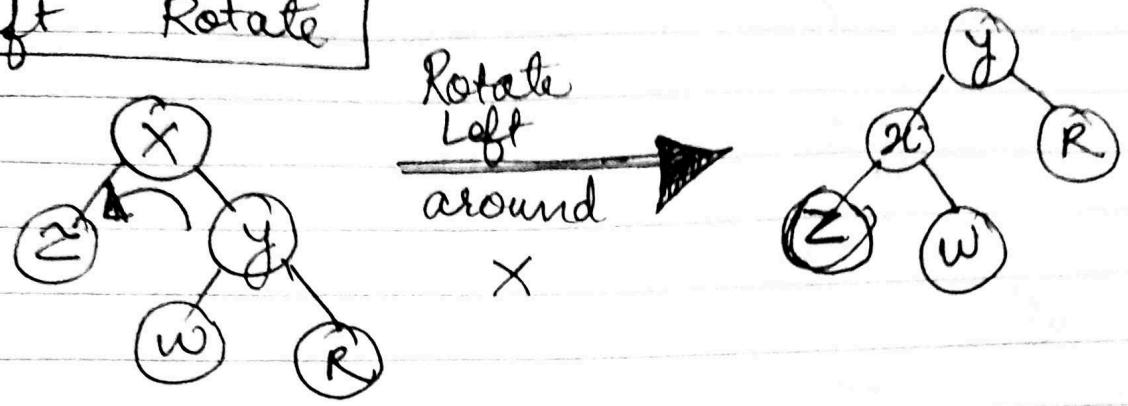


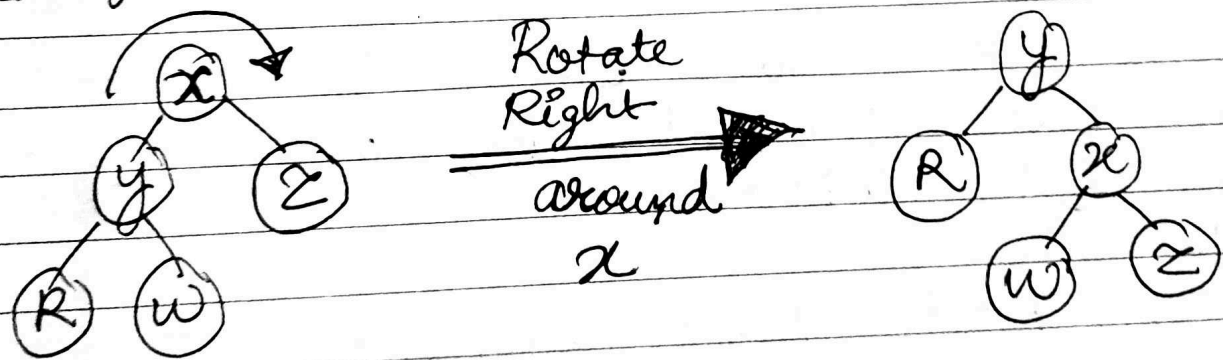
Rotations

Left Rotate



$x \cdot \text{right} = y \cdot \text{left}$
 $y \cdot \text{left} = x$

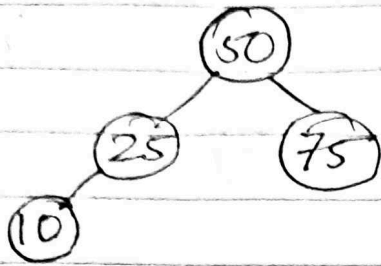
Right Rotate



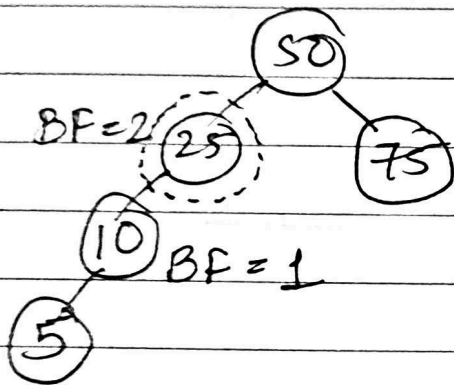
$x \cdot \text{left} = y \cdot \text{right}$
 $y \cdot \text{right} = x$

AVL Quelled cases.

