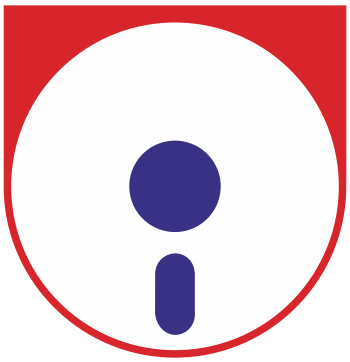


Croatian Open Competition in Informatics

Round 4, January 25th 2025

Tasks

Task	Time limit	Memory limit	Score
Šah	3 seconds	512 MiB	50
Benzinska	1 second	512 MiB	70
Xor	1 second	512 MiB	90
Cipele	2 seconds	512 MiB	120
Tura Mačkica	0.5 seconds	512 MiB	120
Total			450

Task Šah

Two chess giants, Vito and Patrik, will play a game of chess this year in front of the iconic theater on Jane Street, finally proving who is the *greatest player of all time*. However, as standard chess has become boring for them, they decided to modify the rules of the game to make it more interesting. We will mention only the rules that are relevant to this task.

The chessboard will be a square matrix with N rows and N columns. Only the chess pieces **knight**, **rook**, and **queen** will be used. The pieces behave in the same way as in standard chess. A rook attacks a square if it is in the same row or column as that rook. A queen also attacks all squares in the same row and column, but in addition to that, it attacks all squares along the same diagonals. Knights attack squares that are two rows and one column away or vice versa. Examples of these moves can be seen in the explanations of the examples.

Note: Each piece also attacks the square on which it is placed. Additionally, pieces attack through other pieces, i.e., a piece attacks squares according to the rules stated above regardless of whether there is another piece between the square and the attacking piece.

Vito is preparing for the long-awaited showdown and needs your help. He has decided to practice his quick observation skills. He will do this by placing M chess pieces on the board and then determining all the squares that are attacked. Your task is to determine the number of attacked squares on the given board.

Input

The first line contains pozitive integers N and M ($1 \leq N \leq 200, 1 \leq M \leq N^2$).

In the next M lines, each line contains a single uppercase letter of the English alphabet, representing the type of piece, which can be one of `'N'`, `'R'`, and `'Q'`, corresponding to knight, rook, and queen, respectively, and integers r_i and c_i ($1 \leq r_i, c_i \leq N$), representing the row and column where that piece is located.

At most one piece can be placed on any square of the board.

Output

In the first and only line, you need to output the number of attacked squares on the board.

Scoring

Subtask	Points	Constraints
1	13	All pieces on the board are rooks.
2	19	Each piece on the board is either a rook or a queen.
3	18	No additional constraints.

Examples

input	input	input
7 1 Q 4 4	5 1 N 3 3	6 3 R 1 4 Q 2 1 N 5 2
output	**output**	**output**
25	9	25

Clarification of the first and second example: In the sketches, examples are shown. All attacked squares are marked with a dot, except the one on which the piece is located.

(a) first example

(b) second example

Task Benzinska

The camp in Čakovec has already started, but Mr. Malnar is still visiting Zagreb's restaurants. Wanting to burn the calories he consumed, he decided to cycle to Čakovec.

Mr. Malnar starts his journey from Zagreb ($x = 0$) with an initial energy of D and wants to reach Čakovec, which is X meters away from Zagreb ($x = X$). Each meter of the journey requires one unit of energy. To avoid passing out, his energy must not become negative at any point during the trip.

There are n restaurants along the way, with the i-th restaurant located at the x_i-th meter from the starting point. Multiple restaurants can be located at the same position. If Mr. Malnar decides to dine at the i-th restaurant, his energy increases by y_i. He may not eat at the same restaurant multiple times. Help him determine the minimum number of restaurants he must dine at to safely reach Čakovec.

Input

In the first line of input, there are three integers n, D, and X ($1 \leq n \leq 2 \cdot 10^5$, $1 \leq D, X \leq 10^9$), representing the number of restaurants, the initial energy, and the distance between the cities.

In the second line of input, there are n integers x_i ($1 \leq x_i < X$), representing the positions of the restaurants.

