# Treefarm

2023/2024 SEASON – SECOND ROUND

The farm FARM grows trees. Their amount is n and one of them stands on the positions from 1 to n. The tree on position i has a height $h_i$.

The farmer receives and executes q commands from 3 types:

-Question: The farmer receives 2 numbers l and r. He needs to find two living trees i and j, for which $l \le h_i$ , $h_j \le r$ , so that the difference in their heights is minimal, but if there is more than one such pair of trees, then the difference in their positions should be minimal as well. The farmer has to tell the minimum difference in heights and the minimum difference in positions of two trees, having that difference in heights. If there aren't two trees, satisfying the condition, the answer is „-1 -1"

-Planting: The farmer receives one number $h_{newq}$ . He needs to plant a new tree with height $h_{newq}$ on the first position, where no tree has ever been. Formally said: if this is command number x from this type, then the new tree should be on position n+x.

-Cutting: The farmer receives 2 numbers l and r. Due to some virus the farmer needs to cut all trees for which $l \le h_i \le r$. Their positions remain forever empty and these trees are no longer part of the questions.

The farmer also knows that no tree would ever have the same height as another even if the other one has already been cut.

The farmer is busy right now and asks you to write a program, which receives n, the heights $h_1$ , $h_2$ , …. , $h_n$ , q and q commands, and answers every command, which is a Question.

**Input**

The first line of the file **treefarm.in** contains n – the amount of trees.

The next line contains n numbers: $h_1$ $h_2$ $h_3$ ….. $h_{n-1}$ $h_n$ , showing the heights of the first n trees.

The next line contains q – the amount of commands.

The next q lines contain a command of one of these 3 type:

- 1 l r : Question l and r.
- 2 $h_{newq}$ : Planting tree of height $h_{newq}$.
- 3 l r : Cutting for l and r.

**Output**

The file **treefarm.out** should contain as many lines as there are Questions – every line should contain two numbers, answering the question.

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**Constraints**

$1 \leq n, q \leq 10^5$

$0 \leq h_i, h_{newq}, l, r \leq 10^{18}$

$h_1 \neq h_2 \neq \cdots \neq h_n \neq h_{newq}$

**Time Limit: 1 sec.**

**Memory Limit: 256 MB.**

**Sample test**

| Input (treefarm.in) | Output (treefarm.out) |
|---|---|
| 6<br>6 3 9 10 12 8<br>5<br>1 2 8<br>2 7<br>1 2 8<br>3 1 9<br>1 1 15 | 2 5<br>1 1<br>2 1 |

**Sample explanation**

The trees with heights 6, 3 and 8 are between l=2 and r=8. Those with heights 6 and 8 have the minimum difference 2. The difference in their positions is 6-1 = 5.

After planting the new tree the farm looks like this: 6 3 9 10 12 8 7

Now between l=2 and r=8 are the trees with heights 6, 3, 8 *и* 7. The minimum difference is 1 and is between the trees of heights 6 and 7, or 7 and 8. Those with a smaller difference in positions are with heights 7 and 8 – they are next to each other.

After all cutting the farm looks like this: _ _ _ 10 12 _ _ , where with _ are marked the cut trees.

Now between l=1 and r=15 are only the trees with heights 10 and 12, all others have been cut. Their difference is 12-10 = 2 and their difference in positions is 1, because they're next to each other.