Supervisor's Name

Signature & Date

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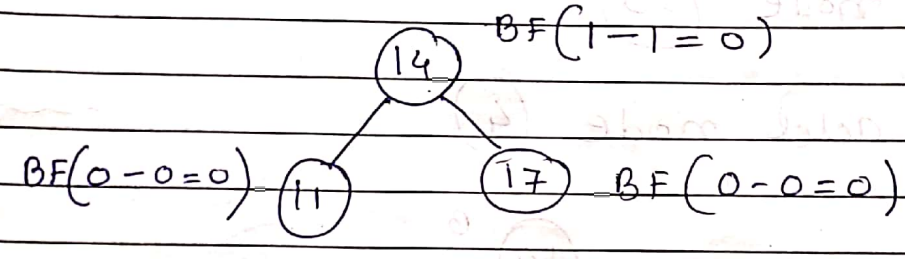
Q.7.b AVL tree

1) LL Rotation (clockwise)
2) RR Rotation (Anticlockwise)
3) Right ~~Rot~~ Left Rotation (clockwise / Anticlockwise)
4) Left Right Rotation (Anticlockwise / clockwise)

Draw AVL Tree

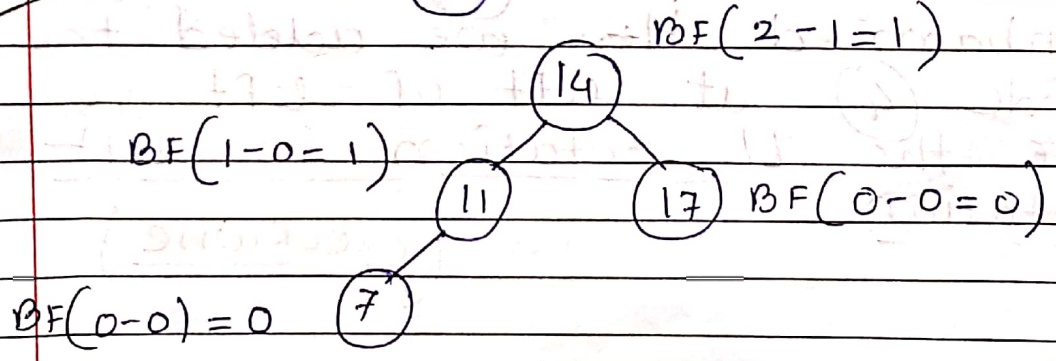
14, 17, 11, 7, 53, 4, 13, 12.



Balance Factor = left height - right height.

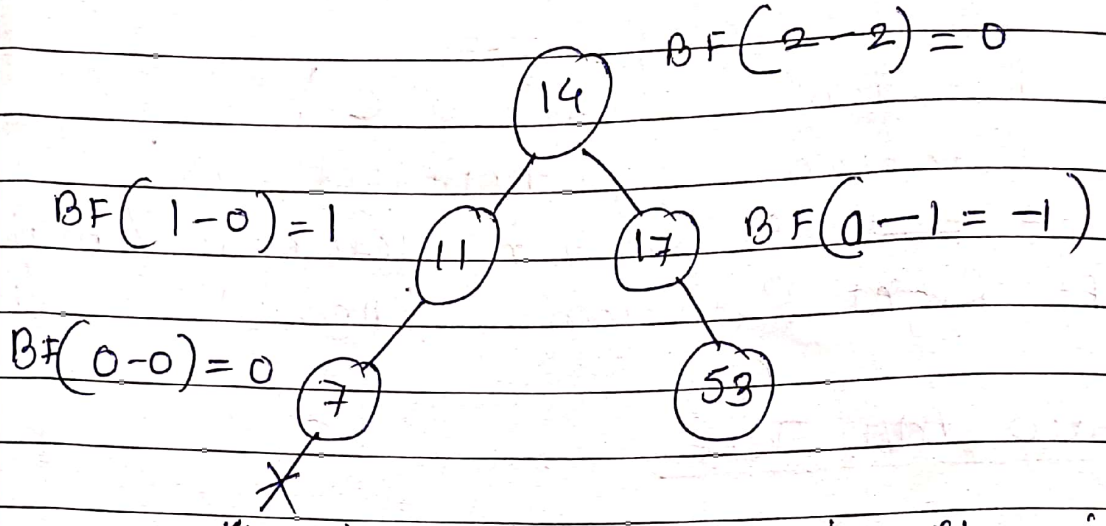
The AVL tree is balance only when the balance factor is 1, 0, -1 otherwise it is unbalaced & to balanced these type of tree we use above 4 rotations.

