Tree

SCSJ2013 Data Structures & Algorithms

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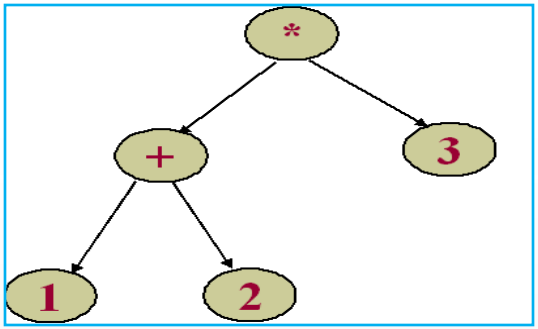
Objectives

At the end of the class students are expected to:

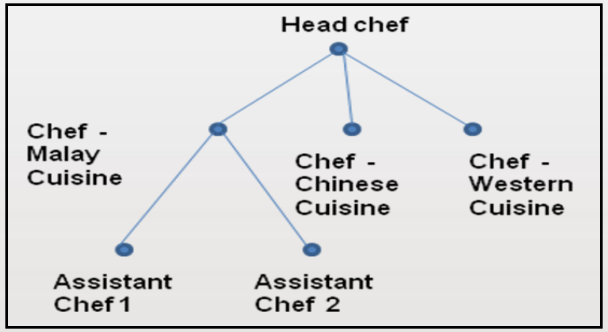
- Understand the tree concept and terms related to tree.
- Identify characteristics of general tree, binary tree and binary search tree
- Identify basic operations of a tree such as tree traversals, insert node, delete node, searching.
- Understand and know how to apply and implement tree in problem solving and in programming.

Introduction to Tree

- Tree is a non-linear data structure that store data in a hierarchy form.
- Example of tree application:
  - Represent algebraic formulas
  - Store data in hierarchy form. Ex: organization chart
  - Decision Tree whereby in artificial intelligence, the information is accessed based on certain decision stored in a tree.



