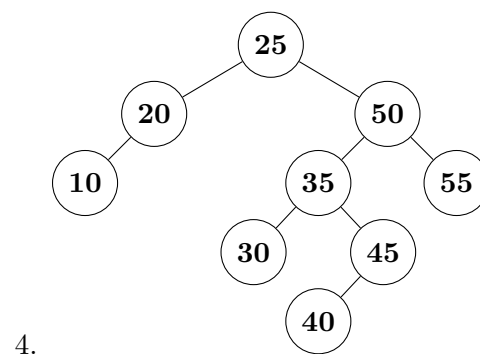
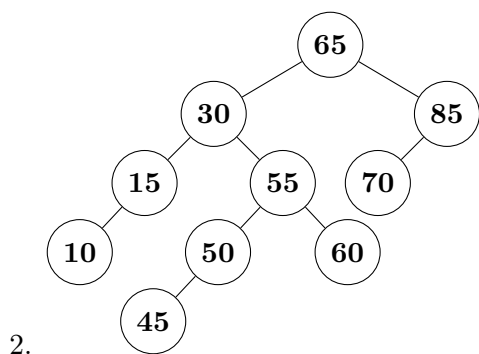
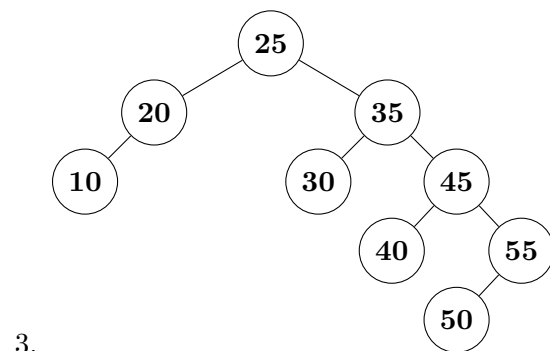
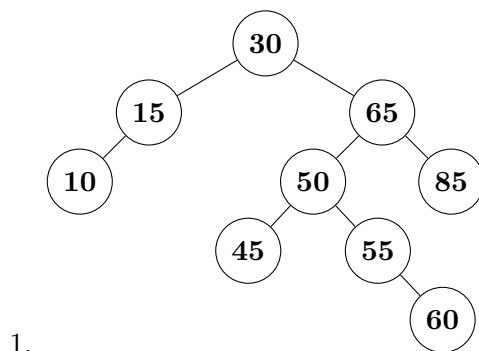


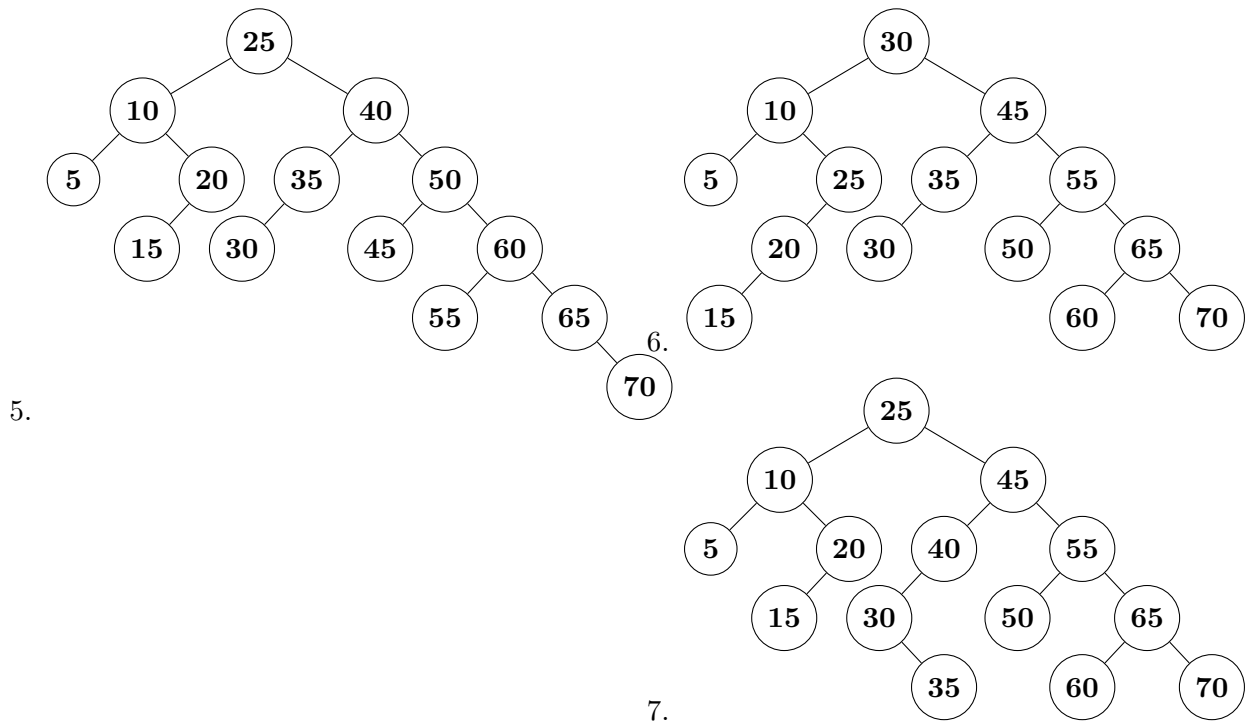
I do not have answers typed for all of these; your best use of these problems is to attempt them and discuss them with your study group; ideally, everyone in the study group will have attempted them individually first. If your answers are the same, this is evidence you are all correct. If they differ, attempt to solve the problem together, discussing how each decision is made. You will likely resolve the discrepancy *and* learn about how these work.

