350 millions items were sold. A famous Kazakhstani businessman decided to repeat that success, by creating a simpler version of this puzzle. Riddick's Cube, the ingenious invention of the businessman, is an $N \times M$ rectangle consisting of 1×1 cells, each of which is colored in some color. The rules of the puzzle are simple: in a single move it is allowed to cyclically move any row or column by one cell in any direction (rows are moved left or right, columns are moved up or down). For example, this is how 2-nd row is moved right and how 3-rd column is moved up::

1 2 3 4		1 2 3 4	1 2 3 4		1 2 7 4
5 6 7 8	=>	8 5 6 7	5 6 7 8	=>	5 6 11 8
9 10 11 12		9 10 11 12	9 10 11 12		9 10 3 12

A configuration of the puzzle is called final, iff either each of the rows contains cells of the same color or each column contains cells of the same color.

The bussinessman is concerned about the solvability of his puzzle and so he wants to estimate its complexity before starting the sales. And he gives that task to you. To estimate the complexity we will simplify the rules: you can shift some columns(possibly none) and then — some rows(possibly none).

You are given a configuration of one of the Riddick's Cubes. If a final configuration can be reached using the simplified rules, then the complexity of the configuration is equal to the minimal number of moves, leading to a final configuration. If a final configuration cannot be reached using the simplified rules, then the Cube is said to be mega complex and its complexity is equal to 100500 (probably, the puzzle can still be solved using the normal rules, but it's too complex).

Input

First line of input contains two integer numbers N and M ($1 \le N, M \le 5$). The following N lines contain M integer numbers each — the description of the puzzle. Each number describes a color in which a corresponding cell is colored. The color numbers are integer numbers in range from 1 to 100. It is not guaranteed that the given configuration is solvable using even normal rules.

Output

Output one integer number — complexity of the given configuration of the puzzle.

Examples

riddicks.in	riddicks.out
2 3 1 2 1 2 3 3	2
2 3 2 2 1 1 2 1	100500

Problem C. Schools

Input file:	`school.in`
Output file:	`school.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

Recently Akim of some state decided to open exactly M music and S sports schools to support education in the state. There are N different cities in the state. For each of the cities both the number of students ready to study in music school and the number of students ready to study in sports school is known. Being a big fan of efficiency, Akim doesn't want to open more than one school in any city (it's possible that he won't open any school in some cities).

You, as Akim's consultant, are given a task of developing a plan that would maximize the number of students that would study in the newly opened schools in the state.

Input

First line of input contains three integer numbers: N ($1 \leq N \leq 300000$), M, S ($0 \leq min(M, S)$, $M + S \leq N$) — the number of cities in the state, the number of music and sports schools that Akim wishes to open respectively.

Each of the following N lines contains two integer numbers: A_i ($1 \leq A_i \leq 10^5$) and B_i ($1 \leq B_i \leq 10^5$) — the number of students in the i-th city that wish to study in music and sports school respectively.

Output

Output one integer number — the number of students that will study in the newly opened schools in an optimal plan.

Examples

school.in	school.out
3 1 1 5 2 4 1 6 4	9
7 2 3 9 8 10 6 3 5 1 7 5 7 6 3 5 4	38

Problem D. Special graph

Input file:	`specialg.in`
Output file:	`specialg.out`
Time limit:	1 second
Memory limit:	64 megabytes

You are given a directed graph with N vertices. The special thing about the graph is that each vertex has at most *one* outgoing edge. Your task is to answer the following two types of queries:

- 1 a — delete the only edge outgoing from vertex a. It is guaranteed that the edge exists. $1 \le a \le N$
- 2 a b — output the length of the shortest path from vertex a to vertex b, if the path exists. Otherwise output "-1" without quotes. $1 \le a, b \le N$

Input

First line of input contains a natural number $N \le 10^5$ — the number of vertices in the graph.

The following line contains N integer numbers, i-th number is $next_i$ ($0 \le next_i \le N$), meaning that there is an edge from vertex i to vertex $next_i$. If $next_i = 0$, assume that there is no outgoing edge from vertex i.

Third line contains a natural number $M \le 10^5$ — the number of queries.

The following M contain a query each. Queries are given in the manner described above.

Output

On the i-th line output the answer for the i-th query of type 2 a b.

Examples

specialg.in	specialg.out
6 3 3 4 5 6 4 6 2 1 6 2 1 4 2 1 2 1 3 2 1 6 2 1 4	4 2 -1 -1 -1
4 4 4 1 3 5 2 2 4 2 2 1 1 4 1 2 2 3 1	1 3 1

Note

In 50% testcases $N \le 2 \times 10^3$,$M \le 2 \times 10^4$.