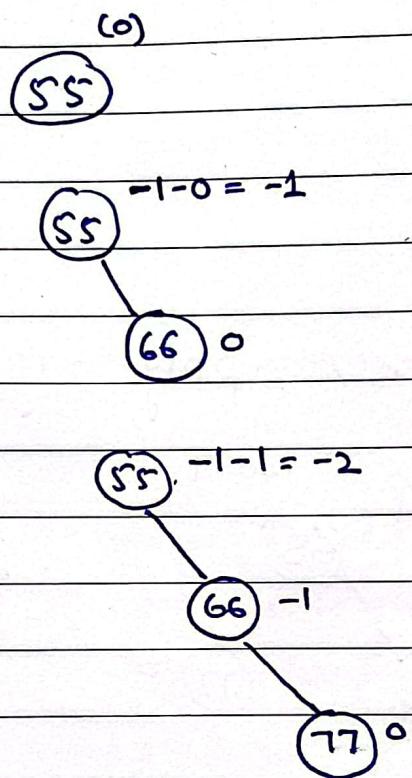


# Insert in AVL

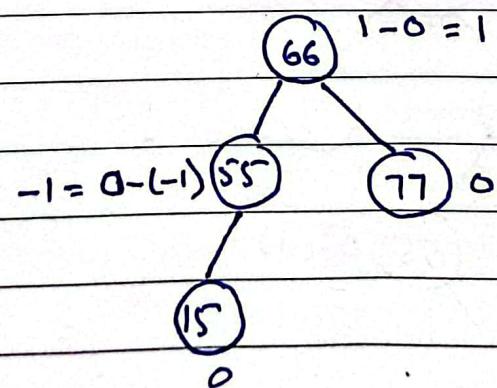
Date: \_\_\_\_\_

Create an AVL Tree using insertion :

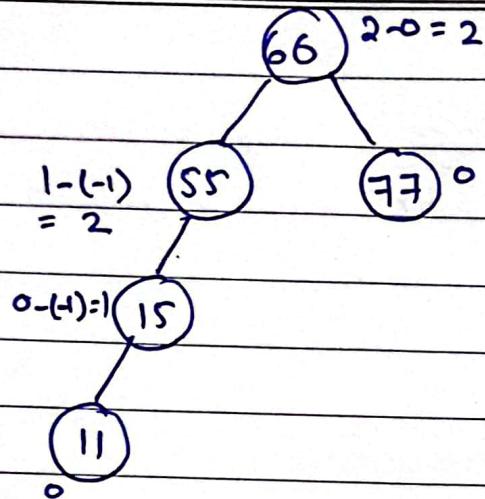
55, 66, 77, 15, 11, 33, 22, 35, 25, 44, 88, 99



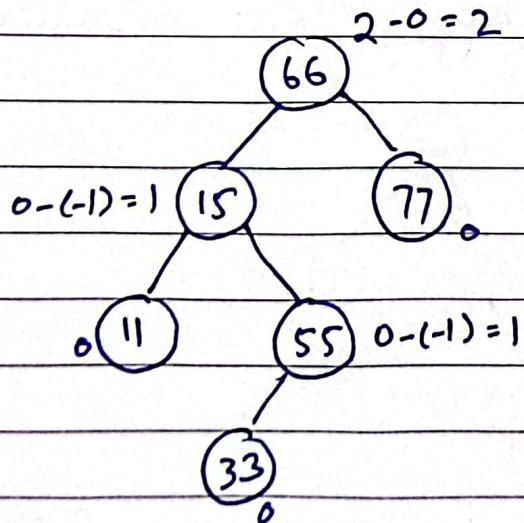
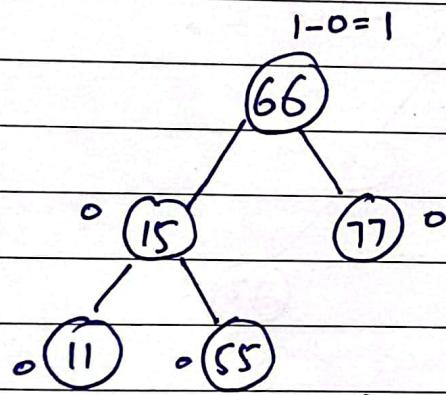
RR Imbalanced, apply left rotation. ~~left~~



