CS 202 - Spring 2022

Homework 2
-
Trees

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Question 1

a) Preorder → X ∪ A B ∩ \ C D E

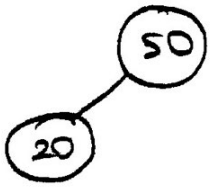
Inorder → A ∪ B X C \ D ∩ E

Postorder → A B ∪ C D \ E ∩ X

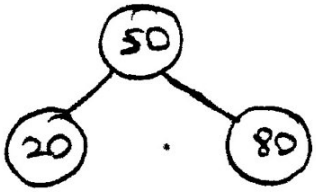
b) * Insert 50

↳ 

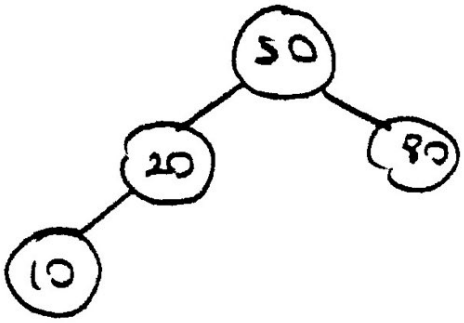
* Insert 20



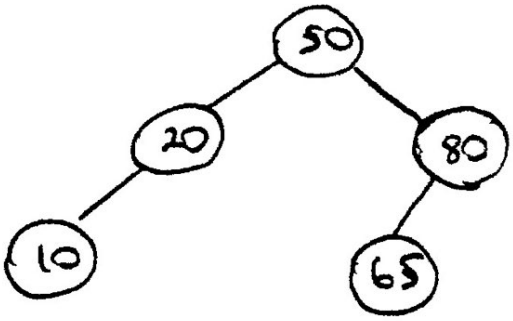
* Insert 80



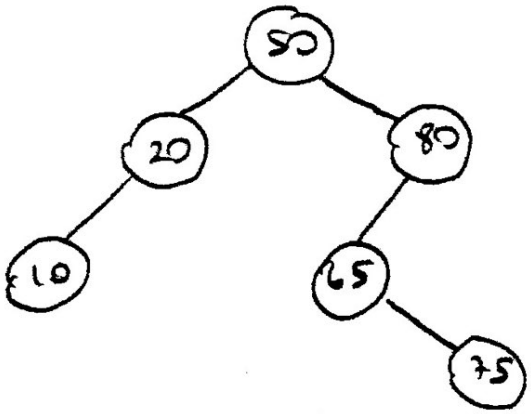
* Insert 10



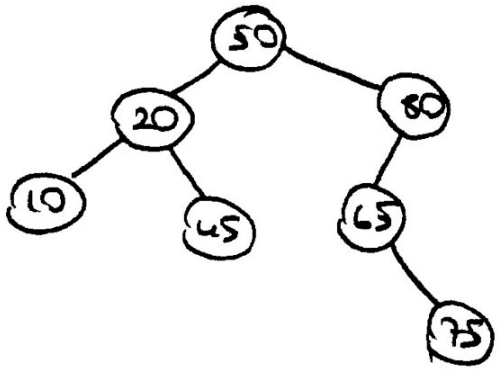
* Insert 65



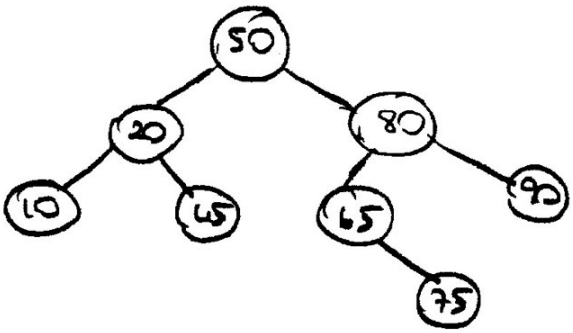
* Insert 75



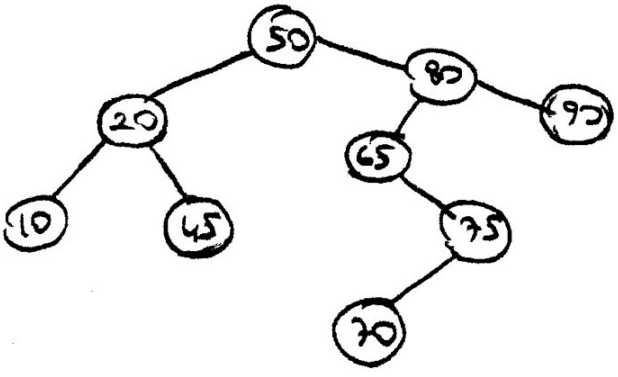
* Insert 45



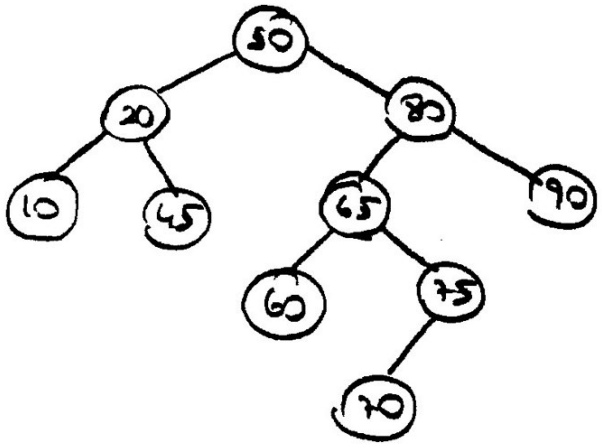
