5848. Operations on Tree

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User Accepted:	105
User Tried:	164
Total Accepted:	106
Total Submissions:	207
Difficulty:	Medium

You are given a tree with `n` nodes numbered from `0` to `n - 1` in the form of a parent array `parent` where `parent[i]` is the parent of the i^{th} node. The root of the tree is node `0`, so `parent[0] = -1` since it has no parent. You want to design a data structure that allows users to lock, unlock, and upgrade nodes in the tree.

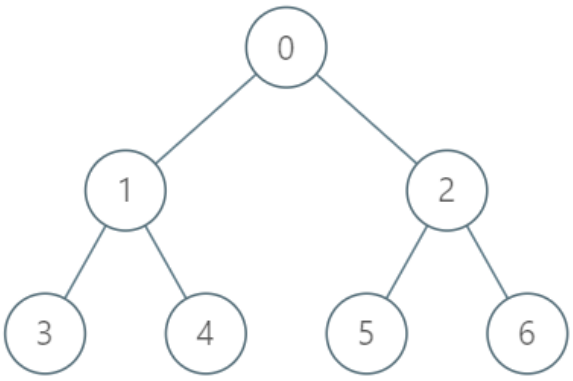
The data structure should support the following functions:

- **Lock: Locks** the given node for the given user and prevents other users from locking the same node. You may only lock a node if the node is unlocked.
- **Unlock: Unlocks** the given node for the given user. You may only unlock a node if it is currently locked by the same user.
- **Upgrade: Locks** the given node for the given user and **unlocks** all of its descendants. You may only upgrade a node if **all** 3 conditions are true:
  - The node is unlocked,
  - It has at least one locked descendant (by **any** user), and
  - It does not have any locked ancestors.

Implement the `LockingTree` class:

- `LockingTree(int[] parent)` initializes the data structure with the parent array.
- `lock(int num, int user)` returns `true` if it is possible for the user with id `user` to lock the node `num`, or `false` otherwise. If it is possible, the node `num` will become **locked** by the user with id `user`.
- `unlock(int num, int user)` returns `true` if it is possible for the user with id `user` to unlock the node `num`, or `false` otherwise. If it is possible, the node `num` will become **unlocked**.
- `upgrade(int num, int user)` returns `true` if it is possible for the user with id `user` to upgrade the node `num`, or `false` otherwise. If it is possible, the node `num` will be **upgraded**.

Example 1:



```
Input
["LockingTree", "lock", "unlock", "unlock", "lock", "upgrade", "lock"]
[[[-1, 0, 0, 1, 1, 2, 2]], [2, 2], [2, 3], [2, 2], [4, 5], [0, 1], [0, 1]]
Output
[null, true, false, true, true, true, false]

Explanation
LockingTree lockingTree = new LockingTree([-1, 0, 0, 1, 1, 2, 2]);
lockingTree.lock(2, 2);    // return true because node 2 is unlocked.
                           // Node 2 will now be locked by user 2.
lockingTree.unlock(2, 3);  // return false because user 3 cannot unlock a node locked by user 2.
lockingTree.unlock(2, 2);  // return true because node 2 was previously locked by user 2.
                           // Node 2 will now be unlocked.
lockingTree.lock(4, 5);    // return true because node 4 is unlocked.
                           // Node 4 will now be locked by user 5.
lockingTree.upgrade(0, 1); // return true because node 0 is unlocked and has at least one locked descendant (no
                           // Node 0 will now be locked by user 1 and node 4 will now be unlocked.
lockingTree.lock(0, 1);    // return false because node 0 is already locked.
```

Constraints:

- `n == parent.length`
- `2 <= n <= 2000`
- `0 <= parent[i] <= n - 1` for `i != 0`
- `parent[0] == -1`
- `0 <= num <= n - 1`
- `1 <= user <= 10^4`
- `parent` represents a valid tree.
- At most `2000` calls **in total** will be made to `lock`, `unlock`, and `upgrade`.

JavaScript

```
/**
 * @param {number[]} parent
 */
var LockingTree = function(parent) {

};

/**
 * @param {number} num
 * @param {number} user
 * @return {boolean}
 */
LockingTree.prototype.lock = function(num, user) {

};

/**
 * @param {number} num
 * @param {number} user
 * @return {boolean}
 */
LockingTree.prototype.unlock = function(num, user) {

};

/**
 * @param {number} num
 * @param {number} user
 * @return {boolean}
```

```
 */
LockingTree.prototype.upgrade = function(num, user) {

};

/**
 * Your LockingTree object will be instantiated and called as such:
 * var obj = new LockingTree(parent)
 * var param_1 = obj.lock(num,user)
 * var param_2 = obj.unlock(num,user)
 * var param_3 = obj.upgrade(num,user)
 */
```

☐ **Custom Testcase** Use Example Testcases

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