A. Balance

Time Limit: 1 second

Points: 100

Emile has an m by n grid of integers. For each row and each column, Emile calculates its imbalance, namely the difference between its largest and smallest entries. Emile describes a grid as balanced if the largest imbalance among the rows is the same as the largest imbalance among the columns.

Help Emile determine whether a given grid is balanced.

Input

The first line of input consists of two integers, m and n, representing the number of rows and columns of the grid. m lines follow, the ith of which consists of n space-separated integers, $a_{i,1}, a_{i,2}, \ldots, a_{i,n}$, the entries of the ith row of the grid.

Constraints

All input will satisfy the following constraints:

- $1 \leq m, n \leq 1,000$
- For all $1 \leq i \leq m, 1 \leq j \leq n$, $-1,000,000,000 \leq a_{i,j} \leq 1,000,000,000$

Output

If the grid is balanced, output `YES`. Otherwise, output `NO`.

Sample Input 1

```
2 3
1 2 3
4 5 6
```

Sample Output 1

```
NO
```

Sample Input 2

```
3 3
3 7 8
4 6 9
1 2 5
```

Sample Output 2

```
YES
```

Sample Input 3

```
1 1
42
```

Sample Output 3

```
YES
```

Explanation

In sample 1, the first row has imbalance given by $3 - 1 = 2$, and the second row has imbalance 2 also. However, each column has imbalance 3. We see that the largest imbalance of any row and the largest imbalance of any column do not agree, so the grid is not balanced.

In sample 2, the rows have imbalance 5, 5 and 4 and the columns have imbalance 3, 5 and 4. Therefore 5 is the largest imbalance of any row and also of any column, so the grid is balanced.

In sample 3, the only row has just one element, so its smallest and largest element are equal. This means that the imbalance of the row is 0, and the same is true for the only column, so the grid is balanced.

B. Matchup

Time Limit: 1 second

Points: 100

Martha is the coach of a team of n chess players. Her team is about to face a rival team, who also have n players. In the match, each player will play just one game against a single member of the opposition.

Martha has extensively studied all the players, and knows exactly what their ability is. A player of greater ability will always defeat a player of lesser ability. If both players are of equal ability, they will draw.

Martha wants to assign her players to the n opponents to ensure a total victory, that is, so that all n of her players will win. Determine whether this is possible.

Input

The first line of input consists of one integer n, representing the number of players on each team. The second line of input consists of n space-separated integers, $a_1, a_2, \ldots, a_n$, the ability of each of Martha's players. The third line of input consists of n space-separated integers, $b_1, b_2, \ldots, b_n$, the ability of each of the opponents.

Constraints

All input will satisfy the following constraints:

- $1 \leq n \leq 100,000$
- For all $1 \leq i \leq n$, $1 \leq a_i, b_i \leq 2,000,000,000$

Output

If Martha's team can be assigned so as to win all their games, output `YES`. Otherwise, output `NO`.

Sample Input 1

```
3
4 5 6
1 2 3
```

Sample Output 1

```
YES
```

Sample Input 2

```
1
2882
2882
```

Sample Output 2

```
NO
```

Sample Input 3

```
4
2 7 8 5
3 6 1 4
```

Sample Output 3

```
YES
```

Sample Input 4

```
4
2 7 8 3
5 6 1 4
```

Sample Output 4

```
NO
```

Explanation

In sample 1, all of Martha's players are better than all of the opponents, so they will all win regardless of the assignment of opponents.

In sample 2, the only game results in a draw, so Martha's player does not win.

In sample 3, Martha's players can be matched with the third, second, fourth and first opponents respectively, in which case they will all win.

In sample 4, Martha's first and fourth players can only beat the third opponent. It follows that at least one of them will be matched with a stronger opponent and hence lose. Martha can guarantee three wins, but not four.

C. Control

Time Limit: 1 second

Points: 100

Mikhail has a square chessboard of side length n squares. He has placed several pieces on this board, all of the same colour. A square is controlled if it is occupied by a piece, or if a piece can move directly to it.

