Summary

What we are going to study?

- Topics
  - general trees, definitions and properties
  - interface and implementation
  - tree traversal algorithms
    - depth and height
    - pre-order traversal
    - post-order traversal
  - binary trees
    - properties
    - interface
    - implementation

  - binary search trees
    - definition
    - h-n relationship
    - search, insert, delete
    - performance

Trees

root

- store elements hierarchically

- the top element: root

- except the root, each element has a parent

- each element has 0 or more children
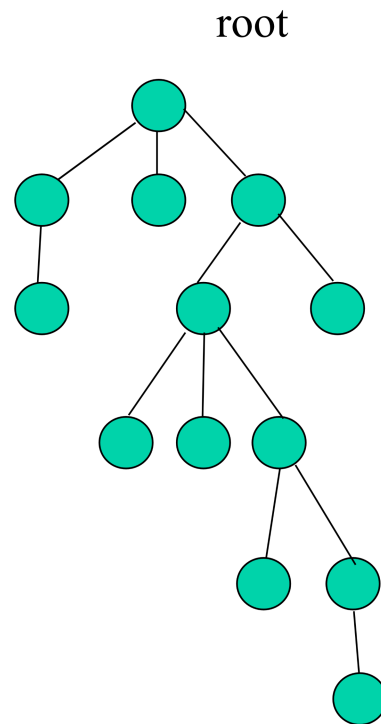
Trees

- **Definition**
  - A tree T is a set of nodes storing elements such that the nodes have a parent-child relationship that satisfies the following
    - if T is not empty, T has a special tree called the root that has no parent
    - each node v of T different than the root has a unique parent node w; each node with parent w is a child of w

- **Recursive definition**
  - T is either empty
  - or consists of a node r (the root) and a possibly empty set of trees whose roots are the children of r

- **Terminology**
  - siblings: two nodes that have the same parent are called siblings
  - internal nodes
    - nodes that have children
  - external nodes or leaves
    - nodes that don't have children
  - ancestors
  - descendants

Trees

root

internal nodes

leaves

Trees

ancestors of u

u

Trees

descendants of u

u