Problem B. Born Slippy

Input file:	*standard input*
Output file:	*standard output*
Time limit:	7.5 seconds
Memory limit:	256 mebibytes

Professor Zhang has a rooted tree with vertices conveniently labeled by $1, 2, \ldots, n$. The i-th vertex has an integer weight w_i.

For each $s \in \{1, 2, \ldots, n\}$, Professor Zhang wants to find a sequence of vertices $v_1, v_2, \ldots, v_m$ such that:

- $v_1 = s$ and v_i is the ancestor of v_{i-1} for each $1 < i \le m$,
- the value $f(s) = w_{v_1} + \sum_{i=2}^{m} (w_{v_i} \text{ op } w_{v_{i-1}})$ is maximum possible. Here, operation x op y is the bitwise AND, OR, or XOR operation on two integers.

Input

There are multiple test cases. The first line of input contains an integer T indicating the number of test cases. For each test case:

The first line contains an integer n and a string op ($2 \le n \le 2^{16}$, op $\in \{\texttt{AND}, \texttt{OR}, \texttt{XOR}\}$): the number of vertices and the operation. The second line contains n integers $w_1, w_2, \ldots, w_n$ ($0 \le w_i < 2^{16}$). The third line contains $n - 1$ integers $p_2, p_3, \ldots, p_n$ ($1 \le p_i < i$) where p_i is the parent of vertex i.

There are about 300 test cases, and the sum of n in all the test cases is no more than 10^6.

Output

For each test case, output the integer $S = (\sum_{i=1}^{n} i \cdot f(i))$ modulo $10^9 + 7$.

Example

standard input	standard output
3 5 AND 5 4 3 2 1 1 2 2 4 5 XOR 5 4 3 2 1 1 2 2 4 5 OR 5 4 3 2 1 1 2 2 4	91 139 195