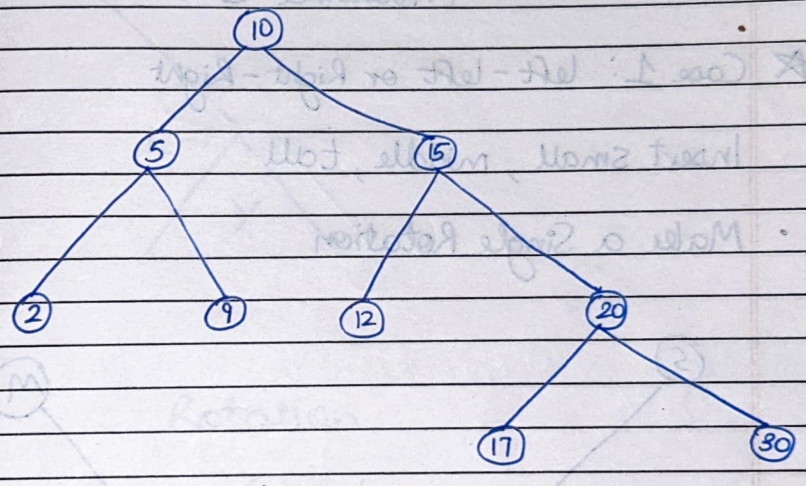
Lecture 6
AVL Trees

Balance == Height of left subtree − Height of right subtree

Perfectly Balanced → Zero
Small Everywhere → Balance Enough



Considering leaf node height = 0

Every node must be balanced

Good Write

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Good Insert Case :

Insert middle, then small, then Tall

Eg.

h

h

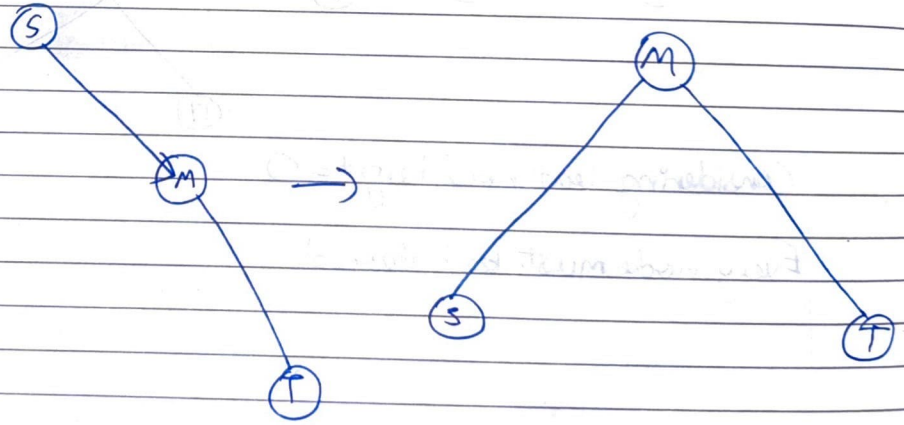
Z

Imbalance Cases

★ Case 1: left-left or Right-Right

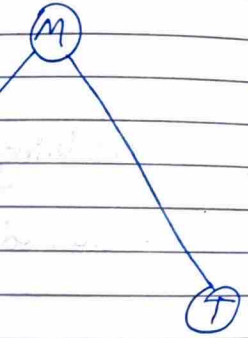
Insert small, middle, tall

- Make a Single Rotation



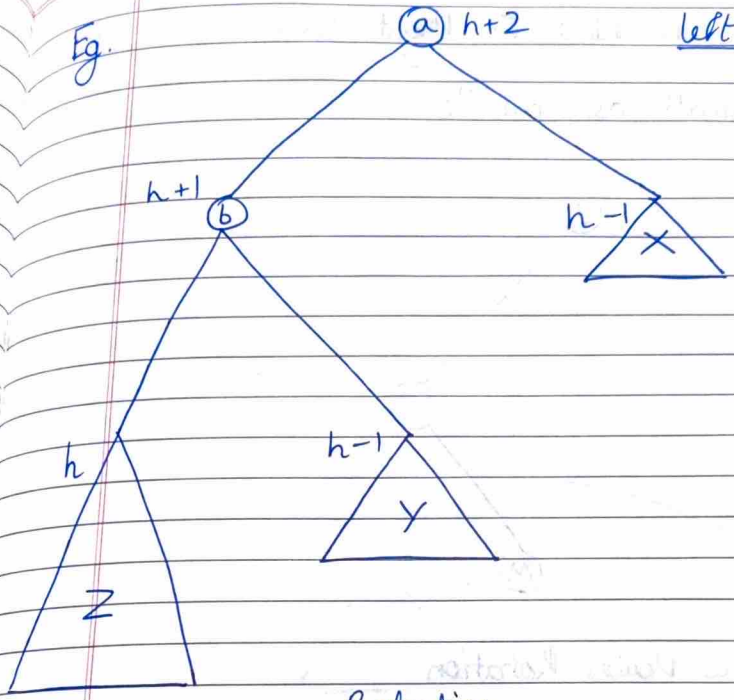
A right child can have its parent as its left child.

