AVL TREE

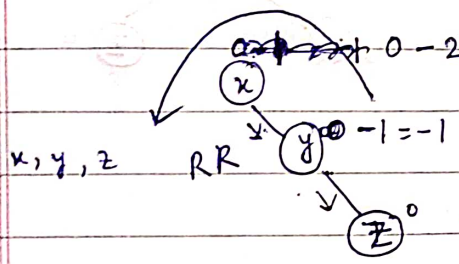
1) It is a ~~BST~~ BST. — Duplicate elements are not allowed.

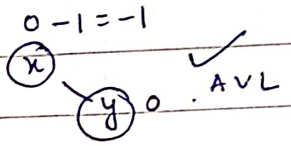
2) height of left subtree − height of right subtree = ~~0~~ {-1, 0, 1}.
↳ Balance Factor

If balance factor = 2, -2, → you have to balance the tree

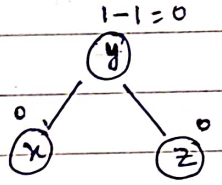
4 - possibilities :—

1)



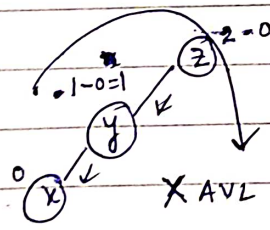


In this case, left rotation is required
middle data will be root



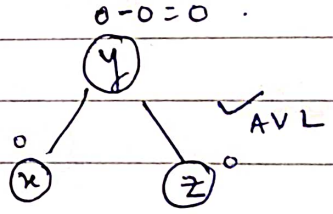
✓ Balanced tree

2) z, y, x.



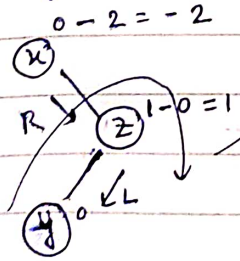
LL

→ not balanced
right rotation is required



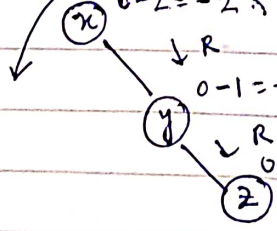
3) x, z, y

RL rotation

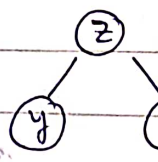


2 rotations required

i) y-z → right rotation
pull z down



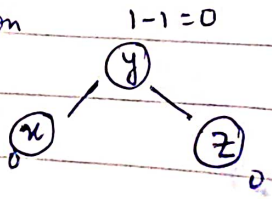
RR.



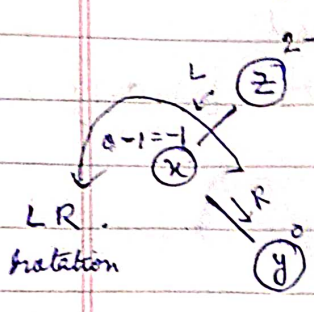
X AVL.

→ Balanced but not BST.
x > z but is on the right

ii) left rotation

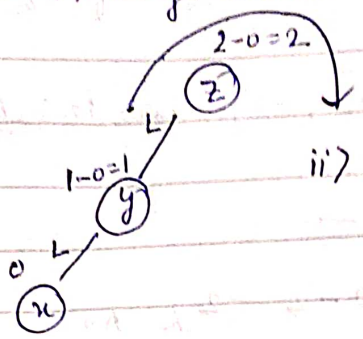


4. z, x, y.