* Insert 90



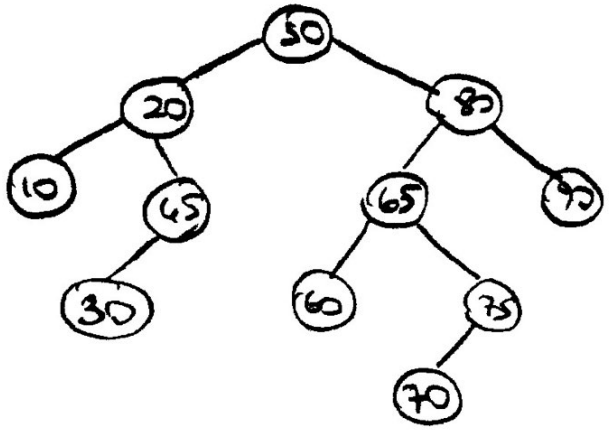
* Insert 70



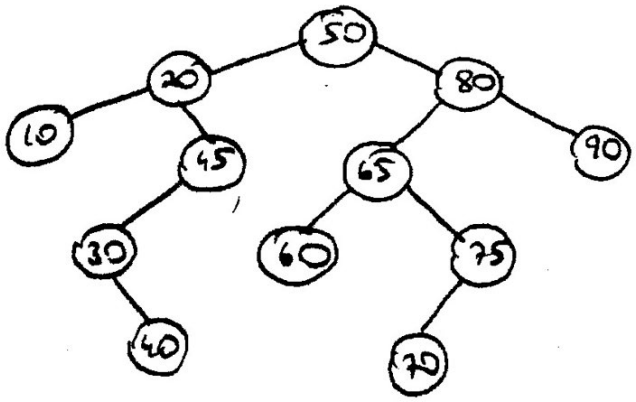
* Insert 60



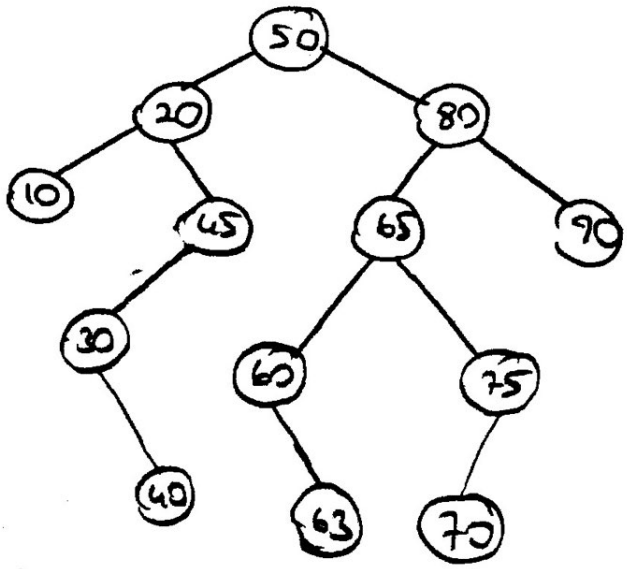
* Insert 30



* Insert 40

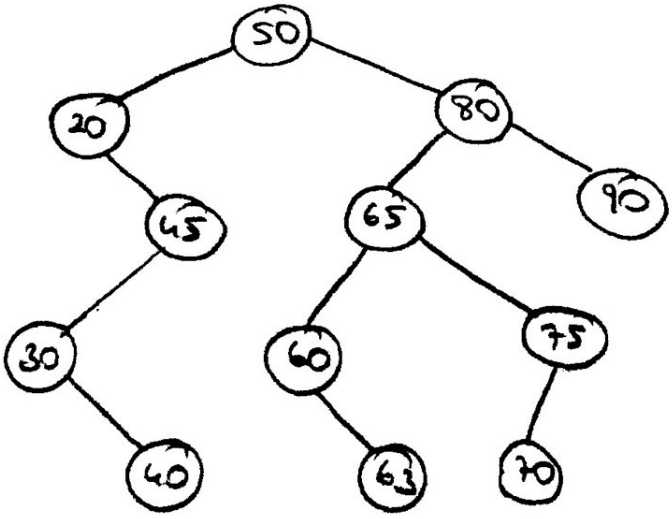


* Insert 63

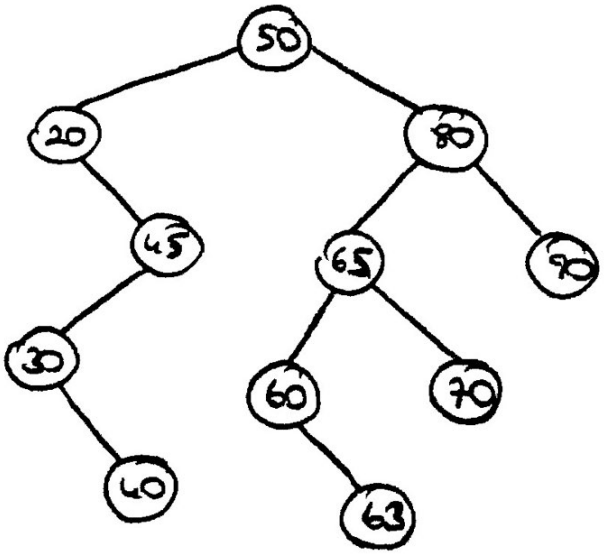


(Resulting tree after last insertion)

