Croatian Open Competition in Informatics

Round 1, November 4th 2023

Tasks

Task	Time limit	Memory limit	Score
Sudoku	1 second	512 MiB	50
Labirint	1 second	512 MiB	70
AN2DL	4 seconds	512 MiB	110
Kocke	2 seconds	512 MiB	110
Mostovi	3 seconds	512 MiB	110
Total			450

Task Sudoku

Sudoku is a logic-based, combinatorial number-placement puzzle. The objective is to fill a 9×9 grid with digits from 1 to 9 in such a way that the following statements hold:

- Each row contains exactly one occurrence of each digit from 1 to 9.
- Each column contains exactly one occurrence of each digit from 1 to 9.
- Each of the nine 3×3 subgrids contains exactly one occurrence of each digit from 1 to 9.

For a given not yet finished sudoku grid, determine if there is a mistake in it.

Note: It is not necessary to check whether the sudoku grid is solvable.

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

Daily sudoku, New York Times, November 1, 2023, Difficulty: Hard

Input

The input describes the sudoku grid.

The characters '`|`', '`-`' and '`+`' frame the 3×3 subgrids.

The character '`.`' represents an empty cell.

All the other characters in the input will be digits from '`1`' to '`9`'.

See the examples for clarification.

Output

Output the word `GRESKA` if there is a mistake in the sudoku board. Otherwise, output the word `OK`.

Scoring

Subtask	Points	Constraints
1	11	It's possible to determine whether there is a mistake by only checking the first rule.
2	12	It's possible to determine whether there is a mistake by only checking the second rule.
3	13	It's possible to determine whether there is a mistake by only checking the third rule.
4	14	No additional constraints.

Examples

input

```
+---+---+---+
|52.|...|.81|
|.39|58.|...|
|.8.|.9.|...|
+---+---+---+
|24.|...|1.3|
|1..|43.|86.|
|.63|..7|.24|
+---+---+---+
|...|1.9|35.|
|..8|.74|6..|
|31.|86.|7.9|
+---+---+---+
```

output

```
OK
```

input

```
+---+---+---+
|3..|6..|..4|
|4.9|8.1|..7|
|..7|.49|6..|
+---+---+---+
|946|157|8.2|
|.2.|3..|745|
|.7.|28.|...|
+---+---+---+
|...|4..|..5|
|8.5|.6.|.2.|
|734|..8|5..|
+---+---+---+
```

output

```
GRESKA
```

input

```
+---+---+---+
|5..|98.|67.|
|6..|...|.31|
|.2.|613|.4.|
+---+---+---+
|.96|8.2|1.7|
|.28|..5|.9.|
|7.3|19.|6..|
+---+---+---+
|962|.7.|.1.|
|1.5|...|76.|
|.7.|5..|9..|
+---+---+---+
```

output

```
GRESKA
```

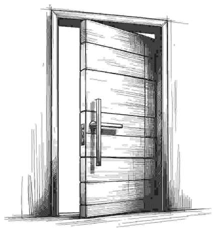
Clarification of the first example:
There is no mistake, so the output is `OK`.

Clarification of the second example:
There is a mistake in the ninth column: the digit 5 appears twice; and there is also a mistake in the lower right 3×3 subgrid: the digit 5 appears twice.

Clarification of the third example:
There are two mistakes: the digit 2 appears twice in the second column, and the digit 6 appears twice in the seventh column.

Task Labirint

What is an EJOI for you?
Game room!



Teo is searching for the Croatian EJOI team! She has already found Gabriel, but is still looking for Vito, Dino, and Ivo.

Teo and the EJOI team are in a labyrinth consisting of $n \times m$ rooms, all of the same size. The rooms form a grid. The top-left room is labeled with $(1, 1)$, and the bottom-right with (n, m). Between each pair of adjacent rooms, there is a door colored in one of four colors: blue (marked with 'P'), red (marked with 'C'), green (marked with 'Z') and orange (marked with 'N').

