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 p_i.

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 j^{th} request of the King satisfies the above conditions for stationing (without considering any other request besides the j^{th} request), the minimum cost of stationing troops under this request should be given. If the j^{th} 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 i^{th} integer representing the cost p_i 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 j^{th} line indicates the minimum cost to meet the King's j^{th} request, and if the King's j^{th} 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	2×10^3
10,11	C3	2×10^3
12,13	A1	10^5
14,15,16	A2	10^5
17	A3	10^5
18,19	B1	10^5
20,21	C1	10^5
22	C2	10^5

Test Point	type	n = m =
23,24,25	C3	10^5

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 $1 \leq n,m \leq 10^5$, $1 \leq p_i \leq 10^5$, $1 \leq u, v, a, b \leq n$, $a \neq b$, $x, y \in \{0, 1\}$.