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لاتنسى عمل لايك ومشاركة القناة لتعم الفائدة للجميع
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Algorithms & Problem Solving
Level 6
Introduction to Rotations
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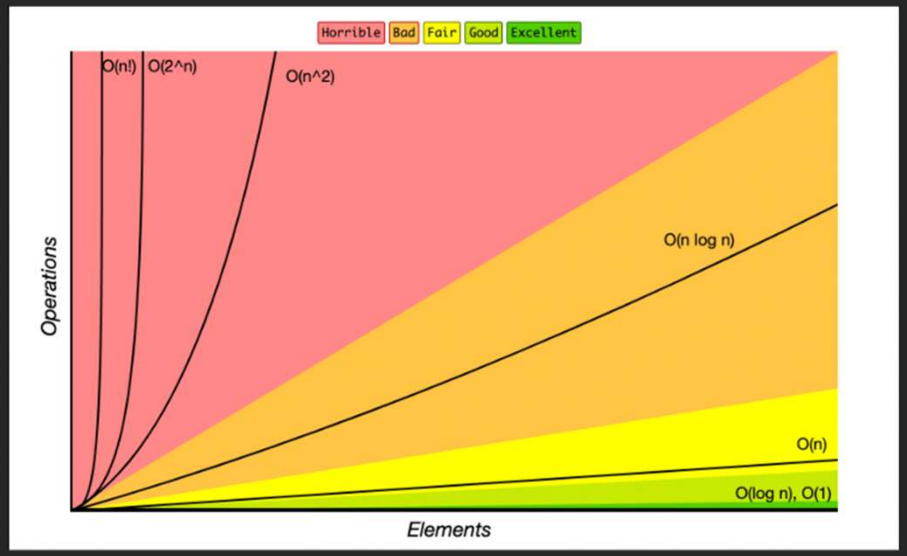
BST Search.

- Best/Average Case is O(Log n)
- Worst Case O(n)



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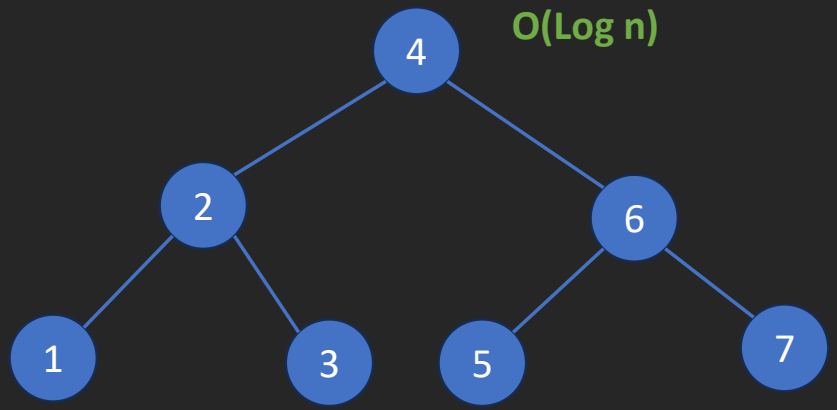
Balanced vs Imbalanced BST

Suppose that we entered data in BST in the following order:
4,2,6,1,3,5,7



Balanced

Suppose that we entered data in BST in the following order:
1,2,3,4,5,6,7

Unbalanced

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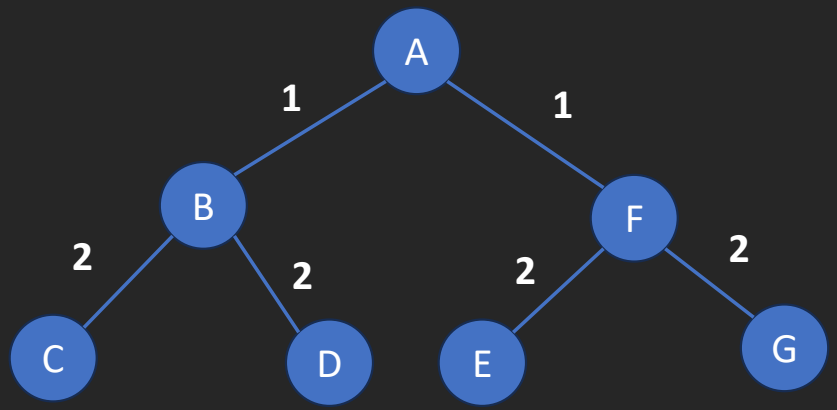
Balanced Or Imbalanced?

