Problem B - Irrigação Sustentável

A group of scientists has recently discovered a vast plain that was previously unknown, where the rare species of plants *Ornithinera Nubilum Inflorica* (ONI) thrives magnificently! Naturally, plans have already been set in motion to build an extensive electrical system there to pump water and irrigate the plantations. Unfortunately, the location is so remote that their access to the electrical grid is quite limited. As a result, the scientists have decided that the irrigation system will be powered by solar energy and have already begun conducting studies to identify the best approach to take.

Part I

To ensure that the irrigation system for the ONI plants can operate continuously, the scientists are collecting data on how the incidence of sunlight at that location has varied over time. Based on this data, they intend to conduct a statistical study on the longest periods of continuous sunlight that occurred in that area.

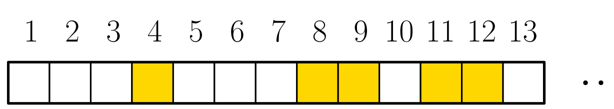
Since it is a remote region, past data on solar incidence has not been well-documented, and therefore the scientists do not yet have all the information they need! They are only aware of a few days with high solar exposure in the region, and they receive information gradually about more days with such exposure. Whenever they receive new data, the scientists need to update their statistics with that new information. Can you help them with this task?

The input consists of $\boldsymbol{N}$ distinct days for which the scientists already know there was high solar exposure in the region. It also includes $\boldsymbol{Q}$ queries, where each query is of one of two types:

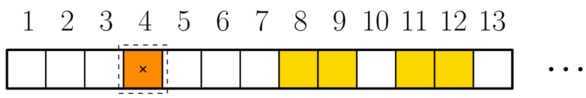
1. Given an integer d, the scientists inform you that there was high solar exposure on day d.
2. Given an integer d, you should inform the scientists about the length of the longest consecutive segment of days with high solar exposure (according to the data available up to that point) that includes day d.

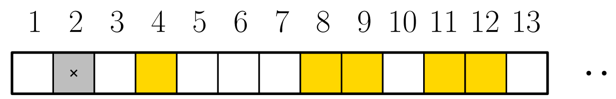
Example

Let's assume that initially the following 5 days with high solar exposure were known:

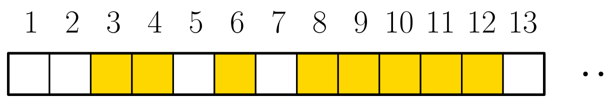


Given a query of **type 2** for day 4, the length of the longest consecutive segment of days with high solar exposure that includes day 4 is **1**. Similarly, given a query of **type 2** for day 2, the longest segment that includes day 2 has a length of **0**.

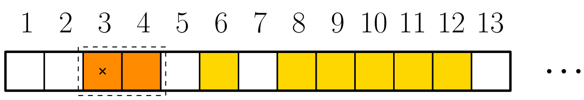


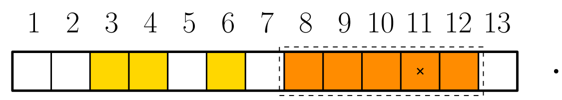


If queries of **type 1** for days 3, 6, and 10 follow, then the scientists will know that there was also high solar exposure on these three days:



Thus, if subsequent queries of **type 2** are made for days 3 and 11, the results will be, respectively, **2** and **5**:





Constraints

The following limits are guaranteed for all test cases of this part that will be given to the program:

$1 \leq d \leq 10^9$	Days
$1 \leq \boldsymbol{N} \leq 10^4$	Number of days with high solar exposure initially known
$1 \leq \boldsymbol{Q} \leq 10^4$	Number of queries

The test cases of this part of the problem are organized into two groups:

Subtask	Points	Additional Constraints
1	20	No queries of type 1
2	20	No further restrictions

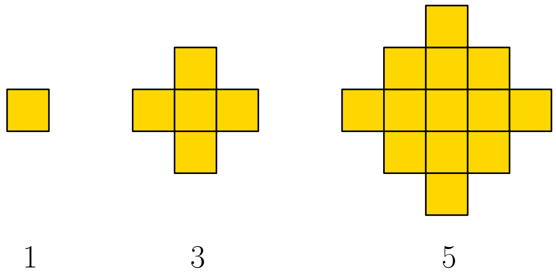
Part II

After assessing the solar incidence of the region, the scientists need to install solar panels to capture energy for the ONI irrigation system. To do this, they need to assess the best locations based on the solar incidence of each point in the region.

Let's represent the region as an infinite grid of cells with origin $(1, 1)$ at the top left corner. The scientists already have information about $\boldsymbol{N}$ cells where solar exposure is high, but, similar to Part I of the problem, they haven't received all the information yet. Gradually, they receive information about more cells where high solar incidence is also observed.

With the help of top physicists and mathematicians, it has been concluded that to maximize energy efficiency, the solar panels need to be arranged in the shape of a diamond, and each panel needs to be placed in a cell with high solar exposure.

