Fast Tree Queries

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	512 megabytes

You are given a tree consisting of n nodes. Initially, node i has the integer i written on it. You need to process q queries of two types:

- **+ a v x** — add x to all integers written on a simple path from node a to node v.
- **? a v** — calculate the xor of all integers written on a simple path from node a to node v.

Input

The first line contains two integers n and q ($1 \le n, q \le 10^5$) — the number of vertices and queries.

Each of the next $n-1$ lines contains two integers u_i and v_i ($1 \le u_i, v_i \le n$) — edges of the tree.

Each of the next q lines contains queries in the format "+ a v x" ($1 \le a, v \le n$, $1 \le x \le 10^4$) or "? a v" ($1 \le a, v \le n$).

Output

For each query of the second type, print the answer in a separate line.

Example

standard input	standard output
5 6 1 2 1 3 3 4 3 5 ? 2 5 + 1 4 1 ? 2 5 + 4 5 2 ? 4 5 ? 1 1	5 1 6 2