**DATA STRUCTURE**

**Project Report**

**PROJECT**

Splay tree

**MADE BY**

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**SPLAY TREE**

**Introduction**

A splay tree is a self-adjusting binary search tree with the additional property that recently accessed elements are quick to access again. It performs basic operations such as insertion, look-up and removal in O(log n) time. For many sequences of non-random operations, splay trees perform better than other search trees, even when the specific pattern of the sequence is unknown. The splay tree was invented by Daniel Dominic Sleator and Robert Endre Tarjan in 1985.

**Can we do better than AVL or Red-Black trees in practical situations?**

Like [AVL](https://www.geeksforgeeks.org/avl-tree-set-1-insertion/) and Red-Black Trees, Splay tree is also [self-balancing BST](http://en.wikipedia.org/wiki/Self-balancing_binary_search_tree). The main idea of splay tree is to bring the recently accessed item to root of the tree, this makes the recently searched item to be accessible in O(1) time if accessed again. The idea is to use locality of reference (In a typical application, 80% of the access are to 20% of the items). Imagine a situation where we have millions or billions of keys and only few of them are accessed frequently, which is very likely in many practical applications.

All splay tree operations run in O(log n) time on average, where n is the number of entries in the tree. Any single operation can take Theta(n) time in the worst case.

**Summary**

* Splay trees have excellent locality properties. Frequently accessed items are easy to find. Infrequent items are out of way.
* All splay tree operations take O(Logn) time on average. Splay trees can be rigorously shown to run in O(log n) average time per operation, over any sequence of operations (assuming we start from an empty tree)
* Splay trees are simpler compared to [AVL](https://www.geeksforgeeks.org/avl-tree-set-1-insertion/) and Red-Black Trees as no extra field is required in every tree node.
* Unlike [AVL tree](https://www.geeksforgeeks.org/avl-tree-set-1-insertion/), a splay tree can change even with read-only operations like search.

### **ROTATIONS**

### Simple rotation

y x

/ \ / \

x C <-> A y

/ \ / \

A B B C

### Zig-Zig and Zag-Zag

z x

/ \ / \

y D A y

/ \ <-> / \

x C B z

/ \ / \

A B C D

### Zig-Zag

z x y

/ \ / \ / \

y D / \ A z

/ \ -> y z <- / \

A x / \ / \ x D

/ \ A B C D / \

B C B C