Tall



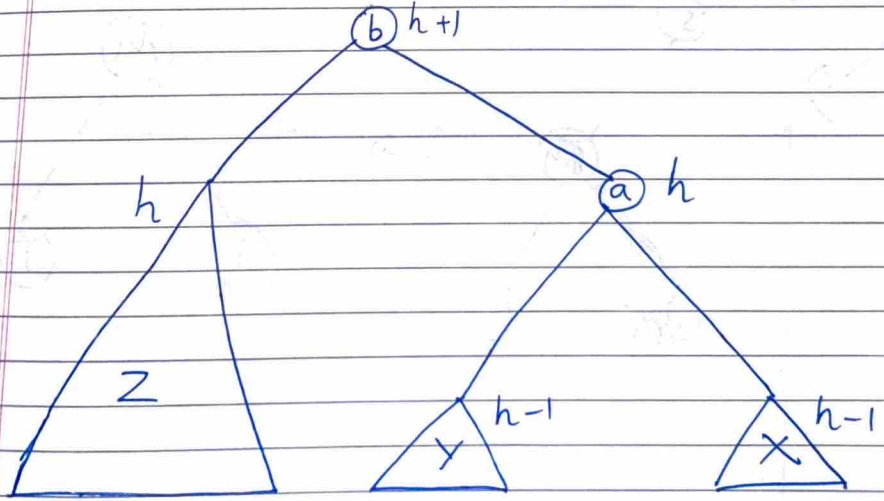
its left child.

Eg.



Left - Left Imbalance

Rotation



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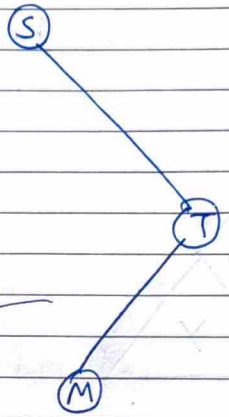
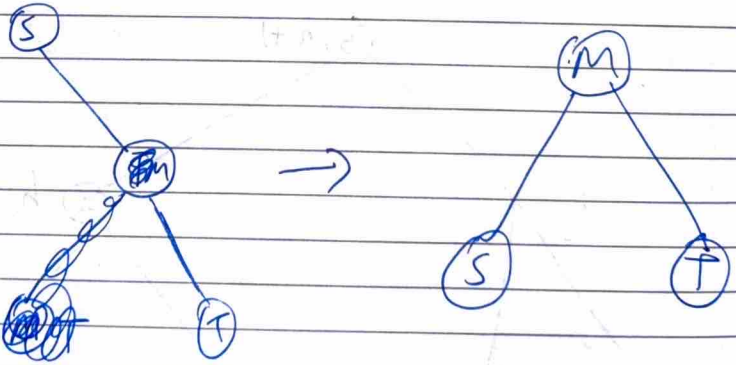
★ Case 2 : Left - Right or Right - left

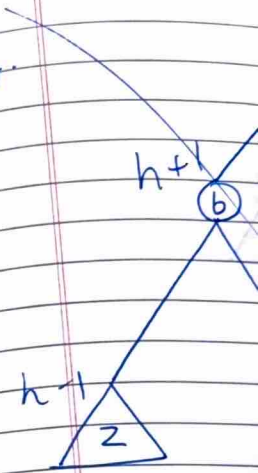
Insert small, tall, middle



- Requires Double Rotation



Eg.