BF = 2 – 2 = 0



Balanced

Rule:
Heights of the two child subtrees of any node differ by no more than one.

DF = Hight(Left Subtree) – Hight(Right Subtree)

Hight = the number of edges for the longest path from the node to the last leaf

Balance Factor (BF) = DF.

If ABS(BF) > 1 then it is not balanced.

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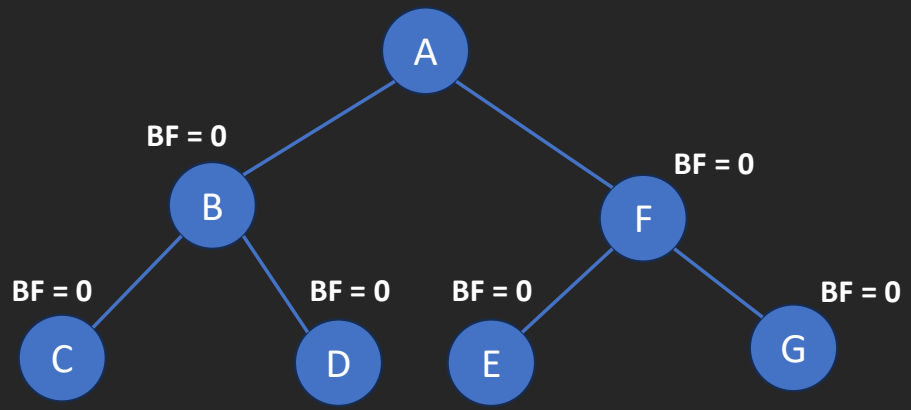
BF for each Node

BF = 0



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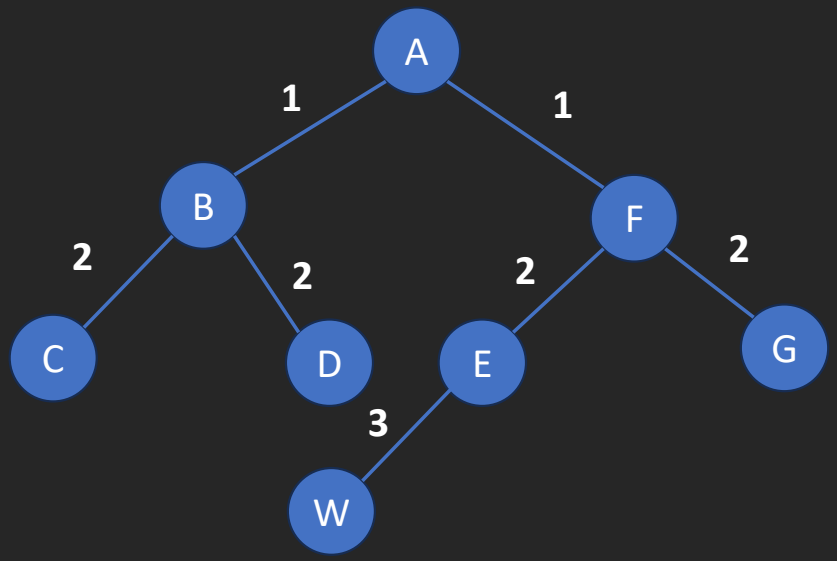
Balanced Or Imbalanced?

BF = 2 – 3 = -1



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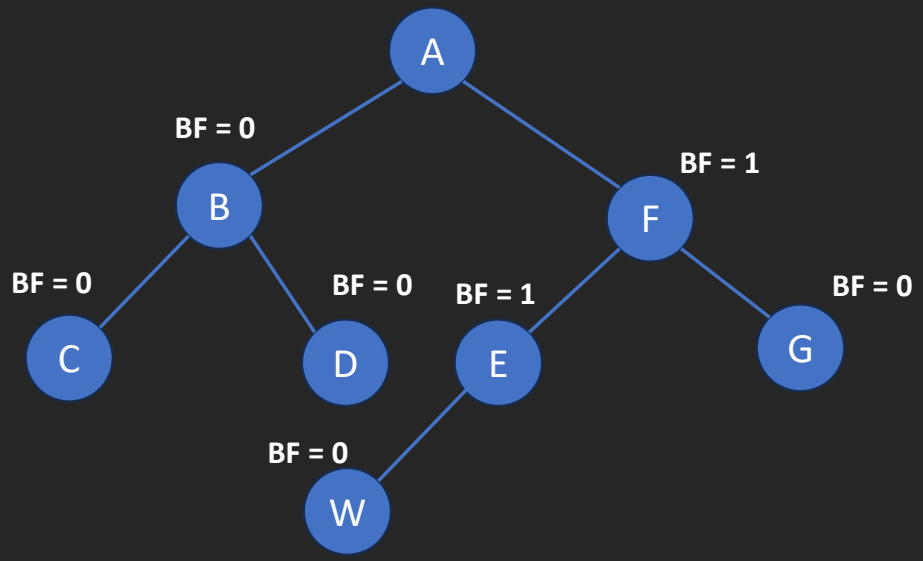
BF for each node

