Sathya Narendra Atmajati Satoto
Individual Assignment 2
Group: Kick_Kepin
Discord: Tuna#4702

1. Explain the differences between linear and non-linear data structures!
2. Describe the following terminology in a tree: base root, key, edge, siblings, parent, child, and leaf!
3. Explain the following types of binary trees: full, complete, and perfect!
4. What makes a tree balanced?
5. Explain the four properties of a binary tree!
6. Explain the intuition of implementing a binary tree using an array!
7. Explain the differences between inorder successor and inorder predecessor!
8. Draw the following binary search tree step by step (14 pictures):

- Insert 80, 30, 60, 50, 75
- Delete 60, 30, 75
- Insert 65, 30, 35
- Delete 80, 65, 35

Answer:

1.

In linear data structures, elements are arranged sequentially in which they are attached to elements before and after it adjacently. All elements of these data structures can be traversed in a single run. Examples of these are arrays, linked lists, stacks and queues.

In non-linear data structures, elements are not arranged linearly and there may be multiple levels in the structure. Elements may connect to more than one other elements, meaning that they cannot be traversed linearly. Examples of these are trees and graphs.

2.

The base root of a tree is the topmost node where the tree starts. A key is the value stored inside a node in the tree. Edges are lines that connect the parent node to the sibling nodes. Siblings are nodes that have the same parent. Parent nodes are the predecessor of nodes following it, and can be identified if it has branches leading to other nodes below it. Child nodes are nodes that have an edge to parent nodes above it. A leaf node is a node that does not have children or child nodes.

3.

A full binary tree is a binary tree that has nodes with two or zero children nodes. A complete binary tree is a binary tree that is filled completely in every level with the exception of the last level. A perfect binary tree is a binary tree in which every node except the leaves have two children and all leaves are in the same level.

4.

A tree is balanced if the height of the left and right subtrees only vary by at most one.

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5.

The first is that the maximum number of nodes on a level in a binary tree is 2^N in which N is the level of a binary tree. The second is that the maximum number of nodes in a binary tree is $2^{(H+1)}-1$ in which H is the height of said tree. The (-1) is so as the root has no accompanying node. The third is that the minimum height of a binary tree of n nodes is ${}^2\text{Log}(n)$. The fourth is that the maximum height of a binary tree of N nodes is N-1.

6.

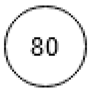
In implementing a binary tree using array, the datas are inserted into the array using formulas. The base root will be at index 0 of the array. The left child of a root/node can be found using the formula 2(index)+1 while the right child can be found using the formula 2(index)+2. If we want to search for the parent of a node, we can use the formula (index-1)/2. In this way, the relationship between nodes in the array are easily identifiable

7.

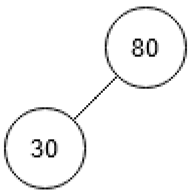
An inorder successor is the node with the smallest key greater than the key of the current node while an inorder predecessor is the node with the largest key smaller than the key of the current node.

8.

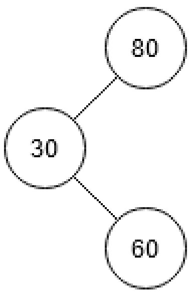
Insert 80



Insert 30



Insert 60



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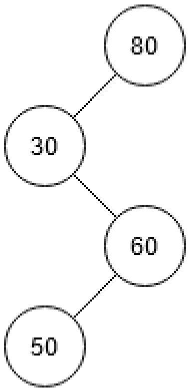
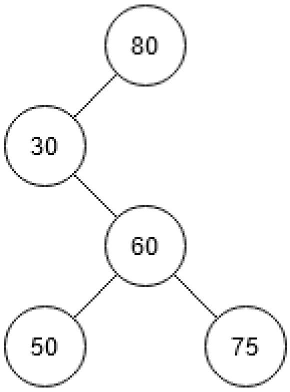
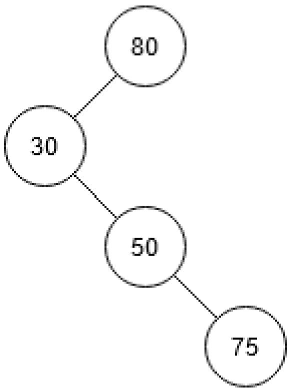
Insert 50



Insert 75



Delete 60



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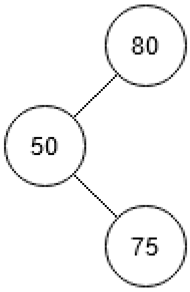
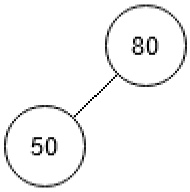
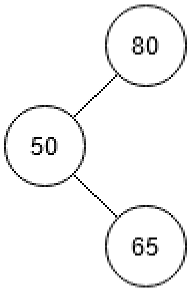
Delete 30



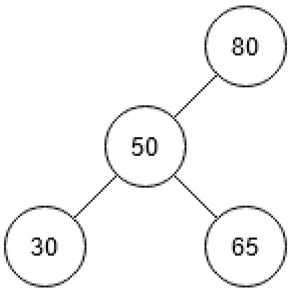
Delete 75



Insert 65



Insert 30



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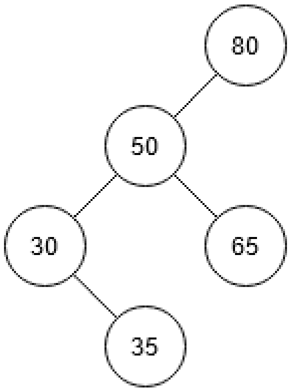
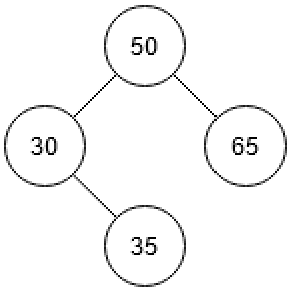
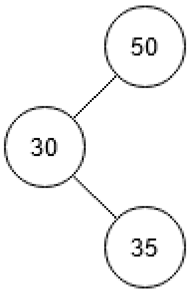
Insert 35



Delete 80



Delete 65



Delete 35