algebraic formulas : (1+2)*3



organization chart

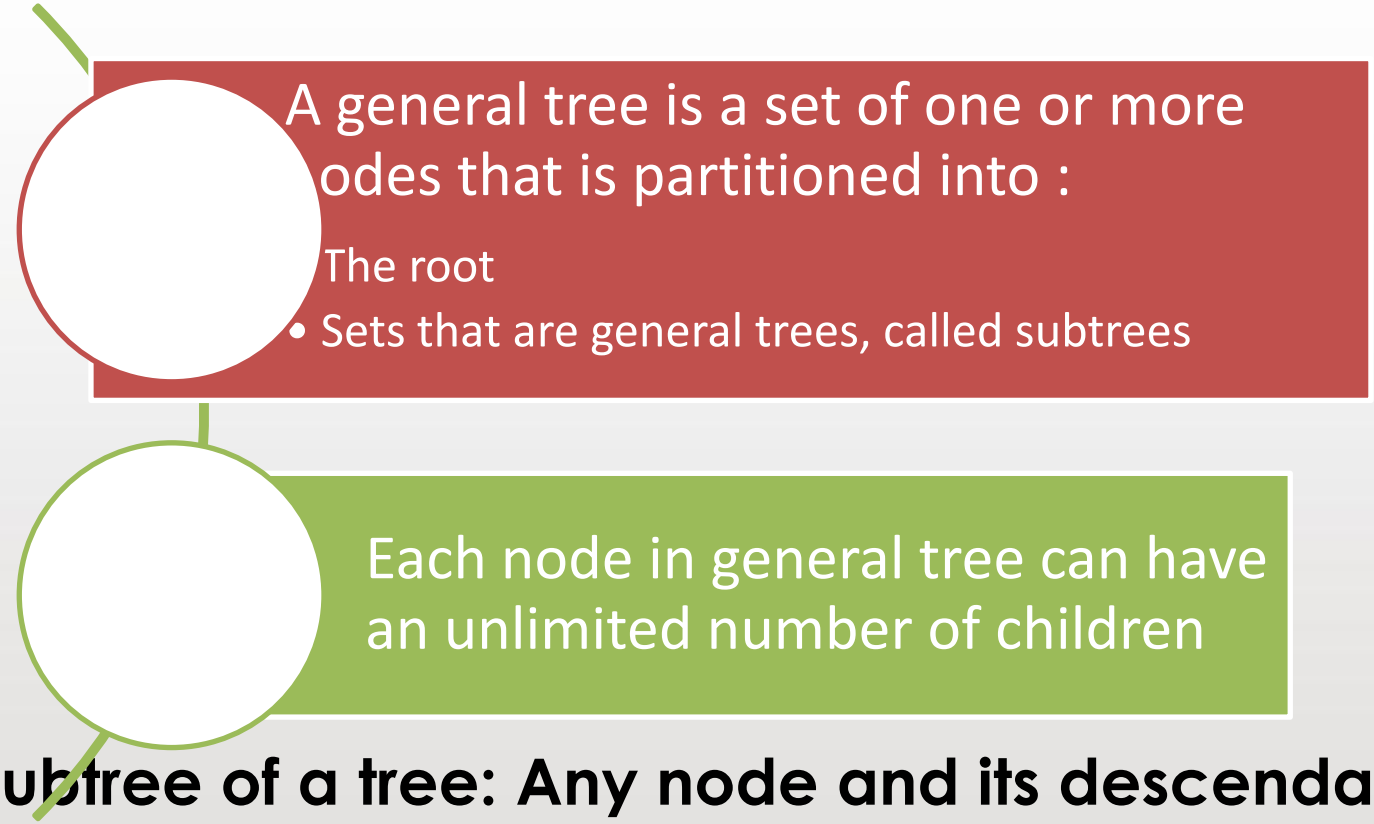
Tree

A tree is a collection of nodes and edges that connect the nodes, whereby:

- The collection can be empty.
- If not empty, a tree consists of a root, and zero or more nonempty subtrees.
- Any two vertices in a tree must have only one path between them or else its not a tree.
- Trees are hierarchical that has parent-child relationship between two nodes