Date: \_\_\_\_\_

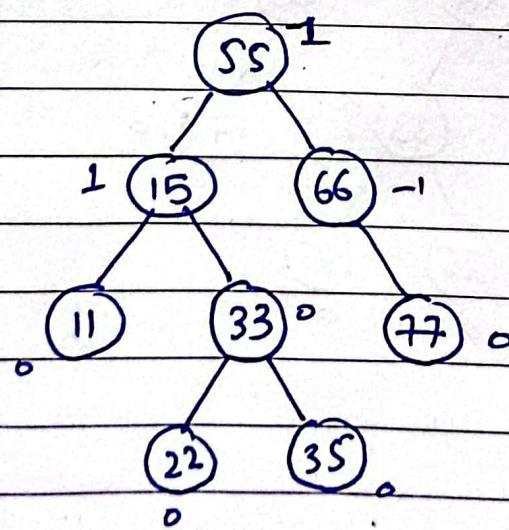
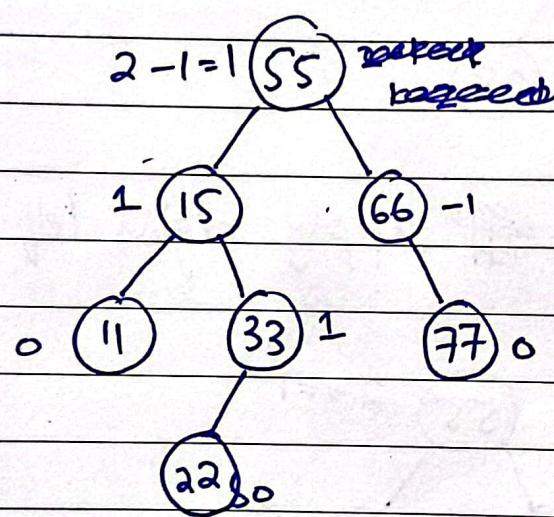
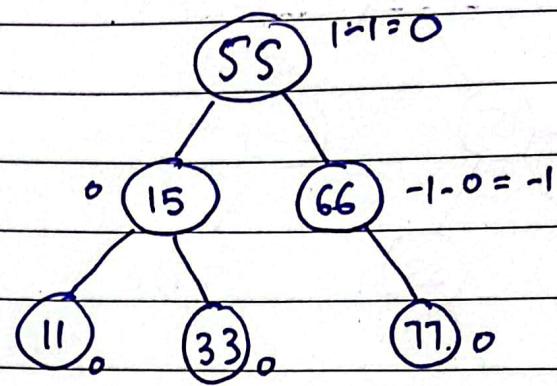


LL Imbalance, apply right rotation.

