



## 5031 - Graph and Queries

Asia - Tianjin - 2010/2011

You are given an undirected graph with  $N$  vertexes and  $M$  edges. Every vertex in this graph has an integer value assigned to it at the beginning. You're also given a sequence of operations and you need to process them as requested. Here's a list of the possible operations that you might encounter:

1. Deletes an edge from the graph.

The format is  $[D\ X]$ , where  $X$  is an integer from 1 to  $M$ , indicating the ID of the edge that you should delete. It is guaranteed that no edge will be deleted more than once.

2. Queries the weight of the vertex with  $K$ -th maximum value among all vertexes currently connected with vertex  $X$  (including  $X$  itself).

The format is  $[Q\ X\ K]$ , where  $X$  is an integer from 1 to  $N$ , indicating the id of the vertex, and you may assume that  $K$  will always fit into a 32-bit signed integer. In case  $K$  is illegal, the value for that query will be considered as undefined, and you should return 0 as the answer to that query.

3. Changes the weight of a vertex.

The format is  $[C\ X\ V]$ , where  $X$  is an integer from 1 to  $N$ , and  $V$  is an integer within the range  $[-10^6, 10^6]$ .

The operations end with one single character,  $E$ , which indicates that the current case has ended. For simplicity, you only need to output one real number - the average answer of all queries.

### Input

There are multiple test cases in the input file. Each case starts with two integers  $N$  and  $M$  ( $1 \leq N \leq 2 * 10^4$ ,  $0 \leq M \leq 6 * 10^4$ ), the number of vertexes in the graph. The next  $N$  lines describes the initial weight of each vertex ( $-10^6 \leq [weight][i] \leq 10^6$ ). The next part of each test case describes the edges in the graph at the beginning. Vertexes are numbered from 1 to  $N$ . The last part of each test case describes the operations to be performed on the graph. It is guaranteed that the number of query operations  $[Q\ X\ K]$  in each case will be in the range  $[1, 2 * 10^5]$ , and there will be no more than  $2 * 10^5$  operations that change the values of the vertexes  $[C\ X\ V]$ .

There will be a blank line between two successive cases. A case with  $N = 0$ ,  $M = 0$  indicates the end of the input file and this case should not be processed by your program.

### Output

For each test case, output one real number - the average answer of all queries, in the format as indicated in the sample output. Please note that the result is rounded to six decimal places.

Explanation for samples:

For the first sample:

D 3 - deletes the 3rd edge in the graph (the remaining edges are (1, 2) and (2, 3))

Q 1 2 - finds the vertex with the second largest value among all vertexes connected with 1. The answer is 20.

Q 2 1 - finds the vertex with the largest value among all vertexes connected with 2. The answer is 30.

D 2 - deletes the 2nd edge in the graph (the only edge left after this operation is (1, 2))

Q 3 2 - finds the vertex with the second largest value among all vertexes connected with 3. The answer is 0 (Undefined).

C 1 50 - changes the value of vertex 1 to 50.

Q 1 1 - finds the vertex with the largest value among all vertex connected with 1. The answer is 50.

E - This is the end of the current test case. Four queries have been evaluated, and the answer to this case is  $(20 + 30 + 0 + 50) / 4 = 25.000$ .

For the second sample, caution about the vertex with same weight:

Q 1 1 - the answer is 20

Q 1 2 - the answer is 20

Q 1 3 - the answer is 10

## Sample Input

```
3 3
10
20
30
1 2
2 3
1 3
D 3
Q 1 2
Q 2 1
D 2
Q 3 2
C 1 50
Q 1 1
E
```

```
3 3
10
20
20
1 2
2 3
1 3
Q 1 1
Q 1 2
Q 1 3
E
```

0 0

## Sample Output

Case 1: 25.000000  
Case 2: 16.666667

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