2 rotations required

i) A left rotation

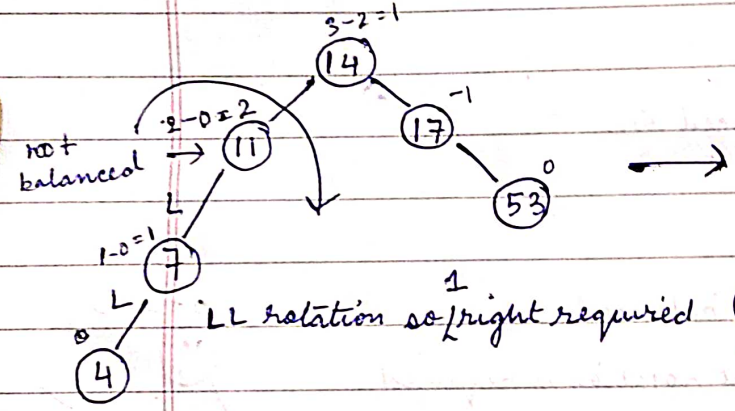


ii) right rotation

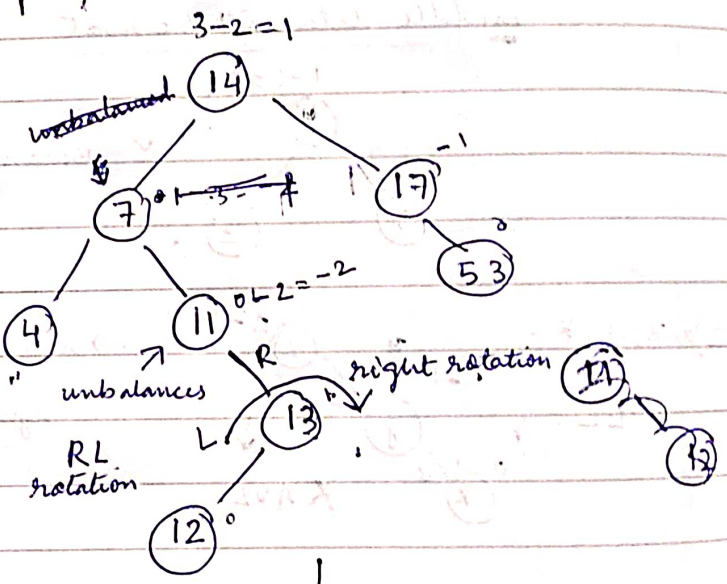
CONSTRUCT AVL TREE BY INSERTING THE FOLLOWING DATA:

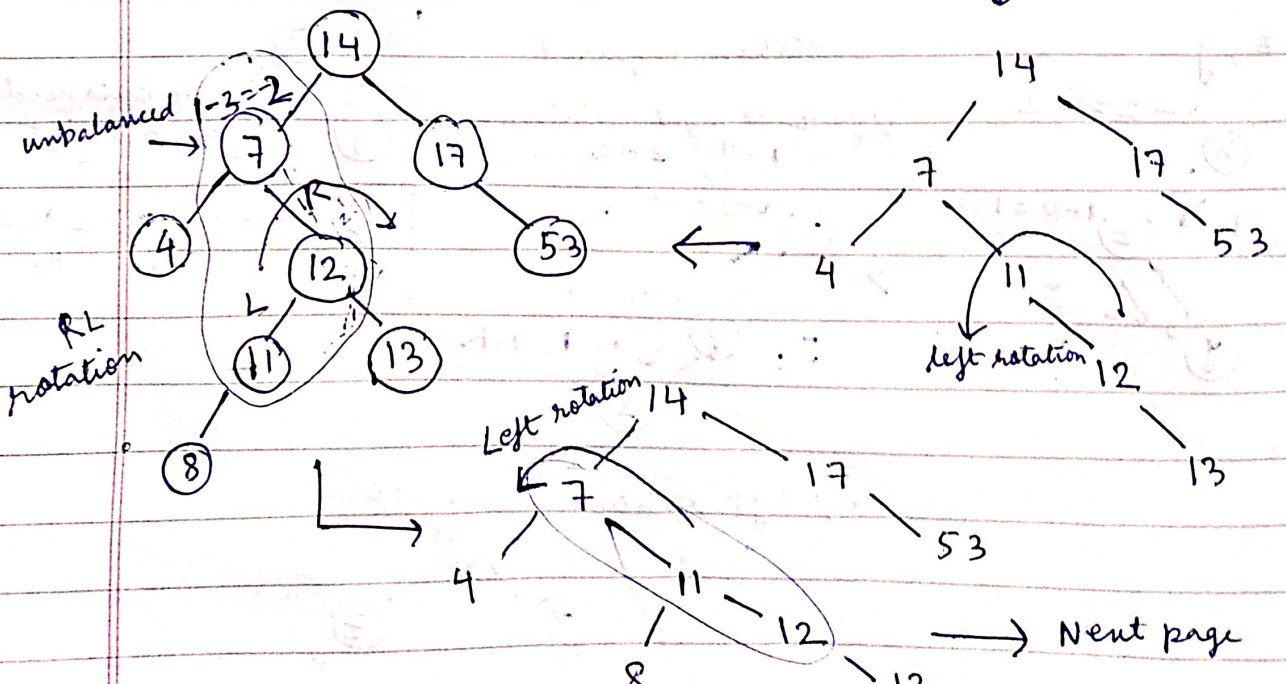
After inserting each & every node check the balance factor.