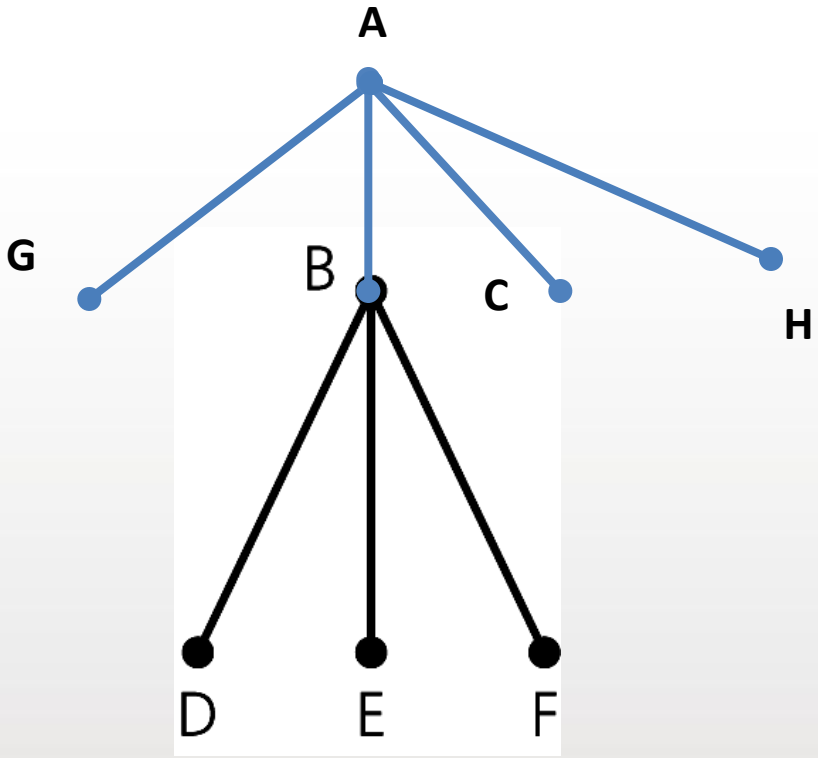
Tree terminology

- **General tree**

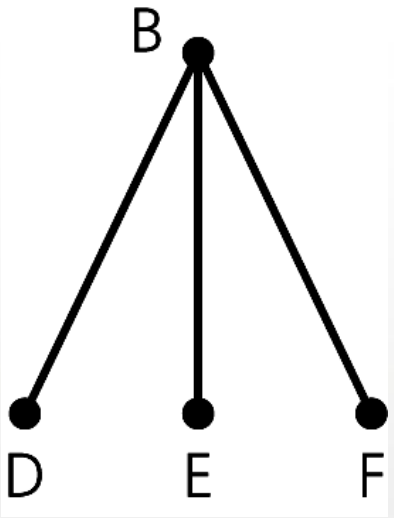


- **Subtree of a tree: Any node and its descendants**

Tree Terminology



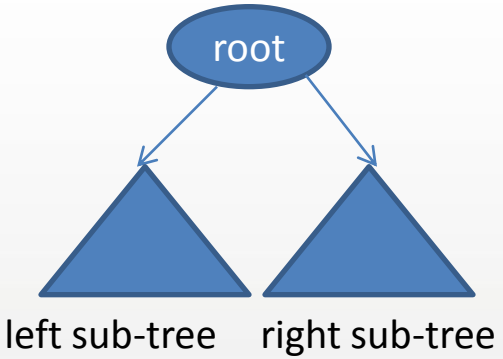
A general tree



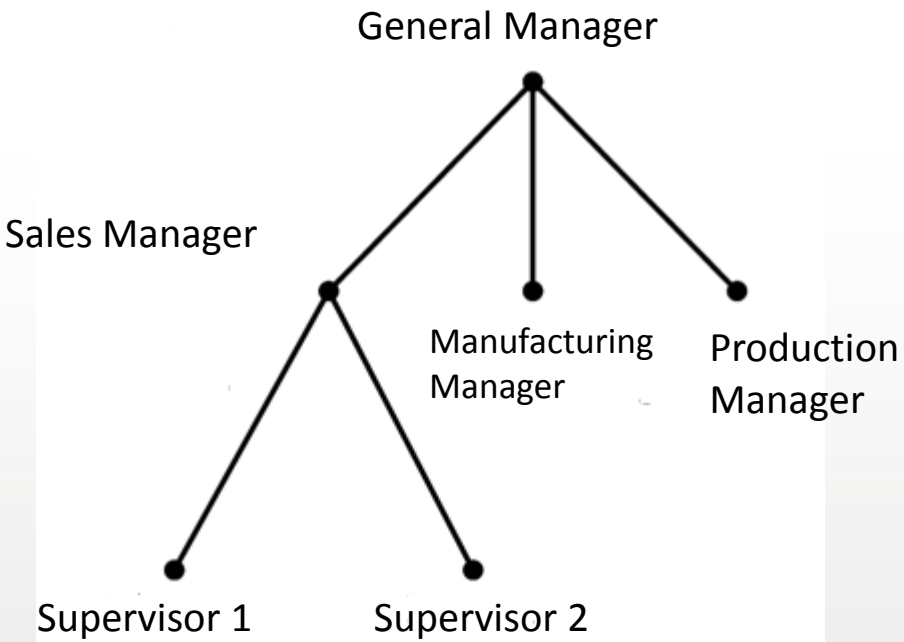
A subtree of the tree in general tree

Binary Tree Definition

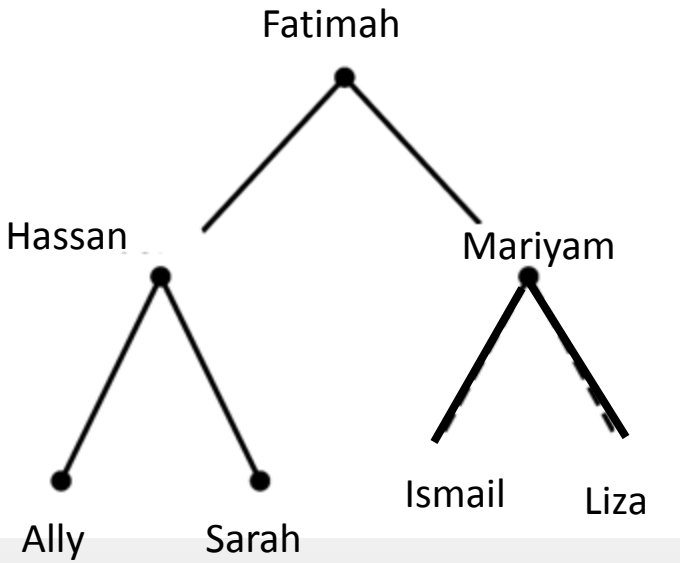
- A tree with restrictions, such that any given node can have at most two child nodes.
- A binary tree consists of a set of nodes such that either :
  - *Tree* is empty, or
  - *Tree* is partitioned into three disjoint subsets:
    - The root
    - Two possibly empty sets that are binary trees, called the left subtree of the *root* and the right subtree of the *root*



