

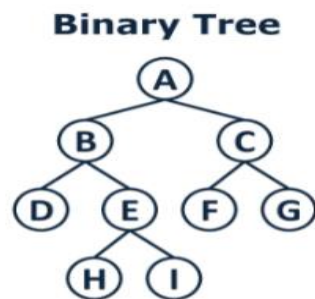
CS1102 Data Structures

Assignment -2

Instructions

1. Deadline to submit assignment is **05:00 PM, 16-11-2021**.
2. All programs should be in JAVA with no predefined Methods.
3. Upload one single ZIP file (.java files) of solutions in TCS-Ion LX. Zip file name should be your roll number.
4. Mention worst case Time and Space complexity of the program.

Q1. Given a binary tree, print its nodes level by level in reverse order, i.e., print all nodes present at the last level first, followed by nodes of the second last level, and so on... Print nodes at any level from left to right.



Traversal – H I D E F G B C A

Q2. Write a Recursive Program in JAVA for reversing Singly Linked list having 10 items.

Q3. There are 25 horses among which you need to find out the fastest 3 horses. You can conduct race among at most 5 to find out their relative speed. At no point you can find out the actual speed of the horse in a race. Find out the minimum no. of races which are required to get the top 3 horses. Write algorithm for the above problem.

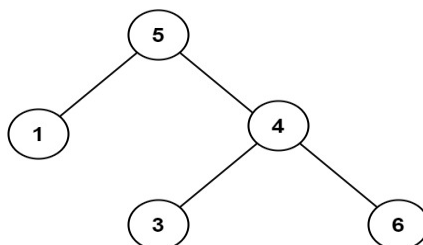
Q4. Write a Program in JAVA for finding out maximum and minimum element in binary tree.

Q5. Given the root of a binary tree, determine if it is a valid binary search tree (BST).

A valid BST is defined as follows:

- The left subtree of a node contains only nodes with keys less than the node's key.
- The right subtree of a node contains only nodes with keys greater than the node's key.
- Both the left and right subtrees must also be binary search trees.

Example 1:

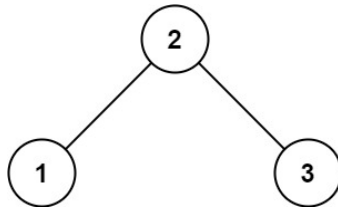


Input: root = [5, 1, 4, null, null, 3, 6]

Output: false

Explanation: The root node's value is 5 but its right child's value is 4.

Example 2:



Input: root = [2,1,3]

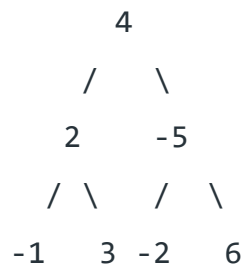
Output: true

Q6. Write a JAVA program/recursive method in java to print all paths from root to leaf in a Binary Tree.

Q7. Write a program in JAVA to count and print leaf nodes of a binary tree.

Q8. Given a Binary Tree having positive and negative nodes, the task is to find the maximum sum level in it.

Input:



Input: root = [4, 2, -5, -1, 3, -2, 6]

Output: 6

Explanation:

Sum of all nodes of 0'th level is 4

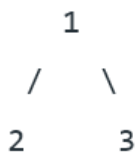
Sum of all nodes of 1'th level is -3

Sum of all nodes of 1'th level is -3

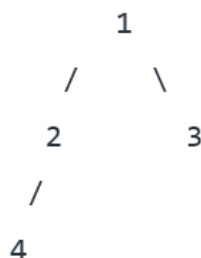
Hence maximum sum is 6

Q9. Write a program in JAVA to find out sum of all the values of binary tree.

Q10. Given a Binary Tree, write a function in JAVA to check whether the given Binary Tree is Complete Binary Tree or not.



Output: True



Output: True



Output: False

Q11. Given a Binary Tree, find the difference between the sum of nodes at odd level and the sum of nodes at even level. Consider root as level 0, left and right children of root as level 1 and so on. Write JAVA program for this.

For example, in the following tree, sum of nodes at odd level is $(5 + 1 + 4 + 8)$ which is 18. And sum of nodes at even level is $(2 + 6 + 3 + 7 + 9)$ which is 27.

The output for following tree should be $18 - 27$ which is -9.



Q12. Given an array of integers, the task is to find the sequence in which these integers should be added to an AVL tree such that no rotations are required to balance the tree. Write JAVA program for this.

Examples:

Input: array = {1, 2, 3}

Output: 2 1 3

Input: array = {2, 4, 1, 3, 5, 6, 7}

Output: 4 2 6 1 3 5 7

Q13. Write a program in JAVA to implement BST with user defined values having Insertion, Traversal and deletion function.

Q14. Given a Binary Tree convert it to a Binary Search Tree. The conversion must be done in such a way that keeps the original structure of Binary Tree. Write JAVA program for this.

Examples

Example 1

Input:

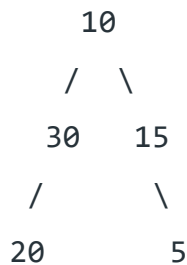


Output:



Example 2

Input:



Output:



Q15. Write a program in JAVA to find out sum of all the values at each levels of binary tree.

Q16. You are given two balanced binary search trees e.g., AVL. Write a function that merges the two given balanced BSTs into a balanced binary search tree. Let there be m elements in the first tree and n elements in the other tree. Your merge function should take $O(m + n)$ time. Write JAVA program for this.

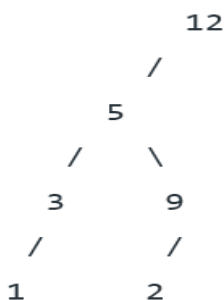
Q17. Given a Binary Tree, check if all leaves are at same level or not. Write JAVA program for this.



Output: Leaves are at same level



Output: Leaves are Not at same level



Output: Leaves are at same level