BF = 2 – 3 = -1



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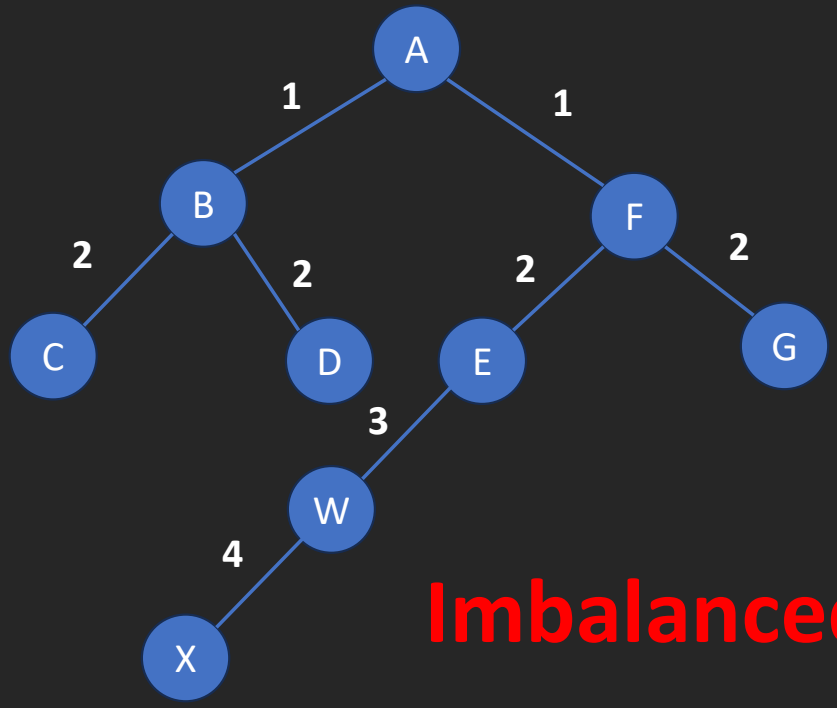
Balanced Or Imbalanced?

BF = 2 – 4 = -2



Imbalanced

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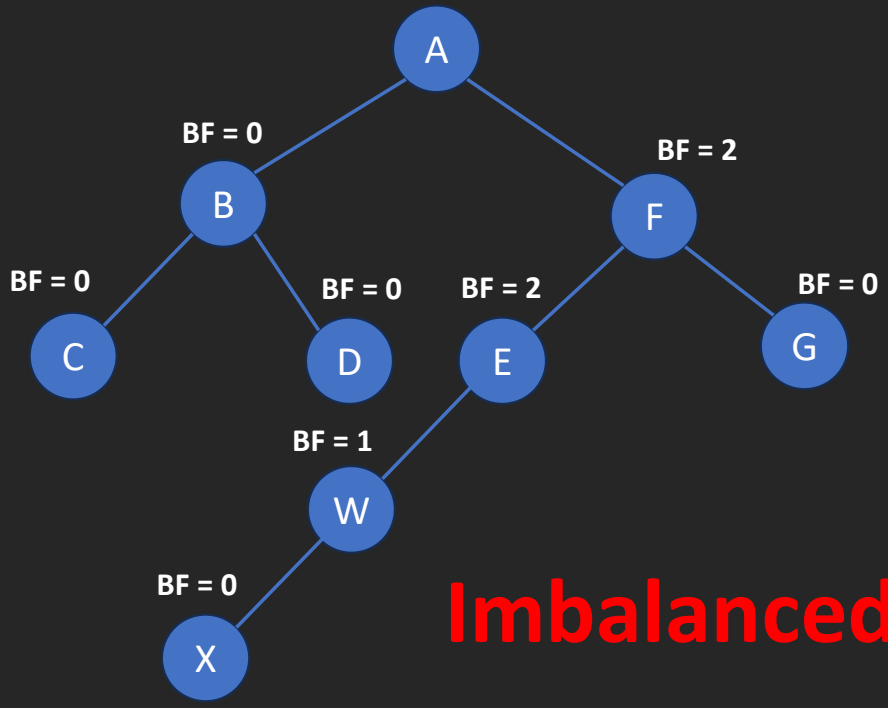
BF for each node

