ECAP770

Advance Data Structures

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Learning Outcomes

After this lecture, you will be able to

- Understand Splay tree

- Operations on Splay tree

Splay Tree

- Splay tree are self-adjusting binary search tree.

- After every operation on splay tree element rearranges the tree so that the element is placed at the root position of the tree.

Splay Tree

- Based on the principle of locality Splay trees put the most recently accessed items near the root.

- 90–10 rule which states that 10% of the data is accessed 90% of the time, other 90% of data is only accessed only 10% of the time

Splaying

- Splaying is a process in which a node is transferred to the root by performing suitable rotations.

- In a splay tree, whenever we access any node (searching, inserting or deleting a node), it is splayed to the root.

Rotations in Splay Tree

Zig rotation / Right rotation

Zag rotation / Left rotation

Zig zag / Zig followed by zag

Zag zig / Zag followed by zig

Zig zig / two right rotations

Zag zag / two left rotations

Factors for selecting a type of rotation

- Does the node which we are trying to rotate have a grandparent?

- Is the node left or right child of the parent?

- Is the node left or right child of the grandparent?

Zig Rotation

- The Zig Rotation in splay tree is like single right rotation in AVL Tree rotations.

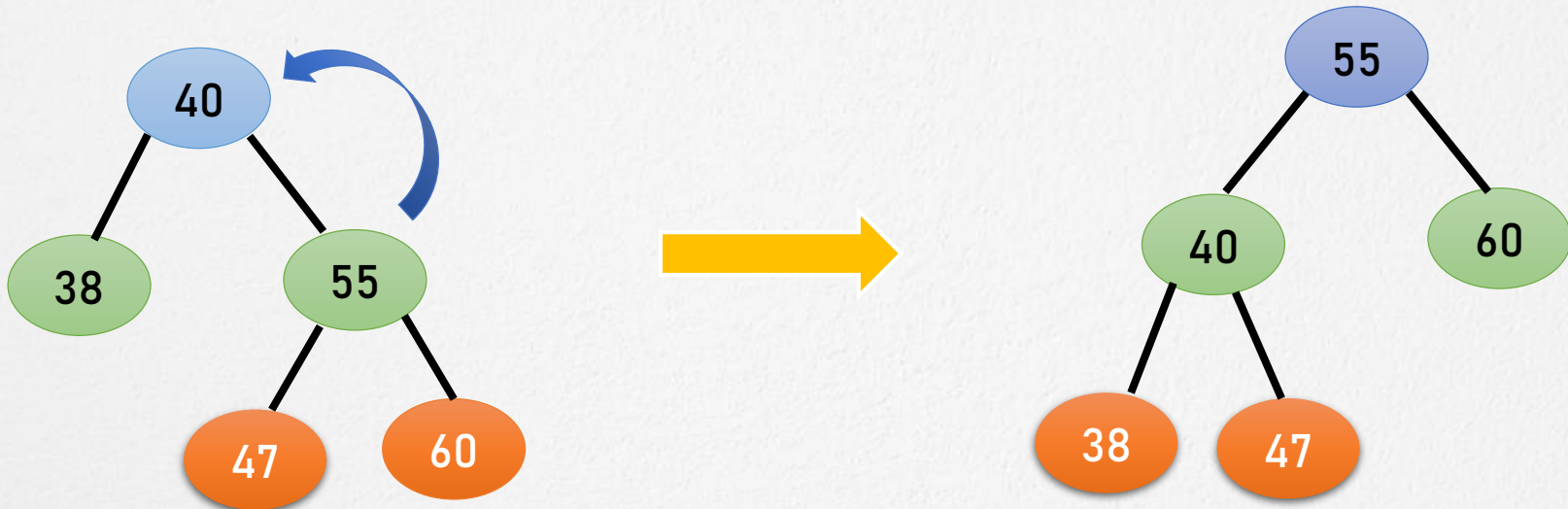- In zig rotation, every node moves one position to the right from its current position.

