Problem 1938: Maximum Genetic Difference Query

Problem Information

Difficulty: Hard
Acceptance Rate: 45.81%
Paid Only: No
Tags: Array, Hash Table, Bit Manipulation, Depth-First Search, Trie

Problem 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] = [nodei, vali]`. For each query `i`, find the **maximum genetic difference** between `vali` and `pi`, where `pi` is the genetic value of any node that is on the path between `nodei` and the root (including `nodei` and the root). More formally, you want to maximize `vali XOR pi`.

Return _an array_`ans` _where_`ans[i]`_is the answer to the_`ith` _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 <= 105` * `0 <= parents[i] <= parents.length - 1` for every node `i` that is **not** the root. * `parents[root] == -1` * `1 <= queries.length <= 3 * 104` * `0 <= nodei <= parents.length - 1` * `0 <= vali <= 2 * 105`

Code Snippets

C++:

```cpp
class Solution {
public:
    vector<int> maxGeneticDifference(vector<int>& parents, vector<vector<int>>& queries) {

    }
};
```

Java:

```java
class Solution {
    public int[] maxGeneticDifference(int[] parents, int[][] queries) {

    }
}
```

Python3:

```python
class Solution:
    def maxGeneticDifference(self, parents: List[int], queries: List[List[int]])
    -> List[int]:
```