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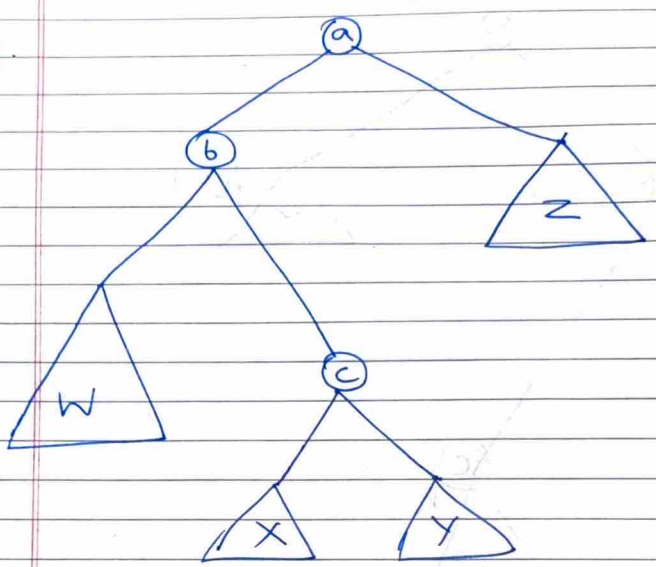
Eg.



Double Rotation

Find Sp

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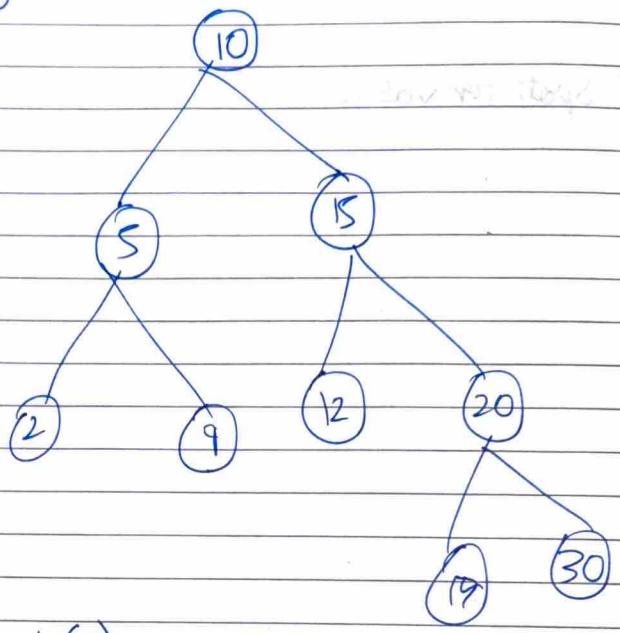
Easy Insert :

Eg.

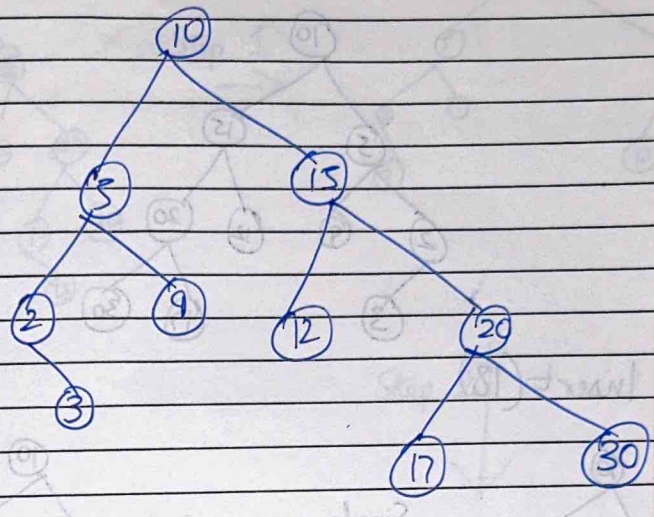


Insert (3)

