CS 5012: Binary Trees Module 4.3 Exercise

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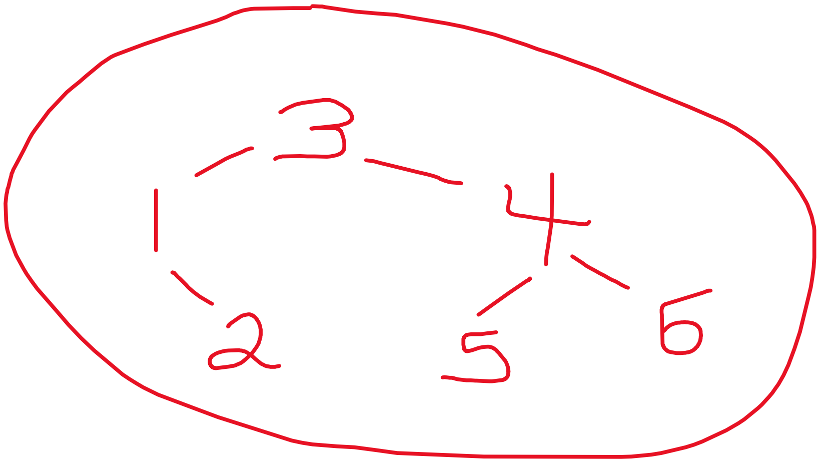
3/2/2021

Question 1:

Assume the implementation of a BinaryTree from slide 30 in *Introduction to Trees*. Draw the binary tree that the following code produces (the code was written in *main*).

```
# create a bunch of nodes with integer values
theRoot = BinaryTree.Node(3) # root node with value 3
n1 = BinaryTree.Node(1)
n2 = BinaryTree.Node(2)
n4 = BinaryTree.Node(4)
n5 = BinaryTree.Node(5)
n6 = BinaryTree.Node(6)
# create a binary tree called 'myTree'
myTree = BinaryTree(theRoot) # create a tree 'myTree' with root = 3
# connect the tree
myTree.root.setLeft(n1)
myTree.root.setRight(n4)
n1.setRight(n2)
n4.setRight(n6)
n4.setLeft(n5)
```



Question 2:

Assume the implementation of a BinaryTree from slide 30 in *Introduction to Trees*. Build a binary tree by providing the code in Python as would be typed in main (similar to the code in Q1), based on the following drawing.

Answer

```
# create the root node
theRoot2 = BinaryTree.Node(3)
# create the other nodes
nn1 = BinaryTree.Node(1)
nn2 = BinaryTree.Node(2)
nn11 = BinaryTree.Node(11)
nn5 = BinaryTree.Node(5)
nn6 = BinaryTree.Node(6)
nn9 = BinaryTree.Node(9)

# create the tree object
theTree2 = BinaryTree(theRoot2)

# connect the tree
theTree2.root.setLeft(nn1)
theTree2.root.setRight(nn6)

nn1.setLeft(nn2)
nn1.setRight(nn11)

n6.setRight(nn9)
nn6.setLeft(nn5)
```

Question 3:

Write a tree-level *getHeight()* method that calculates the height (or depth) of the binary tree (e.g., it would return 3, if called on the tree in Q2).

Note: Think of a way to do this recursively, having each node calculate its height, as if it was the root of its subtree.

Answer

```
"""
Activity: MOE 4.3: Building a Binary Tree
Name: H. Diana McSpadden
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"""


class BinaryTree:
```

