Daily Coding Problem #117

Problem

This problem was asked by Facebook.

Given a binary tree, return the level of the tree with minimum sum.

Solution

A binary tree is a data structure in which each node has at most two children (left and right), and a level is how many parents a node has until it reaches the root.

To better explain this question, let's see this example:

```
  1      (Level 0 = 1)
 / \
2   3    (Level 1 = 2 + 3)
   / \
  4   5  (Level 2 = 4 + 5)
```

One possible way to solve this problem is iterate level by level on the tree's nodes, so we can get theirs respective sum. Like this code:

```python
from Queue import Queue
from collections import defaultdict

class Node:
    def __init__(self, value, left=None, right=None):
        self.value = value
        self.left = left
        self.right = right

def smallest_level(root):
    queue = Queue()
    queue.put((root, 0))
    level_to_sum = defaultdict(int) # Maps level to its sum


    while not queue.empty():
        node, level = queue.get()
        level_to_sum[level] += node.val

        if node.right:
            queue.put((node.right, level + 1))

        if node.left:
            queue.put((node.left, level + 1))

    return min(level_to_sum, key=level_to_sum.get)
```

The complexity of this function is O(N), and works both with positive or negative values. It works by doing a breadth first search and keeping track of the sum in each level.

You can try yourself with these examples:

```
"""
         1
       /  \
     -2   -3           (level 1 is the minimum)
        /  \
       4   -5
"""
root = Node(
    value=1,
    left=Node(-2),
    right=Node(-3, Node(4), Node(-5))
)
print(minimum_level_sum(root))
```

```
"""
          1
      /       \
    2           3
  /  \           \
 4    5           6
       \       /   \
       -1   -7     -8   (level 3 is the minimum)

"""
root = Node(
    value=1,
    left=Node(2, Node(4), Node(5, Node(-1))),
    right=Node(
        value=3,
        right=Node(6, Node(-7), Node(-8))
    )
)
print(minimum_level_sum(root))
```