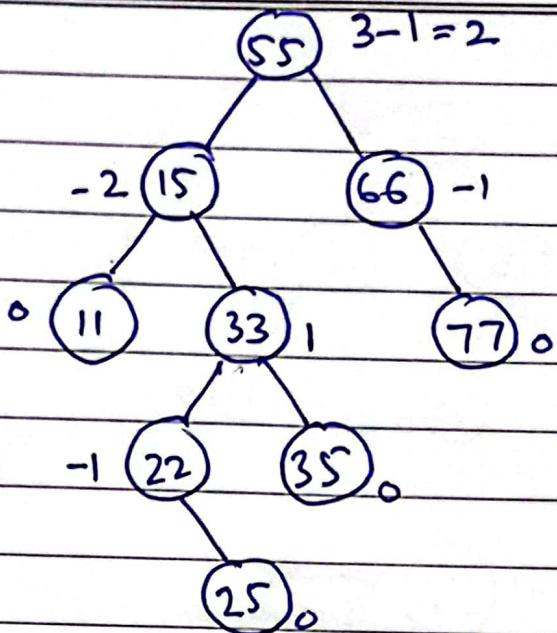


LR Imbalance. apply left right rotation

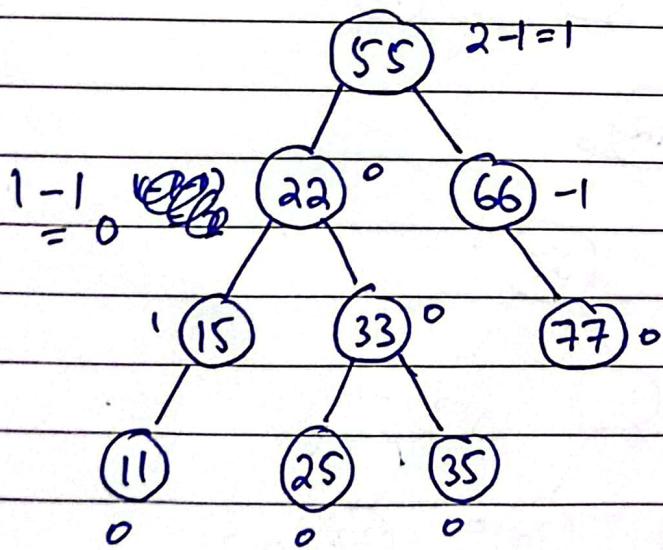
Date: \_\_\_\_\_



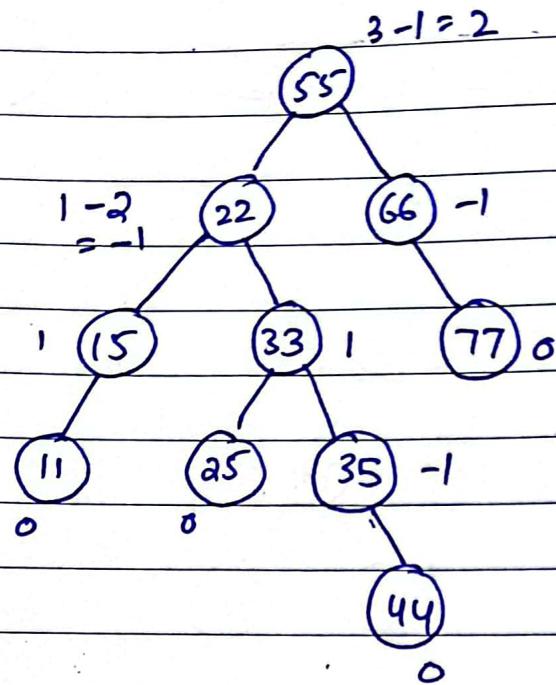
Date: \_\_\_\_\_



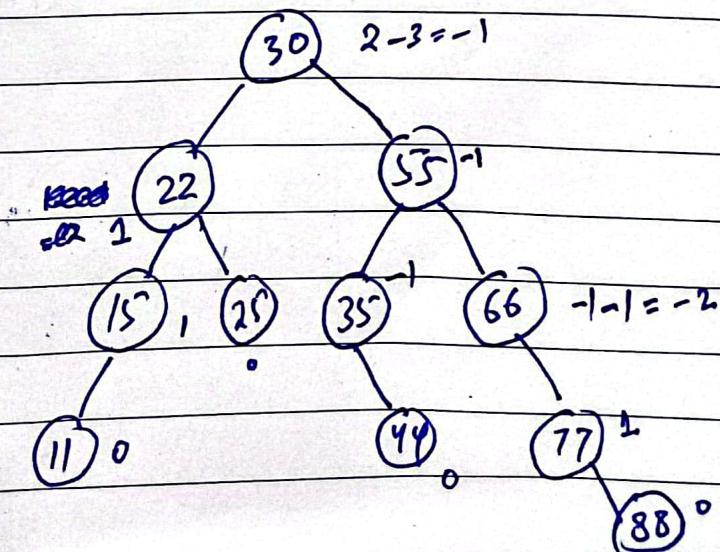
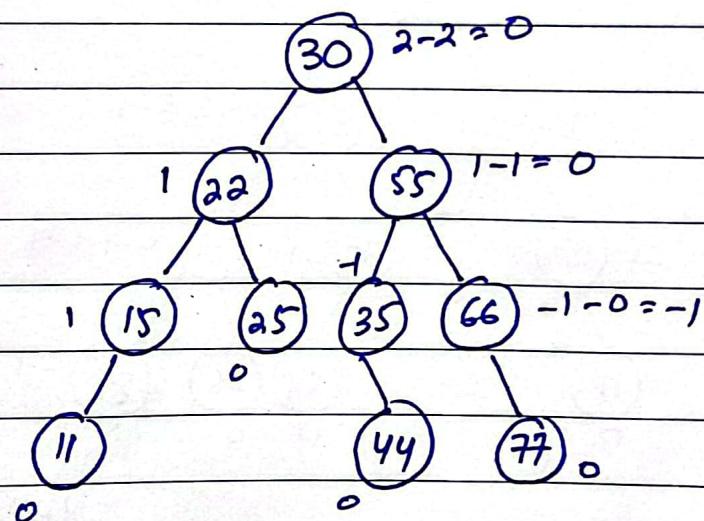
R L Imbalance, ~~not~~ apply right left rotation.