Zig Rotation / Right rotation
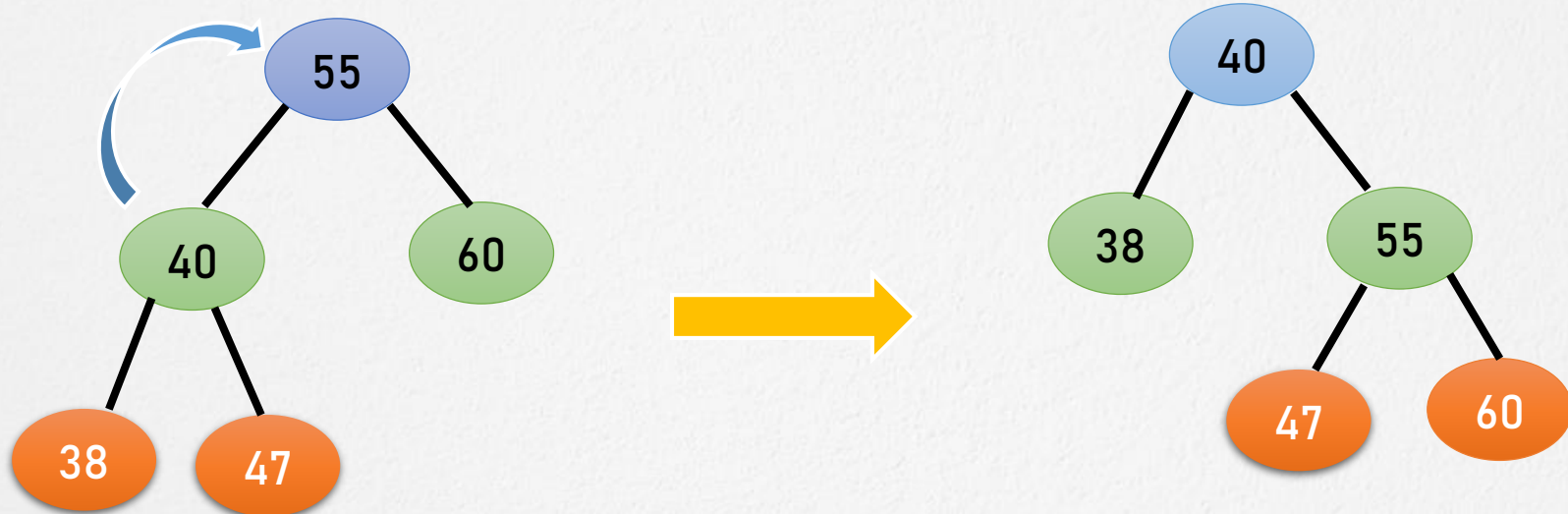
Splay 40

Zag Rotation

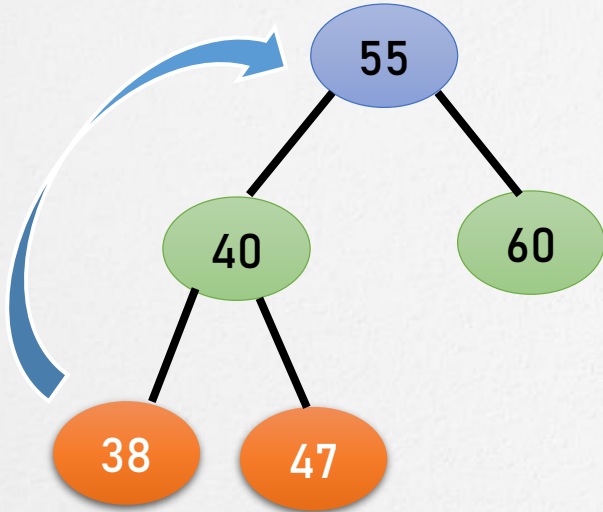In zag rotation, every node moves one position to the left from its current position.
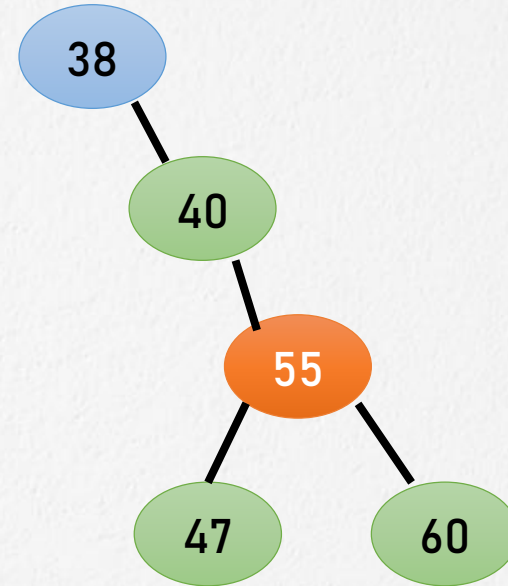

Splay 55

Zig-Zig Rotation

- The Zig-Zig Rotation in splay tree is a double zig rotation.

