Splay Tree

Splay tree is another variant of a binary search tree. In a splay tree, recently accessed element is placed at the root of the tree. A splay tree is defined as follows...

Splay Tree is a self - adjusted Binary Search Tree in which every operation on element rearranges the tree so that the element is placed at the root position of the tree.

In a splay tree, every operation is performed at the root of the tree. All the operations in splay tree are involved with a common operation called **"Splaying"**.

Splaying an element, is the process of bringing it to the root position by performing suitable rotation operations.

In a splay tree, splaying an element rearranges all the elements in the tree so that splayed element is placed at the root of the tree.

By splaying elements we bring more frequently used elements closer to the root of the tree so that any operation on those elements is performed quickly. That means the splaying operation automatically brings more frequently used elements closer to the root of the tree.

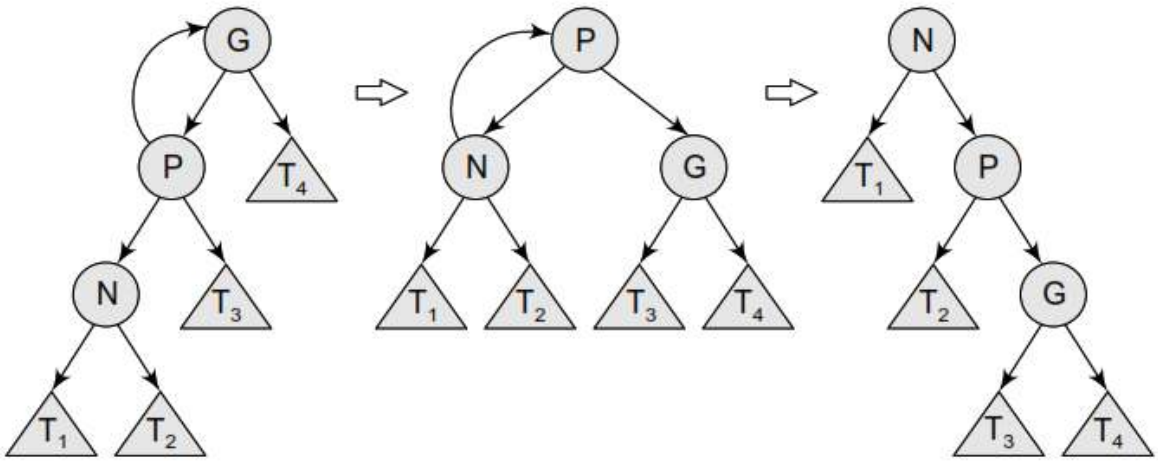
Every operation on splay tree performs the splaying operation. In splay tree, to splay any element we use the following rotation operations...

Rotations in Splay Tree

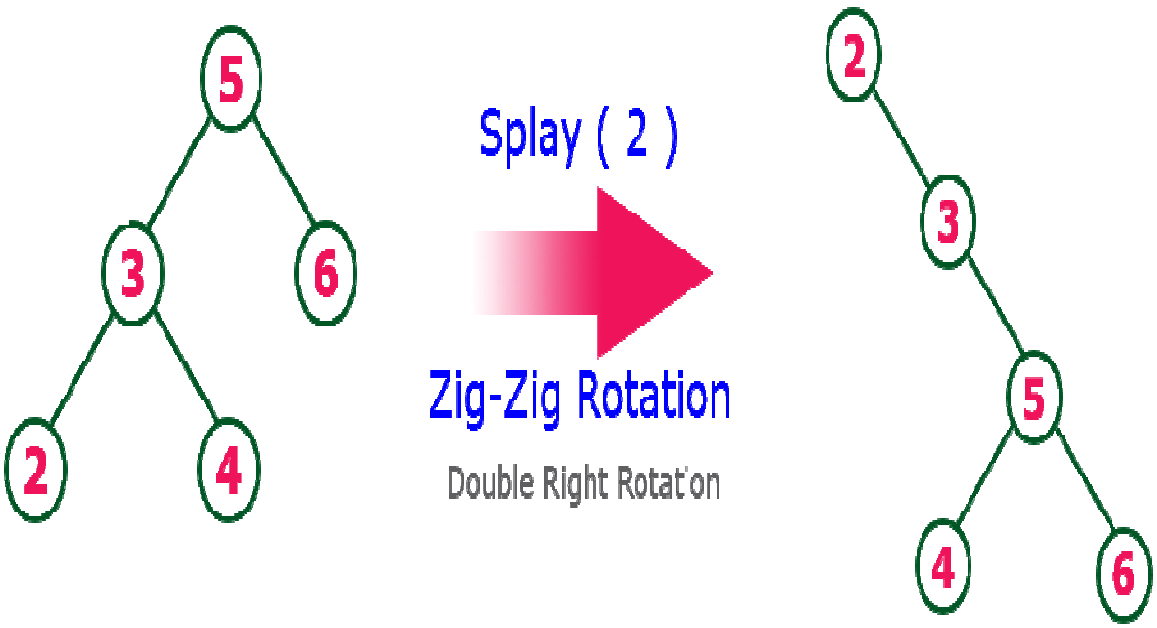
- **Zig - Zig Rotation (Left-Left or Right-Right)**
- **Zig - Zag Rotation (Left-Right or Right-Left)**