Now add (7)



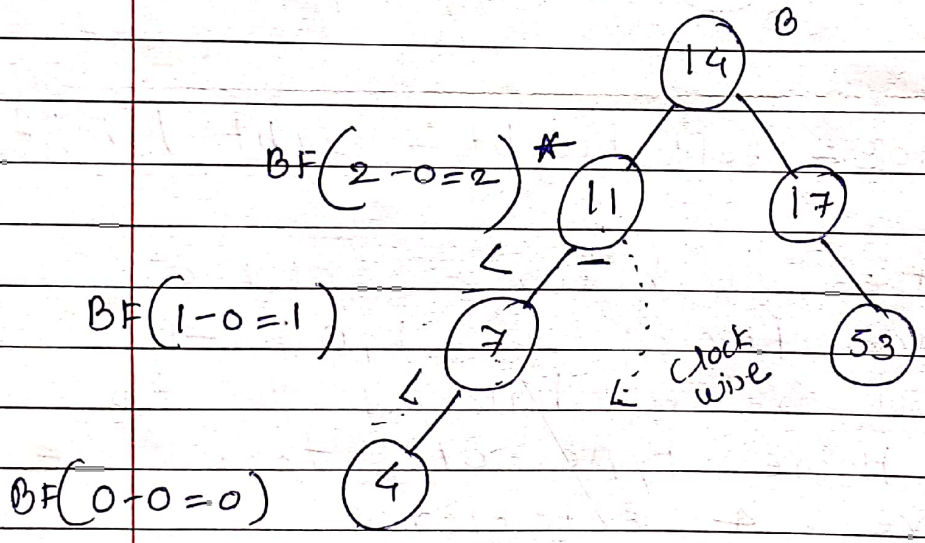
The tree is balanced after inserting the node (7)

Now insert the next node (53)



The tree is balanced after inserting then node (53)

Now added node (4)



So here at node (11) the tree is unbalanced. Here we added the node (4) at left of left so we use the LL rotation i.e left Rotation (clockwise)

(3)

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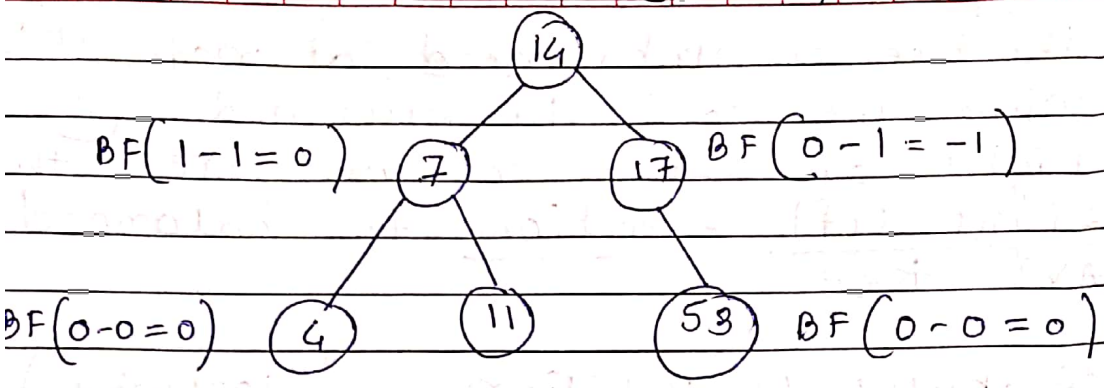
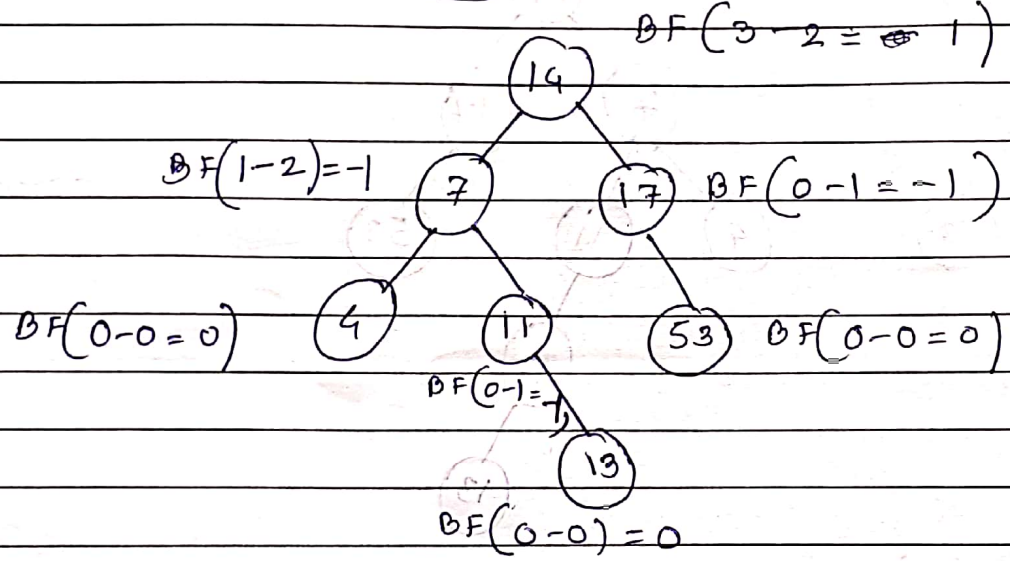


