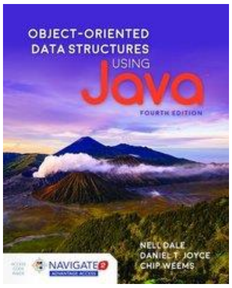
Chapter 7

The Binary Search Tree ADT



Section 1

AN OVERVIEW OF TREES

Objectives

- Review tree terminology

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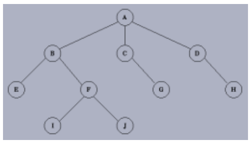
Trees

- A **tree** is a nonlinear, two-dimensional data structure
- A tree is of hierarchical form, whereby an item can have more than one immediate successor



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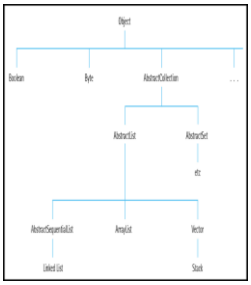
Usefulness of Trees

- Trees are useful for representing hierarchical relationships among data items



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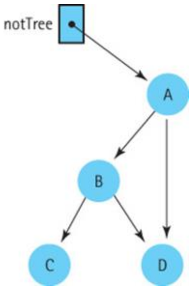
Example of Not a Tree Structure



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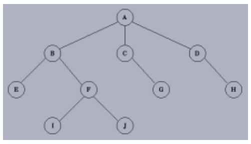
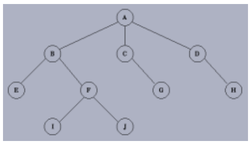
Trees Terminology: The Root Node

- A tree consists of **nodes** and **branches**
- A tree structure is characterized as a set of nodes that originates from a unique starting node called the **root**



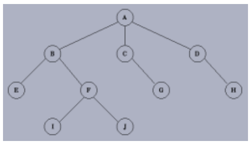
Trees Terminology: Parent and Child Nodes

- A node may be considered a **parent** of 0, 1, 2, or more **child** nodes
- Node B is the parent node of nodes E and F
- Node J is a child node of node F



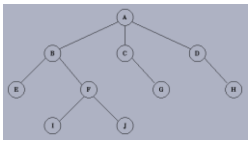
Trees Terminology: Internal Nodes

- An **internal** (or **inner**) node is a node that has a minimum of one child node
- Nodes A, B, C, D, and F are internal or inner nodes



Trees Terminology: Leaf Nodes

- A node with no children nodes is called a **leaf** node
- Nodes E, G, H, I, and J are leaf nodes



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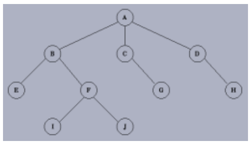
Trees Terminology: Descendant Nodes

- The children nodes of a node and children of these children are called **descendants**
- The descendants of node B are nodes E, F, I, and J



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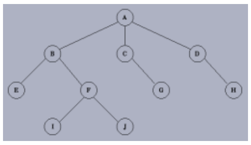
Trees Terminology: Ancestor Nodes

- The parent nodes and grandparents of a node are called its **ancestors**
- The ancestors of node F are nodes B and A



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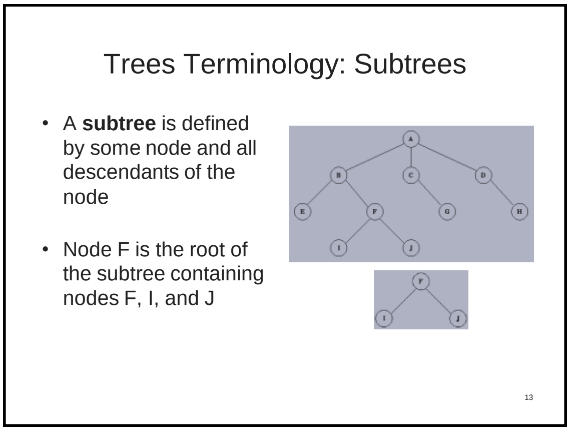

Trees Terminology: Subtrees

- A **subtree** is defined by some node and all descendants of the node
- Node F is the root of the subtree containing nodes F, I, and J