Zig-Zig Rotation

The **Zig-Zig Rotation** in splay tree is a double zig rotation. In zig-zig rotation, if the accessed element N contains both parent and grand parent(G), perform the rotation by taking x as reference and perform rotation N and G in clock wise or antilock wise rotation based on left-left or right-right. Repeat this procedure until accessed element x is reached to root node position.

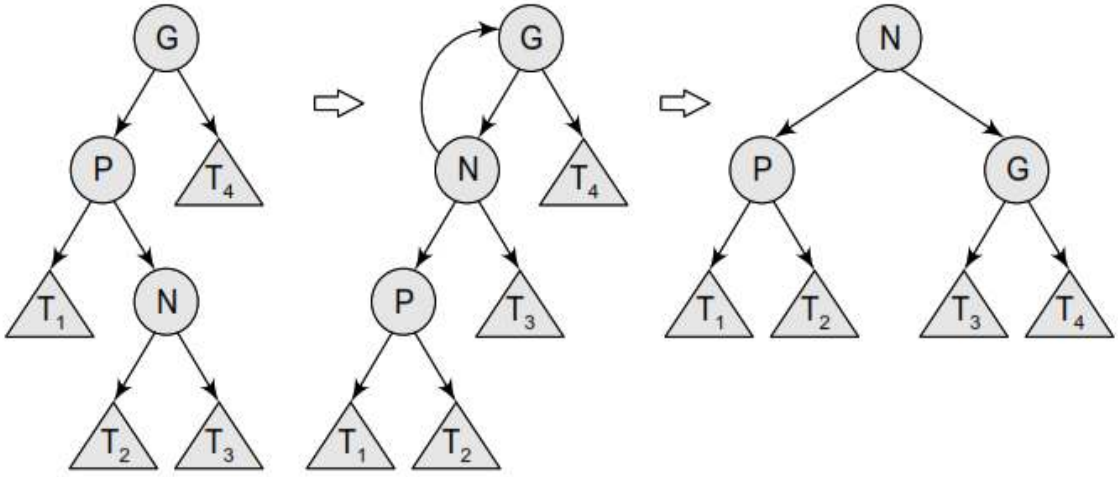


Consider the following example with accessed element is 2. i.e it is left-left. So perform rotation between 2(X) and 5(G) in clock wise.

