Rooted Trees

A *directed tree* is a directed graph for which the underlying undirected graph is a tree.

A directed tree is called a *rooted tree* if there is a unique vertex r, called the *root* so that r has in-degree 0, and all other vertices have in-degree 1.

A *leaf* in a rooted tree is a vertex with outdegree zero.

A *branch node* is a vertex which is not a leaf.

Level k of a rooted tree is the level containing all vertices at distance k from the root.

If there is an edge (u, v) in a rooted tree, then v is a *child* of u, and u is the *parent* of v.

An *ancestor* of a vertex v is a vertex on the path from r to v. Vertex v is a *descendant* of u if u is an ancestor of v.

Two vertices with a common parent are called *siblings*.

The *subtree* at vertex v is the subgraph induced by the root v and all of its descendants.

A *binary* rooted tree is such that every vertex has at most two children. It is a *complete* binary tree if every branch node has exactly two children.