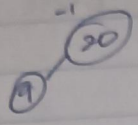
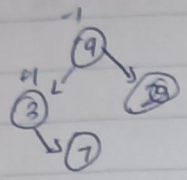
1/ insert (20):

2/ insert (9):



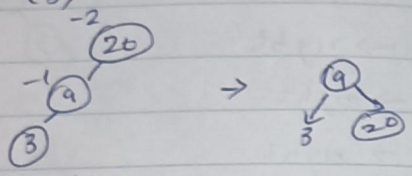
9 < 20
→ to left sub tree
→ left is null, insert (9) to left.

4/ insert (7):



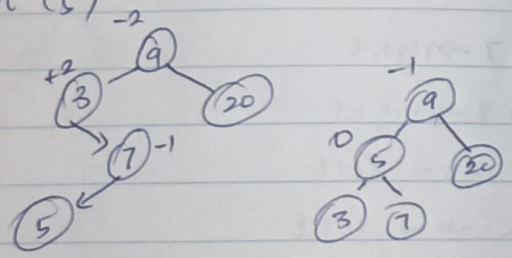
7 < 9 → to left
7 ≥ 3 to right
(5)'s right is null, insert 7

insert (3)



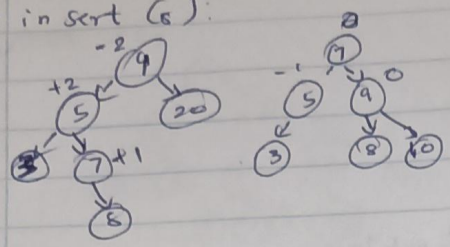
3 < 20 - to left sub tree
3 < 9 → to left subtree
the tree's left is heavier
→ rotate right.

in sort (5)



5 < 9 → to left
5 ≥ 3 → to right
5 < 7 → to left
(7)'s left is null, inset (5) (3)'s t
is right heavily
→ double rotate left.

6/ insert (6):



8 < 9 → to left

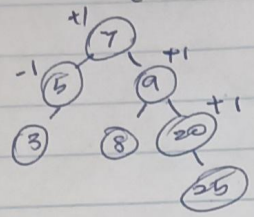
8 ≥ 5 → to right

8 ≥ 7 → to right

(7)'s right is null, insert (8)

tree is left heavy Rotate left right

7/ insert (25)



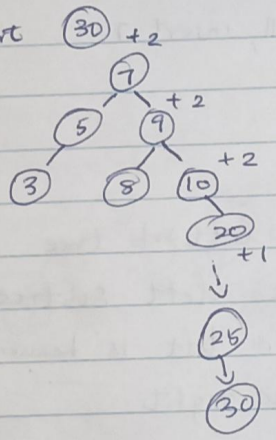
25 ≥ 7 → right

25 ≥ 9 → right

25 ≥ 20 → right

(20)'s right is null, insert (25)

8/ insert (30)



30 ≥ 7 → right

30 ≥ 9 → right

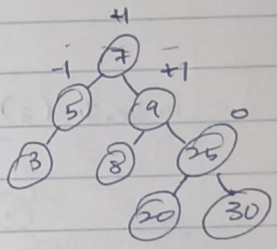
30 ≥ 20 → right

30 ≥ 20 → right

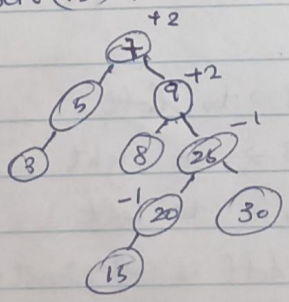
30 ≥ 25 → right.

(20)'s tree is right heavy

→ 1 rotate left.



9/ insert (15):



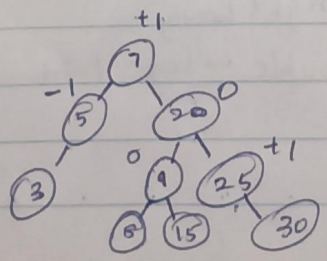
15 ≥ 7 → right

15 ≥ 9 → right

15 < 25 → left

15 < 20 → left

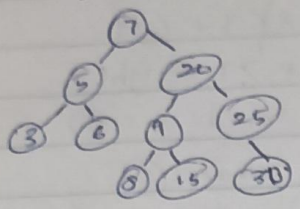
(20)'s left is null, insert 15



(9)'s tree is right weight

Rotate left right.

