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CS 335
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Lab 1

#1a

A binary search tree can act as an effective hash map as the lookup and insert speed of a binary search tree is fast, which is key to a hash map's performance. The other advantage is that when a hash map is implemented through arrays, when the array is full, the array has to be resized and the items need to be reinserted into the new array. This could be potentially a costly operation, but when a binary search tree is used, this problem could be avoided. Additionally, a binary search tree is more efficient with space and there are not any empty items like in an array.

#1b

[Picture of the solution in the next page]

a)


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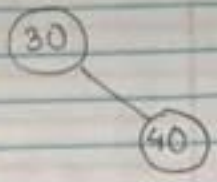
b)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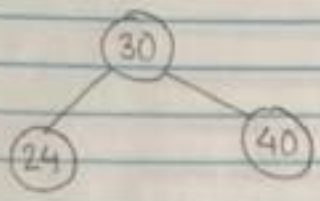
c)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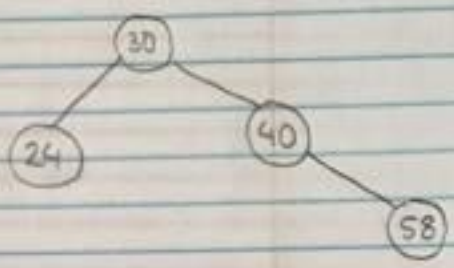
d)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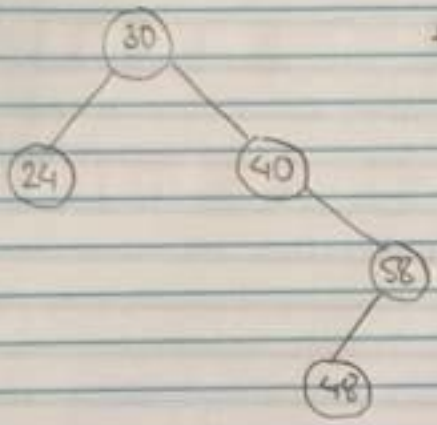
e)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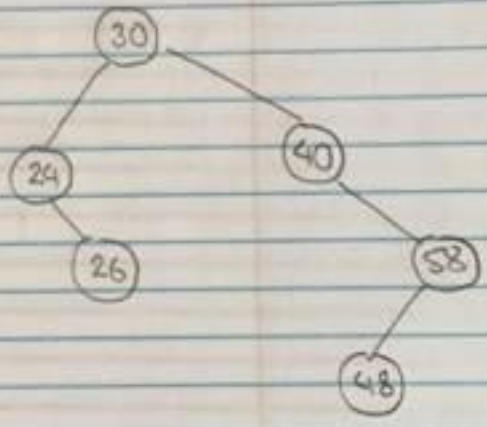
f)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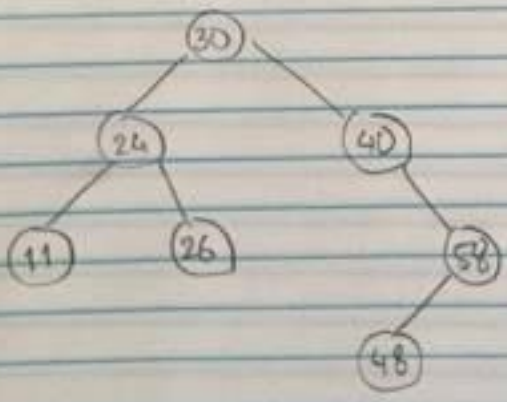
g)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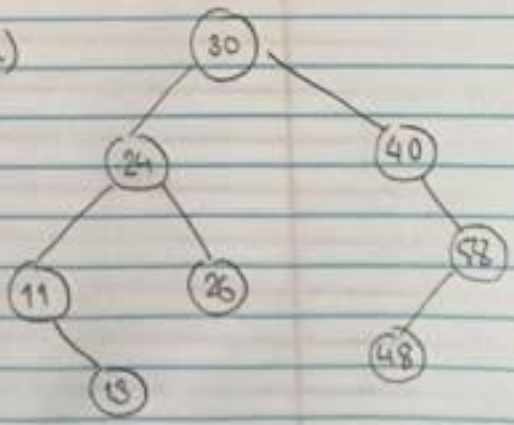
h)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#2a