Mikhail has four types of pieces:

- queens (denoted `Q`), which can move vertically, horizontally and diagonally;
- rooks (denoted `R`), which can move vertically and horizontally;
- bishops (denoted `B`), which can move diagonally;
- knights (denoted `N`), which can move two squares horizontally and one square vertically, or vice versa.

Note that queens, rooks and bishops cannot jump over other pieces.

Help Mikhail determine how many squares are controlled by his pieces.

Input

The first line of input consists of two integers, n and k, representing the number of rows and columns of the board, and the number of pieces. k lines follow, the ith of which consists of a character t_i, representing the type of the ith piece, followed by two space-separated integers r_i and c_i, representing the row and column where it is positioned.

Constraints

All input will satisfy the following constraints:

- $1 \leq n \leq 100$
- $1 \leq k \leq n^2$
- For all $1 \leq i \leq k$, t_i is either `Q`, `R`, `B` or `N`
- For all $1 \leq i \leq k$, $1 \leq r_i, c_i \leq n$
- No two pieces are on the same square, that is, the pairs (r_i, c_i) are all distinct

Output

Output a single integer, the number of squares controlled by Mikhail's pieces.

Sample Input 1

```
3 2
N 1 1
B 2 2
```

Sample Output 1

```
7
```

Sample Input 2

```
5 3
B 4 1
R 5 1
Q 1 5
```

Sample Output 2

```
19
```

Explanation

In sample case 1, the board is as pictured below. Squares which are controlled but not occupied are denoted by `*`.

```
| N |   | * |
|   | B | * |
| * | * | * |
```

The bishop in the centre can move to any corner of the board, and the knight in the corner can move to row 2 column 3 or row 3 column 2.

In sample case 2, the board is as pictured below. Squares which are controlled but not occupied are denoted by `*`.

```
| * | * | * | * | Q |
|   |   | * | * | * |
|   | * | * |   | * |
| B | * |   |   | * |
| R | * | * | * | * |
```

The queen can move along its row and column, as well as the long diagonal. The bishop can move along either diagonal, although the square in row 5 column 2 is already covered by the rook, which can move along its row. Rooks can also move vertically, but the squares in rows 2 and 3 of column 1 are inaccessible to this rook as the bishop blocks the way.

D. Election

Time Limit: 1 second

Points: 100

The city of Breforth is holding an election for its Mayor. There are k candidates, each of which is denoted by an ID number between 1 and k inclusive. The city uses a preferential voting system, in which each of the n voters ranks all k candidates from first to last preference. The election is then decided by the following process.

1. Allocate each voter to their first preference candidate.
2. If any candidate has a majority of the votes, they are declared the winner.
3. Otherwise, identify the candidate with the fewest votes. They are eliminated.
   - If two or more candidates have the equal fewest votes, break the tie by eliminating the candidate with the smallest ID number.
   - For each vote allocated to the eliminated candidate, reassign it to the voter's next preference that has not already been eliminated.
4. Return to step 2.

The votes have been cast, and you must now determine which candidate has won the election.

Input

The first line of input consists of two integers, n and k. n lines follow, the ith of which consists of k space-separated integers, $a_{i,1}, a_{i,2}, \ldots, a_{i,k}$, the jth of which represents the jth preference of the ith voter.

Constraints

All input will satisfy the following constraints:

- $1 \leq n \leq 10,000$
- $1 \leq k \leq 100$
- For all $1 \leq i \leq n$, for all $1 \leq j \leq k$, $1 \leq a_{i,j} \leq k$
- For all $1 \leq i \leq n$, for all $1 \leq j_1 < j_2 \leq k$, $a_{i,j_1} \neq a_{i,j_2}$, that is, each preference of a given voter is for a different candidate

Output

Output one integer, the ID of the winning candidate.