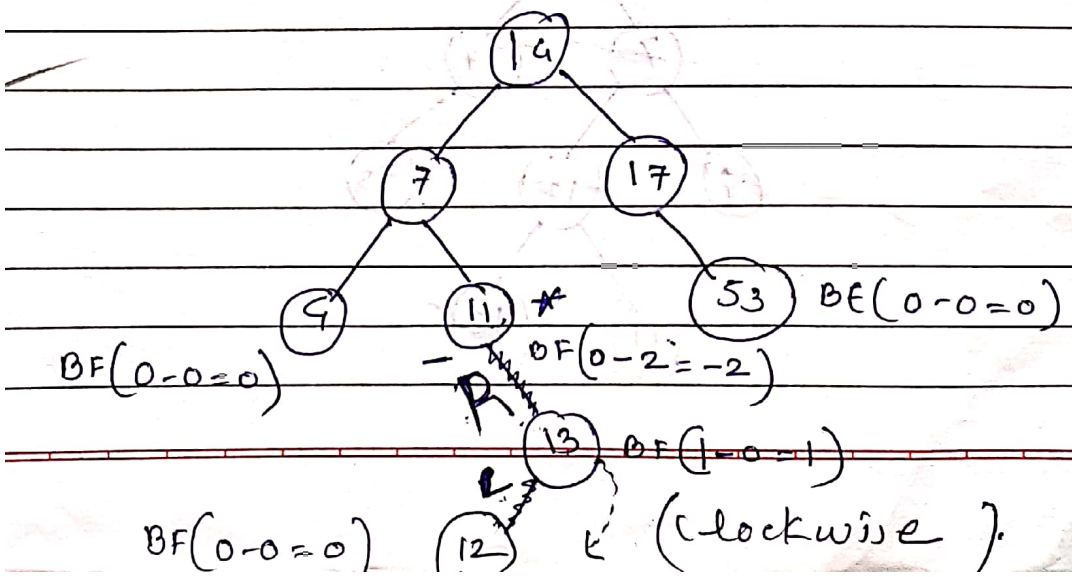
so the tree is balanced.

Now insert (13).



Now again the tree is balanced after inserting Node (13)

Now add Node (12)



(clockwise).

(4)