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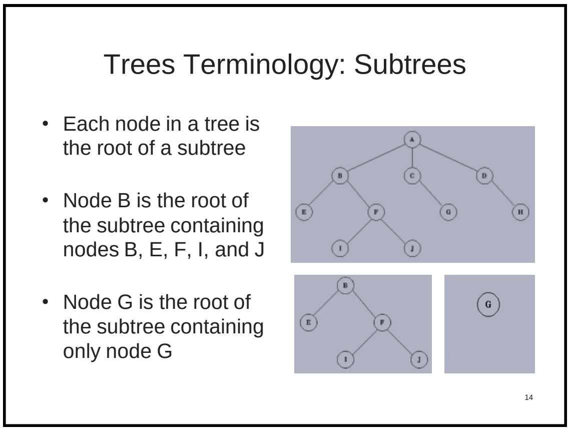

Trees Terminology: Subtrees

- Each node in a tree is the root of a subtree
- Node B is the root of the subtree containing nodes B, E, F, I, and J
- Node G is the root of the subtree containing only node G

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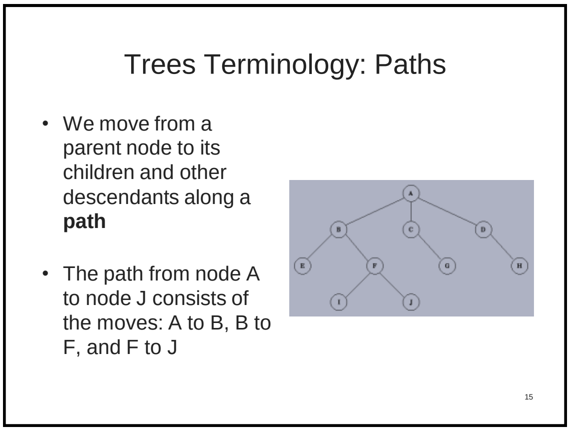

Trees Terminology: Paths

- We move from a parent node to its children and other descendants along a **path**
- The path from node A to node J consists of the moves: A to B, B to F, and F to J

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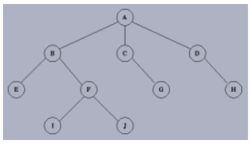
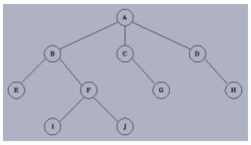
Trees Terminology: Path Length

- The **length** of a path is the number of edges on the path
- The path from node A to node J has length 3 (The path consists of the edges: A to B, B to F, and F to J)

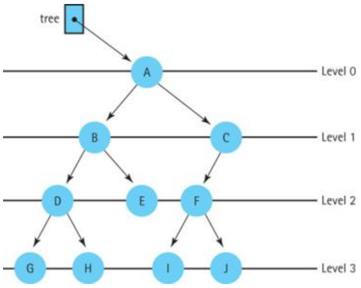


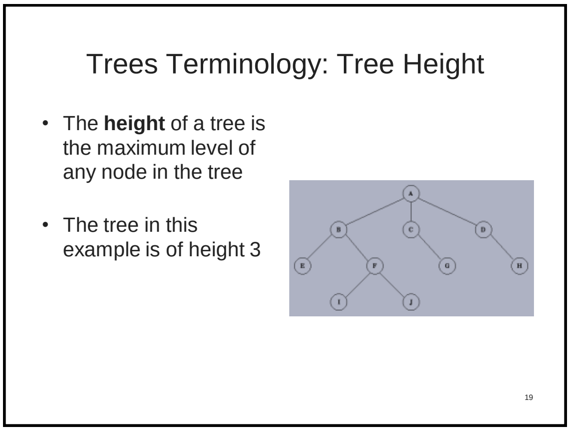
Trees Terminology: Node Level

- The **level** of a node is the length of the path from the root to the node
  - Node A (the root node) has level 0
  - Nodes B, C, and D are of level 1
  - Nodes E, F, G, and H are of level 2
  - Nodes I and J are of level 3



Trees Terminology: Node Level





Trees Terminology: Tree Height

- The **height** of a tree is the maximum level of any node in the tree
- The tree in this example is of height 3

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