A General Tree vs A Binary Tree



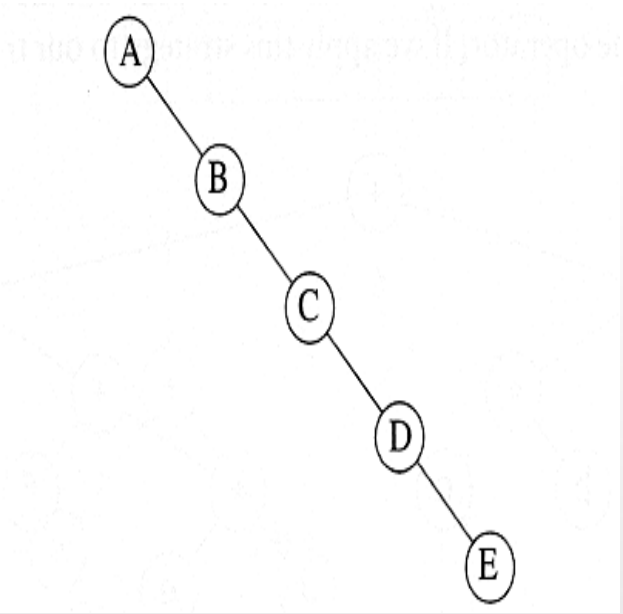
An organization chart



Family Tree

Balanced Binary Trees

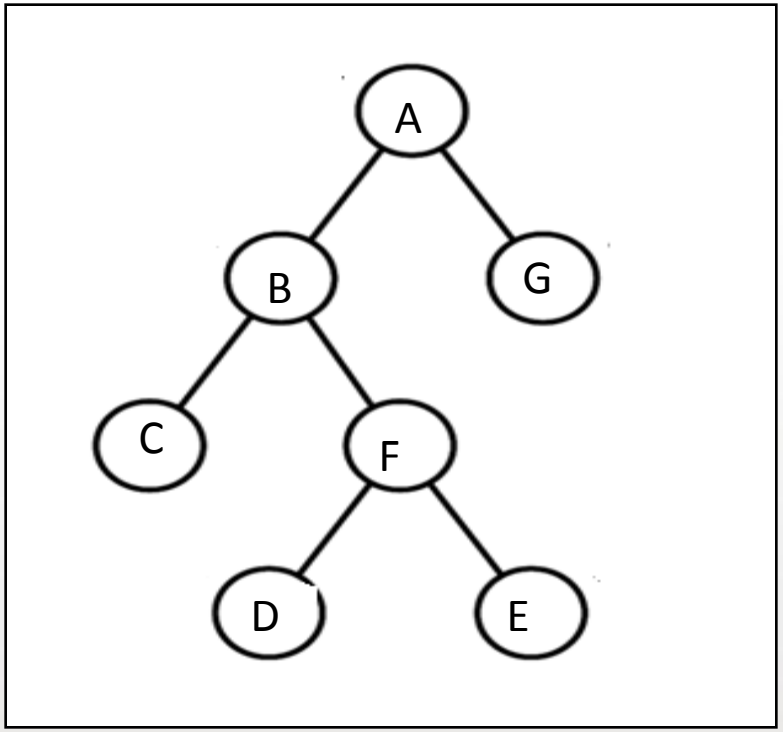
- A binary tree is **balanced** if the heights of any node's two sub-trees differ by no more than 1
- Complete binary trees are balanced.
- Full binary trees are complete and balanced.
- The depth of an average binary tree is considerably smaller than n, even though in the worst case, the depth can be as large as n – 1.



Unbalanced tree : skewed to the right. Depth = n-1 (4)

Example of of Binary Tree Traversals

Pre-order traversal :
ABCFDEG
In-order traversal:
CBDFEAG
Post-order traversal:
CDEFBGA



Summary

Tree provide a hierarchical organization of data with parent-child relationship.

There are many types of tree such as general tree, binary tree and binary search tree.

Traversing a tree is to visit every node in a tree either pre-order, in-order and post-order traversal.

An in-order traversal of a binary search tree visits the tree's nodes in sorted search-key order


Thank
You