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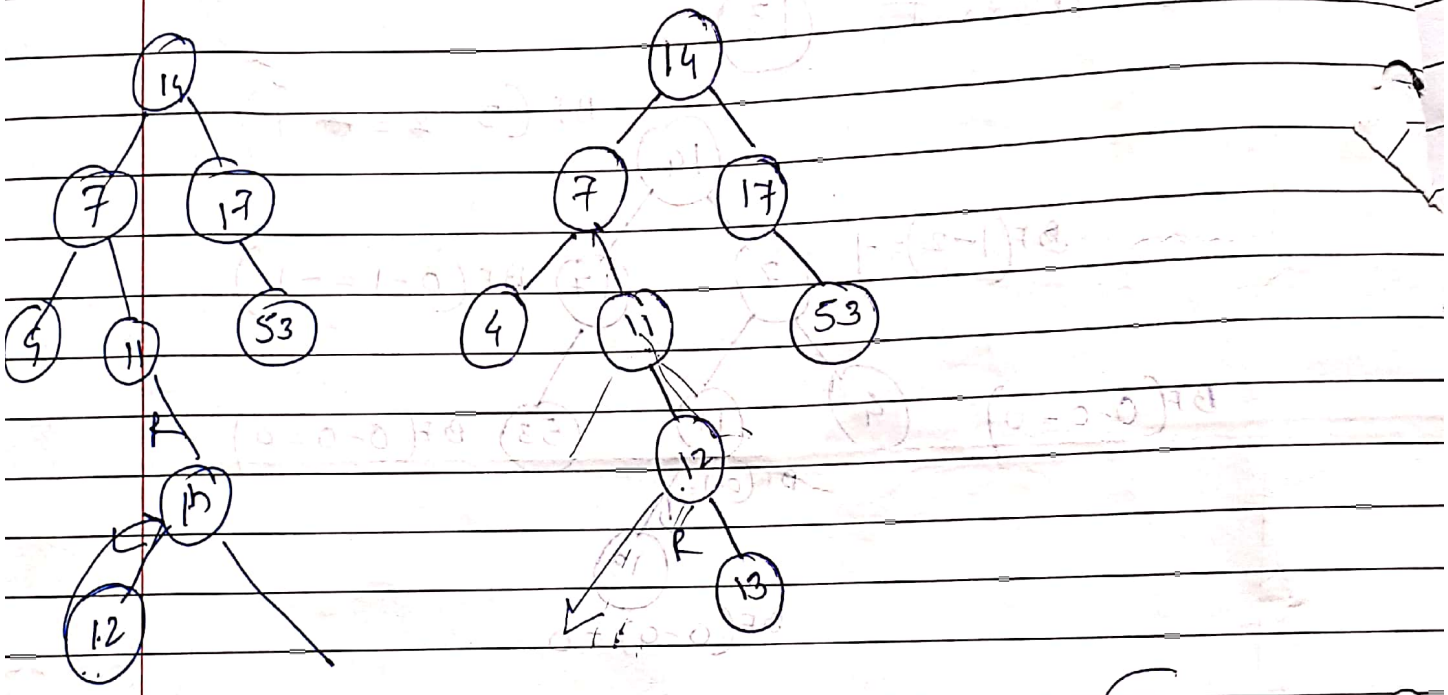
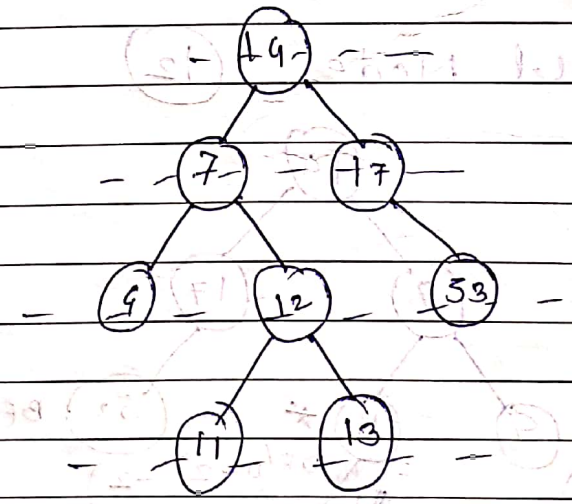
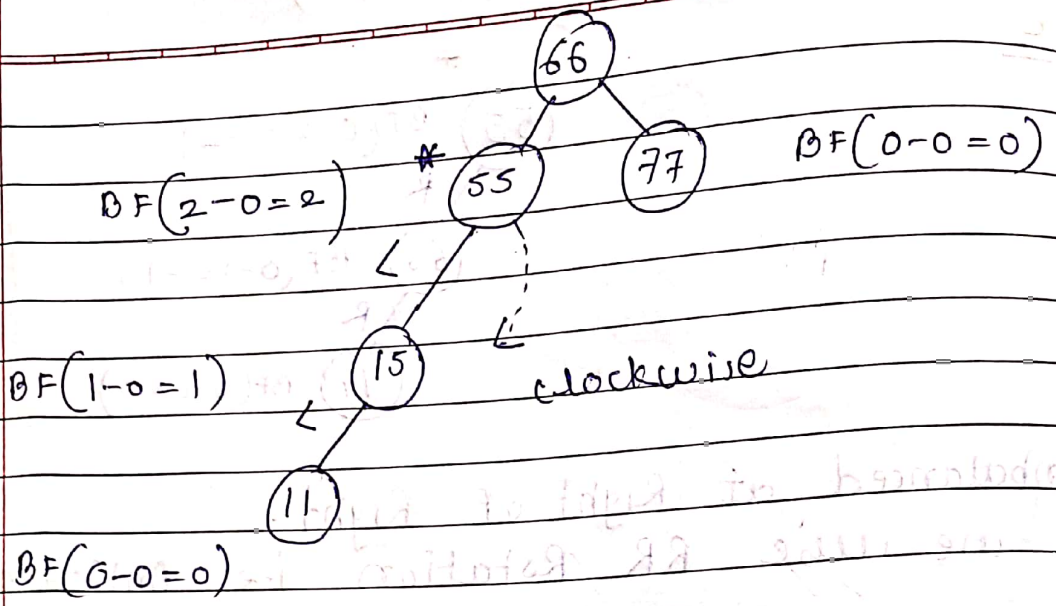
the tree is imbalanced at node (11) where we added the new node (12) at Right of left so we use the Right left rotation to balanced the AVL tree

