TOPIC Harsh

Date

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Assignment - 3
Data structure & Algorithm.

Ques 1. what is Binary tree?

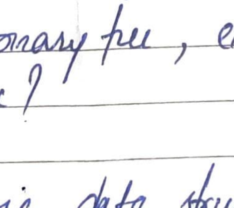
Ans; A binary tree is a type of data structure in which each node has at most two children referred to as the left child & the right child

- Commonly used in searching & sorting algorithm decision - making process.

→ key characteristics of Binary tree?

1. node; Each element in the tree is a Node which Contains a value & links to left & right Children.
2. root; the topmost node in a Binary tree.
3. Leaf; Nodes that have no children.
4. subtree; Each child node represents the root of a Subtree

Example of Binary tree



Ques 2. what is difference between binary search tree, binary tree, complete binary tree, extensible binary tree, Strict binary tree?

Ans 1. Binary tree;

→ It is a basic data structure where each node has atmost 2 children, called the left child & the right child

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2. Binary Search tree (BST);

→ It is a special type of binary tree that Satisfies property!

- for any node with a value v; all nodes in its left subtree have values less than v.
- All nodes in its right subtree have values greater than v.

3. Complete binary tree;

→ All level are fully filled expect possibly the last

→ Nodes are filled from left → right

→ often used in heaps.

4. Strict Binary tree;

→ Also called full / proper Binary tree.

→ Every node has either 0 or 2 children.

5 Extensible Binary tree;

→ self - adjusting tree that can dynamically rebalance (eg → AVL, Red -black tree).

Ques? What is AVL Tree. Explain insertion, deletion & rotation in AVL tree?

Ans; An AVL Tree is a self -balancing binary search tree Named. In an AVL tree, the height difference between the left & Right subtrees of every node is at most.

1) Insertion :.

Insert as in Normal BST : Place the new node in the Correct position according to the binary search Tree.

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(ii) update Balance factors: traverse up the tree from the Inserted node.

(iii) check for Balance; If any node's balance factor becomes -2 or +2, Perform a rotation to rebalance.

2. Rotation in AVL tree;

→ Single rotation: left rotation used to fix a right heavy imbalance

- Right Rotation; used to fix a left-heavy imbalance

(ii) Double rotation;

- left-right rotation: Applied when there's a left right imbalance
- Right-left rotation Applied when there is a right-left imbalance.

Deletion in an AVL tree.

1. Delete as in a normal BST → Remove the node following Standard binary search tree deletion

2. update balance factors; move up from the deleted node's parent & update balance factors

3. Check for Balance:- If any node becomes unbalanced Perform rotations to restore Balance

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Ques 4. What is red Black tree? What are 6 mandatory conditions?

Ans:- A Red-Black Tree is a self Balancing binary search tree in which each node stores an extra bit to signify its color, either red or black. This coloring helps the tree maintain balance allowing for efficient search, insertion & deletion operations.

→ Properties:

1. Binary Search Tree Property:
The tree must be a valid binary tree; that is for any node N, all nodes in the left subtree of N must be less than N, and all nodes in the right subtree of N must be greater than N

2. Node color: Every node is either Black or red.

3. Root property: Root node of the tree must always be black

4. Leaf Property: A red node cannot have a red child i.e red.

5. Red property: A red node cannot have a red child i.e, red nodes cannot be adjacent.

6. Black height property: every path from a node to its descendant leaves must have the same number of black nodes.

Ques 5. What is insertion / deletion in red Black tree?

Ans:- Insertion in a Red-Black Tree:

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1, Insert a in a Binary search tree:
= Place the new node in the correct location as per BST rules.
2 Color the new node red.
3 fix violations:- Performs rotations & recoloring to restore the properties.
→ Case 1 :- Parent of the new node is Black so No violation & no action is needed.
→ case 2; Parent is read & the uncle is red (Re - coloring case) :- Change the color of the parent & the uncle black & color of grandparent red.
→ case 3:- Parent is red & the uncle is black Or absent :- Perform the rotation to make it a left - right or right - left ie then Perfor same with grand parent & re color the Nodes.

Deletion in a Red - Black tree;

1. Delete as in a Binary search tree:
If node has 2 children, replace it with its in order successor.

2. Handle double Black;
If a Black node is deleted it can create a double black situation, violating the Black height property.

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Ques 6 what is splay tree?

Ans It is a type of self adjusting binary search tree In which recently. accessed elements are moved closer to the root

→ features;

- self - adjusting
- No explicit balancing
- Amortized efficiency

→ operation in a splay tree;

- search
- insertion
- deletion

→ Advantages

- fast access for accessed nodes
- simplicity
- efficient.