**Defend the Kingdom**

**Problem Description**

Country Z has n cities and (n-1) bidirectional roads. Each bidirectional road connects two cities, and any two cities can be reached by a number of roads.

Z, the Minister of Defense of Country Z, stations troops in the cities. There are several requirements for stationing troops in the cities:

-A city may or may not have an army stationed in it.

-For any two cities directly connected by the road, troops must be stationed in at least one of them.

-Stationing an army in a city incurs a cost. The cost of stationing an army in a city numbered i is pi.

Z quickly came up with a plan for stationing troops that minimizes the total cost. But the King gave Z m requests, each specifying whether two of the cities should have troops. Z had to answer each request one by one. Specifically, if the jth request of the King satisfies the above conditions for stationing (without considering any other request besides the jth request), the minimum cost of stationing troops under this request should be given. If the jth request of the King cannot be met, the output -1. Now please come and help Z.

**Input**

The first line has two integers and a string representing the number of cities ‘n’, the number of requirements ‘m’, and the data type ‘type’ in turn. type is a string consisting of capital letters ‘A’, ‘B’, or ‘C’ and a number from ‘1’, ‘2’, and ‘3’. It can help you get some points. You may not need to use this parameter. The meaning of this parameter is described in [Data Size and Conventions].

The second line has n integers, with the ith integer representing the cost pi of stationing troops in city i.

The next (n-1) lines, with two integers u and v in each line, indicate that there is a two-way road from u to v.

Next m lines, each with four integers a, x, b, y, indicate that a requirement is to station x armies in city a and y armies in city b, where x,y can only take the values 0 or 1:

-If x is 0, it means that city a must not host troops.

-If x is 1, it means that city a must host troops.

-If y is 0, it means that city b must not host troops.

-If y is 1, it means that city b must host troops.

Every two adjacent pieces of data in the input file are separated by a space.

**Output**

There are m lines of output, each containing an integer. The jth line indicates the minimum cost to meet the King’s jth request, and if the King’s jth request cannot be met, output -1.

**Sample Input**

5 3 C3

2 4 1 3 9

1 5

5 2

5 3

3 4

1 0 3 0

2 1 3 1

1 0 5 0

**Sample Output**

12

7

-1

**Hint**

**[Explanation of the Sample]**

- For the first requirement, the cost is minimal when stationing troops in cities 4 and 5.

- For the second requirement, the cost is minimal when stationing troops in cities 1, 2, and 3.

- The third requirement cannot be met, because not stationing troops in cities 1 and 5 means that there are no troops in either of the two cities directly connected by roads.

**[Data Size and Conventions]**

| Test Point | type | n = m = |
| --- | --- | --- |
| 1,2 | A3 | 10 |
| 3,4 | C3 | 10 |
| 5,6 | A3 | 100 |
| 7 | C3 | 100 |
| 8,9 | A3 | 2×103 |
| 10,11 | C3 | 2×103 |
| 12,13 | A1 | 105 |
| 14,15,16 | A2 | 105 |
| 17 | A3 | 105 |
| 18,19 | B1 | 105 |
| 20,21 | C1 | 105 |
| 22 | C2 | 105 |
| 23,24,25 | C3 | 105 |

The meaning of data type:

- ‘A’: City i is directly connected to city i + 1.

- ‘B’: Any city is no more than 100 away from city 1 (distance is defined as the number of edges on the shortest path), that is, if the tree is rooted at city 1, the depth is no more than 100.

- ‘C’: There is no special constraint on the tree shape.

- ‘1’: Guarantee a = 1, x = 1 when asked, that is, require stationing troops in city 1. No restrictions on b and y.

- ‘2’: Guarantee a and b are adjacent when asked (directly connected by a road)

- ‘3’: There is no special constraint on the inquiry.

For 100% of the data, guarantee 1 ≤ n,m ≤ 105, 1 ≤ pi ≤ 105, 1 ≤ u, v, a, b ≤ n, a ≠ b, x, y∈{0, 1}.