- In zig-zig rotation, every node moves two positions to the right from its current position.
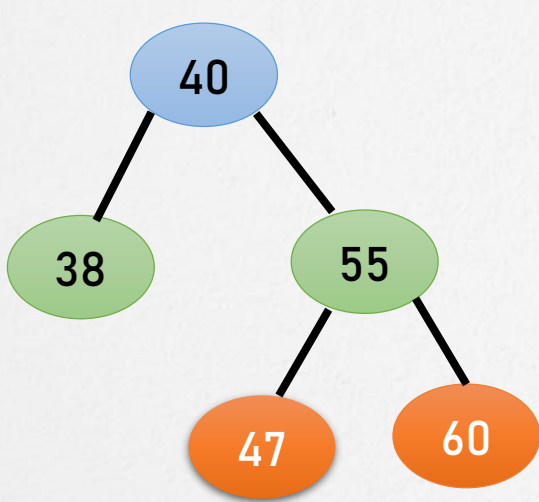
Zig-Zig Rotation

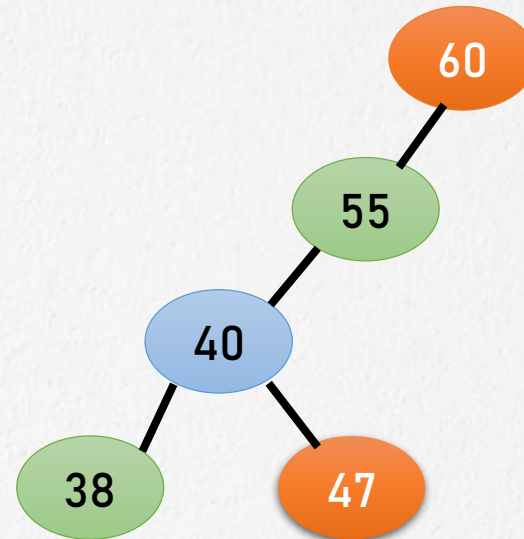Splay 38

Double right rotation

Zag-Zag Rotation

- The Zag-Zag Rotation in splay tree is a double zag rotation.