1 AVL Tree Insertions

Consider the following AVL Trees. For each, we are examining it in the middle of the “insert” operation. A Key has been inserted into the tree, but we have not yet performed any rotations. Which key did we just insert?

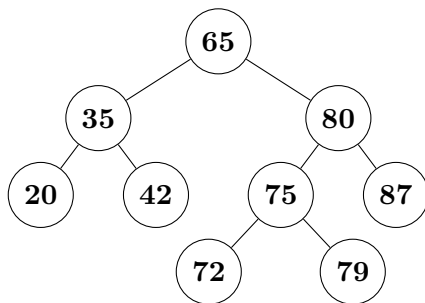
Then, draw what the tree will be after the call to insert finishes. Remember that an AVL insertion potentially has an action other than a simple Binary Search Tree’s insertion step.



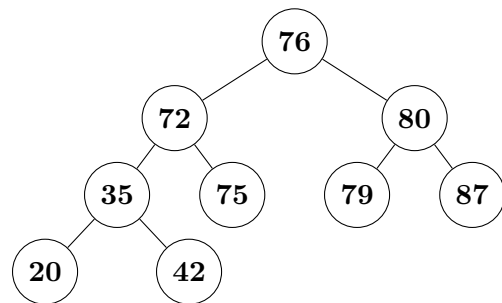


Perform the indicated insertion operations to the given trees.

