1938. Maximum Genetic Difference Query

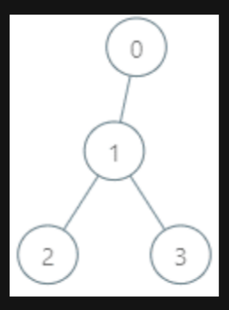
Description

There is a rooted tree consisting of `n` nodes numbered `0` to `n - 1`. Each node's number denotes its **unique genetic value** (i.e. the genetic value of node `x` is `x`). The **genetic difference** between two genetic values is defined as the **bitwise- XOR** of their values. You are given the integer array `parents`, where `parents[i]` is the parent for node `i`. If node `x` is the **root** of the tree, then `parents[x] == -1`.

You are also given the array `queries` where `queries[i] = [node_i, val_i]`. For each query `i`, find the **maximum genetic difference** between `val_i` and `p_i`, where `p_i` is the genetic value of any node that is on the path between `node_i` and the root (including `node_i` and the root). More formally, you want to maximize `val_i XOR p_i`.

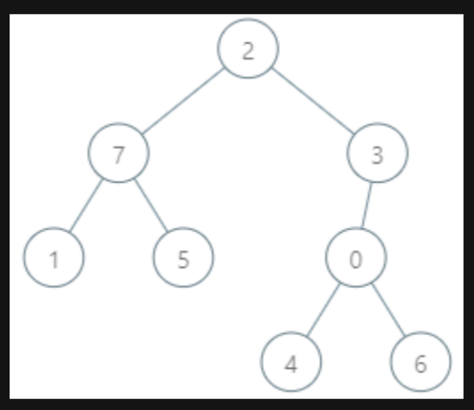
Return *an array* `ans` *where* `ans[i]` *is the answer to the* `i^th` *query*.

Example 1:




```
Input: parents = [-1,0,1,1], queries = [[0,2],[3,2],[2,5]]
Output: [2,3,7]
Explanation: The queries are processed as follows:
- [0,2]: The node with the maximum genetic difference is 0, with a difference of 2 XOR 0 = 2.
- [3,2]: The node with the maximum genetic difference is 1, with a difference of 2 XOR 1 = 3.
- [2,5]: The node with the maximum genetic difference is 2, with a difference of 5 XOR 2 = 7.
```

Example 2:




```
Input: parents = [3,7,-1,2,0,7,0,2], queries = [[4,6],[1,15],[0,5]]
Output: [6,14,7]
Explanation: The queries are processed as follows:
- [4,6]: The node with the maximum genetic difference is 0, with a difference of 6 XOR 0 = 6.
- [1,15]: The node with the maximum genetic difference is 1, with a difference of 15 XOR 1 = 14.
- [0,5]: The node with the maximum genetic difference is 2, with a difference of 5 XOR 2 = 7.
```

Constraints:

- `2 <= parents.length <= 10^5`
- `0 <= parents[i] <= parents.length - 1` for every node `i` that is **not** the root.
- `parents[root] == -1`
- `1 <= queries.length <= 3 * 10^4`
- `0 <= node_i <= parents.length - 1`
- `0 <= val_i <= 2 * 10^5`