1st apply LL Rotation. (clockwise)

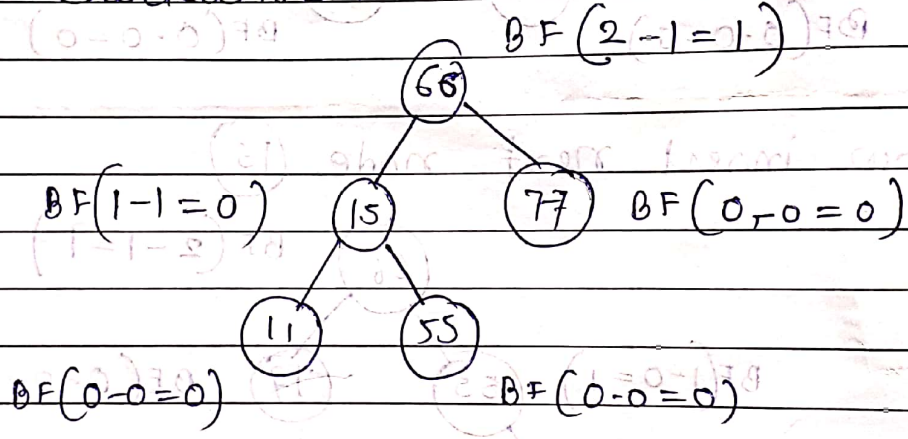


Now apply RR rotation. (anticlockwise)

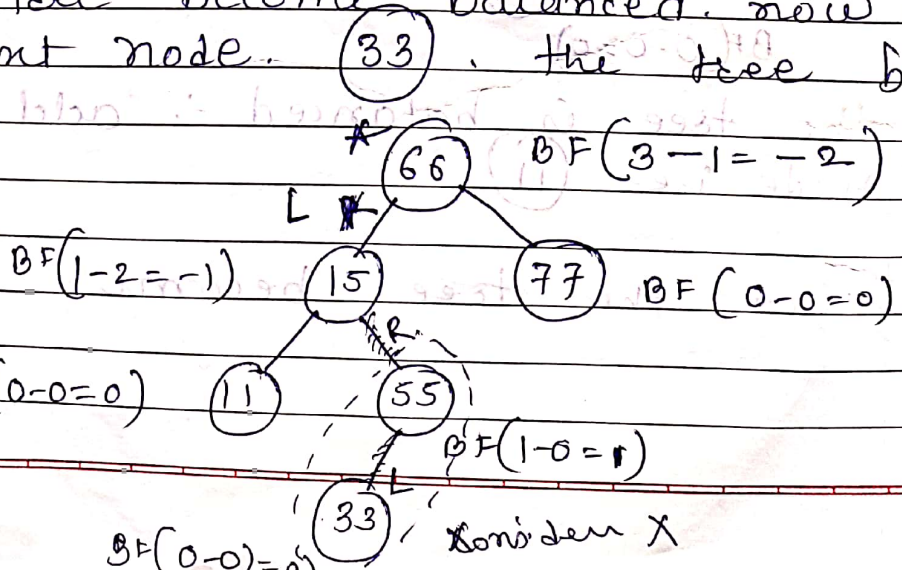




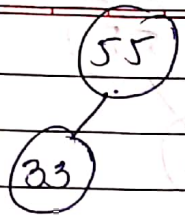
it is unbalanced because of adding the Node (11) at left of left. so we take left Rotation. i.e LL Rotation i.e clockwise.



