DSA

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Assignment No - 3.

Title - Tree BST [integer]

objectives -

- To understand the concept of tree data structure and its traversal.
- To implement program to construct BST and find the largest path, minimum node, search specific node and create mirror of constructed BST.

problem statement -

- Begining with an empty binary search tree construct the binary search tree by inserting in the order given.
- After constructing a binary tree Insert a new node.
- Find the number of nodes in longest path from the root.
- minimum data values found into the tree
- change a tree so that the roles of the left and right pointers are swapped at every node.
- Search a value

outcomes -

Student will be able to represent a binary search tree and perform preorder, inorder and postorder. on it.

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Software and Hardware requirement -

Student will be able to represent a binary Search tree and perform preorder, inorder and postorder on it.

- operating System - 64 bit open source linux
- programming tools - c++ programming tool recommended like G++ / Gcc

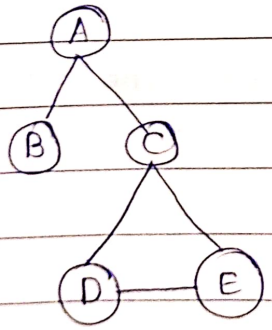
Theory -

Tree - Tree is a non-linear data structure in which the data is arrange in an hierar-chical structure in a recursive way

or

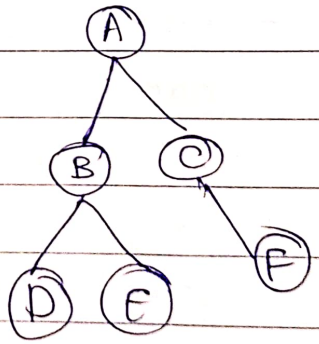
The tree is an non-linear graph which do not have any circuit.

Ex.



①

Not a Tree



②

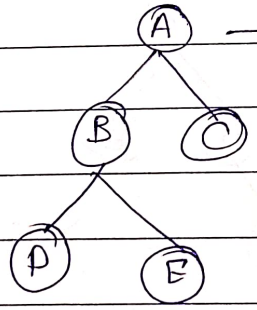
Tree

Basic terminology

1) Root node
2) leaf node
3) Internal node
4) height
5) deapth
6) degree
7) edge
8) level
9) Forest

1) **Root Node:-** Root node is node with no incoming nodes it is tree parent node of other node.

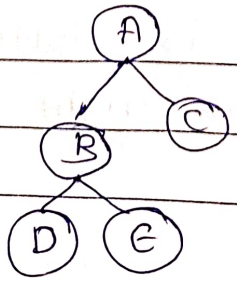
Ex



— root node.

2) **Leaf node -**

leaf node is a node with no outgoing degree it is the lowest node in the tree with no child.



← leaf node.

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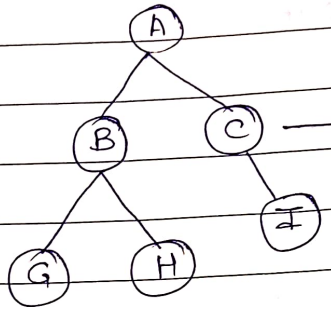
3) Internal node -
The node which has at least one child is called internal node.

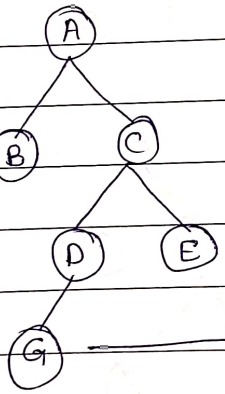
Ex.



→ Internal node

Height - The height of the tree is defined as the total number of edges from the root node to the lowest node of the tree

Ex.



→ lowest node

Height of the tree is - 3.

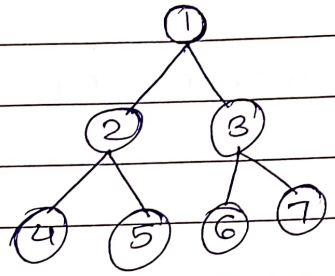
* Tree traversal

① ~~Internal~~ Inorder - In the inorder traversal the left subtree is visited first then the root and later the right subtree.

2> preorder - In the pre-order traversal the root is visited first then the left subtree & then right subtree.

3> Postorder -
In the post order traversal the left subtree and then right subtree and at last the root.

Ex.



1> Inorder traversal - 4, 2, 5, 1, 6, 7,
2> preorder traversal - 1, 2, 4, 5, 3, 6, 7
3> postorder traversal - 4, 5, 2, 6, 7, 3, 1.

Recursion - The process in which a function calls itself directly or indirectly is called as recursion and the corresponding function is called a recursive function.

Properties of recursion -
- performing the same operations multiple times with different inputs.
- In every step, we try smaller inputs to make the problem smaller.

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Algorithm of Height -

- Recursively do a deapth first search.
- If the tree is empty then return 0.
- Otherwise do the following.
- Get the max deapth of the left subtree
- Recursively i.e. call max deapth (tree) > left Subtree)
- Get the max deapth of the right subtree recursively.

max deapth - max(max deapth of left subtree, max deapth of right subtree) + 1

Return max - deapth -

Algorithm.

① Algorithm for preorder Traversal

pre-order (root)

1) Follow step 2 to 4 unit root != null
2) write root → data.
3) preorder (root → left)
4) pre-order (root → right)
5) End loop.

Algorithm for searching an element.

1) Search (root, item)

step 1 - if (item = root → data)

- return root

else if (item < root → data)

return search (root → left, item)
else
return search (root → right, item)
End if

Conclusion - This lab assignment gave us brief knowledge Tree data structure.