



## USACO 2014 DECEMBER CONTEST, GOLD PROBLEM 2. MARATHON

[Return to Problem List](#)

Contest has ended.

[Log in to allow submissions in analysis mode](#)

English (en)

Problem 2: Marathon [Nick Wu, 2014]

An avid marathon runner herself, Bessie enjoys creating marathon courses for her fellow cows to run. She has most recently designed a route specified by  $N$  checkpoints ( $1 \leq N \leq 100,000$ ) that must be visited in sequence.

Unfortunately, Bessie realizes that the other cows may not have the stamina to run the full route. She therefore wants to know how long certain sub-routes take to run, where a sub-route is a contiguous subsequence of the checkpoints from the full route. To make matters more complicated, Bessie knows that the other cows, being lazy, might choose to skip one checkpoint any time they run a sub-route -- whichever one results in a minimum total travel time. They are not allowed to skip the first or last checkpoints in a sub-route, however.

In order to build the best possible marathon course, Bessie wants to investigate the ramifications of making changes to the checkpoint locations in her current course. Please help her determine how certain changes to checkpoint locations will affect the time required to run different sub-routes (taking into account that the cows might choose to omit one checkpoint any time they run a sub-route).

Since the course is set in a downtown area with a grid of streets, the distance between two checkpoints at locations  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by  $|x_1 - x_2| + |y_1 - y_2|$ .

INPUT: (file marathon.in)

The first line gives  $N$  and  $Q$  ( $1 \leq Q \leq 100,000$ ).

The next  $N$  lines contain  $(x, y)$  locations of  $N$  checkpoints in the sequence they must be visited along the route. All coordinates are in the range  $-1000 \dots 1000$ .

The next  $Q$  lines consist of updates and queries, one per line, to be processed in the order they are given. Lines will either take the form "U I X Y" or "Q I J". A line of the form "U I X Y" indicates that the location of checkpoint  $I$  ( $1 \leq I \leq N$ ) is to be changed to location  $(X, Y)$ . A line of the form "Q I J" asks for the minimum travel time of the sub-route from checkpoint  $I$  to checkpoint  $J$  ( $I \leq J$ ), given that the cows choose to skip one checkpoint along this sub-route (but not the endpoints  $I$  and  $J$ ).

SAMPLE INPUT:

```
5 5
-4 4
-5 -3
-1 5
-3 4
0 5
Q 1 5
U 4 0 1
U 4 -1 1
Q 2 4
Q 1 4
```

OUTPUT: (file marathon.out)

For each sub-route length request, output on a single line the desired length.

SAMPLE OUTPUT:

```
11
8
8
```

Contest has ended. No further submissions allowed.

---