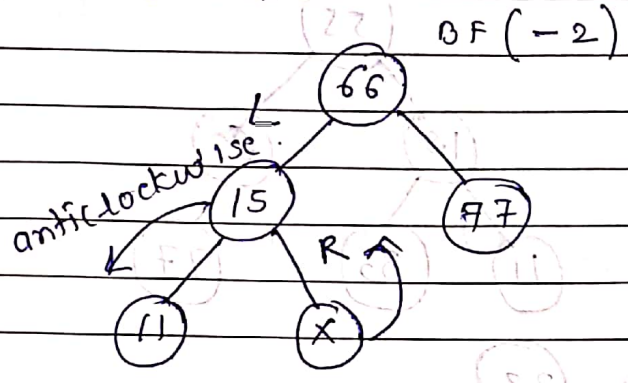
so the tree become balanced. now add the next node. (33). the tree become



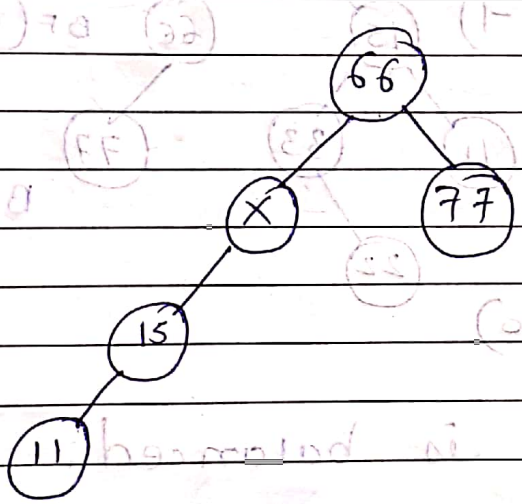
consider (55) as a subtree (X).



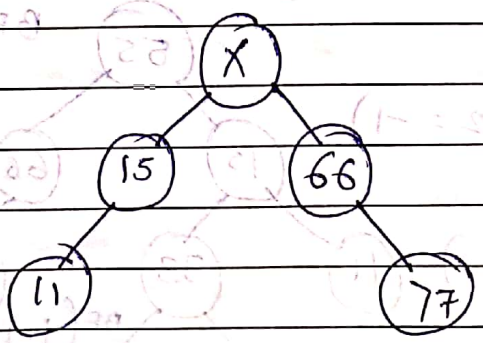
so the tree became.



∴ 1st take Right (RR) Rotation i.e- anticlockwise.



now take LL Rotation i.e. clockwise.



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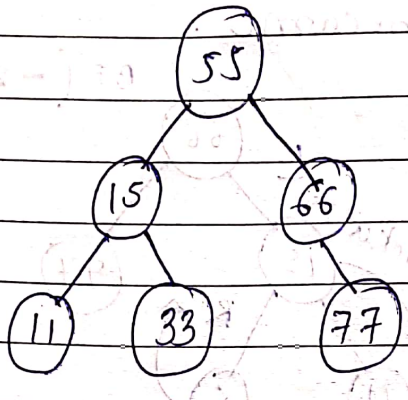
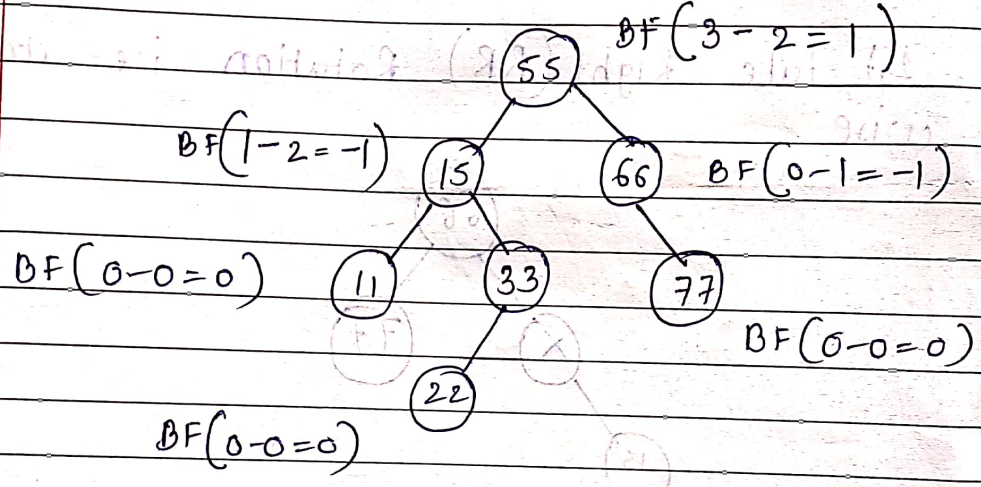
X → 55

