1. The array representation of a **binary search tree (BST)** is given below [None value means the node is empty]:

   [None, 6, 4, 11, 2, 5, 8, 12, None, None, None, None, None ,10, None, 20]

   (The first None value indicates a dummy node of the tree)

   Answer the following questions-

   A. Draw the BST. **[2.5]**

   B. A specific type of traversal prints out the node values in sorted order. What is the traversal's name? Write that particular traversal sequence of the tree in part A. **[2.5]**

   C. Write the **post order traversal** sequence of the tree in part A. Use that traversal sequence to insert the elements in that order in an initially empty BST, and show the resulting BST. **[3]**

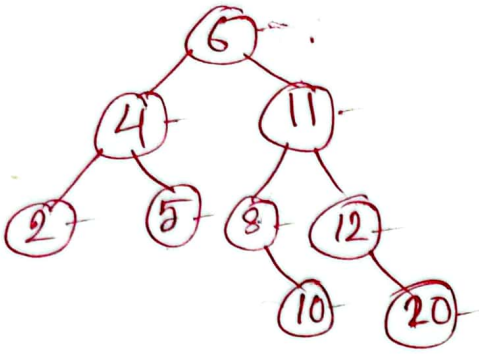
   Note: Consider the first element of the post order sequence as the root.

   D. Perform the following operations step by step on the Binary Search Tree you created in **part** C. A.

   i. Delete node 6 with the help of its successor.

   ii. Delete node 8 with the help of its predecessor. **[2]**

A



B. Inorder Sequence:

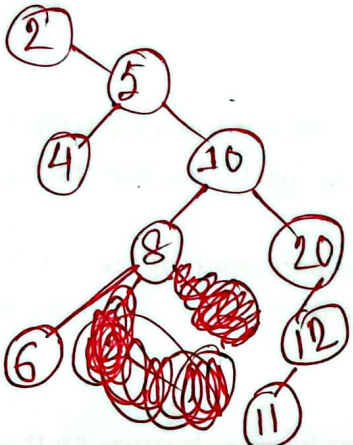
The traversal sequence—

~~2 4 5 8 6 8~~

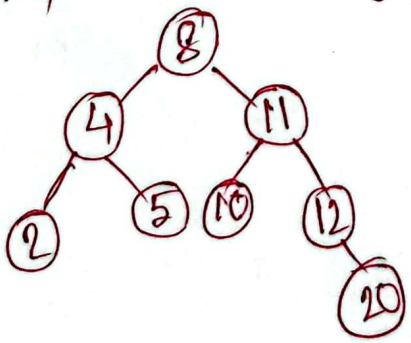
2 4 5 6 8 10 11 12 20

C. Post Order Traversal sequence-

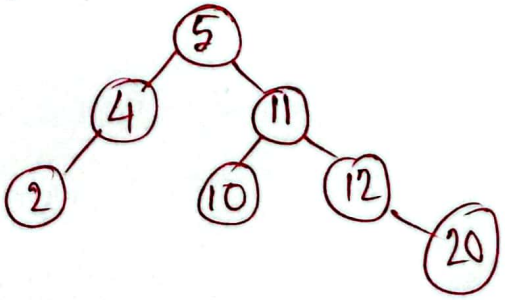
2 5 4 10 8 20 12 11 6



D. a) The successor of node 6 is 8. After deleting 6:



b) The predecessor of node 8 is 5.
After deleting 5, the resulting tree-



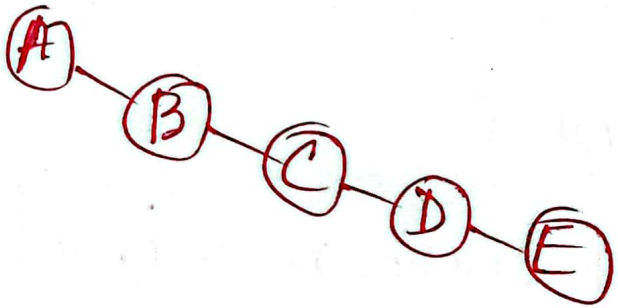
2. What is the maximum height of a tree with N nodes? Justify your answer with an example. [2]

Maximum height = N - 1

All nodes being the right child/left child of the parent, the maximum height will be N-1.

Suppose, N=5

∴ Tree with 5 nodes of maximum height.

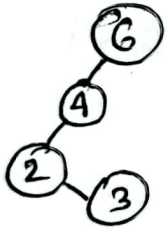


3. If we insert nodes into a BST in different orders, will it generate different binary trees? Justify your answer with examples. [3]

It will. Let's consider 6, 4, 2, 3 are four node. we can insert this in different ways and there will different types trees for each ways.

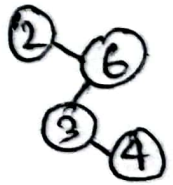
Such as if insert in this sequence : $6 \rightarrow 4 \rightarrow 2 \rightarrow 3$

Tree is →



Now this sequence → $6 \rightarrow 2 \rightarrow 4 \rightarrow 3$ | Tree :

And now " → $2 \rightarrow 6 \rightarrow 3 \rightarrow 4$ | Tree :



So, yes it will generate different types of trees.

4. Write a recursive function that counts the total number of nodes in a Binary Tree. Consider the node class and Binary tree class are already defined.

```
def count_node(root):
    #TO DO
```

[5]

```
def count_node(root):
    if root is None:
        return 0
    return 1 + count_node(root.right)
             + count_node(root.left)
```