* Delete 10

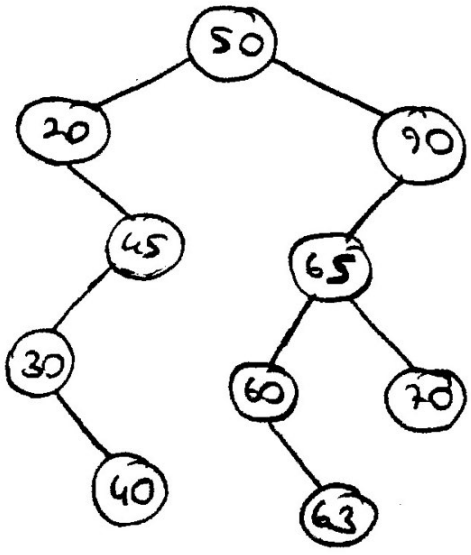


* Delete 75

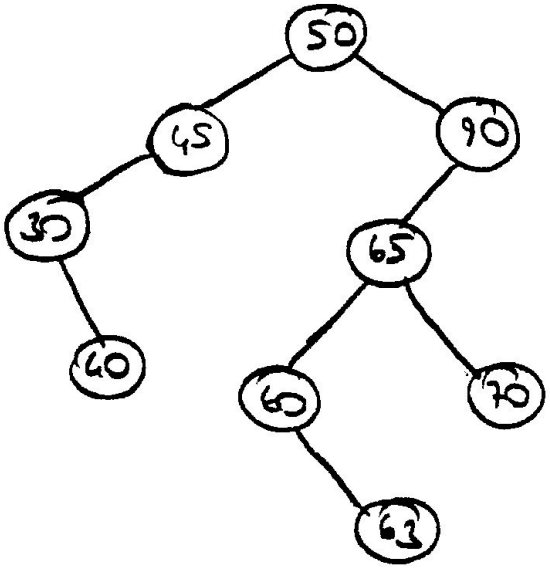


65

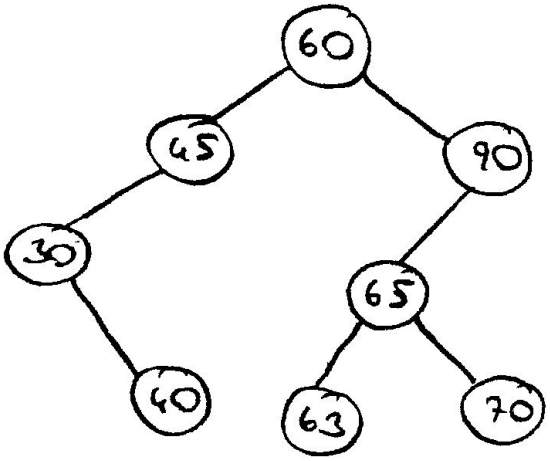
* Delete 80



* Delete 20

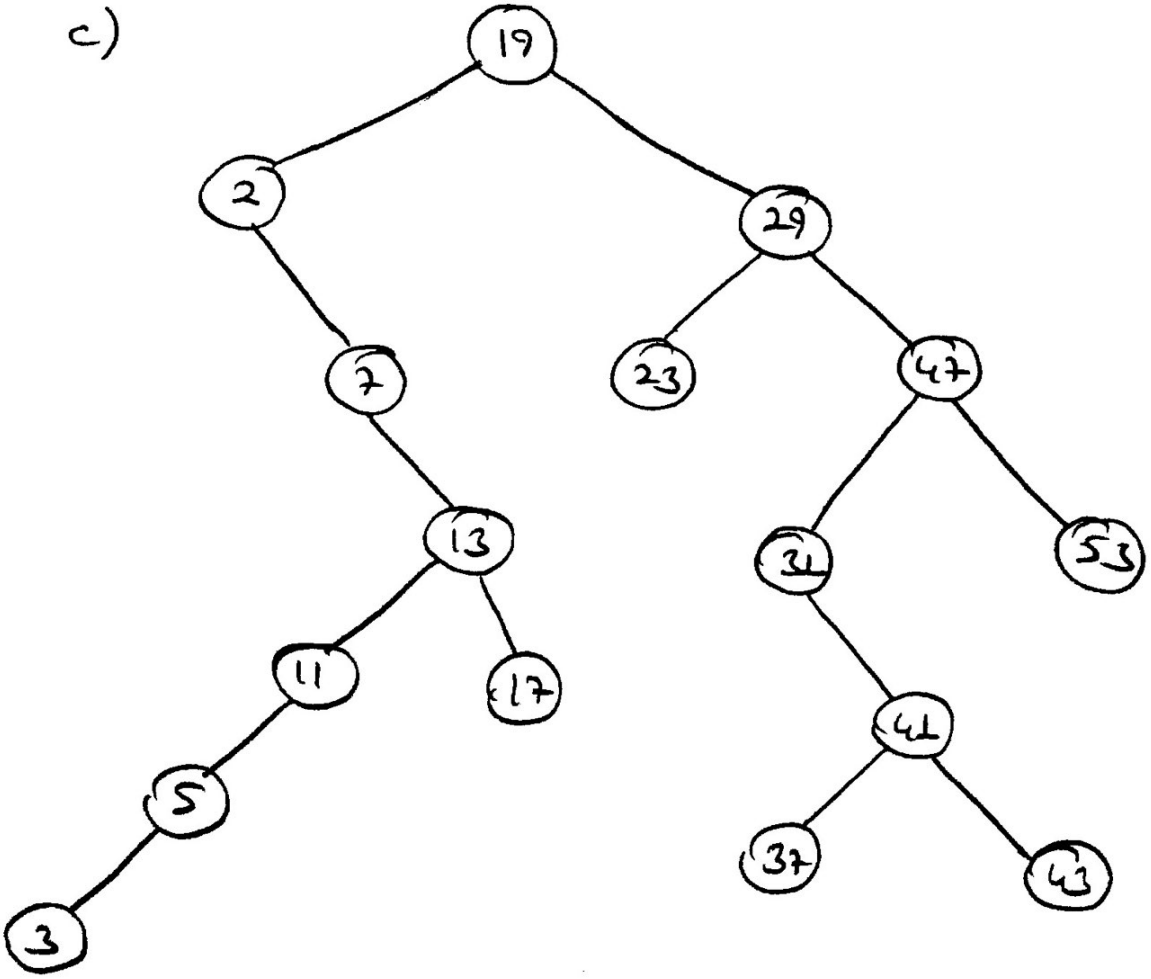


* Delete 50



(Resulting tree after deletions)

c)