BF = 2 – 4 = -2



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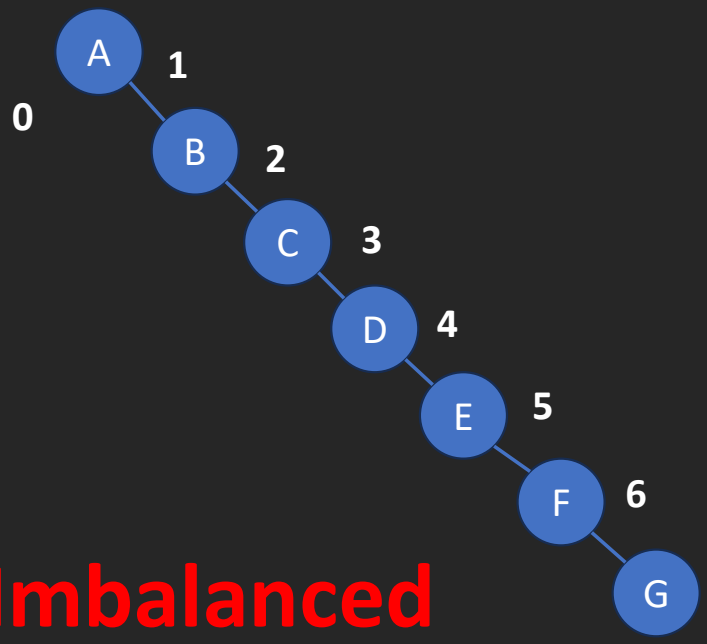
Balanced Or Imbalanced?

BF = 0 – 6 = -6



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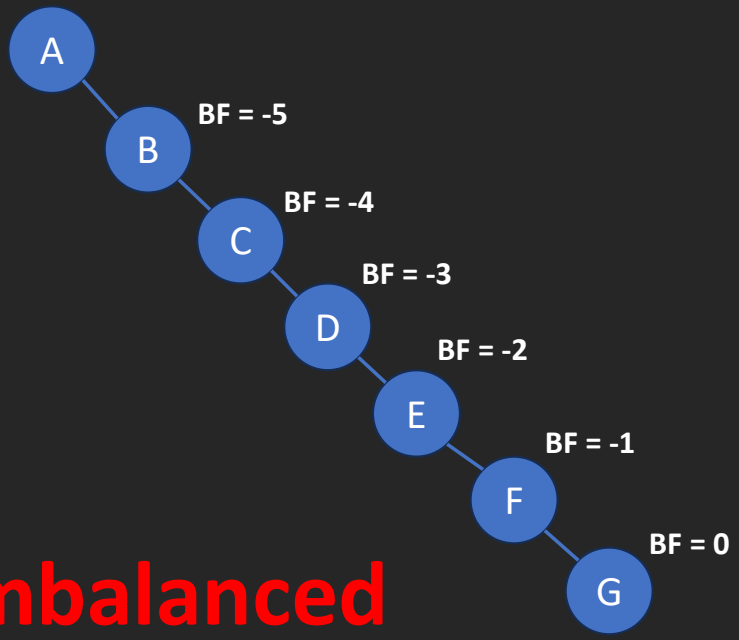
BF for each node

