

# USA Computing Olympiad



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## USACO 2023 DECEMBER CONTEST, GOLD

### PROBLEM 3. HAYBALE DISTRIBUTION

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English (en) ▾

Farmer John is distributing haybales across the farm!

Farmer John's farm has  $N$  ( $1 \leq N \leq 2 \cdot 10^5$ ) barns, located at integer points  $x_1, \dots, x_N$  ( $0 \leq x_i \leq 10^6$ ) on the number line. Farmer John's plan is to first have  $N$  shipments of haybales delivered to some integer point  $y$  ( $0 \leq y \leq 10^6$ ) and then distribute one shipment to each barn.

Unfortunately, Farmer John's distribution service is very wasteful. In particular, for some  $a_i$  and  $b_i$  ( $1 \leq a_i, b_i \leq 10^6$ ),  $a_i$  haybales are wasted per unit of distance left each shipment is transported, and  $b_i$  haybales are wasted per unit of distance right each shipment is transported. Formally, for a shipment being transported from point  $y$  to a barn at point  $x$ , the number of haybales wasted is given by

$$\begin{cases} a_i \cdot (y - x) & \text{if } y \geq x \\ b_i \cdot (x - y) & \text{if } x > y \end{cases}$$

Given  $Q$  ( $1 \leq Q \leq 2 \cdot 10^5$ ) independent queries each consisting of possible values of  $(a_i, b_i)$ , please help Farmer John determine the fewest amount of haybales that will be wasted if he chooses  $y$  optimally.

#### INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains  $N$ .

The next line contains  $x_1 \dots x_N$ .

The next line contains  $Q$ .

The next  $Q$  lines each contain two integers  $a_i$  and  $b_i$ .

#### OUTPUT FORMAT (print output to the terminal / stdout):

Output  $Q$  lines, the  $i$ th line containing the answer for the  $i$ th query.

#### SAMPLE INPUT:

```
5
1 4 2 3 10
4
1 1
2 1
1 2
1 4
```

#### SAMPLE OUTPUT:

```
11
13
18
30
```

For example, to answer the second query, it is optimal to select  $y = 2$ . Then the number of wasted haybales is equal to  $2(2 - 1) + 2(2 - 2) + 1(3 - 2) + 1(4 - 2) + 1(10 - 2) = 1 + 0 + 1 + 2 + 8 = 13$ .

#### SCORING:

- Input 2:  $N, Q \leq 10$
- Input 3:  $N, Q \leq 500$
- Inputs 4-6:  $N, Q \leq 5000$
- Inputs 7-16: No additional constraints.

Problem credits: Benjamin Qi

Contest has ended. No further submissions allowed.

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