4 cases depending on where a new node is inserted
① LL (Left child's Left subtree)



Insert 5

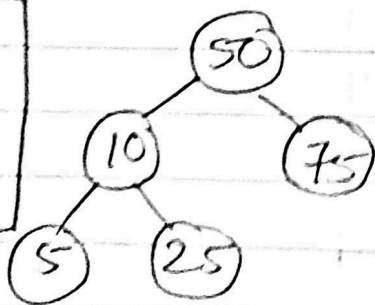


25 is the node which is imbalanced
5 has been inserted in 25's left child's left subtree.

∴ LL Case

Action - Rotate Right around 25.

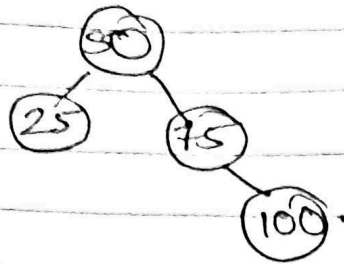
After
Right
Rotation



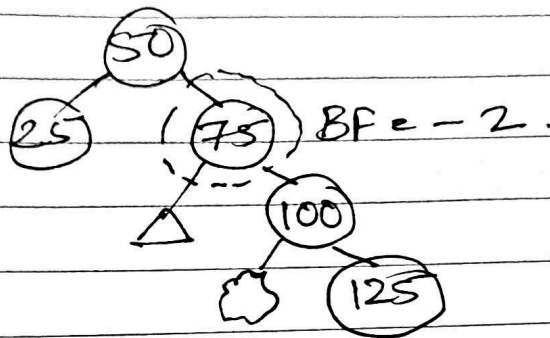
Date _____
Page _____

new node is inserted in.

② RR (Right child's Right Subtree)



Insert 125



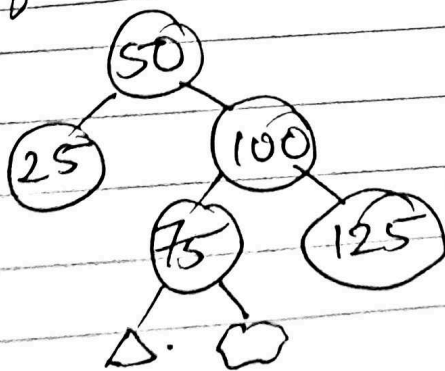
Imbalanced node = 75

125 is inserted in 75's right child's right subtree.

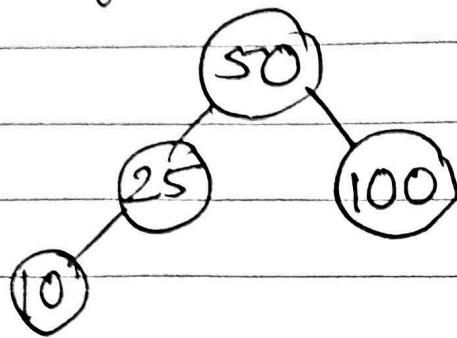
∴ RR case.

Action - Rotate left around 75

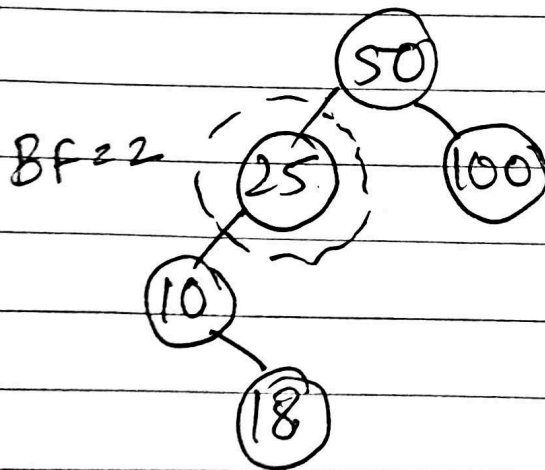
After Left Rotation



③ LR (Left child's Right Subtree)



Insert 18



Imbalanced node = 25

18 is inserted in 25's left child's right subtree.