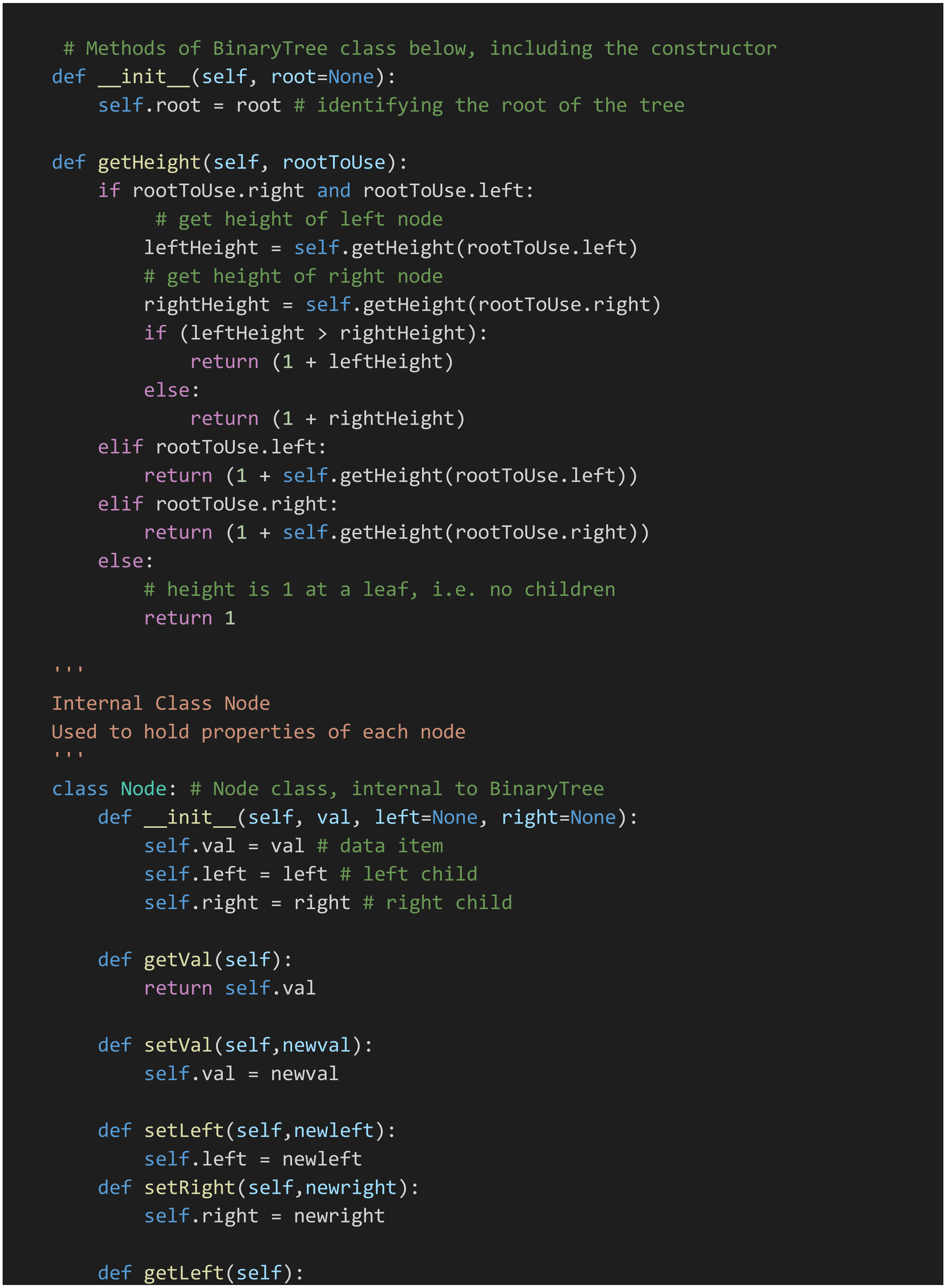

```
 # Methods of BinaryTree class below, including the constructor
def __init__(self, root=None):
    self.root = root # identifying the root of the tree

def getHeight(self, rootToUse):
    if rootToUse.right and rootToUse.left:
         # get height of left node
        leftHeight = self.getHeight(rootToUse.left)
        # get height of right node
        rightHeight = self.getHeight(rootToUse.right)
        if (leftHeight > rightHeight):
            return (1 + leftHeight)
        else:
            return (1 + rightHeight)
    elif rootToUse.left:
        return (1 + self.getHeight(rootToUse.left))
    elif rootToUse.right:
        return (1 + self.getHeight(rootToUse.right))
    else:
        # height is 1 at a leaf, i.e. no children
        return 1

'''
Internal Class Node
Used to hold properties of each node
'''
class Node: # Node class, internal to BinaryTree
    def __init__(self, val, left=None, right=None):
        self.val = val # data item
        self.left = left # left child
        self.right = right # right child

    def getVal(self):
        return self.val

    def setVal(self,newval):
        self.val = newval

    def setLeft(self,newleft):
        self.left = newleft
    def setRight(self,newright):
        self.right = newright

    def getLeft(self):
            return self.left

        def getRight(self):
            return self.right
        ## -------------- end of internal class Node --------------



# create a bunch of nodes with integer values
theRoot = BinaryTree.Node(3) # root node with value 3
n1 = BinaryTree.Node(1)
n2 = BinaryTree.Node(2)
n4 = BinaryTree.Node(4)
n5 = BinaryTree.Node(5)
n6 = BinaryTree.Node(6)
# create a binary tree called 'myTree'
myTree = BinaryTree(theRoot) # create a tree 'myTree' with root = 3
# connect the tree
myTree.root.setLeft(n1)
myTree.root.setRight(n4)
n1.setRight(n2)
n4.setRight(n6)
n4.setLeft(n5)

height = myTree.getHeight(theRoot)

print(height)
```

References:

Joe James: https://www.youtube.com/watch?v=aGaMgkJX5-o