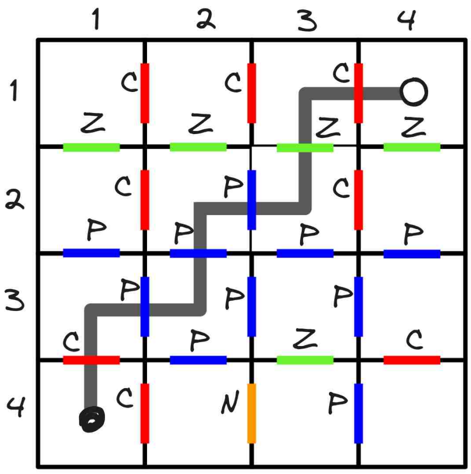


Illustration of the third example. The black circle marks the room in which Teo and Gabriel are located at in the fourth question, and the white circle marks the room in which Vito, Ivo and Dino are located at. The gray path is one of the possible paths that passes through three different door colors.

At some point, Gabriel says: *I know where the rest of the team is, but I will only tell you if you can answer all of my questions.*

Gabriel's questions are: *If we are currently in room (a_i, b_i) and the rest of the team is in room (c_i, d_i), what is the minimum number of door colors we have to go through to reach them?*

Teo is very good at answering Gabriel's questions, but there are simply too many of them. She does not have much time (the bus is leaving soon), so she is asking you to help her answer q of Gabriel's questions!

Input

The first line contains integers n and m $(1 \le n, m \le 100,\ 1 < n \times m)$, the number of rooms.

The i-th of the following n lines contains $m - 1$ characters ('P', 'C', 'Z' or 'N'), where the j-th character marks the colour of the door that connects rooms $(i,\ j)$ and $(i,\ j + 1)$.

The i-th of the following $n - 1$ lines contains m characters ('P', 'C', 'Z' or 'N'), where the j-th character marks the colour of the door that connects rooms $(i,\ j)$ and $(i + 1,\ j)$.

The next line contains the integer q $(1 \le q \le 100)$, the number of Gabriel's questions.

In the i-th of the following q lines, there are four integers a_i, b_i, c_i, d_i $(1 \le a_i, c_i \le n, 1 \le b_i, d_i \le m,$ $(a_i, b_i) \ne (c_i, d_i))$, the description of Gabriel's i-th question.

Output

In the i-th of q lines, output the answer to Gabriel's i-th question.

Scoring

Subtask	Points	Constraints
1	11	$n = 1$
2	13	All doors that connect rooms (i, j) with $(i, j+1)$ are blue, and all doors that connect rooms (i, j) with $(i+1, j)$ are red.
3	24	Every door is either red or blue.
4	22	No additional constraints.

Examples

input

```
1 8
CPZNCCP
4
1 1 1 8
1 3 1 5
1 8 1 4
1 2 1 3
```

output

```
4
2
3
1
```

input

```
3 3
PP
PP
PP
CCC
CCC
3
1 1 3 3
3 3 2 2
1 1 1 3
```

output

```
2
2
1
```

input

```
4 4
CCC
CPC
PPP
CNP
ZZZZ
PPPP
CPZC
4
3 1 2 3
1 1 4 4
2 2 3 3
1 4 4 1
```

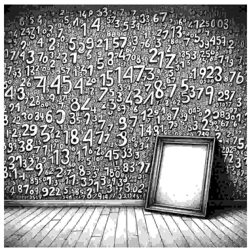
output

```
1
2
1
3
```

Clarification of the third example:
The third example is illustrated in the text.

For the first question, Teo and Gabriel can use just the blue doors to reach the rest of the team; for the second question, they can use blue and green doors; for the third again only blue is enough; and for the fourth, they can use blue, green, and red doors.

Task AN2DL



While wandering around Building 21, you came across a wall completely covered with numbers, arranged in a table of n rows and m columns. Soon you noticed that there was a frame leaning against the wall large enough to frame r rows and s columns of the table on the wall. And next to the frame you found a pencil and a piece of paper containing an empty table.

