Trees

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

General Trees (definition)

- There is a **unique path** from the root to each node in the tree
- A **tree** is either **empty** or a root node connected to 0 or more trees (called **subtrees**)

CSC 212: Data Structures and Abstractions
14: Trees

Marco Alvarez
Department of Computer Science and Statistics
University of Rhode Island
Fall 2017
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**

**Path**

- A path from node $v_0$ to $v_n$ is a sequence of nodes $v_0, v_1, v_2, \ldots, v_n$, 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 $v$

**Depth and Height**

- The length of a path is the number of edges in the path
- 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
Tree Properties

**root**

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

The height of the tree is the height of the root.

How to implement general trees?

Node:
- data
- parent
- children array

Traversals
Traversing a tree

A traversal is a method that “visits” every node in a tree once

<html>
<head>
<title>My Title</title>
</head>
<body>
<h1>A Heading</h1>
<a href="http://www.uri.edu">Link Text</a>
</body>
</html>
Preorder Traversal

1. `algorithm preorder(p) {`
2.   `visit(p)`
3.   `for each child c of p {`
4.     `preorder(c)`
5.   `
6. }

Postorder Traversal

1. `algorithm postorder(p) {`
2.   `for each child c of p {`
3.     `postorder(c)`
4.   `
5.   `visit(p)`
6. }

UNIX File System

How to compute amount of space used by files in folders and subfolders?