Date: \_\_\_\_\_

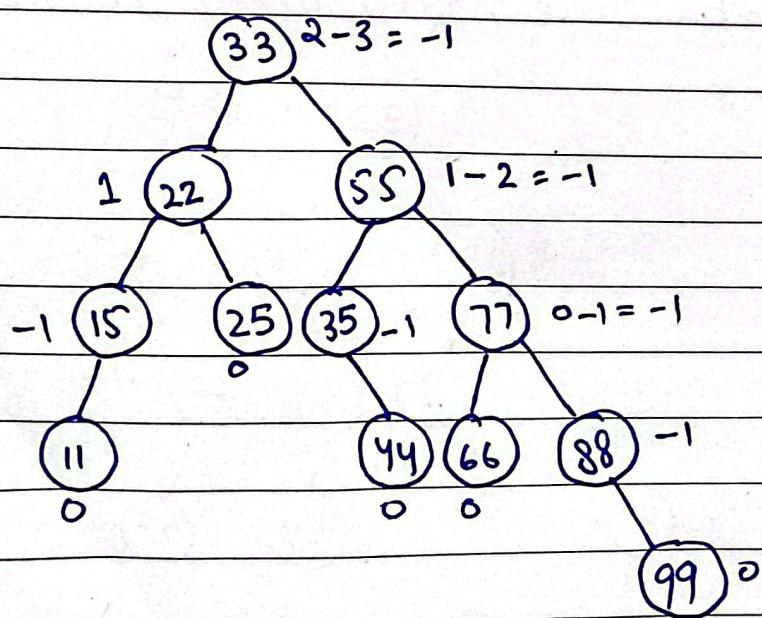
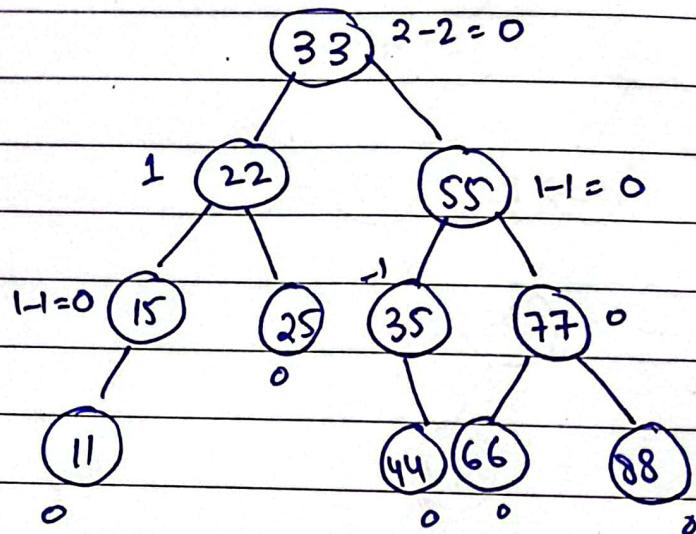


2R Imbalance, apply LR Rotation.



Date: \_\_\_\_\_

## RR Imbalance , Left Rotation .



# Deletion in AVL Tree

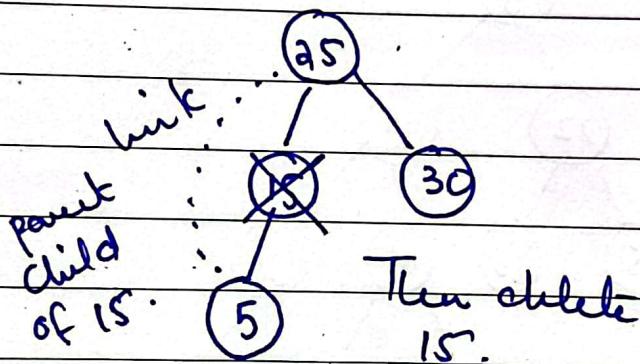
Date: \_\_\_\_\_

Case I : Delete leaf node .

Delete the node .

Case II : Delete Node w/ 1 child .

link the parent node with the child node of the node that needs to be deleted then delete the node .



Case III : Delete Node w/ 2 children .

