LAB 6 : Binary Tree

[CO2]

Instructions for students:

- Complete the following methods.
- You may use Java / Python to complete the tasks.
- DO NOT CREATE a separate folder for each task just follow the given template.
- If you are using **JAVA**, then follow the **Java Template**.
- If you are using **PYTHON**, then follow the **Python Template**.

NOTE:

- **YOU CANNOT USE ANY OTHER DATA STRUCTURE OTHER THAN ARRAY UNLESS MENTIONED IN THE QUESTION.**
- **YOUR CODE SHOULD WORK FOR ANY VALID INPUTS.**

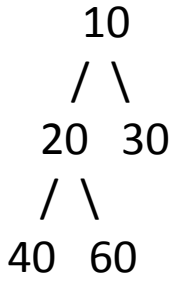
Python List, Negative indexing and append() is STRICTLY prohibited

TOTAL MARKS: 5*6=30

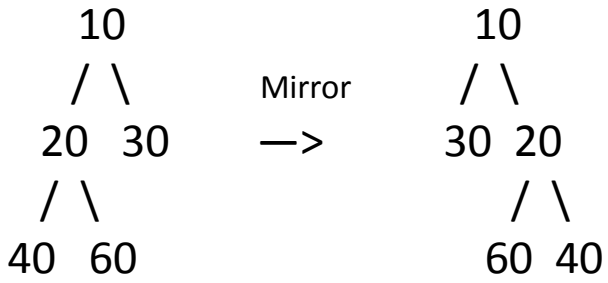
1. Mirror Tree:

Given a binary tree, convert it into its mirror.

Sample Input:



Sample Output:

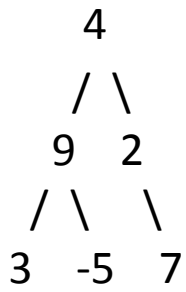


Inorder Traversal of mirror: 30 10 60 20 40

2. Level Min:

Given a binary tree, find the smallest value in each level.

Sample Input: [For **Python** You can use a dictionary here]



Sample Output: 4 2 -5

Explanation:

There are 3 levels in the tree

Level 0: {4}, min= 4

Level 1: {2, 9}, min= 2

Level 2: {7, 3, -5}, min = -5

3. Sum of Nodes:

Alice and Bob are having a competition on who is better at math between them. To decide who is better, Alice gave Bob a task of summation. Alice gave Bob a tree and asked him to sum the values each node consist. However, Alice added a condition with this task. Bob needs to divide the values of each node with the node's level and sum the modulus except for root node. For root node, he needs to sum the value of the node. Now, Bob finds it difficult to do it but he can not loose. Thus, he came to you for help. Your task is to write a method that takes the root of a tree and return the sum.

*** You can create as much helper function you want**

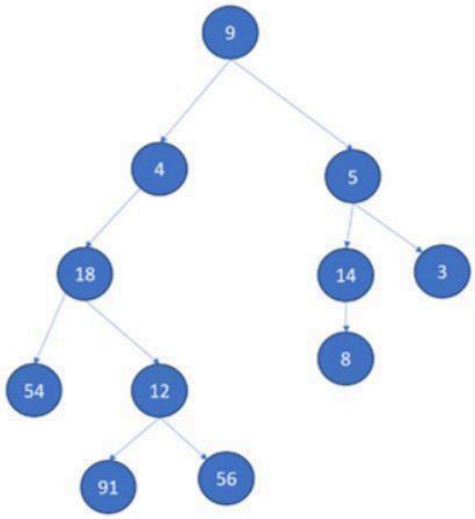
*** You can not modify the given codes nor the parameters.**

*** Hint: You know _order traversal of the tree.**

Example:

Test 1

Input



Output

15

Explanation:

Level 0 → 9

Level 1 → (4%1) + (5%1) = 0

Level 2 → (18%2) + (14%2) + (3%2) = 1

Level 3 → (54%3) + (12%3) + (8%3) = 2

Level 4 → (91 % 4) + (56%4) = 3

Output → 9+0+1+2+3 = 15

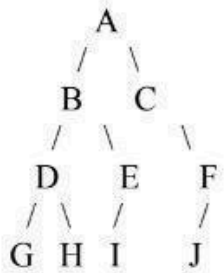
4. Swap Children Nodes:

Write a **recursive** function **swap_child()** that takes the root of a binary tree, node's level and a number M as a parameter. The function will swap the left and right children of all the nodes at level M and above. Here, 0 < M < height of the tree (root's height). Consider, the Node class for Binary Tree already defined with elem, left and right variables. **YOU CANNOT USE LIST OR DICTIONARY, any built-in function, global variables.**

Python Notation:

```
def swap_child(root, level, M):
        # To do
```

Function Call :
swap_child(root, 0, 2). Here root refers to the tree below.

Input Tree	Resulting Tree	Explanation
		Here M = 2 and all the nodes from level 2 and above are swapped left with right. Here above means the level that situated at a higher position of the tree

5. Subtraction of Nodes:

Write a **recursive** function **subtract_summation**() that takes the root of a binary tree as a parameter. The function will **subtract** the **summation** of the **right subtree** of the given root **from** the **summation** of the **left subtree** of the given root. Consider, the **Node** class for Binary Tree already defined with elem, left and right variables. You can use helper functions.

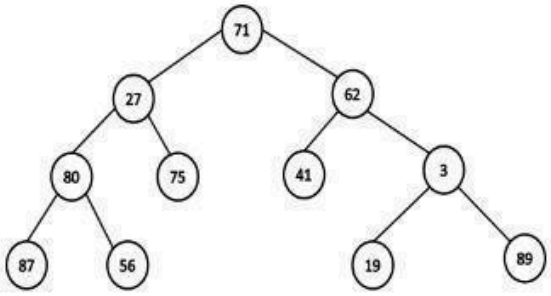
YOU CANNOT USE LIST OR DICTIONARY. You cannot use any built-in function.

Python Notation:

```
def subtract_summation(root):
    // To do
    return None
```

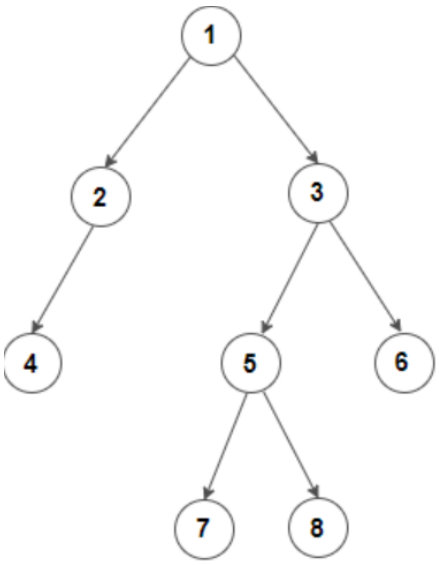
Function Call :

print(**subtract_summation**(root)). Here root refers to the tree below.

Sample Input	Sample Output	Explanation
	111	Summation of left subtree - summation of right subtree = (27+75+80+87+56) - (62+41+3+19+89) = 111

6. Difference of Level Sum

Given a Binary Tree, Write a function that finds the difference between sum of all nodes present at odd and even levels in a binary tree, i.e. sum of all odd level nodes - sum of all even level nodes.

Sample Input:	Sample Output	Explanation
	4	-1+2+3-4-5-6+7+8 = 4