14, 17, 11, 7, 53, 4, 13, 12, 8, 60, 19, 16, 20



LL rotation so 1 right required





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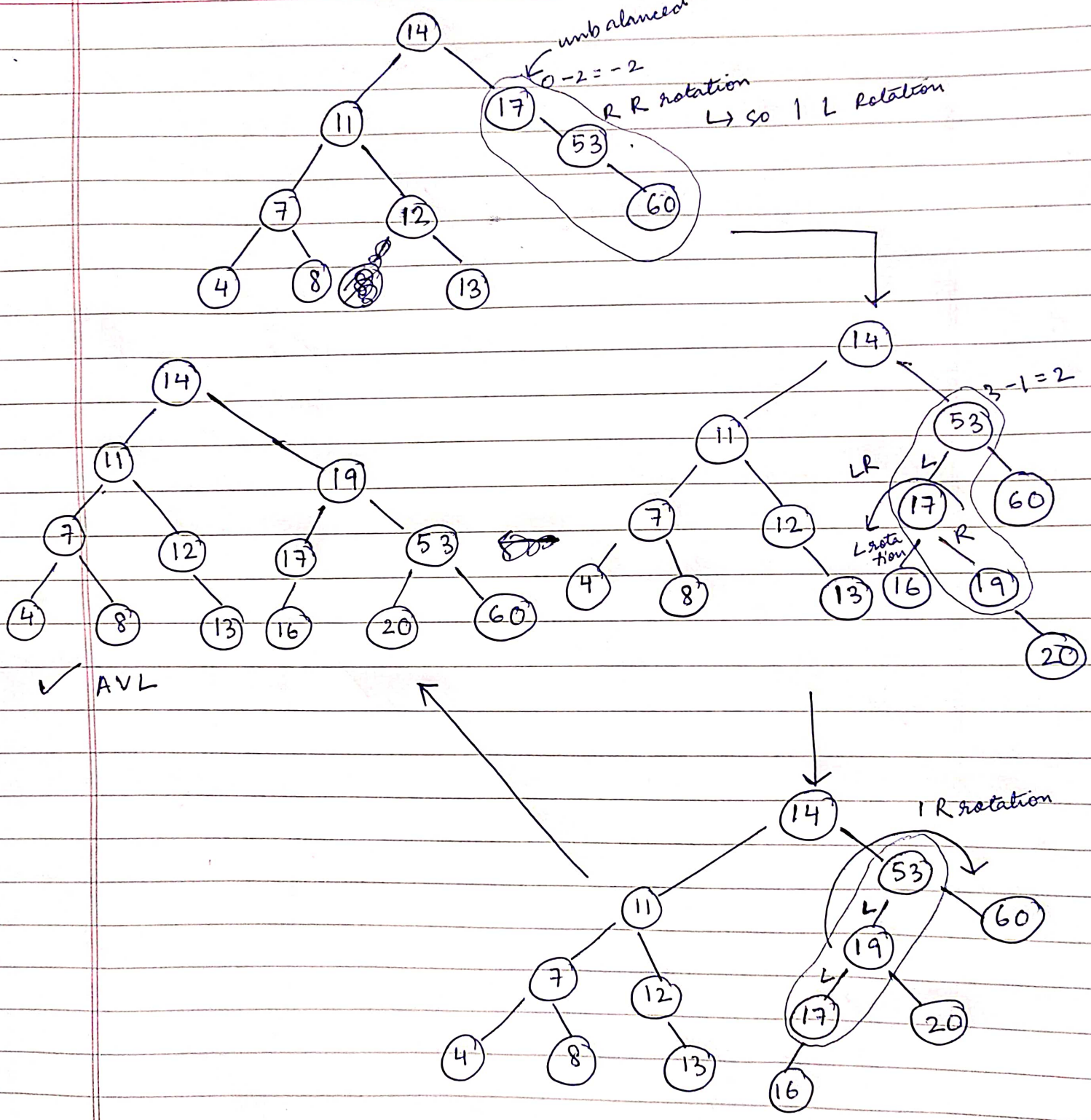
7, 12, 11