You are sad that the table on the piece of paper is empty, so you decided to play around with the frame to fill it.

You leaned the frame against the wall so that the number in the i-th row and j-th column is in the upper left corner, and the borders of the frame are parallel to the edges of the wall. Considering the numbers inside the frame, and since you like large numbers, you have decided to write the largest among them in the i-th row and j-th column of the table on the piece of paper.

You repeated the process for every possible position of the frame on the wall (such that the frame is entirely on the wall, and that there are exactly $r \times s$ numbers inside it), making sure that the edges of the frame are parallel to the edges of the wall.

When you were done, the table on the piece of paper was even more beautiful than the one on the wall. What numbers are in the table on the piece of paper?

Input

The first line contains two integers n and m ($1 \leq n, m \leq 4\,000$), the number of rows and columns of the table on the wall.

Each of the following n lines contain m integers $a_{i,j}$ ($|a_{i,j}| \leq 10\,000$), where $a_{i,j}$ is the number in the i-th row and j-th column of the table on the wall.

The last line contains two integers r and s ($1 \leq r \leq n, 1 \leq s \leq m$), the size of the frame.

Output

Output the numbers written in the table on the piece of paper.

Scoring

Subtask	Points	Constraints
1	12	$n, m \leq 40, r = n, s = m$
2	17	$n, m \leq 40$
3	25	$n, m \leq 1\,000$
4	56	No additional constraints.

Examples

input

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

output

```
4
```

input

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

output

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

input

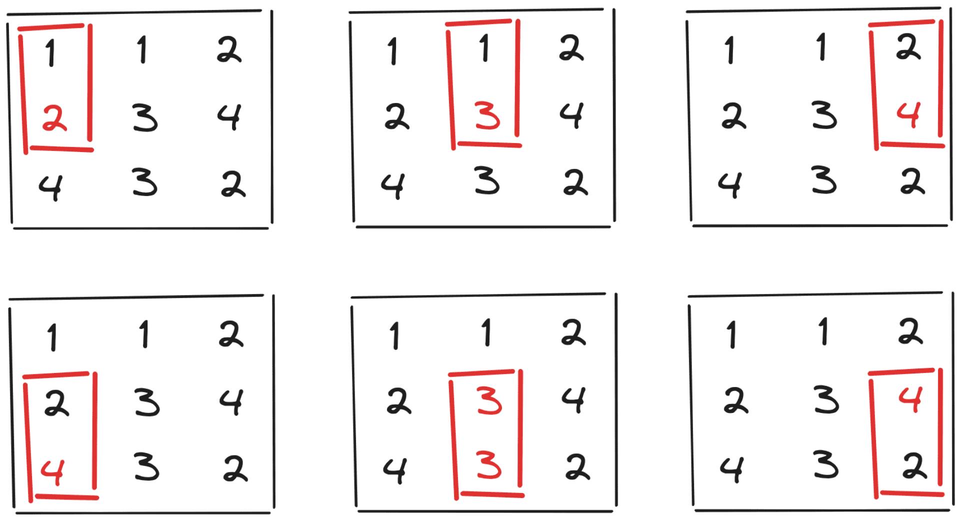
```
5 5
-1 -3 -4 -2 4
-8 -7 -9 -10 11
5 2 -8 -2 1
13 -3 -2 -6 -9
11 6 2 7 4
2 3
```

output

```
-1 -2 11
5 2 11
13 2 1
13 7 7
```

Clarification of the first example:
The frame is big enough to fit the entire table on the wall. The largest number inside the frame is 4, so that is the only number written on the table on the piece of paper.

Clarification of the second example:
All possible frame positions are shown in the picture below. The largest number for each of the positions is written in red.



