

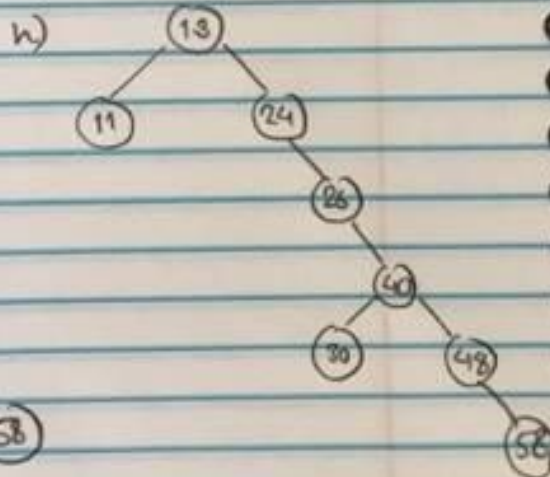
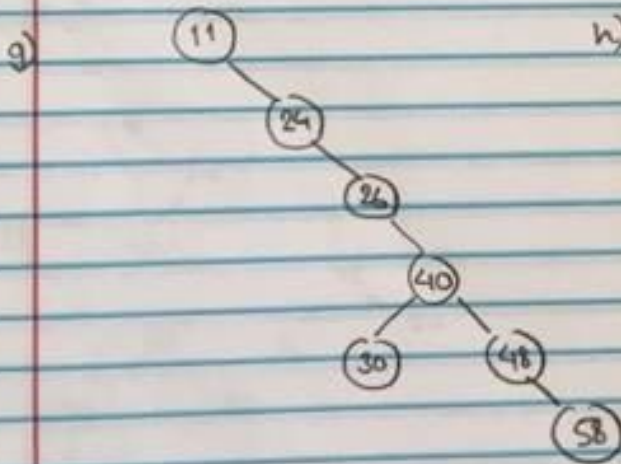
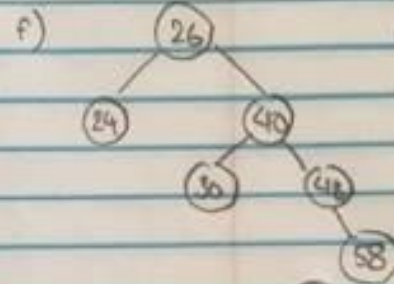
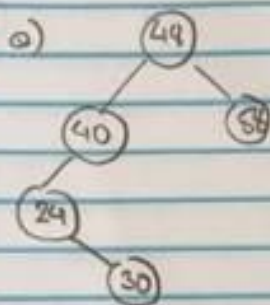
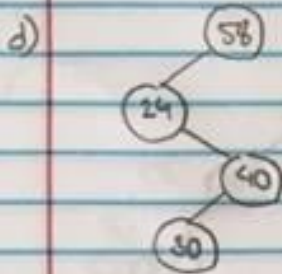
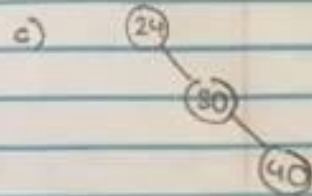
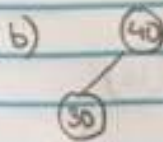
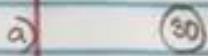
#1a

A splay tree is a binary search tree that has an additional feature called splaying. Splaying is the action of moving a node to the top of a tree via a specific series of operations. Splaying in a splay tree occurs whenever a node is inserted, deleted or accessed. No a splay tree is not always better than an AVL tree. The worst case time for a splay tree is $O(n)$ whereas the worst case time for an AVL tree is $O(\log n)$.

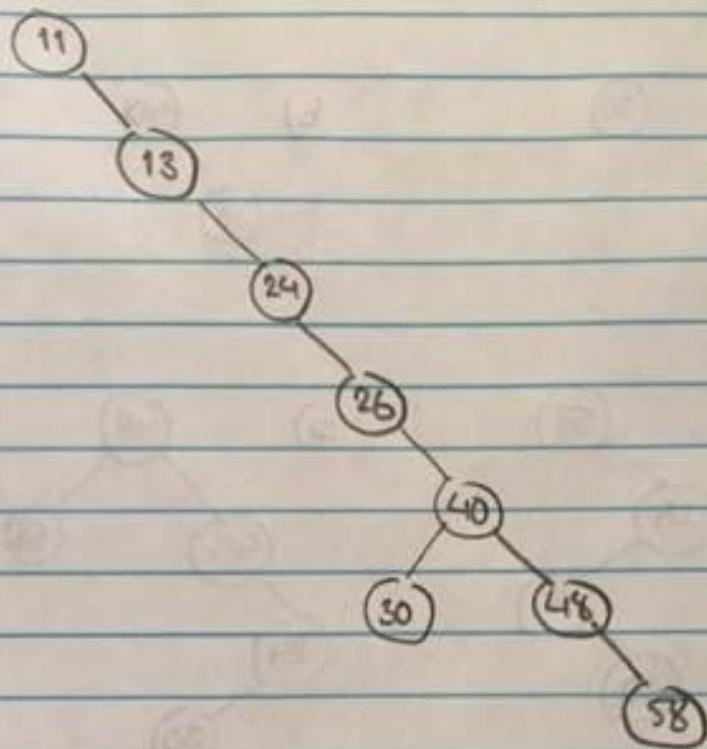
#1b

[Solutions in the next two pages]

30, 40, 24, 58, 48, 26, 11, 13



After the lookup



#2

For this program, I built a BST, AVL Tree and a Splay Tree, filling them up as a hash map, with integers from 0 through 799. I time the insertion process for each of the tree for these 800 insertions. Then I look up 500 different values, from 50 to 550. I time this as well for each of the trees. Finally I delete all these nodes one by one, which I time as well for each of the three trees.

For the performance, I noticed that in terms of Insertion, BST has the worst time while AVL tree is a little worse off than Splay tree. For looking up, BST again has the worst time while AVL and Splay tree does a much better job. For deletion, BST seems to be much better off than AVL and Splay trees. I believe that this is probably because my insertions have keys that are ascending, which makes a very unbalanced BST. While AVL and Splay both tend to balance the tree, the BST remains unbalanced, making the insertion and looking up time bad compared to the other two.

#3

One of the applications of a splay tree would be a Lexicographic Search Tree (LST). LSTs have alphabets in the nodes. If the node is a square node then it means that it's a terminal node. The edges of the tree can be used to access strings from the tree. When a string is requested, the characters of the string are splayed one by one. As the first character of the string will become the root when a string is accessed, the most frequent accessed strings will be near the root.

Another practical use of splay trees are network routers. In a router, if an IP address has been used, chances are that the same IP address will be used again. Hence, the most commonly accessed addresses will be closer to the top of the tree, making the process of looking them up faster.

Sources:

<http://cs.indstate.edu/~rcheruku/splaytree.pdf>

<https://www.quora.com/What-are-some-practical-applications-of-AVL-trees-and-splay-trees>