Stellar Energy Grid

Problem Statement

Oski has been appointed Chief Energy Architect of the futuristic metropolis of Astraea. The city's power network consists of N cosmic reactors (numbered 1 to N), connected by $N-1$ bidirectional high-voltage lines. The network forms a tree structure, meaning there is a unique simple path between any pair of reactors. Each reactor i has an initial energy output of A_i units.

Oski is tasked with analyzing and optimizing energy flow across the network. He needs to process Q events, which can be of two types:

1. **Energy Grid Rating Query (`1 u v`):**
   Oski needs to analyze the simple path $P(u,v) = (x_1, x_2, \ldots, x_k)$ between reactor $u = x_1$ and reactor $v = x_k$. For any contiguous subsegment $(x_l, x_{l+1}, \ldots, x_r)$ along this path ($1 \le l \le r \le k$), its **Resonance Power** is defined as the bitwise XOR sum of the energy outputs of all reactors in that subsegment:

   $$R(l,r) = A_{x_l} \oplus A_{x_{l+1}} \oplus \cdots \oplus A_{x_r}$$

   The **Total Energy Grid Rating** $E(u,v)$ for the path is the sum of the Resonance Powers over all possible contiguous subsegments of $P(u,v)$:

   $$E(u,v) = \sum_{1 \le l \le r \le k} R(l,r)$$

2. **Reactor Energy Update (`2 u x`):**
   Oski adjusts the output of reactor u, updating its energy value A_u to x.

Help Oski calculate $E(u,v) \pmod{10^9+7}$ for each query of type 1.

Input Format

- The first line contains two integers N and Q ($1 \le N, Q \le 10^5$) — the number of reactors and the number of operations.
- The second line contains N integers $A_1, A_2, \ldots, A_N$ ($0 \le A_i < 2^{20}$) — the initial energy output of each reactor.
- The next $N-1$ lines each contain two integers u_i and v_i ($1 \le u_i, v_i \le N, u_i \ne v_i$), representing an energy line between reactors u_i and v_i.
- The next Q lines describe the operations:
  - `1 u v` : Calculate $E(u,v) \pmod{10^9+7}$. ($1 \le u, v \le N, u \ne v$)
  - `2 u x` : Update the energy output of reactor u to x. ($1 \le u \le N, 0 \le x < 2^{20}$)

Output Format

For each query of type 1, print $E(u,v) \pmod{10^9+7}$ on a new line.

Sample Input

```
5 4
3 5 2 1 4
1 2
1 3
2 4
2 5
1 4 3
1 4 5
2 1 7
1 4 3
```

Sample Output

```
38
15
30
```

Explanation

Initial State: The reactor energy outputs are $A = [3, 5, 2, 1, 4]$.

Query 1 (`1 4 3`):

- Path $P(4, 3)$ goes $4 \to 2 \to 1 \to 3$.
- Energy values along the path are $[1, 5, 3, 2]$.
- All contiguous subsegments and their XOR sums ($R(l, r)$):
  - Length 1: $[1] \to 1$, $[5] \to 5$, $[3] \to 3$, $[2] \to 2$
  - Length 2: $[1, 5] \to 4$, $[5, 3] \to 6$, $[3, 2] \to 1$
  - Length 3: $[1, 5, 3] \to 7$, $[5, 3, 2] \to 4$
  - Length 4: $[1, 5, 3, 2] \to 5$
- Sum $E(4, 3) = 1 + 5 + 3 + 2 + 4 + 6 + 1 + 7 + 4 + 5 = 38$.

(Note: $E(u, v)$ is calculated as the sum of XOR sums over all path subsegments modulo $10^9 + 7$.)

Update 1 (`2 1 7`):

- Oski updates reactor 1 so that $A_1 = 7$.

Query 3 (`1 4 3`):

- Energy values along the path are $[1, 5, 7, 2]$.
- All contiguous subsegments and their XOR sums ($R(l, r)$):
  - Length 1: $[1] \to 1$, $[5] \to 5$, $[7] \to 7$, $[2] \to 2$
  - Length 2: $[1, 5] \to 4$, $[5, 7] \to 2$, $[7, 2] \to 5$
  - Length 3: $[1, 5, 7] \to 3$, $[5, 7, 2] \to 0$
  - Length 4: $[1, 5, 7, 2] \to 1$
- Sum $E(4, 3) = 1 + 5 + 7 + 2 + 4 + 2 + 5 + 3 + 0 + 1 = 30$.