

# Pinball

Input file:            **standard input**  
Output file:           **standard output**  
Time limit:            4 seconds  
Memory limit:         1024 megabytes

There are two horizontal straight lines  $y = 0$  and  $y = H$  on the 2-dimensional plane. Between the two lines there are initially  $n$  tiny wooden boards which can be regarded as single points. The  $i$ -th wooden board is located at  $(x_i, y_i)$ .

Maintain  $q$  operations of the following three types.

- $+ x y$ : Add a wooden board located at  $(x, y)$  to the plane.
- $- x y$ : Remove the wooden board located at  $(x, y)$  from the plane.
- $? x y v_y g$ : A pinball is released from  $(x, y)$ .

Let  $\vec{v} = (v_x, v_y)$  be the velocity of the ball (that is to say, if the ball is currently located at  $(x, y)$  it will move to  $(x + v_x\epsilon, y + v_y\epsilon)$  after  $\epsilon$  seconds). If  $g \geq x$  then  $v_x = 1$ , otherwise  $v_x = -1$ , while  $v_y$  is given by the query. The value of  $v_y$  is either 1 or  $-1$ .

When the ball hits a wooden board or one of the two horizontal straight lines,  $v_y$  will be reversed (that is,  $v_y$  becomes  $-v_y$ ) while  $v_x$  remains unchanged.

Calculate the  $y$  coordinate of the pinball when its  $x$  coordinate equals to  $g$ .

## Input

There are multiple test cases. The first line of the input contains an integer  $T$  ( $1 \leq T \leq 10^4$ ) indicating the number of test cases. For each test case:

The first line contains three integers  $H$ ,  $n$  and  $q$  ( $2 \leq H \leq 10^9$ ,  $1 \leq n, q \leq 10^5$ ) indicating the position of the upper horizontal straight line, the number of initial wooden boards and the number of operations.

For the following  $n$  lines, the  $i$ -th line contains two integers  $x_i$  and  $y_i$  ( $1 \leq x_i \leq 10^9$ ,  $1 \leq y_i < H$ ) indicating the position of the  $i$ -th wooden board.

For the following  $q$  lines, the  $i$ -th line first contains a character  $op$  ( $op \in \{+, -, ?\}$ ) indicating the type of the  $i$ -th operation.

- If  $op = +$  then two integers  $x$  and  $y$  ( $1 \leq x \leq 10^9$ ,  $1 \leq y < H$ ) follow, indicating the position of the wooden board to be added. It's guaranteed that there is currently no board located at  $(x, y)$ .
- If  $op = -$  then two integers  $x$  and  $y$  ( $1 \leq x \leq 10^9$ ,  $1 \leq y < H$ ) follow, indicating the position of the wooden board to be removed. It's guaranteed that there is currently a board located at  $(x, y)$ .
- If  $op = ?$  then four integers  $x$ ,  $y$ ,  $v_y$  and  $g$  ( $1 \leq x, g \leq 10^9$ ,  $1 \leq y < H$ ,  $v_y \in \{-1, 1\}$ ) follow, indicating the initial position of the pinball, the initial velocity along the  $y$ -axis of the pinball and the target  $x$ -coordinate. It's guaranteed that there is currently no board located at  $(x, y)$ .

It's guaranteed that neither the sum of  $n$  nor the sum of  $q$  of all test cases will exceed  $2 \times 10^5$ .

## Output

For each operation of the third type output one line containing one integer indicating the answer.

## Example

standard input	standard output
2	1
5 2 8	4
4 2	2
6 4	2
? 10 4 -1 3	4
+ 8 2	4
? 3 3 -1 12	2
? 3 1 1 12	2
- 4 2	
? 3 3 -1 12	
? 3 1 1 12	
? 7 3 1 6	
10 1 2	
5 5	
? 9 2 1 9	
? 9 2 -1 9	

## Note

We illustrate the queries of the first sample test case as below. Wooden boards are represented as diamonds.