The following figure illustrates examples of diamonds with lengths 1, 3, and 5:



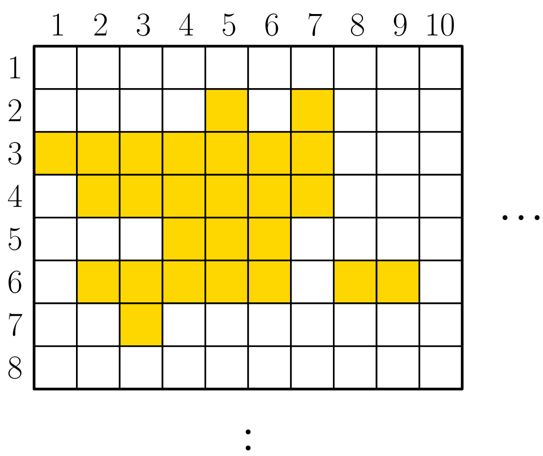
Can you help the scientists once again?

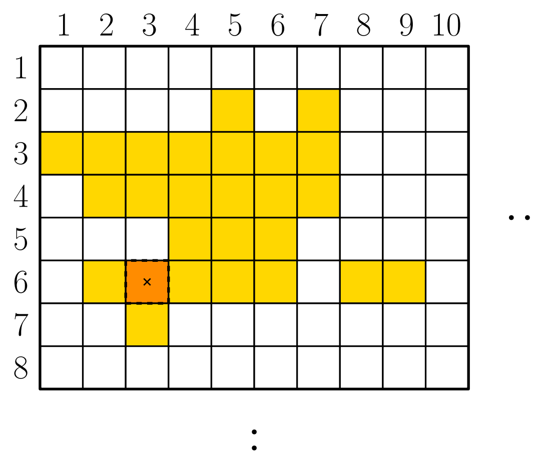
N distinct cells are given in the region where the scientists already know there is high solar exposure. ***Q*** queries are also provided, where each query falls into one of two types:

1. Given a point (l, c), the scientists inform you that there is high solar exposure in the cell on row l and column c.
2. Given a point (l, c), tell the scientists the length of the largest diamond centered at cell (l, c) and formed only by cells with high solar exposure.

Example

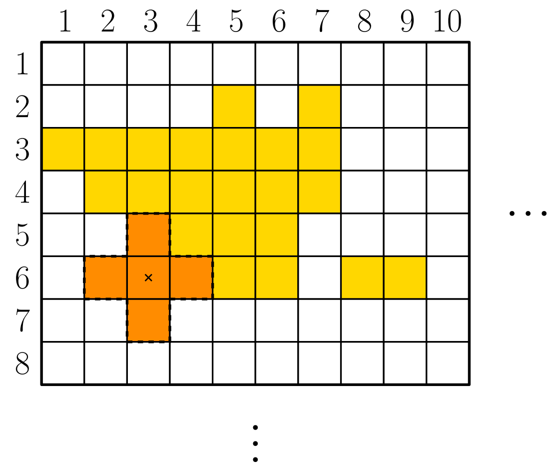
Let's suppose that initially the 26 cells with high solar exposure from the left image are known. Given a query of **type 2** for cell $(6, 3)$, the length of the largest diamond centered at $(6, 3)$ and formed only by cells with high solar exposure is **1**:

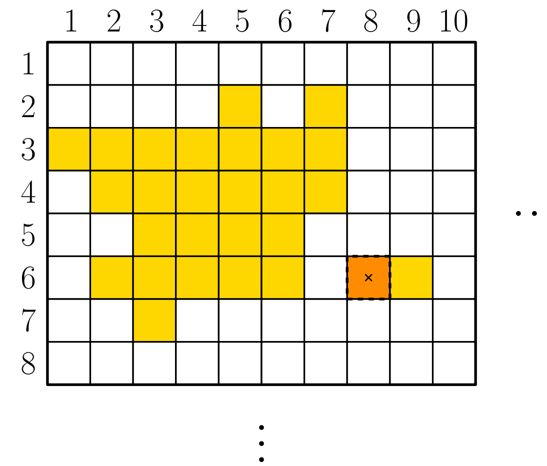




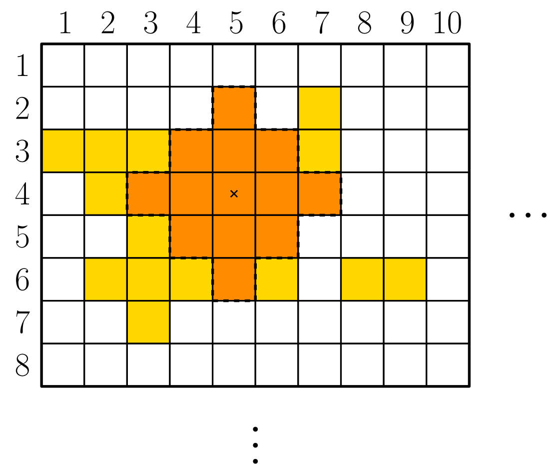
If a query of **type 1** is made for cell $(5, 3)$, the scientists now know that this cell also has high solar exposure.