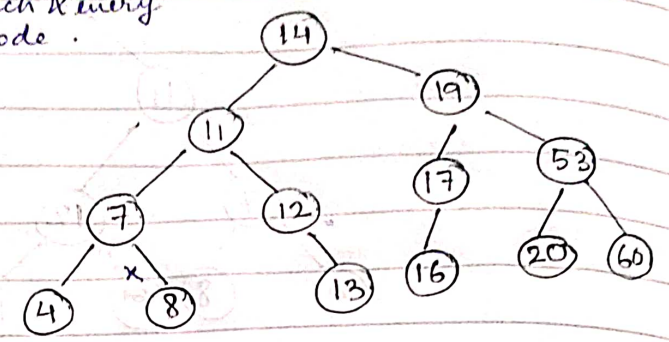
Short cut → median of 7, 12, 11



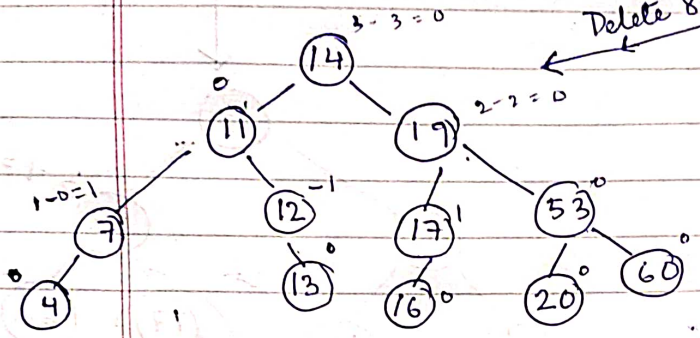
DELETION IN AVL TREE

Deletion would be same as in BST & after deletion, check balance factor of each & every node.

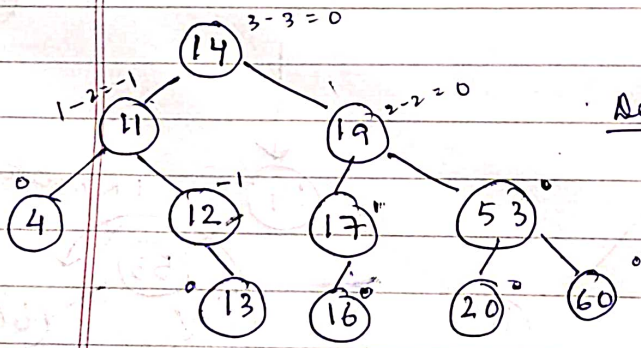
8, 7, 11, 14, 17



Delete 8

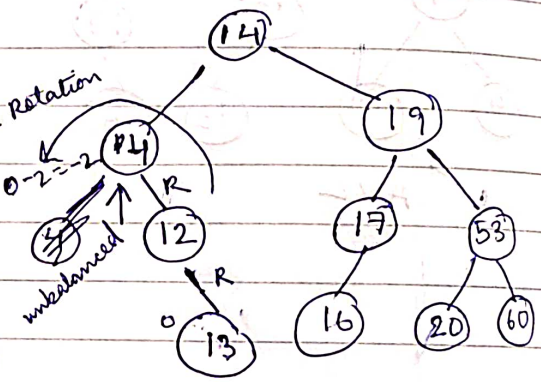


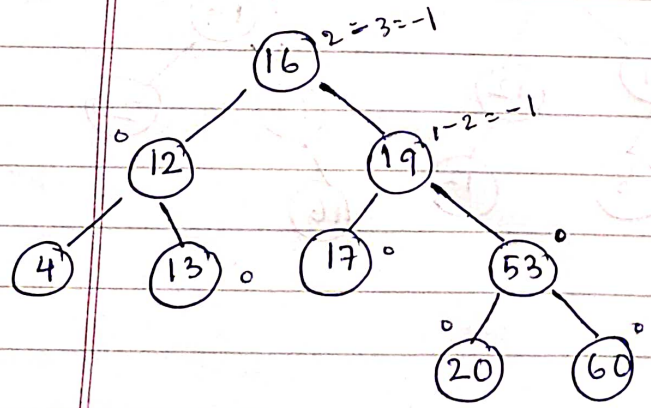
Delete 7 (Replace 7 with its ~~one~~ child 4)