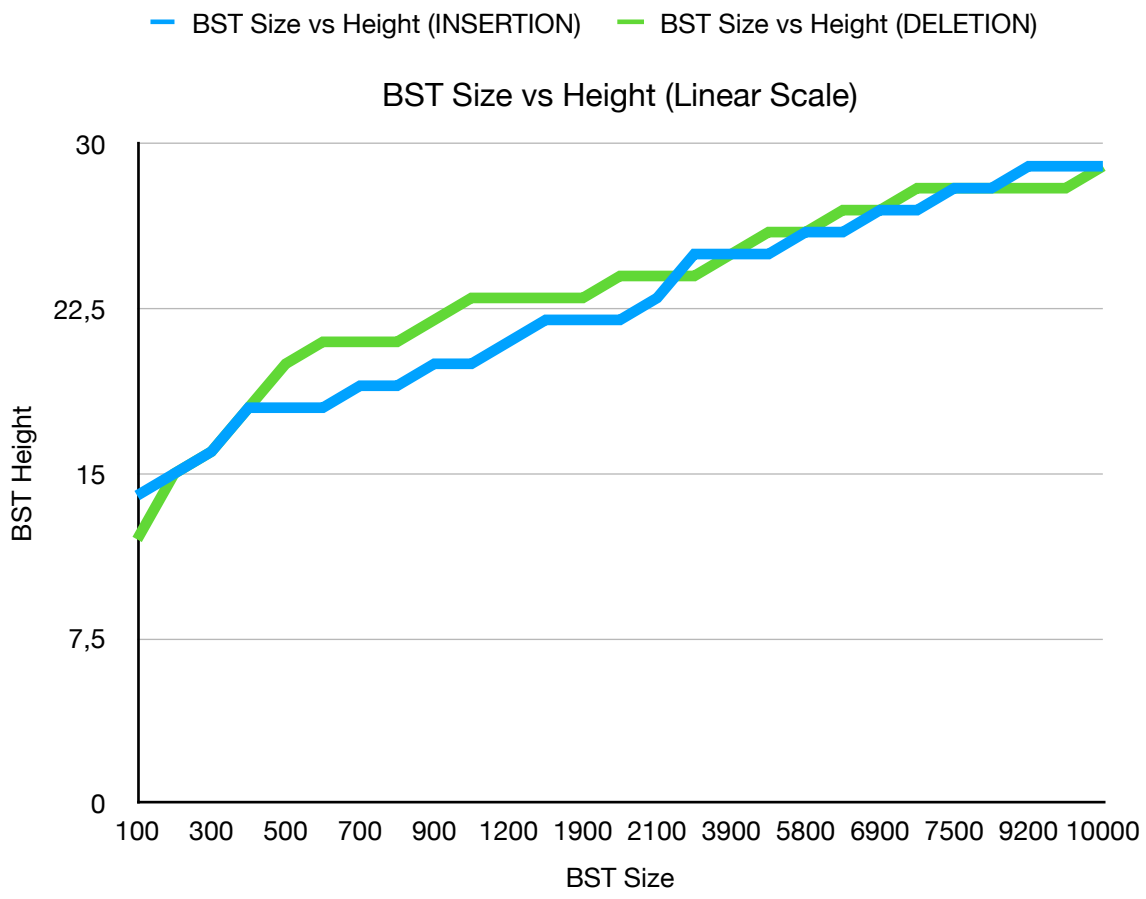


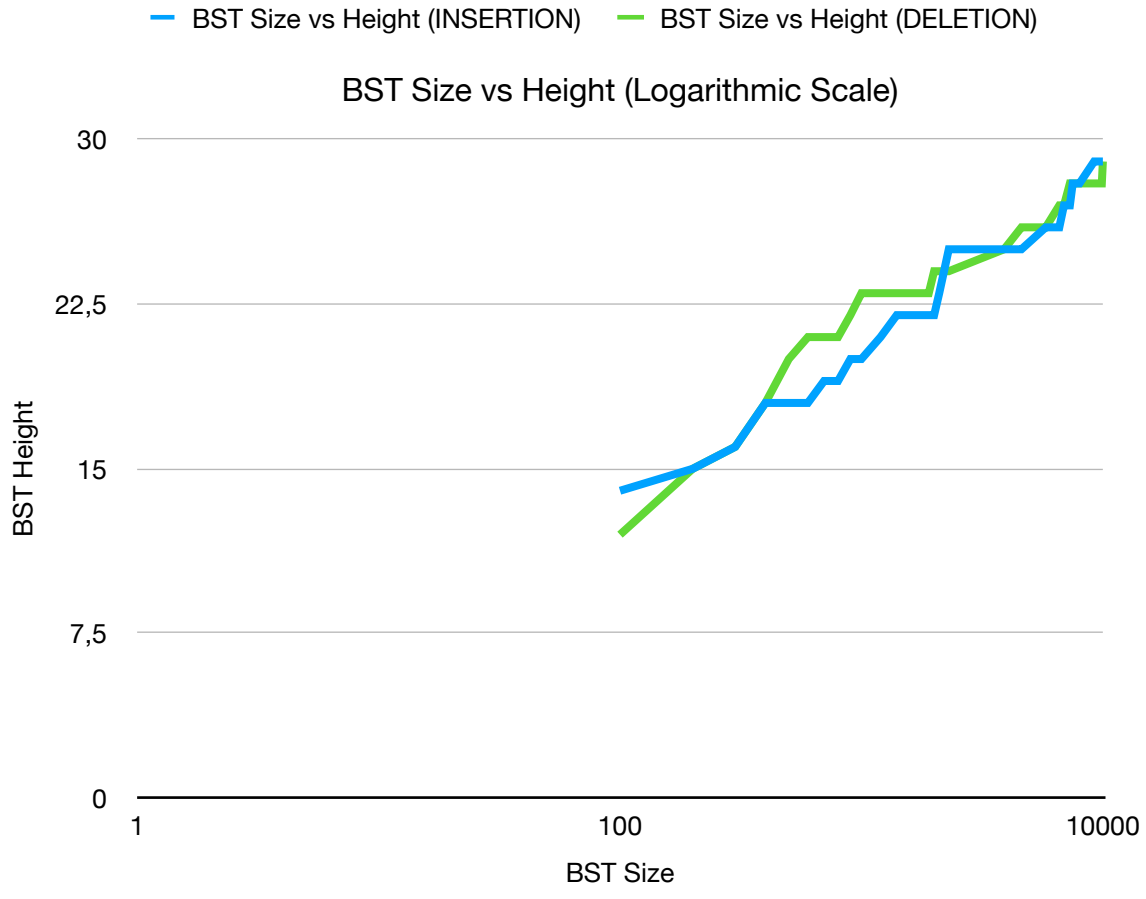
Preorder Traversal

↳ 19 - 2 - 7 - 13 - 11 - 5 - 3 - 17 - 29 - 23 - 47 - 31 - 41 - 37 - 43 - 53

(8)

Question 3


BST Size vs Height (INSERTION)
BST Size vs Height (DELETION)
BST Size vs Height (Linear Scale)
30
22,5
15
7,5
0
BST Height
100 300 500 700 900 1200 1900 2100 3900 5800 6900 7500 9200 10000
BST Size


BST Size vs Height (INSERTION)
BST Size vs Height (DELETION)
BST Size vs Height (Logarithmic Scale)
30
22,5
15
7,5
0
BST Height
1
100
10000
BST Size

Comments:

- For the change of binary tree height with tree size, the expectation is that the height of the tree changes proportionally to the logarithm of tree size.
- Graphs demonstrate that the tree height changes proportionally to the logarithm of tree size. However, there are some deflections, too. The reason is that binary search tree cannot be always a full binary tree. So, some levels on the tree may not be full.
- For the insertion and deletion results, since we shuffled the array and changed the insertion and deletion order of the items, we cannot expect to get same graph. That is why, insertion and deletion charts somehow differs from each other. It is also the result of that binary search tree is not always full and height of the binary tree is affected by deletion and insertion order.