E. "Bomb alert 2"

Statement

During her last visit in SkylineCity, Cat-woman managed to identify the suspects who might have been able to set up the bomb in the Intergalatical Congress Center. However, she left out a significant detail: transit in the city is regulated by traffic lights that slowed down the suspects' progress. As a consequence, some of them cannot have placed the bomb, so you have to start your work again...

For this sake, you are given a squared map of the city. Every square in it corresponds to **1 minute walk**, meaning that a given suspect takes one minute to go from one square to another adjacent one (on top, at the bottom, on the left or on the right of the current square). On this map, lines are labelled L and columns C. Positions of **traffic lights** are labelled 2 while **obstacles** (walls, buildings,...) are labelled 1. Finally, **freely accessible squares** are labelled 0.

However, you should know that SkylineCity has a unique way of regulating traffic. **Traffic lights are all simultaneously green for a minute, and then red for a minute.** When a traffic light is red, it is impossible to move into, or out of, its location.

In addition, the police provided you with the location history of every suspect, with a location **every 60 minutes**. Furthermore, all traffic lights were green when the suspects' first positions were taken.

Given all of this new information, you are to determine which suspects had the time to set the bomb between two of their recorded positions.

Input

- On the first line, two integers N and P separated by spaces, with $1 \leq N \leq 10^5$ and $2 \leq T \leq 10^5$: respectively the **number of suspects** and the **number of known**

positions for each one of them ;

Then, for each of the N suspects :

- On a first line, a character string S composed of lower-case letters [a-z] and of length $[2; 100]$: the suspect's **name**.

- Then, the T next lines represent the **consecutive positions of the suspect**. Each line contains two integers separated by a space, L and C, with $1 \leq L, C \leq M$;

- An integer M : the **size of the matric**, with $2 \leq M \leq 5 * 10^3$;

- The **matrix** of size $M * M$, line by line. The matrix contains the integers 0, 1 or 2 described above, separated by spaces ;

- On the last line, two integers Lb and Cb, $1 \leq Lb, Cb \leq M$: the **coordinates of the bomb**.

Output

- On a single line, the list sorted by alphabetical order of the names of suspects that might have set the bomb, separated by spaces. If none of them could, print $NONE$.
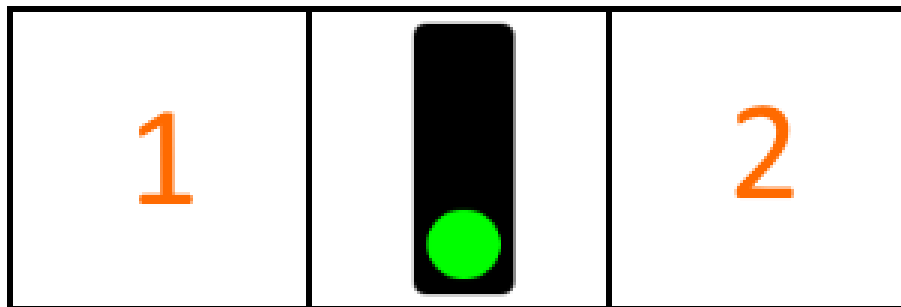
Examples

Understanding traffic lights:
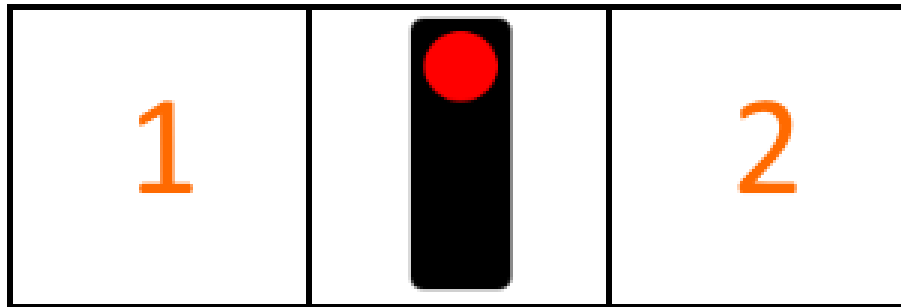
How to cross a red light

In order to go from cell 1 to cell 2, one needs to wait 1 minute for the traffic light to go green, move onto the cell of traffic light in 1 minute, wait 1 minute for the latter to go green again, and finally reach cell 2 in 1 minute. The journey thus lasts 4 minutes in total.

How to cross a green light

In order to go from cell 1 to cell 2, one needs to move onto the cell of the traffic light in 1 minute, wait for the light to go green again in 1 minute, and finally reach cell 2 in 1 minute. The journey is then 3 minutes in total.

Example 1

Input
1 2 voldemort 1 1 2 2 2 0 0 0 0 2 1

Output
voldemort

Explanation : Voldemort started from cell [1, 1] (in the upper-right corner), he was then able to go to [2, 1] (lower-right corner) in 1 minute, and to [2, 2] (lower-left corner) in 1 minute. The total journey took him 2 minutes.

Example 2

Input
2 2 thanos 1 1 1 2 loki 1 3 3 1 3 0 0 0 0 1 1 0 1 0 3 3

Output
NONE

Explanation: The bomb is surrounded with walls, it is thus unreachable.

Example 3

Input
1 3
ultron
1 1
1 2
3 1
3
0 0 2
0 1 0
0 1 0
3 3

Outut
ultron

Explanation : Ultron was able to get from his first position to the bomb in 6 minutes, since when he arrives in $[1, 2]$ the traffic light has just gone red, and he needs to wait 1 minute for it to green again. Once it is green, he is able to visit its cell, but the light goes red again. Ultron then waits one minute for it to green again. It then takes him 2 minutes to reach the bomb's location.

Similarly, it takes him 5 minutes to get from the bomb's location to his 2nd known position, making him a potential culprit.