In the third line of input, there are n integers y_i ($1 \leq y_i \leq 10^9$), representing the energy Mr. Malnar gains by dining at each respective restaurant.

Output

In a single line of output, print the minimum number of restaurants Mr. Malnar must dine at to safely reach Čakovec. If it is not possible to reach Čakovec, print `'-1'` (without quotes).

Scoring

Subtask	Points	Constraints
1	15	$y_i = y_j$ for every i, j
2	30	$n \leq 1\,000$
3	25	No additional constraints.

Probni primjeri

input

```
5 5 12
3 4 7 8 11
3 2 1 2 1
```

output

```
3
```

input

```
5 10 40
1 20 30 2 38
7 7 7 7 7
```

output

```
5
```

input

```
4 5 12
3 6 9 10
2 1 2 2
```

output

```
-1
```

Clarification of the first example:
At $x = 3$, Mr. Malnar will have 2 energy units left. At the first restaurant, he will dine, and his energy will increase to $2 + 3 = 5$. At $x = 4$, he will have 4 energy units left. At the second restaurant, he will

dine, and his energy will increase to $4 + 2 = 6$. At $x = 8$, he will have 2 energy units left. At the fourth restaurant, he will dine, and his energy will increase to $2 + 2 = 4$. In total, he dined at three restaurants.

Task Xor

Fran recently learned the operation *xor*, which for two integers x and y returns the result by applying the bitwise exclusive or (*exclusive or*). The operation *xor*, denoted as $\oplus$, compares the corresponding bits of the numbers x and y and sets the result bit at each position according to the following rule:

- If the bits at the corresponding position are different (0 and 1, or 1 and 0), then the result bit is 1.
- If the bits are the same (0 and 0, or 1 and 1), then the result bit is 0.

For example, for $x = 5$ and $y = 3$, the binary representations are: $x = 101_2$, $y = 011_2$. Applying *xor* to the corresponding bits gives $x \oplus y = 101_2 \oplus 011_2 = 110_2 = 6$. In other words, $5 \oplus 3 = 6$.

Fran received an array of n integers $a_1, a_2, \ldots, a_n$ and decided to do the following:

1. For every pair of indices (i, j) where $1 \leq i \leq j \leq n$, he calculated the sum $a_i + a_j$.
2. Now he wants to calculate the result of the *xor* of all the obtained sums.

Help Fran calculate the required result.

Input

In the first line of input, there is n ($1 \leq n \leq 5 \cdot 10^5$), the length of the array.

In the second line, there are n numbers $a_1, a_2, \ldots, a_n$ ($0 \leq a_i < 2^{30}$) as described in the problem statement.

Output

In the only line of output, print the required result.

Scoring

Subtask	Points	Constraints
1	7	$n \leq 2000$
2	17	$a_i < 2^{10}$ for every i
3	45	$n \leq 10^5$
4	21	No additional constraints.

Examples

input

```
3
2 4 5
```

output

```
14
```

input

```
4
6 7 3 1
```

output

```
3
```

input

```
7
2 3 5 7 9 11 13
```

output

```
6
```

Clarification of the first example:
The sums are $2+2=4$, $2+4=6$, $2+5=7$, $4+4=8$, $4+5=9$, and $5+5=10$. The result is $4 \oplus 6 \oplus 7 \oplus 8 \oplus 9 \oplus 10 = 14$.

Task Cipele

Lana has n pairs of shoes, labeled from 1 to n. All the shoes are stored in a long wardrobe. The shoes labeled 1 are initially at the top of the wardrobe (close to the door), while the shoes labeled n are at the bottom (far from the door).

On the i-th of the next q days, Lana will want to wear the shoes labeled a_i. To retrieve a pair of shoes from the wardrobe, she first needs to remove all the pairs that are closer to the door before she can take out the desired pair. Once she retrieves the desired shoes, she will return other shoes to the wardrobe in the same order as they were before. Retrieving one pair of shoes from the wardrobe takes 1 second, and returning shoes to the wardrobe takes no additional time.

At the end of the day, Lana will take off the shoes and either:

- return them to the top of the wardrobe, or
- leave them in the hallway, if there is space available in the hallway.

