

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 their respective sum. Like this code:

```
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 minimum_level_sum(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))
```

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