1. Insert the key 76 into this tree.

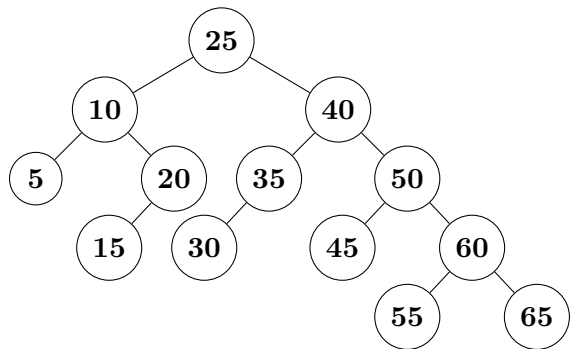
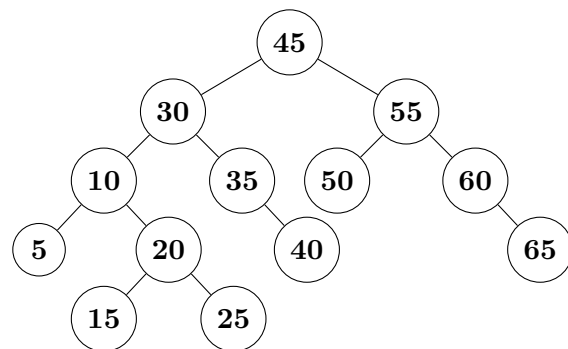
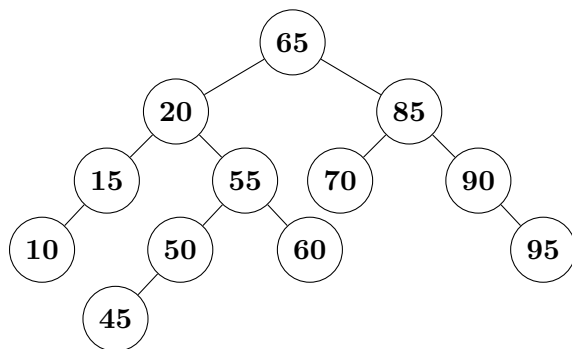
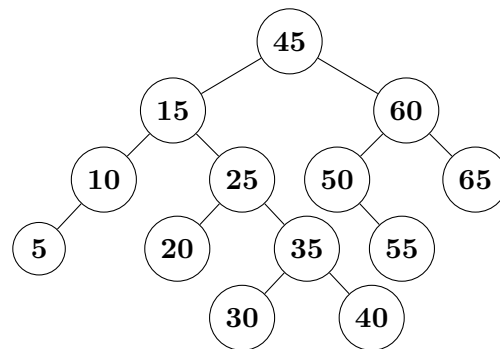
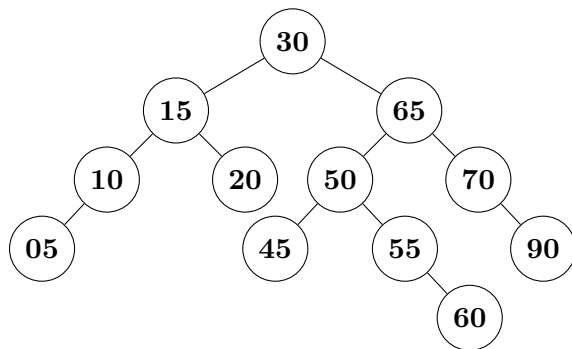


2. Insert the key 65 into this tree.



2 AVL Deletion

Consider the following AVL Trees. For each, which key can I delete such that the delete procedure will require at least two update procedures? *Do not select a node that has two children for your answer.*



3 Traversals

I have a binary tree T (**not** a binary search tree). Each non-nullptr node of T contains a single character. I will provide you with two traversals of the tree; draw the tree and provide the missing traversal.

1.
 - An in-order traversal of the tree reads “FBCDAHG”
 - A post-order traversal of the tree reads “BFDHGAC”
2.
 - An in-order traversal of the tree reads “BCGAHFD”
 - A post-order traversal of the tree reads “BGACFDH”
3.
 - A post-order traversal of the tree reads “MPDTQXA”
 - An in-order traversal of the tree reads “MDPAXQT”
4.
 - A post-order traversal of the tree reads “DPXAMTQ”
 - An in-order traversal of the tree reads “PDQAXTM”
5.
 - A pre-order traversal of the tree reads “MXRTUAQBE”
 - An in-order traversal of the tree reads “RTXUMQAEB”
6.
 - A pre-order traversal of the tree reads “BTAUMREXQ”
 - An in-order traversal of the tree reads “UAMTERXBQ”
7.
 - A pre-order traversal of the tree reads “QRMXTEBAU”
 - An in-order traversal of the tree reads “MRQETXABU”

Additional Practice Questions

Reinforcement : here are some good exercises to check for understanding. In the textbook of Goodrich/Tamassia, consider trying R-10.1, R-10.3, R-10.5, R-10.6, R-10.8, R-10.9, R-10.22 (note: use AVL tree, we have not discussed Red/Black trees), R-10.24 (same caveat)

Creativity: C-10.1, C-10.2, C-10.4, C-10.9