Problem 2467: Most Profitable Path in a Tree

Problem Information

Difficulty: Medium
Acceptance Rate: 67.42%
Paid Only: No
Tags: Array, Tree, Depth-First Search, Breadth-First Search, Graph

Problem Description

There is an undirected tree with `n` nodes labeled from `0` to `n - 1`, rooted at node `0`. You are given a 2D integer array `edges` of length `n - 1` where `edges[i] = [ai, bi]` indicates that there is an edge between nodes `ai` and `bi` in the tree.

At every node `i`, there is a gate. You are also given an array of even integers `amount`, where `amount[i]` represents:

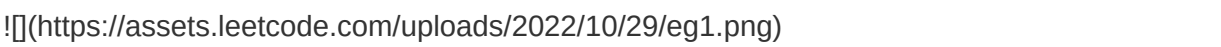
* the price needed to open the gate at node `i`, if `amount[i]` is negative, or, * the cash reward obtained on opening the gate at node `i`, otherwise.

The game goes on as follows:

* Initially, Alice is at node `0` and Bob is at node `bob`. * At every second, Alice and Bob **each** move to an adjacent node. Alice moves towards some **leaf node** , while Bob moves towards node `0`. * For **every** node along their path, Alice and Bob either spend money to open the gate at that node, or accept the reward. Note that: * If the gate is **already open** , no price will be required, nor will there be any cash reward. * If Alice and Bob reach the node **simultaneously** , they share the price/reward for opening the gate there. In other words, if the price to open the gate is `c`, then both Alice and Bob pay `c / 2` each. Similarly, if the reward at the gate is `c`, both of them receive `c / 2` each. * If Alice reaches a leaf node, she stops moving. Similarly, if Bob reaches node `0`, he stops moving. Note that these events are **independent** of each other.

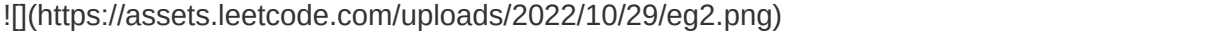
Return _the**maximum** net income Alice can have if she travels towards the optimal leaf node._

Example 1:



Input: edges = [[0,1],[1,2],[1,3],[3,4]], bob = 3, amount = [-2,4,2,-4,6] **Output:** 6 **Explanation:** The above diagram represents the given tree. The game goes as follows: - Alice is initially on node 0, Bob on node 3. They open the gates of their respective nodes. Alice's net income is now -2. - Both Alice and Bob move to node 1. Since they reach here simultaneously, they open the gate together and share the reward. Alice's net income becomes -2 + (4 / 2) = 0. - Alice moves on to node 3. Since Bob already opened its gate, Alice's income remains unchanged. Bob moves on to node 0, and stops moving. - Alice moves on to node 4 and opens the gate there. Her net income becomes 0 + 6 = 6. Now, neither Alice nor Bob can make any further moves, and the game ends. It is not possible for Alice to get a higher net income.

Example 2:



Input: edges = [[0,1]], bob = 1, amount = [-7280,2350] **Output:** -7280 **Explanation:** Alice follows the path 0->1 whereas Bob follows the path 1->0. Thus, Alice opens the gate at node 0 only. Hence, her net income is -7280.

Constraints:

* `2 <= n <= 105` * `edges.length == n - 1` * `edges[i].length == 2` * `0 <= ai, bi < n` * `ai != bi` * `edges` represents a valid tree. * `1 <= bob < n` * `amount.length == n` * `amount[i]` is an **even** integer in the range `[-104, 104]`.

Code Snippets

C++:

```
class Solution {
public:
int mostProfitablePath(vector<vector<int>>& edges, int bob, vector<int>&
amount) {

}
};
```

Java:

```
class Solution {
public int mostProfitablePath(int[][] edges, int bob, int[] amount) {

}
}
```

Python3:

```
class Solution:
def mostProfitablePath(self, edges: List[List[int]], bob: int, amount:
List[int]) -> int:
```