- a) Find the largest node in Left subtree or ~~smallest~~ smallest node in the right subtree . Replace the node ~~to be~~ with the node to be deleted .

Deletion min or max .

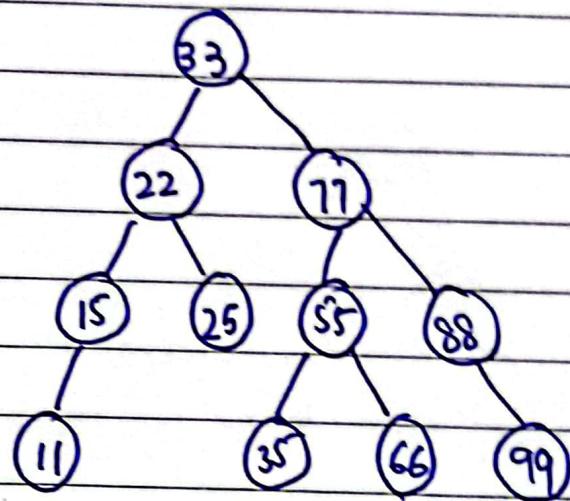
Example :

Date: \_\_\_\_\_

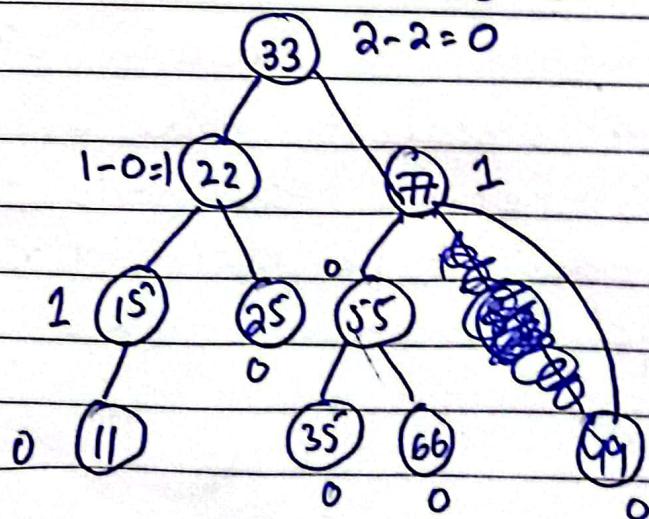
Delete the nodes in following order.  
88, 99, 22, 33.

Solution :-

Deletion is performed the same way as in BST but you have to perform balance factor and rotations if unbalanced after every deletion.



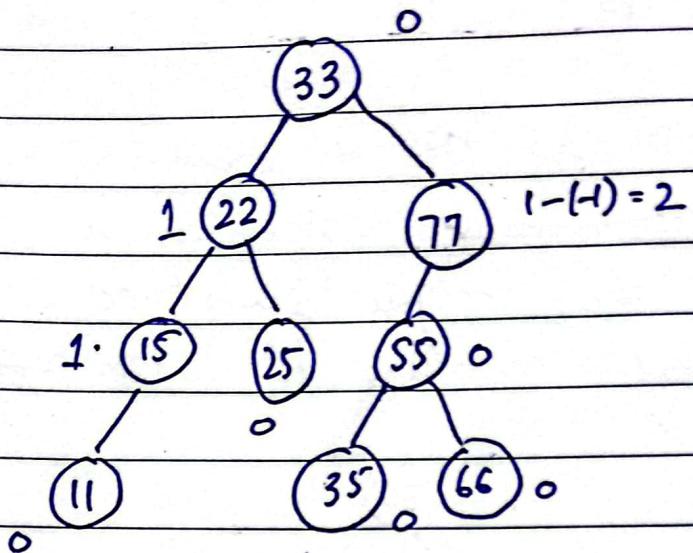
Delete 88. And calculate Balance Factor.



Tree is balanced.