Delete 11

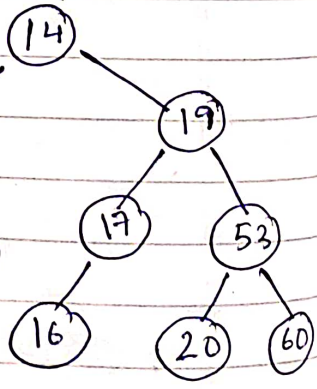
also can be replaced by 12





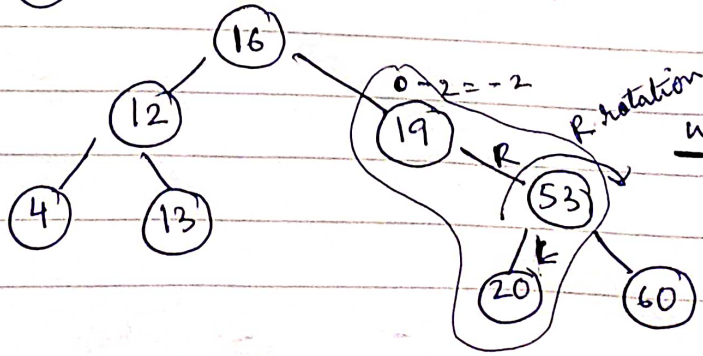
Delete 14

Replace 14 by 16

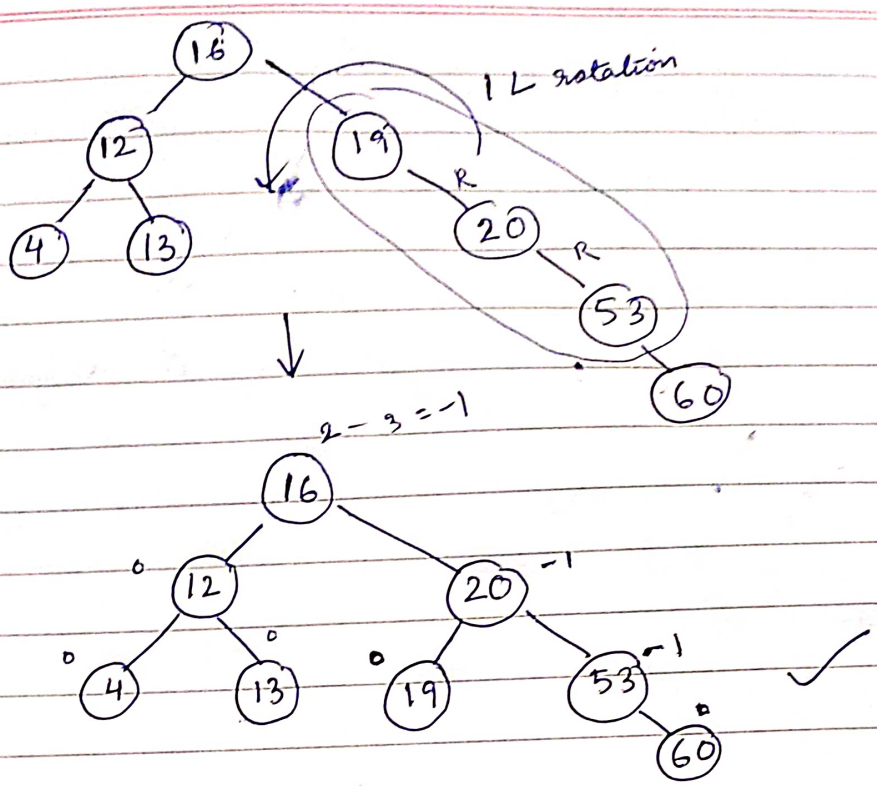


Delete 17

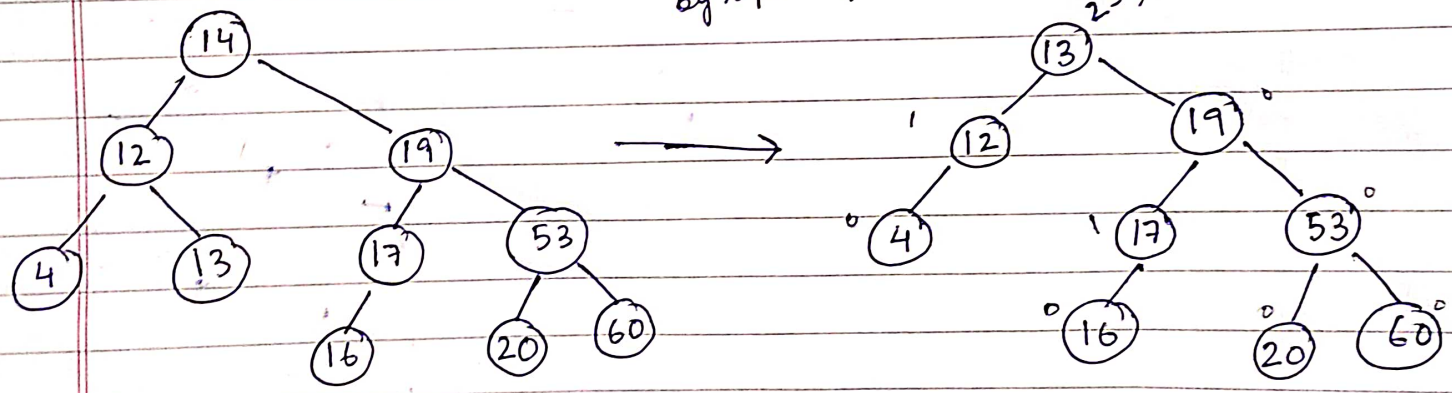
~~Replacing~~



next page



Alternative way to delete 14.
by replacing 14 with 13



Delete 17.