- In zag-zag rotation, every node moves two positions to the left from its current position.
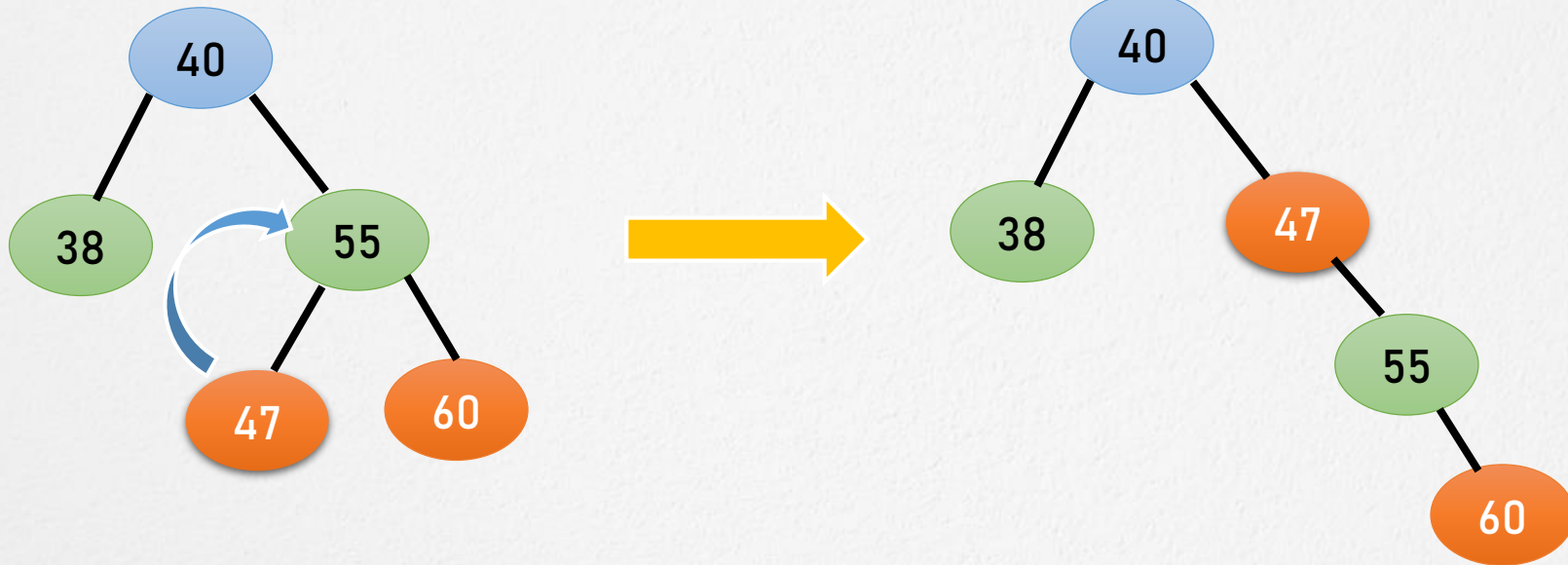
Zag-Zag Rotation
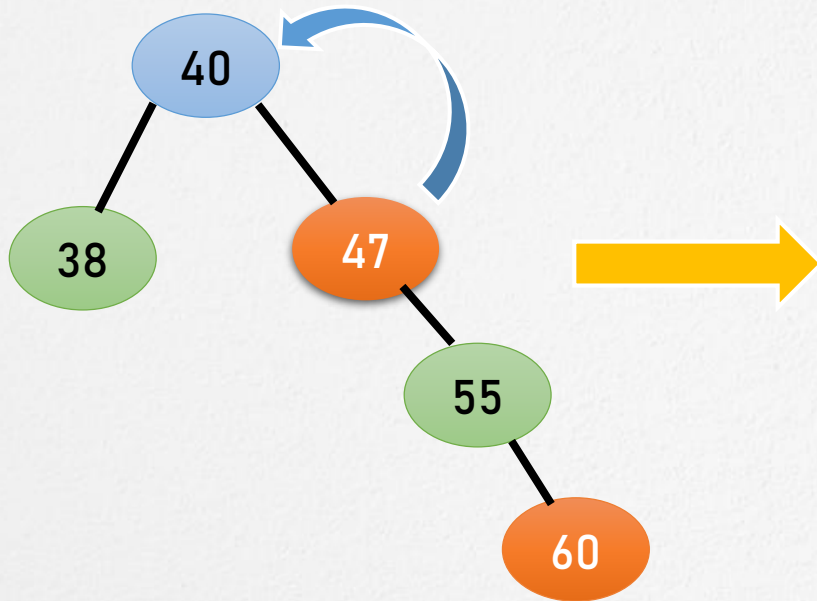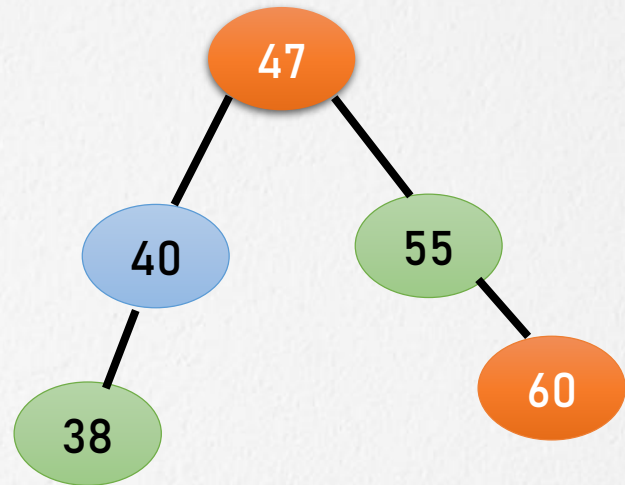

Splay 60

Double left rotation

Zig-Zag Rotation

Splay 47

Single right rotation (Zig)

Zig-Zag Rotation

Splay 47

Single left rotation (Zag)

Splay Tree operations

- Insertion

- Deletion

- Search

Advantages: Splay Trees

- Splaying ensures that frequently accessed elements stay near the root of the tree so that they are easily accessible.

- The average case performance of splay trees is comparable to other fully-balanced trees: O(log n).

- Splay trees do not need bookkeeping data; therefore, they have a small memory footprint.

Disadvantages

- A splay tree can arrange itself linearly. Therefore, the worst-case performance of a splay tree is $O(n)$.

- Multithreaded operations can be complicated since, even in a read-only configuration, splay trees can reorganize themselves.

That's all for now…