Tom and Jerry (tomjerry)

The upcoming season of the (in)famous TV show, Tom and Jerry, is filmed at an extravagant location: the Central Park of New York. In each episode, Tom and some of his cat friends are trying to catch Jerry, while the mouse is enjoying its recreational stroll in the park. Jerry, once he learns that the cats are lurking around, tries to get away from them and escape the park as quickly as possible.

Will the cats be able to catch Jerry this time?

The Central Park is a square grid of $M \times M$ cells, where $M \geq 3$. The rows and columns of the grid are numbered from 1 to M (inclusive). Cell (r, c) is located in the c-th column of the r-th row ($1 \leq r, c \leq M$). Cell (r, c) is called a *border cell* if either $r = 1$, $r = M$, $c = 1$ or $c = M$ is satisfied. Two cells are called *adjacent* if they share a common side or corner.

When the chase begins, Jerry is at cell (R_J, C_J), where $1 < R_J, C_J < M$, i.e., it is not a border cell. He knows that N cats are after him, and cat i ($1 \leq i \leq N$) occupies cell (R_i, C_i) ($1 \leq R_i, C_i \leq M$).

In every step:

1. Jerry moves first. He may run from his current cell to one of the 8 adjacent cells, or stay at the same cell. He cannot move to a cell occupied by a cat.
2. The cats move next. Each cat runs to a cell adjacent to its currently occupied one. They choose the one with minimal Euclidean distance to the cell occupied by Jerry (after his move). Note that this cell is always unique.

It is allowed for multiple cats to move to the same cell. Cats are also allowed to move to the cell occupied by Jerry. The chase ends once one of the following events occur at the end of a step:

- There is at least one cat at the same cell as Jerry. In this case, Jerry is caught, failing to escape.
- Jerry is at a border cell and there aren't any cats at the same cell. In this case, Jerry escapes.

Jerry is an experienced avoider of nasty kitties, so he is aware of the rules above, and plays the chase optimally: he escapes the park using the least number of steps, if possible, or otherwise stays away from getting caught for the most number of steps.

For the next season of the show, T episodes are filmed. For each episode, your program has to determine if Jerry is able to escape, given the starting cells of Jerry and the cats. If he is, then compute the minimal number of steps he has to take. If he isn't, then compute the maximal number of steps he can take before getting caught.

Input

The first line contains two integers M and T, the size of the park and the number of episodes. The descriptions of T episodes follow.

Each episode is described by three lines. The first line contains two integers R_J and C_J, specifying the starting cell of Jerry. The second line contains N, the number of cats. The third line contains $2N$ integers $R_1, C_1, R_2, C_2, \ldots, R_N, C_N$, describing the starting cells of the cats.

Output

For each episode, you need to print a single line. If Jerry can escape, the line should contain the string `ESCAPED` and a positive integer: the minimal number of steps after which Jerry escapes. If he cannot escape, the line should contain the string `CAUGHT` and a positive integer: the maximal number of steps after which Jerry gets caught.

Constraints

- $3 \le M \le 10^9$.
- $1 \le T \le 50\,000$.
- $1 < R_J, C_J < M$.
- $1 \le N \le 50\,000$.
- $1 \le R_i, C_i \le M$ for each $i = 1 \ldots N$.
- $(R_J, C_J) \ne (R_i, C_i)$ for each $i = 1 \ldots N$.
- The total number of cats in all episodes does not exceed $250\,000$.

Scoring

– **Subtask 1** (0 points)	Examples.
– **Subtask 2** (6 points)	$N = 1$ for each episode.
– **Subtask 3** (10 points)	$N = 2$ and $R_J = R_1 = R_2$ for each episode.
– **Subtask 4** (11 points)	$M \le 10$.
– **Subtask 5** (13 points)	$M \le 1000$ and $T \le 50$.
– **Subtask 6** (19 points)	It is possible for Jerry to escape in all episodes.
– **Subtask 7** (41 points)	No additional limitations.

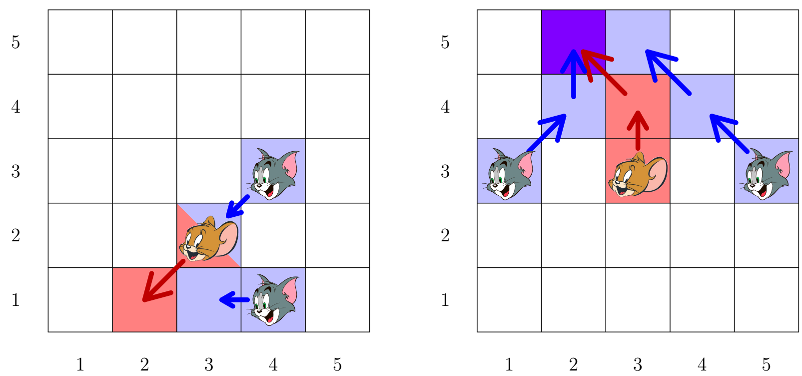
Example

input	output
5 2 2 3 2 1 4 3 4 3 3 2 3 1 3 5	ESCAPED 1 CAUGHT 2

Explanation

In this sample case, the park is a grid of size 5×5, and there are two episodes.

In the **first episode of the sample case**, Jerry can escape after 1 step by running to the border cell $(1, 2)$, which is not reachable by any of the cats in the same step. Note that he cannot escape by running to the border cell $(1, 3)$, as the cat at cell $(1, 4)$ could move there, and catch him before escaping. Also note that it is possible for him to escape after 2 steps, by running to cell $(2, 2)$ first, and from there to cell $(2, 1)$ next, but the task asks for the minimal number of steps to escape.



Optimal moves for the first (left) and second (right) episodes of the sample case.

In the **second episode of the sample case**, it can be proved that Jerry cannot escape, and gets caught after at most two steps, irrespective of where he runs to. Note that, for some of his available first moves, Jerry may get caught after just one step. But he plays optimally and avoids the cats for as many steps as possible.