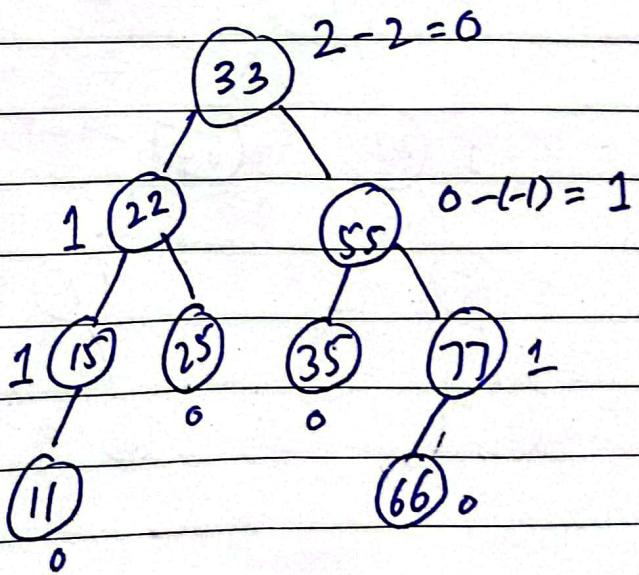
Now delete 99. Calculating B.F

Date: \_\_\_\_\_



This is LL Imbalance as there is no subtree on the right of 77 so we will take the nodes on the left that is 77, 55, 35 and apply rotation.

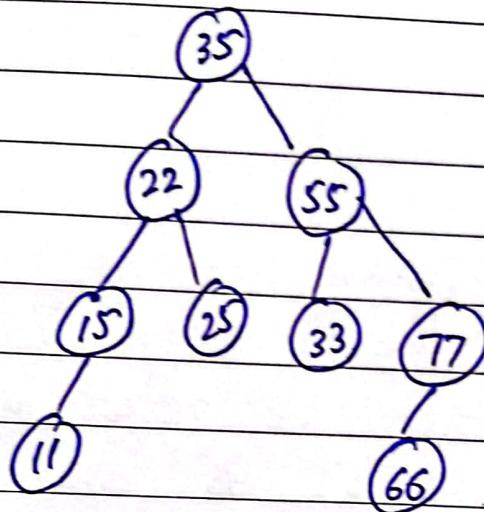
You can also take 77, 55, 66 and apply LR Rotation but LL is easier option.



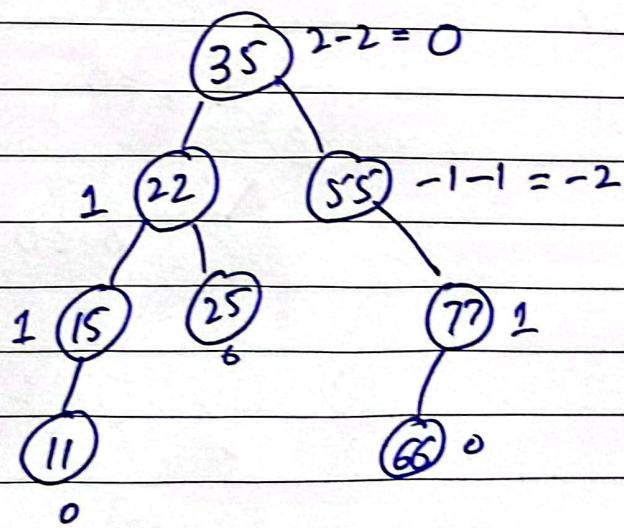
Date: \_\_\_\_\_

Delete 33.

Now 33 has 2 children, so  
find ~~minimum~~ minimum node  
from the right-subtree that is  
35 and replace it with ~~root~~ 33.

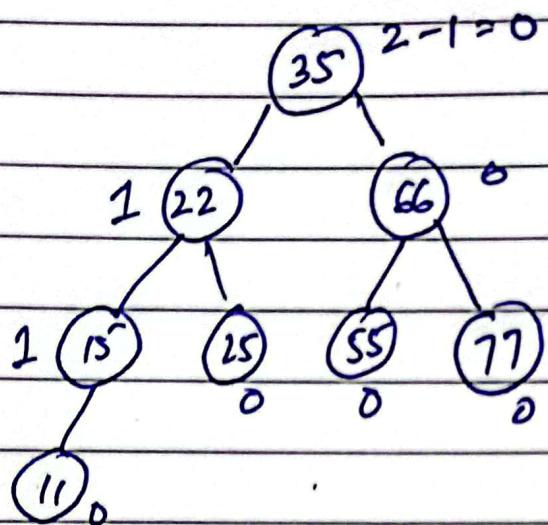


Now delete 33 that is now  
leaf node. and calculate B.F.



Date: \_\_\_\_\_

RL Imbalance . Apply RL Rotation.  
on 55 , 77, 66. Calculate B.F



Balanced!