33

...

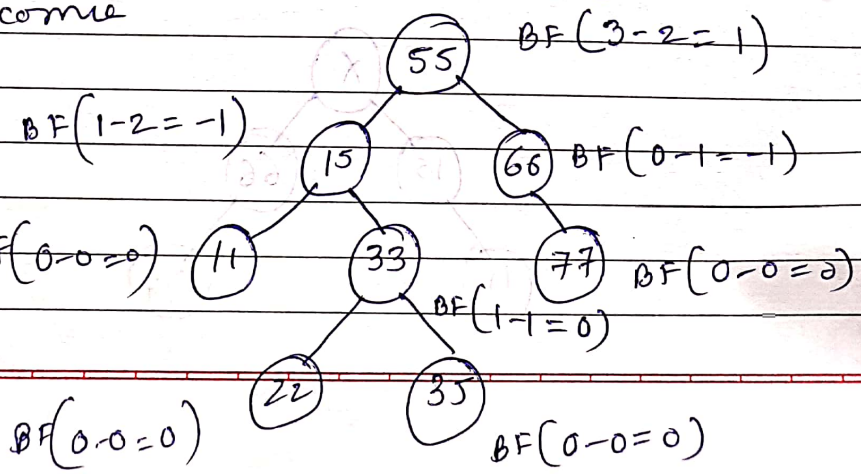


adel node 22



So the tree is balanced.

Now adel next Node 35 the tree become



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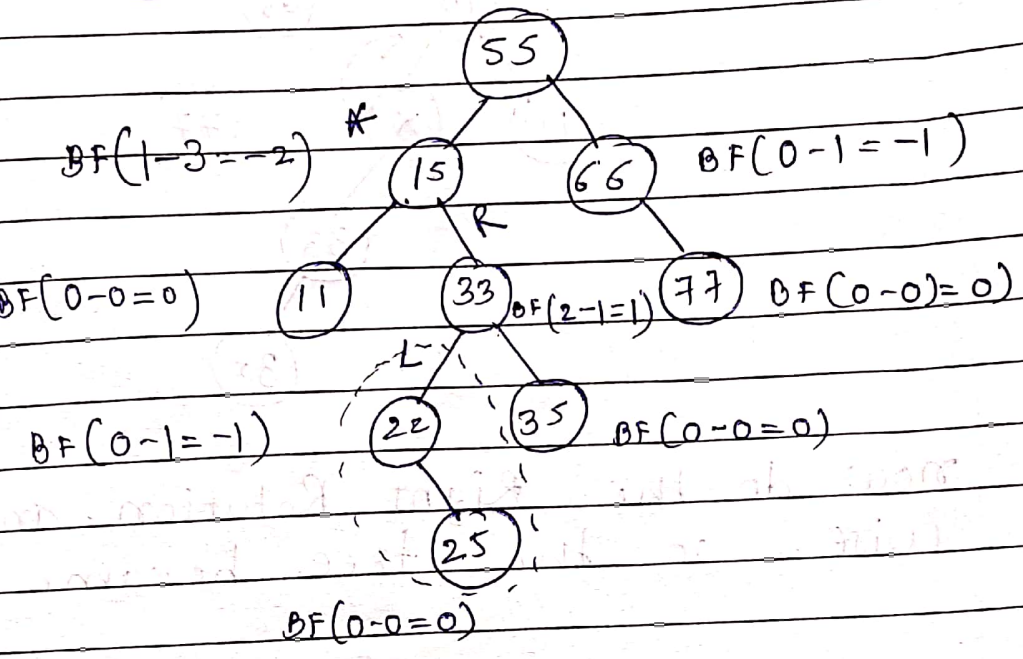
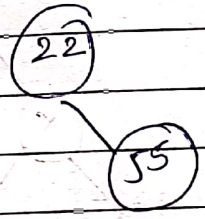
(9.)

the tree is balanced now added next node (25). the tree becomes.