The hallway can hold up to m pairs of shoes. **Additionally**, Lana can move any shoes from the hallway to the top of the wardrobe at any time (except when in the process of taking out the desired pair). If the desired pair of shoes is already in the hallway at the beginning of the day, Lana can immediately wear them without spending any time retrieving them.

Lana is very busy and wants to minimize the total time spent retrieving shoes from the wardrobe. Help her determine the minimum time she can spend retrieving shoes over the next q days!

Input

The first line contains integers n, m and q ($1 \leq n \leq 2 \cdot 10^5, 0 \leq m \leq 2 \cdot 10^5, 1 \leq q \leq 10^6$) number of shoes, number of spaces in the hallway and number of days.

The second line contains q integers a_i ($1 \leq a_i \leq n$) shoe label that Lana wants to wear on the i-th day.

Output

In the first and only line, output the minimum time required to retrieve the shoes in all q days.

Scoring

Subtask	Points	Constraints
1	17	$n, m, q \leq 1\ 000$
2	27	$n = m$
3	37	$m = 0$
4	24	$q \leq 2 \cdot 10^5$
5	15	No additional constraints.

Examples

input	input	input
5 1 6 2 1 2 1 2 1	6 0 4 5 4 3 4	3 2 7 1 2 3 2 3 1 3
output	**output**	**output**
5	17	4

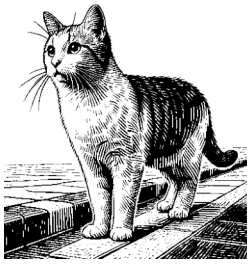
Clarification of the first example:

On the first day, Lana will take the shoes labeled 2 out of the wardrobe. This action will take her 2 seconds. At the end of the day, she will leave those shoes in the hallway and keep them there indefinitely.

Now, whenever she needs to retrieve the shoes labeled 1 from the wardrobe, it will take her 1 second. However, if she needs the shoes labeled 2, she can immediately wear them from the hallway without spending any time.

The total time she will spend retrieving shoes is: $2 + 1 + 0 + 1 + 0 + 1 = 5$ seconds.

Task Tura Mačkica



Everyone knows that Zagreb has n parks, m cats and $n+m$ streets which connect the parks. The cats are very territorial animals so in each street there is at most one cat. It patrols the street by viciously attacking everyone who travels in one direction of that street, but from the people who are travelling in the opposite direction it demands pets before it lets them through. The City of Zagreb, aware of this circumstance, has made sure that the citizens can reach any park from any other park using only n streets without cats.

The Tourist Center has decided to open a so called Cat Tour in Zagreb. The tours visitors will be able to pet every cat in Zagreb and return to the starting location so they can do it all over again. To make sure the tourists don't get lost the tourist center will put up signs in each street telling them which street they shoud take next, so the Cat Tour cannot travel the same street twice (not even in the opposite directions). Obviously, tourists expect to pet every single cat, that no cat attacks them and that the tour is as short as possible.

Help the tourist center by finding the length of the shortest possible Cat Tour or say that it is not possible.

Input

The first line contains integers n, m ($1 \leq n \leq 2 \cdot 10^4, 0 \leq m \leq 2 \cdot 10^4$), number of parks and cats.

The following n lines contain pairs a, b ($1 \leq a, b \leq n$) which describe the streets without cats. Note that it is possible that $a = b$ or that two or more streets connect the same parks.

The following m lines contain pairs x, y ($1 \leq x, y \leq n$) which describe the streets where a cat allows passage from x to y. Note that it is possible that two or more streets connect the same parks.

Output

In the first and only line, output the length of the shortest possible Cat Tour or "-1" if no Cat Tours exist.

Scoring

Subtask	Points	Constraints
1	11	$n, m \leq 20$
2	41	There exists a street connecting a park to itself which is not patrolled by a cat
3	68	No additional constraints.

Examples

input

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

output

```
2
```

input

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

output

```
10
```

input

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

output

```
-1
```

Clarification of the first example:

The shortest Cat Tour is $3 \to 5 \to 3$.