Task Kocke

For his thirteenth birthday, Donald's parents bought him a brand-new set of Lego cubes. In the set, there are n cubes of equal size, where the i-th cube came in color i. Using these cubes he decided to build a wall.

Donald will build his wall on a row-like Lego base that has k places where cubes can be put in. He puts the cubes in the following way:

- First, he puts the cube with color 1 on an arbitrary spot on the base.
- For each cube from 2 to n, he places it in a spot neighboring the previously placed cube. If that spot isn't empty, he puts the new cube on top of all the others.

After he built the wall, Donald wrote on a piece of paper a sequence of length k: on the i-th position in the sequence he wrote the color of the top cube in the i-th place, or 0 if there isn't a cube in that place.

He immediately asked himself how many different sequences could he have written on the piece of paper. Two sequences are considered different if there exists a position in which they differ. After some time, he has managed to calculate the solution, but he is not sure whether it is correct, so he asks for your help.

Input

The only line has integers n and k ($2 \le n, k \le 5\,000$), the number of cubes, and the length of the base.

Output

In the only line, print the answer to Donald's question, modulo $10^9 + 7$.

Scoring

Subtask	Points	Constraints
1	20	$n, k \le 18$
2	30	$n, k \le 50$
3	30	$n, k \le 500$
4	30	No additional constraints.

Examples

input

```
4 3
```

output

```
8
```

input

```
3 5
```

output

```
14
```

input

```
100 200
```

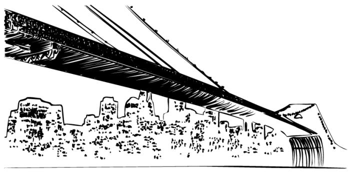
output

```
410783331
```

Clarification of the first example:
All possible sequences are: (0, 3, 4), (2, 3, 4), (0, 4, 3), (1, 4, 3), (4, 3, 0), (4, 3, 2), (3, 4, 0), (3, 4, 1).

Clarification of the second example:
One of the possible sequences is (0, 3, 2, 0, 0). Donald can achieve that by putting the first cube on the second place, second cube on the third place, and third cube on the second place (on top of the first cube).

Task Mostovi



When Leonhard Euler resolved the famous Königsberg bridge problem, he had no clue he had discovered a whole new area of mathematics - graph theory!

Unfortunately, the Königsberg bridge problem is far too easy for the programmers of this era, so Euler came up with another problem - the Zagreb bridge problem!

The bridges of Zagreb form a graph with n nodes and m edges where the edges represent the bridges and the nodes represent the riverine islands. The graph is connected, in other words, it's possible to get from any node to any other by traveling across the edges. Now Euler asked, how many edges are there such that after their removal the graph becomes disconnected?

Again, Euler didn't know that this problem is also famous today (those damn Codeforces blogs). So the author of this problem decided to give you an even harder one, how many edges are there such that after the removal of the nodes which it connects, the remaining $n - 2$ nodes become disconnected?

Input

The first line contains integers n and m ($4 \le n \le 100\,000$, $n - 1 \le m \le 300\,000$) - the number of nodes and edges respectively.

Each of the next m lines contains integers a_i and b_i ($1 \le a_i, b_i \le n$) - this means nodes a_i and b_i are connected with an edge.

There are no loops or multiple edges.

Output

In a single line output the number of edges with the given property.

Scoring

Subtask	Points	Constraints
1	13	$n \le 100, m \le 300$
2	17	$n \le 1\,000, m \le 3\,000$
3	25	$n \le 1\,000$
4	12	$m - n \le 20$
5	43	No additional constraints.

Examples

input

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

output

```
1
```

input

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

output

```
4
```

Clarification of the first example:
By removing edge $(1, 3)$ and corresponding nodes 1 and 1, the remaining graph has two connected components, node 2 and node 4. In other words, it is not connected. It is easy to check it is the only edge with this property.

Clarification of the second example:
The edges with the given property are $(1, 2)$, $(2, 4)$, $(2, 6)$ abd $(2, 5)$.