Chapter 10: Elementary Data Structures

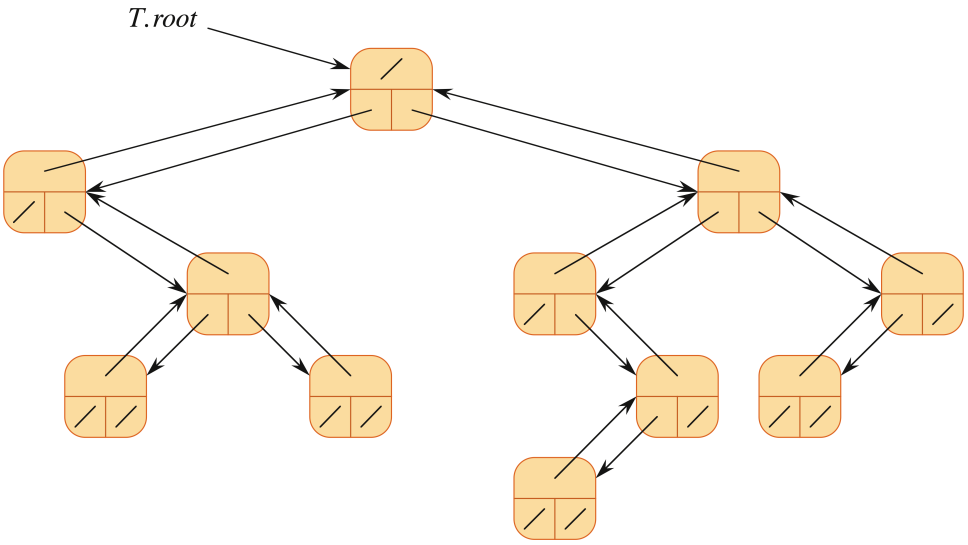
Section 10.3: Representing Rooted Trees

- Trees are composed by tree nodes.
- Each tree node has a key field and some other pointer fields pointing to other nodes. Number of pointer fields in a tree node may be different for different types of trees.
- A tree T has an attribute $T.root$: a pointer to the root of the tree.

Binary Trees

For each node x, there are 3 pointer fields and one data field

- $x.p$ is a pointer to x's parent.
- $x.left$ is a pointer to x's left child.
- $x.right$ is a pointer to x's right child.
- $x.data$ is a pointer to x's satellite data



Rooted Tree with Bounded Branches

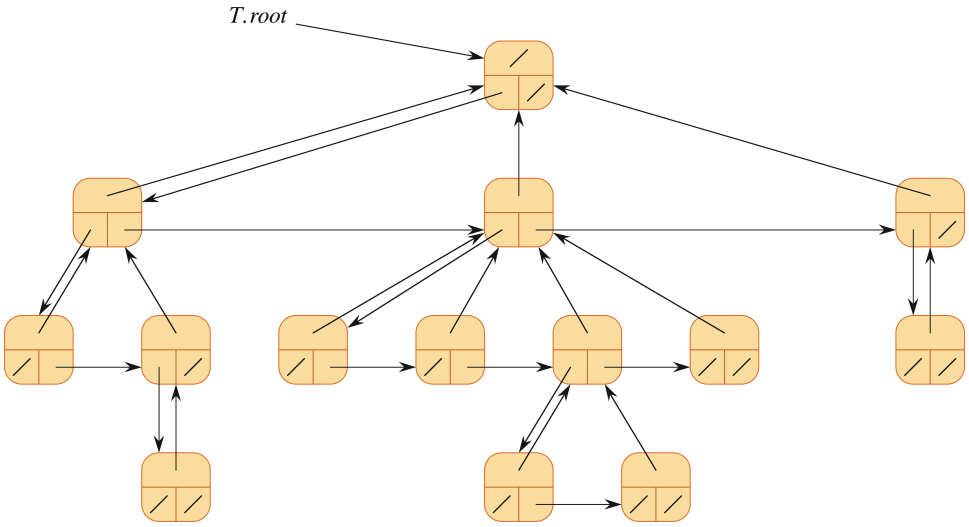
We can represent a general tree that has a bounded number of branches by using an array of pointers. Let the bound be r. A node in such a tree will have the following fields:

- $x.p$ is a pointer to x's parent.
- $x.child[1:r]$ is a pointer to x's children, up to r of them.
- $x.data$ is a pointer to x's satellite data

In general, this would be space inefficient as most of the child pointers will be NIL. But it provides an easy and fast way to access the i child of any node.

Rooted Trees with Unbounded Branches

- Each node can have any number of children.
- Using left-child, right-sibling representation allows us to represent an arbitrary tree using only three pointers per node.
- Three pointer fields for each node x.
  - $x.p$ is a pointer to x's parent.
  - $x.left$ is a pointer to x's left-most child.
  - $x.right$ is a pointer to the sibling of x immediately to the right.



- **Recommended Exercises**: 10.3-1, 10.3-2, 10.3-4.