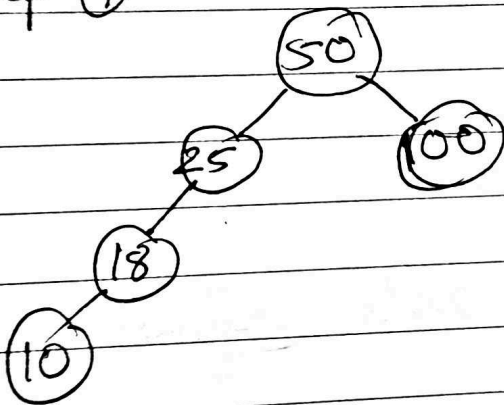
∴ LR case

Action - Double Rotation

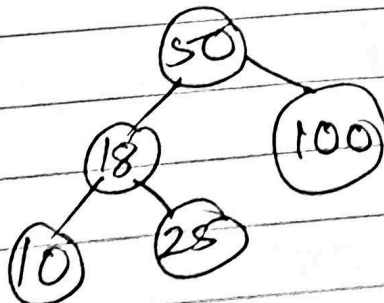
1) Left Rotate around 25's left child.

2) Right Rotate around 25.

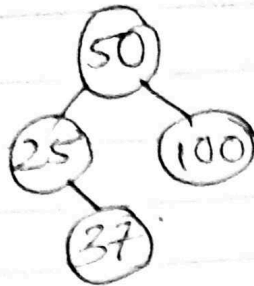
After step ①



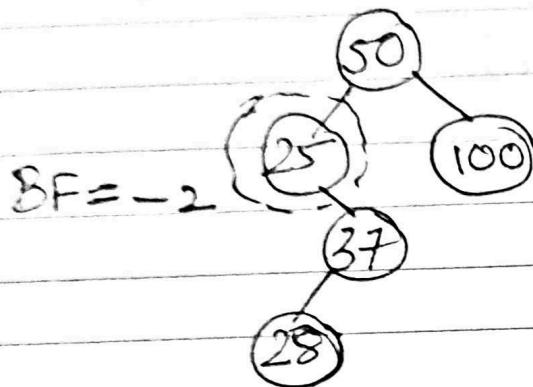
After step ②



④ RL case (Right child's Left Subtree)



Insert 28



Imbalanced node = 25

28 is insert in 25's right child's left subtree.

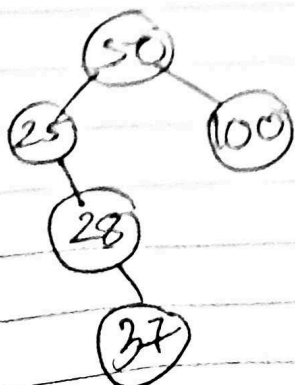
∴ 'RL' case

Action - Double Rotation

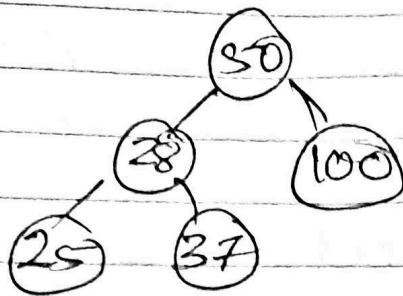
1) Right rotate around 25's right child

2) Left Rotate around 25

After step 1.



After step 2.



AVL Tree Insert Summary

- 1) Perform standard BST Insert.
- 2) Update the heights of all nodes along the path from Insertion point to root.
- ~~3) When an~~
- 3) Calculate the balance factor for each node on the path.
- 4) For the 1st node with a balance factor > 1 or < -1 , perform Tree rotations depending on which case among LL, LR, RR, RL is applicable.

CASE

MEANING

ACTION

~ Pnt

LL

Insertion in
Left Subtree of
Left child of
the imbalanced
node (X)

Rotate Right
around X.

RR

Insertion in
Right Subtree
of Right child
of X

Rotate
Left Round
X.

LR

Insertion in
Right Subtree
of Left child
of X

1) Rotate left
around left
child of X.

2) Rotate Right
around X.

RL

Insertion in
Left Subtree
of Right child
of X

1) Rotate right
around right
child of X

2) Rotate left
around X.