Sample Input 1

```
5 3
1 2 3
```

```
1 2 3
1 2 3
2 3 1
2 3 1
```

Sample Output 1

```
1
```

Sample Input 2

```
5 3
2 1 3
3 2 1
1 3 2
2 1 3
1 3 2
```

Sample Output 2

```
2
```

Sample Input 3

```
4 3
1 3 2
2 3 1
2 1 3
3 1 2
```

Sample Output 3

```
3
```

Explanation

In sample case 1, there are five voters and three candidates. Candidate 1 receives three first-preference votes, Candidate 2 gets two, and Candidate 3 gets none. Candidate 1 has a majority , so they win.

In sample case 2, there are five voters and three candidates. Candidates 1 and 2 receive two first-preference votes each and Candidate 3 gets only one. No candidate has a majority, so Candidate 3 is eliminated. Voter 2 is then reallocated to their second preference, namely Candidate 2. Candidate 2 then has three votes, which is a majority, so they win.

In sample case 3, there are four voters and three candidates. Candidate 2 receives two first-preference votes each and Candidates 1 and 3 get one each.

No candidate has a majority, so Candidate 1 is eliminated with the tie broken by ID number. Voter 1 is then reallocated to their second preference, namely Candidate 3. The remaining candidates have two votes each, so no candidate has a majority and Candidate 2 is eliminated on the basis of their ID number. Voter 2 is reallocated to their second preference, namely Candidate 3. However, the second preference of Voter 3 (Candidate 1) is already eliminated, so they are reallocated to their third preference, namely Candidate 3. Candidate 3 then has all four votes, which is a majority, so they win.

E. Illuminate

Time Limit: 1 second

Points: 100

Leseli manages the lights on a residential street. There are houses only on one side of the street, and they are numbered $1, 2, 3, \ldots, m$. There are n lights installed, each of which can illuminate the sidewalk from house ℓ_i to house r_i inclusive. The local council requires that the sidewalk is illuminated from house L to house R inclusive, but due to budget cuts Leseli should use as few lights as possible to achieve this.

Help Leseli find the fewest number of lights that must be turned on in order to illuminate the required range of sidewalk.

Input

The first line of input consists of four space-separated integers, n, m, L and R representing the number of lights, the number of houses and the left and right endpoints of the required range. n lines follow, the ith of which consists of two space-separated integers ℓ_i and r_i, representing the left and right endpoints of the range covered by the ith light.

Constraints

All input will satisfy the following constraints:

- $1 \leq n \leq 100,000$
- $1 \leq m \leq 10^{18}$
- $1 \leq L \leq R \leq m$
- For all $1 \leq i \leq n$, $1 \leq \ell_i \leq r_i \leq m$

Output

Output one integer, the fewest number of lights required to illuminate the sidewalk from house L to house R inclusive, or `-1` if there is no solution.

Sample Input 1

```
3 4 1 4
1 2
2 3
3 4
```

Sample Output 1

```
2
```

Sample Input 2

```
5 20 5 19
2 10
6 14
9 16
12 18
17 20
```

Sample Output 2

```
3
```

Sample Input 3

```
4 5 1 5
1 2
1 3
3 5
4 5
```

Sample Output 3

```
2
```

Sample Input 4

```
3 5 1 5
4 5
3 3
1 2
```

Sample Output 4

```
3
```

Sample Input 5

```
2 5 1 5
1 2
4 5
```

Sample Output 5

```
-1
```

Sample Input 6

```
5 8 1 8
1 3
4 8
4 5
6 8
1 3
```

Sample Output 6

```
2
```

Explanation

In sample case 1, the only solution is to use lights 1 and 3. Light 1 covers the first two houses, and light 3 covers the last two houses.

In sample case 2, the only solution is to use lights 1, 3 and 5. This covers the range from house 2 to house 20, with houses 9 and 10 covered twice.

In sample case 3, there are several solutions. For example, lights 2 and 3 together cover all five houses, including house 3 twice.

In sample case 4, all three lights are required. Note that the order of lights does not matter.

In sample case 5, neither light can cover house 3, so there is no solution.

In sample case 6, we prefer the solution with lights 1 and 2 only to the solution with lights 3, 4 and 5.