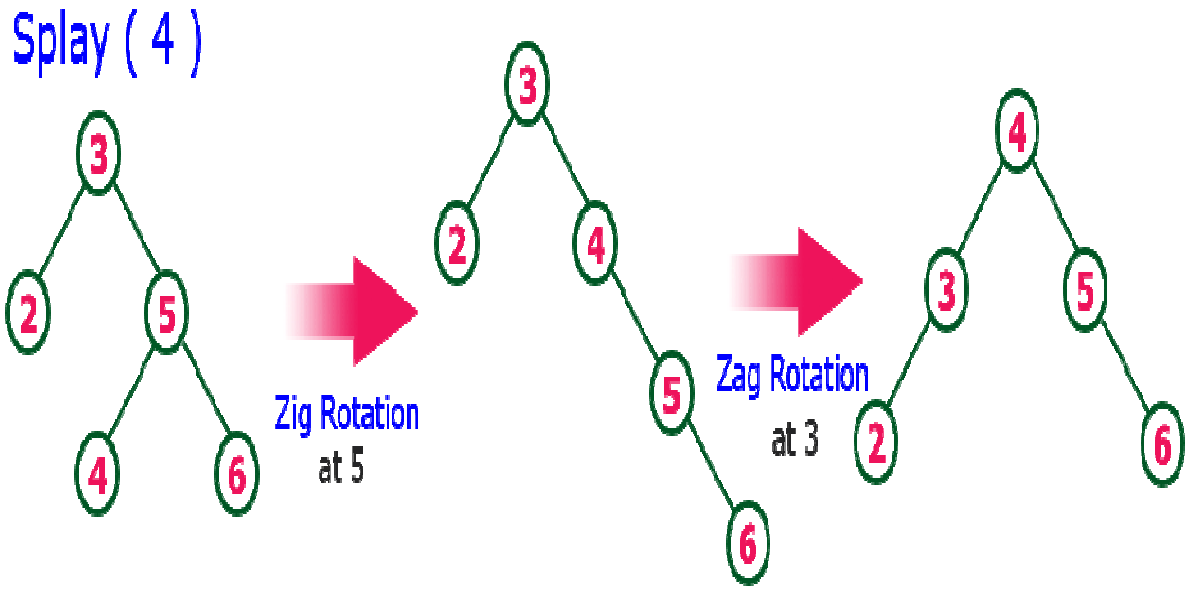


Zig-Zag Rotation

The **Zig-Zag Rotation** in splay tree is a sequence of zig rotation followed by zag rotation. In zig-zag rotation, every node moves one position to the right followed by one position to the left from its current position.



Consider the following example:-



Inserting a Node in a Splay Tree

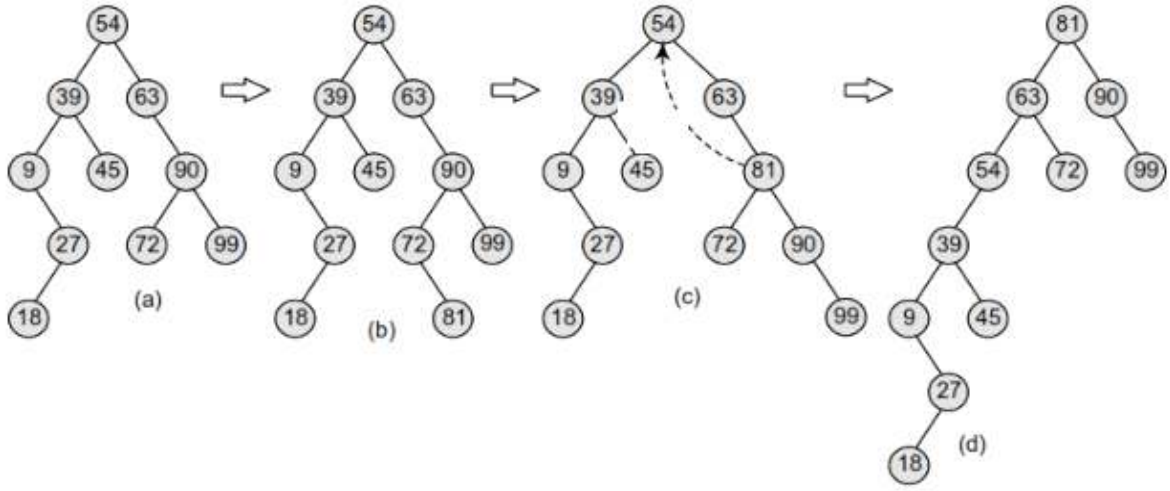
Although the process of inserting a new node N into a splay tree begins in the same way as we insert a node in a binary search tree, but after the insertion, N is made the new root of the splay tree. The steps performed to insert a new node N in a splay tree can be given as follows:

Step 1 Search N in the splay tree. If the search is successful, splay at the node N.

Step 2 If the search is unsuccessful, add the new node N in such a way that it replaces the NULL pointer reached during the search by a pointer to a new node N. Splay the tree at N.

Example :- Consider the splay tree given on the left. Observe the change in its structure when 81 is added to it.

Solution



Deleting a Node from a Splay Tree

To delete a node N from a splay tree, we perform the following steps:

- Search for N that has to be deleted. If the search is unsuccessful, splay the tree at the last non-null node encountered during the search.
- If the search is successful and N is not the root node, then let P be the parent of N. Replace N by an appropriate descendent of P (as we do in binary search tree). Finally splay the tree at P.