Hard

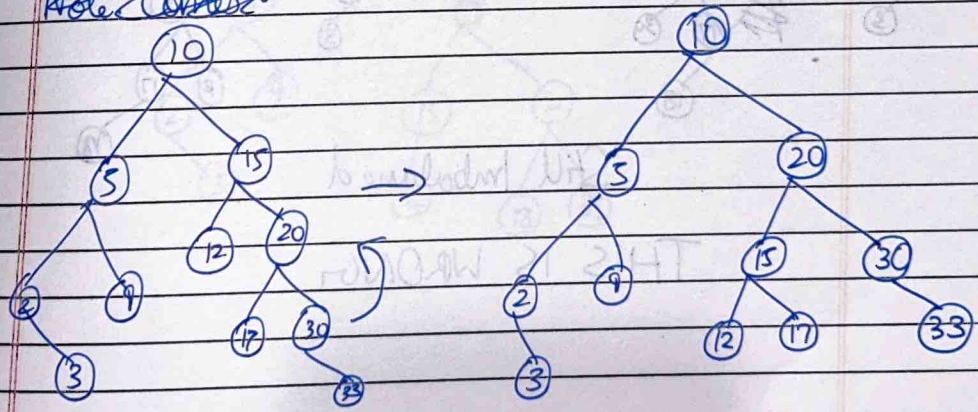
In

Hard Insert : (Bad Case 1)



Insert (33)

~~Note: Comes~~



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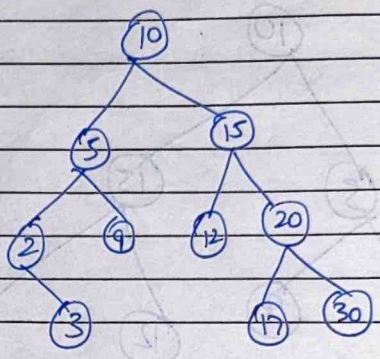
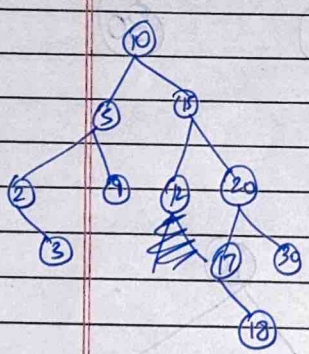
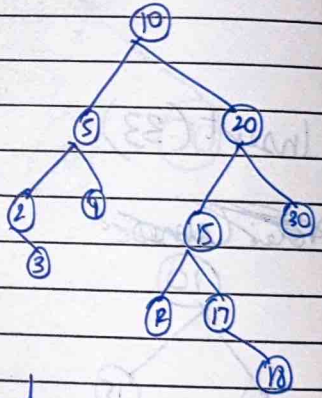
Hard Insert : (Bad Case 2)



Insert (18)

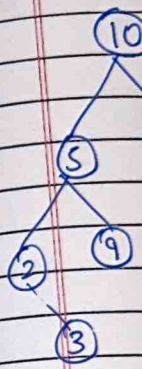


Single Rotation →



Still Imbalanced

THIS IS WRONG



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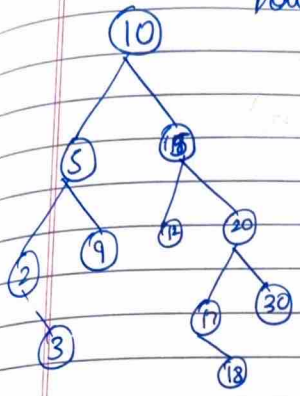
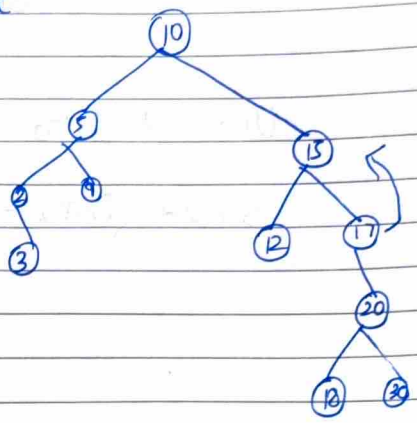
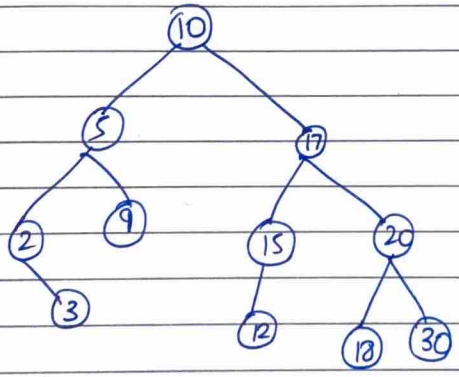
Double Rotation



Step 1 →



Step 2 ↓



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Building AVL Tree

Unsorted Data → $\Theta(n \log n)$

Sorted Data → $\Theta(n)$