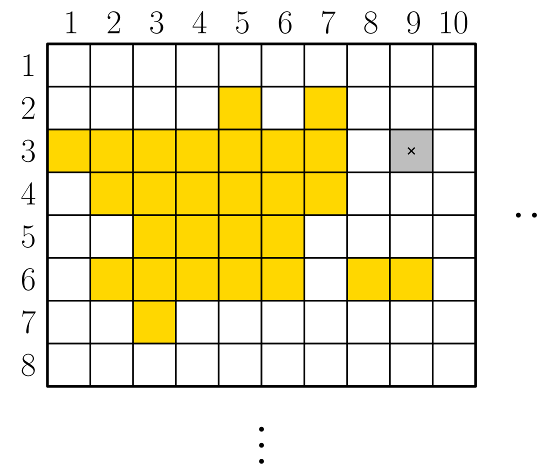
Therefore, if a new query of **type 2** is made for cell $(6, 3)$ after that, the length of the largest diamond centered at $(6, 3)$ becomes **3**. The response to a query of **type 2** for cell $(6, 8)$ is **1**:





Finally, the answer to a query of **type 2** for cell $(4, 5)$ is **5**, and the answer to a query of **type 2** for cell $(3, 9)$ is **0**:





Constraints

The following limits are guaranteed for all test cases of this part that will be given to the program:

$1 \leq l, c \leq 10^9$	Cell coordinates
$1 \leq \boldsymbol{N} \leq 10^4$	Number of cells with high solar exposure initially known
$1 \leq \boldsymbol{Q} \leq 10^4$	Number of queries

The test cases of this part of the problem are organized into three groups:

Subtask	Points	Additional Constraints
3	15	No queries of type 1 and all cells have $l \leq 10$
4	15	No queries of type 1
5	30	No further restrictions

Summary of Subtasks

The test cases for the problem are organized into five groups with different additional restrictions:

Subtask	Points	Part	Additional Constraints
1	20	Parte I	No queries of type 1
2	20	Parte I	No further restrictions
3	15	Parte II	No queries of type 1 and all cells have $l \leq 10$
4	15	Parte II	No queries of type 1
5	30	Parte II	No further restrictions

Input Format

The first line contains an integer $\boldsymbol{P}$, corresponding to the part of the test case it represents. If $\boldsymbol{P} = 1$, then the test case refers to Part I. If $\boldsymbol{P} = 2$, then it refers to Part II.

Part I

The input then contains a line with two integers: $\boldsymbol{N}$ (number of initially known days with high solar exposure) and $\boldsymbol{Q}$ (number of queries).

Next, $\boldsymbol{N}$ lines follow, each containing an integer d indicating that there is high solar exposure on day d. All $\boldsymbol{N}$ integers are distinct.

Finally, $\boldsymbol{Q}$ lines follow, each containing two integers: t and d. The integer t corresponds to the type of the query, which can be 1 or 2, and d represents the day to which the query refers.

It is guaranteed that there is no more than one query of type 1 referring to the same day, and there is no query of type 1 referring to one of the $\boldsymbol{N}$ initially given days.

Part II

The first line contains a line with two integers: $\boldsymbol{N}$ (number of cells in the region with initially known high solar exposure) and $\boldsymbol{Q}$ (number of queries).

Next, $\boldsymbol{N}$ lines follow, each containing two integers l and c, indicating that there is high solar exposure in the cell in row l and column c. All $\boldsymbol{N}$ cells are distinct.

Finally, $\boldsymbol{Q}$ lines follow, each containing three integers: t, l, and c. The integer t corresponds to the type of the query, which can be 1 or 2, and (l, c) are the coordinates of the cell to which the query refers.

It is guaranteed that there is no more than one query of type 1 referring to the same cell, and there is no query of type 1 referring to one of the $\boldsymbol{N}$ initially given cells.

Output Format

For each query of type 2, in order, print a line with an integer indicating the response to the query, taking into account the previous type 1 queries.

Example 1 Input

```
1
5 7
8
4
11
9
12
2 4
2 2
1 3
1 6
1 10
2 3
2 11
```

Example 1 Output

```
1
0
2
5
```

Example 1 Description

This example corresponds to the example mentioned in Part I of the problem statement.

Example 2 Input

```
2
26 6
2 5
2 7
3 1
3 2
3 3
3 4
3 5
3 6
3 7
4 2
4 3
4 4
4 5
4 6
4 7
5 4
5 5
5 6
6 2
6 3
6 4
6 5
6 6
6 8
6 9
7 3
2 6 3
1 5 3
2 6 3
2 6 8
2 4 5
2 3 9
```

Example 2 Output

```
1
3
1
5
0
```

Example 2 Description

This example corresponds to the example mentioned in Part II of the problem statement.

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