

# CSC 212: Data Structures and Abstractions

## Trees

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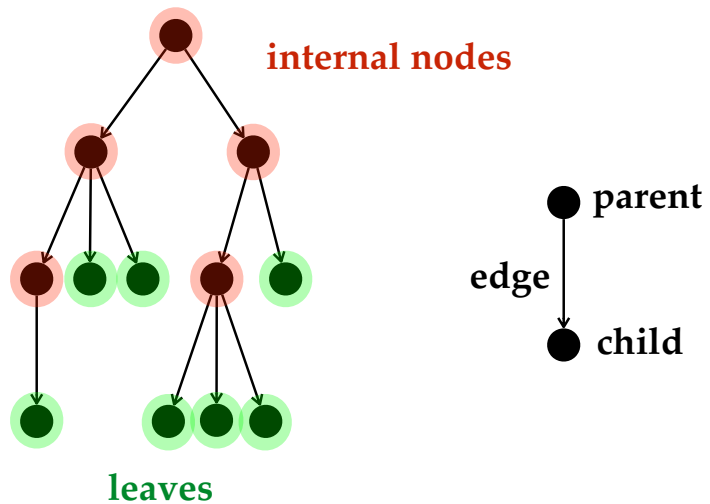
## Trees

- Lists, Stacks, Queues are **linear data structures**
- Trees allow for **hierarchical** relationships
  - nodes have **parent-child** relation



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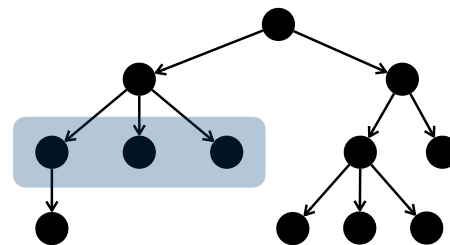
## Trees (jargon)



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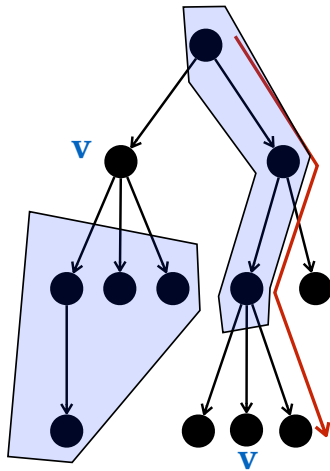
## Trees (jargon)

- Each node is either a **leaf** or an **internal node**
  - an internal node has one or more children
  - a leaf node (external node) has no children
- Nodes with the same parent are **siblings**



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## Paths



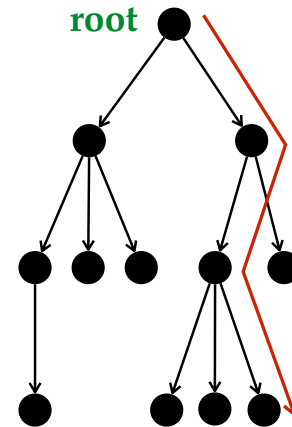
A **path** from node  $v_0$  to  $v_n$  is a sequence of nodes  $v_0, v_1, v_2, \dots, v_n$ , where there is an edge from one node to the next

The **descendants** of a node  $v$  are all nodes reached by a path from node  $v$  to the leaf nodes

The **ancestors** of a node  $v$  are all nodes found on the path from the root to node  $v$

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## Depth and Height



The length of a **path** is the number of edges in the path

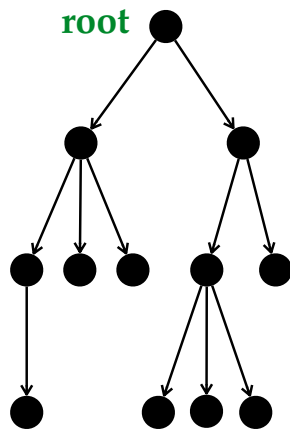
**length = 3**

The **depth** (level) of a node  $v$  is the length of the path from the root node to  $v$

The **height** of a node  $v$  is the length of the path from  $v$  to its deepest descendant

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## Tree Properties



The **depth of the tree** is the depth of deepest node

The **height of the tree** is the height of the root

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