Dynamic LCA

A forest of rooted trees initially consists of N ($1 \le N \le 100{,}000$) single-vertex trees. The vertices are numbered from 1 to N.

You must process the following queries, where ($1 \le A, B \le N$) :

- **link** A B : add an edge from vertex A to B, making A a child of B, where initially A is a root vertex, A and B are in different trees.
- **cut** A : remove edge from A to its parent, where initially A is a non-root vertex.
- **lca** A B : print the lowest common ancestor of A and B, where A and B are in the same tree.

Input

The first line of input contains the number of initial single-vertex trees N and the number of queries M ($1 \le M \le 100{,}000$). The following M lines contain queries.

Output

For each **lca** query output the lowest common ancestor (vertex number between 1 and N).

Example

Input:
5 9
lca 1 1
link 1 2
link 3 2
link 4 3
lca 1 4
lca 3 4
cut 4
link 5 3
lca 1 5

Output:
1
2
3
2