10/ insert (6):

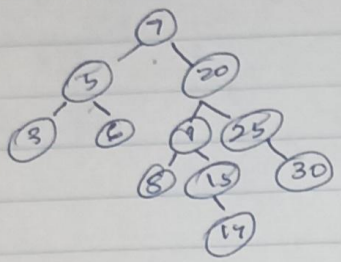


6 < 7 → left

6 ≥ 5 → right

(5)'s right is null → insert (6)

11/ insert (17):



17 ≥ 7 - Right

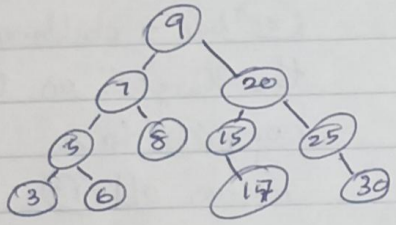
17 < 20 → left

17 ≥ 9 → Right

17 ≥ 15 → Right

(15)'s Right is null → insert (17)

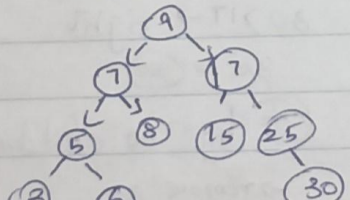
12/



the tree is right heavy

→ double rotate left

13/ Delete (20)



20 > 9 → right

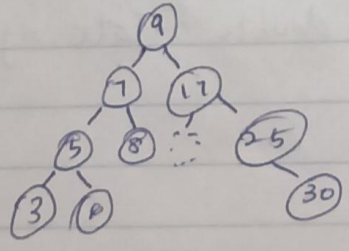
20 = (20)

node (20) has 2 children

→ the largest in the left sub tree is (17)

→ copy (17) to (20), remove the old (17)

14/ Delete (15)



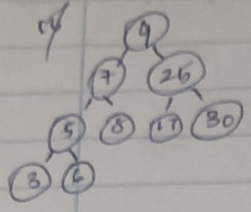
15 > 9 → right

15 < 17 → left, 15 = (15)

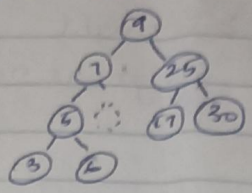
remove (15)

(17)'s tree is right heavy simple rotate le

14/

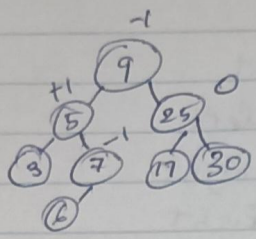


8/ Delete (8):

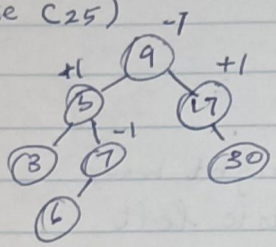


8 < 9 → left
8 > 7 → right
found - 8 = (8)
remove (8)
(7) 's tree is left heavy
Single rotate right

15/

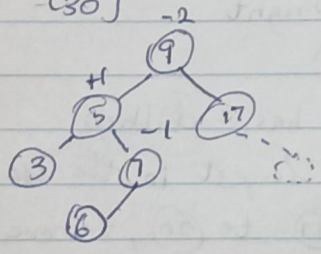


17/ Delete (25)



25 > 9 → right
25 = (25)
(25) has 2 children
the largest on the left
copy (17) to 25
remove old (17)

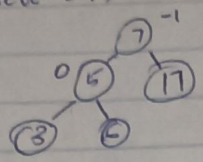
18/ Delete (30)



30 > 9 → right
30 > 17 → right
30 = (30)
(30) has no children
→ remove 30

The tree is left heavy
double rotate right

19/ Delete (9)



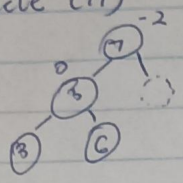
9 > 7 → right

9 = (9)

(9) has no left child

Set (17) notate right child in (9)'s position

20/ Delete (11)



17 > 7 → right

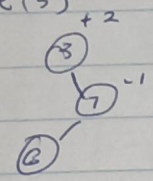
17 = (17)

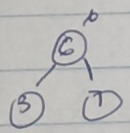
(17) has no children

→ remove 17 Tree is left heavy.

→ simple rotate right.

21/ Delete(5)





5 = (5)

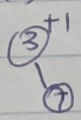
(5) has 2 children

copy the largest on the left (3) to (5)

remove old (3)

Tree is right heavy rotate left.

22/ Delete (6)



(6)

(6) has 2 children

copy thee largest on the left (5)

remove old (3)

Remove (7)

found 7

remove (7)

Remove 3

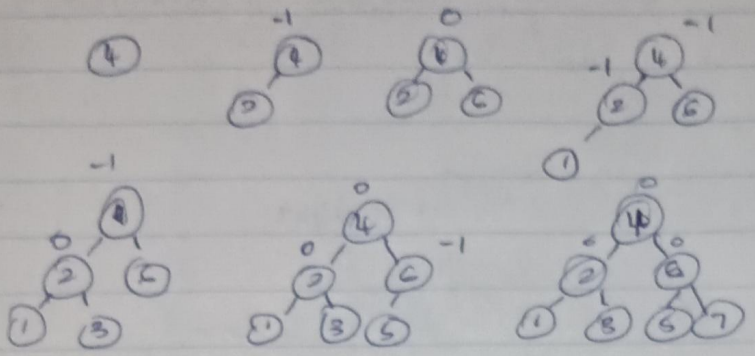
3 > (3)

3 don't have left child

Set the right child as parrent

1 2 3 4 5 6 7

order to insert : 4, 2, 6, 1, 3, 5, 7



no rotation.