BF = 0 – 6 = -6



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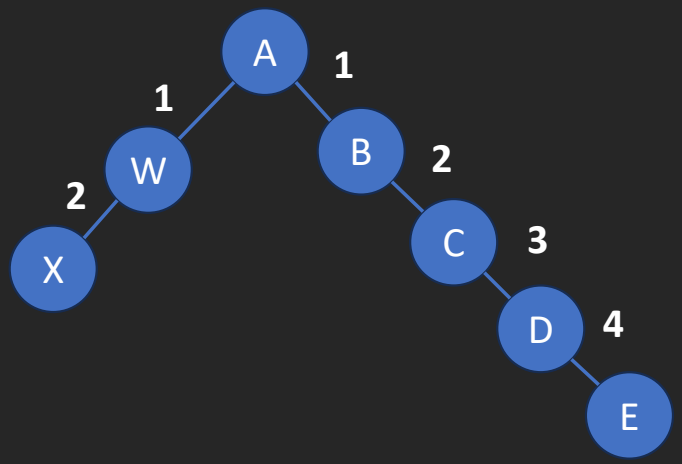

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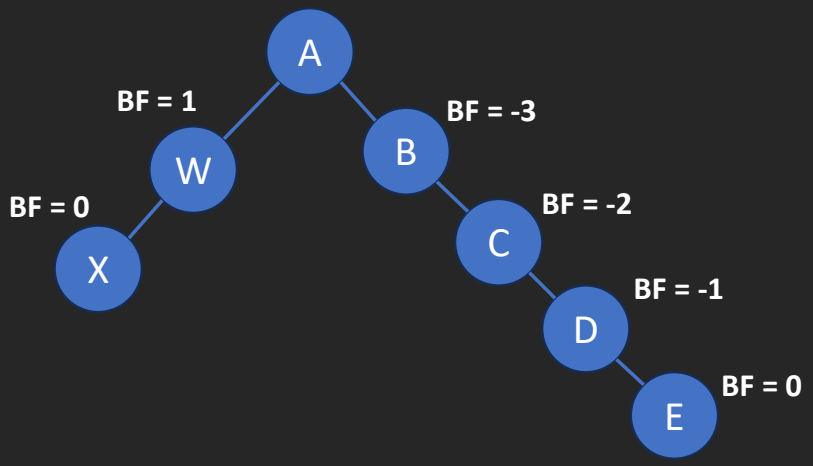

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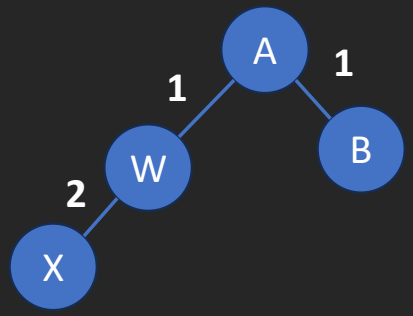
Balanced Or Imbalanced?

BF = 2 – 1 = 1



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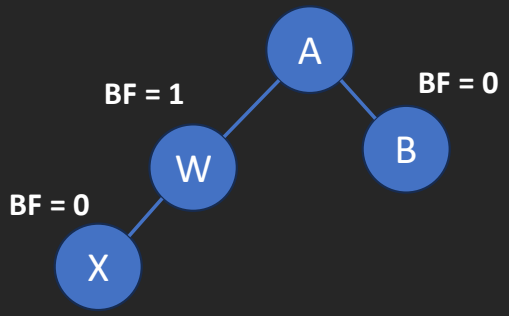
BF for each node

BF = 2 – 1 = 1



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Node Is Balanced If...

- Should be -1, 0, or +1 for each node ➔ Abs(BF) <=1.
- If Abs(BF) > 1 then it is Imbalanced.
- If at any time they differ by more than one, rebalancing is done to restore this property.

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What is AVL?

- AVL trees, named after their inventors Adelson-Velsky and Landis, are self-balancing binary search trees.
- In an AVL tree, the heights of the two child subtrees of any node differ by no more than one.
- If at any time they differ by more than one, rebalancing is done to restore this property.

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In order to rebalance a node you need to do rotations

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What are Rotations?

- To maintain balance after insertions and deletions, AVL trees use rotations.
- Rotations are pivotal tree manipulations that shift nodes and their subtrees around to move higher nodes lower and lower nodes higher, thus restoring the required balance of the tree.
- Concept of rotations as operations that reorder the nodes of the tree to maintain or restore balance.

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Types of Rotations:

- There are four types of basic rotations:
  - RR – Right Rotation (Single Right Rotation)
  - LL – Left Rotation (Single Left Rotation)
  - LR – Left-Right (Double Rotations)
  - RL – Right-Left Rotations (Double Rotations)

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