Tree Terminology

A tree is a collection of nodes. A tree is either empty or it contains a node called the root that is linked to zero or more subtrees. The subtrees of a node T are called the children of T and T is called the parent of the subtrees.

A node with zero children is called a leaf.

A path in a tree is a sequence of nodes, \( n_0, n_1, \ldots, n_j \), where \( n_i \) is the parent of \( n_{i+1} \) for \( 0 \leq i < j \).

The length of a path is one less than the number of nodes in the path (this is equivalent to saying the length is the number of edges in the path).

The height of a tree is the length of the longest path from the root to a leaf. The height of an empty tree is -1. The height of a tree with only one node (the root) is 0.

The depth of a node, \( n \), is the length of the path from the root to \( n \).

A preorder traversal of a tree rooted at node \( n \), is a traversal where node \( n \) is visited (the meaning of visited will vary based on the purpose of the traversal) followed by a preorder traversal of each child \( T \).

A postorder traversal of a tree rooted at node \( n \), is a traversal where a postorder traversal of each child of \( n \) is completed followed by a visit to \( n \).

A level order traversal of a tree rooted at node \( n \), is a traversal where the nodes in the tree are visited based on the depth of the node: \( n \) is visited, followed by all nodes at depth 1, followed by all nodes at depth 2, ... until all the nodes at a depth equal to the height of the tree have been visited. A level order traversal is sometimes called a breadth first traversal.

A binary tree is a tree where each node has at most 2 children.

An inorder traversal of a binary tree rooted at node \( n \), is a traversal where an inorder traversal of the left child is completed followed by a visit to \( n \) followed by an inorder traversal of the right child.

A complete binary tree is a binary tree in which every level but the deepest is full and the deepest level is either full or the nodes are as far left as possible.