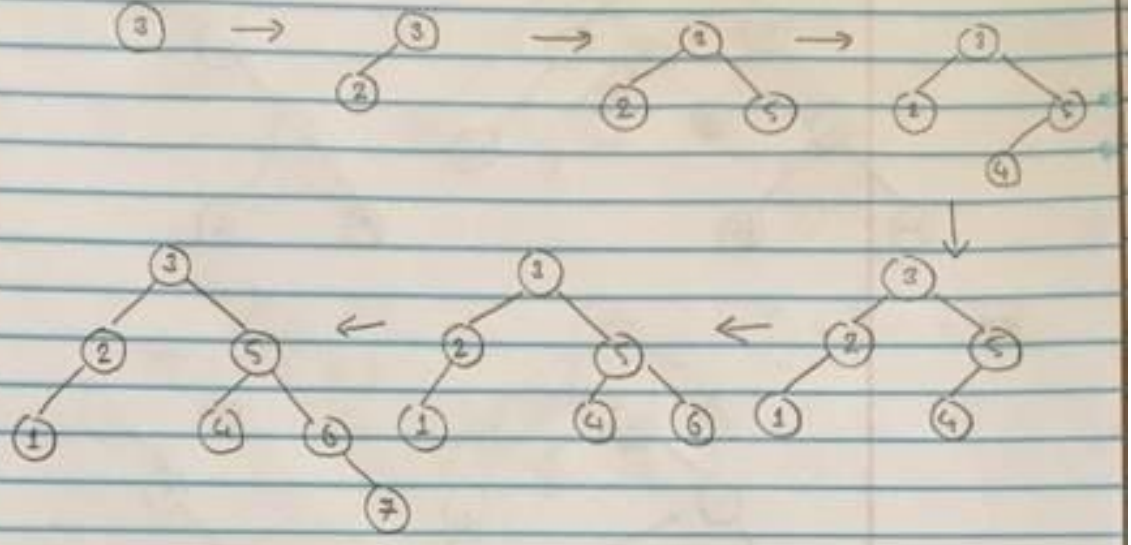
As an AVL Tree is a tree that satisfies that height-balance property, it always guarantees a well balanced tree in contrast to a Binary Search Tree that never does rebalancing. This means that the height of the tree will be small, guaranteeing that all operations are O(log n) in average and worst cases. Operations such as finding, inserting, deleting etc., will be much faster in an AVL Tree.

The disadvantage could be that the deletions could be more expensive because of the extra steps compared to a simple BST.

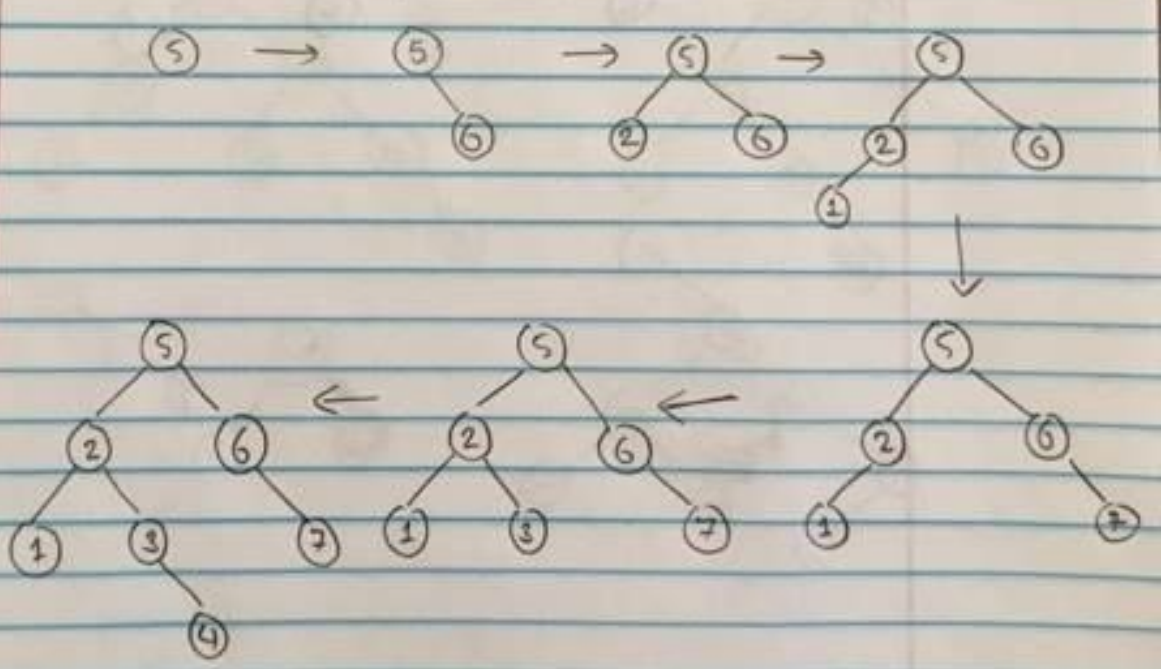
#2b

Yes, the order does matter. Let us look at the examples in the next page where the order of the same elements results in two different AVL Trees.

Order 1: 3, 2, 5, 4, 1, 6, 7



Order 2: 5, 6, 2, 1, 7, 3, 4



#3

With my use case, I have used the Binary Search Tree and the AVL Tree implementations to create a hash map. The map represents the jersey number and the names of the players of my favorite soccer club Chelsea FC.

I have an array that is holding the names of the players in increasing order of their jersey numbers. Hence, when I insert them into the trees, they are inserted in order, with the key representing the jersey number and the value representing the player's name.