6 Appendices

Appendix A: Rebuilding a Tree

So you want to know how to rebuild a tree, eh? The quick and easy way is to buy some saplings and replant them. The much harder way is by using the following process. Let us take the following in-order and pre-order traversal.

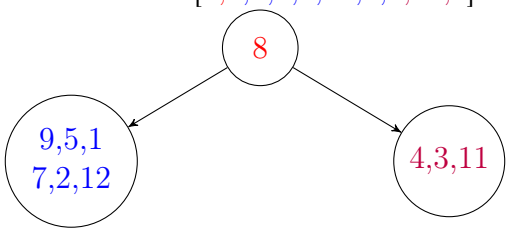
In-Order: [9,5,1,7,2,12,8,4,3,11]
Pre-Order: [8,5,9,7,1,12,2,4,11,3]

So the first step is to recognize that the Pre-Order traversal will always start with the root of the orignal tree.

In-Order: [9,5,1,7,2,12,8,4,3,11]
Pre-Order: [8,5,9,7,1,12,2,4,11,3]

We know that the in order traversal will visit nodes in the order of ***Left, Root, Right***. Which means that all the values to the left of the root will be the contents of the left subtree and that all the values to the right of the root will be the contents of the right subtree. We can also notice that the these values will be grouped together in both the Pre-Order and In-Order lists.

In-Order: [9,5,1,7,2,12,8,4,3,11]
Pre-Order: [8,5,9,7,1,12,2,4,11,3]



Now if you look at the original traversals, we have sublists which represent each subtree. That means the In-Order and Pre-Order traversal of the left subtree is [9,5,1,7,2,12] and [5,9,7,1,12,2] respectively. This also means the In-Order and Pre-Order traversal of the right subtree is [4,3,11] and [4,11,3] respectively.
If you are having a hard time visualizing it, here is everything split up.

Root: 8

Left Subtree	Right Subtree
In-Order: [9,5,1,7,2,12]	In-Order: [4,3,11]
Pre-Order: [5,9,7,1,12,2]	Pre-Order: [4,11,3]

Again we know that the Pre-Order Traversal always starts with the root so the root of the left subtree is 5 and the root of the right subtree is 4.

In-Order: [9,5,1,7,2,12,8,4,3,11]
Pre-Order: [8,5,9,7,1,12,2,4,11,3]
Or in other words:

Root: 8

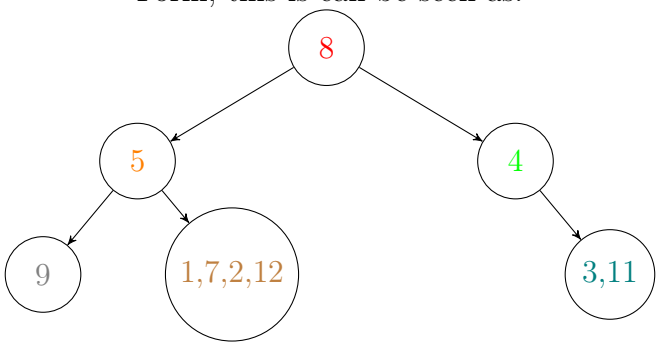
Left Subtree	Right Subtree
Root: 5	Root: 4
In-Order: [9,5,1,7,2,12]	In-Order: [4,3,11]
Pre-Order: [5,9,7,1,12,2]	Pre-Order: [4,11,3]

If we apply the same logic as before we can get the left and right subtrees of the original left subtree. We can also get the left and right subtrees of the original right subtree. Notice that the root of the right subtree does not have any left children.

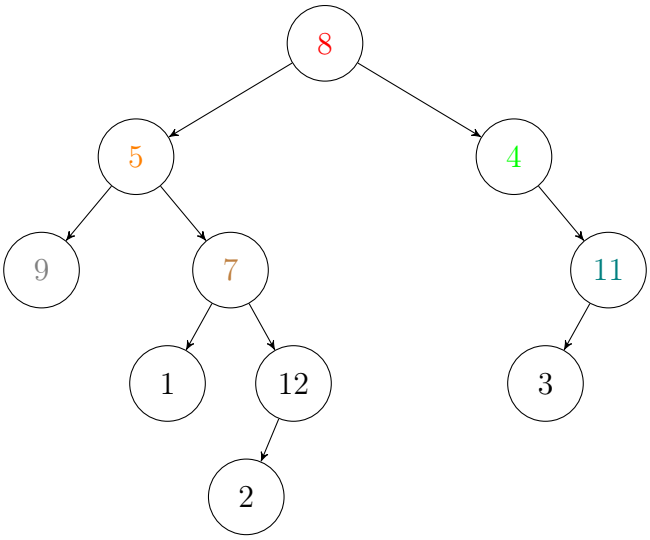
Root: 8
In-Order: [9,5,1,7,2,12,8,4,3,11]
Pre-Order: [8,5,9,7,1,12,2,4,11,3]

Left Subtree		Right Subtree	
Root: 5		Root: 4	
In-Order: [9,5,1,7,2,12]		In-Order: [4,3,11]	
Pre-Order: [5,9,7,1,12,2]		In-Order: [4,11,3]	
Left Subtree	Right Subtree	Left Subtree	Right Subtree
In-Order: [9]	In-Order: [1,7,2,12]	In-Order: []	In-Order: [3,11]
Pre-Order: [9]	Pre-Order: [7,1,12,2]	Pre-Order: []	Pre-Order: [11,3]

In graph Form, this is can be seen as:



I am running out of colors and I believe that I shown the pattern well enough that I will let you finish building this tree on your own. The final tree should look something like:


8
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