Day 10

Friday, 27 August, 2021 9:08 PM

TREE

→ hierarchy (links should in hierarchy)
→ non linear
→ tree ← nodes

→ Recursive in nature

* Binary tree
* degree of a node
  ↳ no. of children a node has.

A → B & C
B → C, D

$\deg(A) = 2$

$\deg(B) = 2$

$\boxed{\deg(C) = 0 = \log(2) - \log(2)}$

↳ pt. leaf nodes is 0

* Internal Node

Applications

↳ Organization Chart
↳ Folder Structure
↳ In OOPS (Inheritance)

↳ BST - Binary Tree
↳ Binary Heap
↳ R, B+ tree
↳ Spanning tree ; Shortest path algo
↳ Expression tree in compilers

Advanced BST

* Trie
* Splay Tree
* Binary Index Tree
* Segment Tree

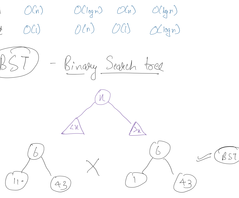
→ Represented using arrays

Binary Tree node almost 2 children

Time / Space Complexity BT [1, 2, 3, 4]

	Array (unsorted)	Array (sorted)	Linked List	BST (balanced)
Search	$O(n)$	$O(\log n)$	$O(n)$	$O(\log n)$
Insert	$O(1)$	$O(n)$	$O(1)$	$O(\log n)$

BST - Binary Search tree

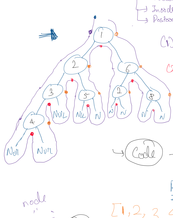


Tree Traversals (level order)

① BFS : Breadth First Search
② DFS : Depth First Search

Top Bottom ; NL by NL

→ Preorder R L R
→ Inorder L R R
→ Postorder L R R



(1) Preorder : 1 2 3 4 5 6 7 8
(2) Inorder : 4 3 2 5 1 7 6 8
(3) Postorder : 4 3 5 2 7 8 6 1

↳ Code → 3 traversals
↳ Recursive
↳ Iterative

node

[1, 2, 3, 4 ...]

← node

helper (node , out)
→ if (node == null) return ;
→ out → node.val
→ helper (node → left , out)
→ helper (node → right , out)

node → null [ ]

node → 1 → NULL, NULL [ ]

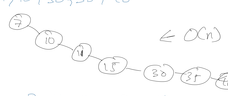
→ Balancing in BT

↳ abs (height(l) − height(r)) ≤ 1

10, 11, 15, 30, 35, 40, 7

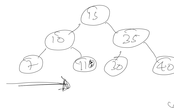
O1: 7, 10, 11, 15, 30, 35, 40

→



← O(n)

O2 : 15, 10, 7, 11, 35, 30, 40



height = log n

Sort → insert
↳ O(n² log n)

→ Rotation :- O(1)

①

(3 − 1 = 2)

Right Rotation

②

→ AVL Tree , Red Black Tree → map, set

AVL Tree
↳ strict in terms Balance

Red Black Tree
↳ less strict of Balance (Less storekeeping)

Search, Insert, Delete → O(log n)
Sorted traversal → O(n)

• Set

arr = [1, 1, 3, 4, 8, 3, 4] ← Sorted order

↳ set → {1, 3, 4, 8}
↳ find()
↳ find(3) → end()
↳ find(3) → iterator
↳ count()
↳ erase()

• Map STL

↳ [1, 1, 6, 3, 4, 3, 1]

↳

Key	Value
1	3
3	2
4	1
6	1