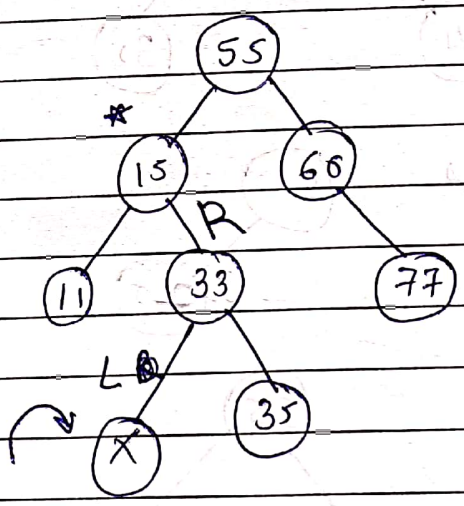


Right left

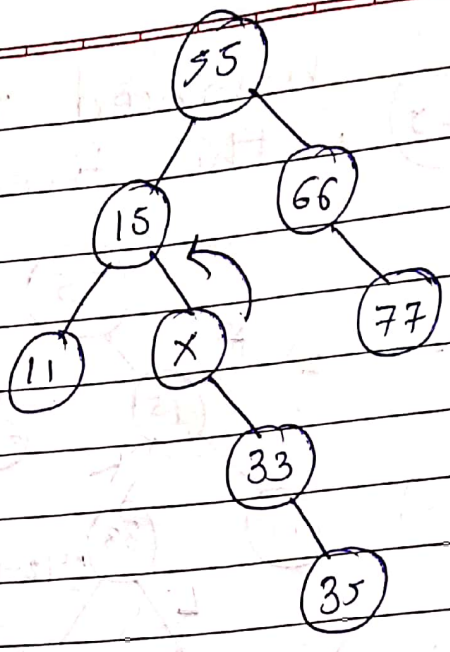


consider it as X

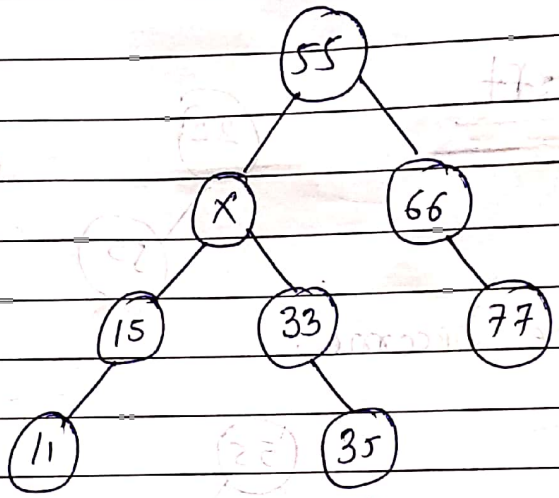
the tree become.



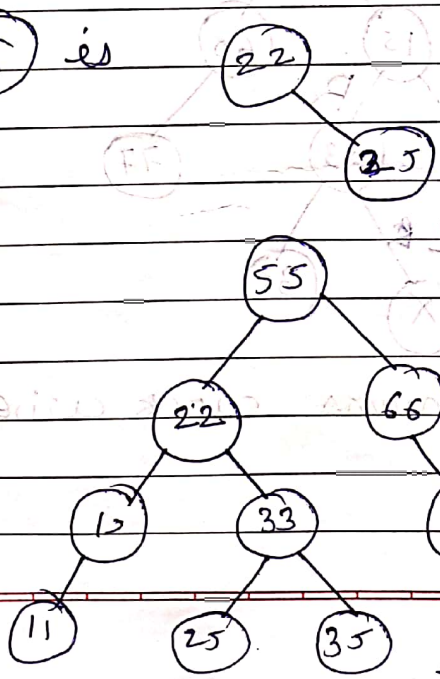
1st R. left means clock wise. then the tree became.



now do the Right Rotation. anticlock wise. so the tree became.



now X is



Balanced AVL tree