

# CSE 2320 Notes 9: Rooted Trees

(Last updated 10/2/06 8:17 PM)

CLRS, 10.4

TREES

Representing Trees

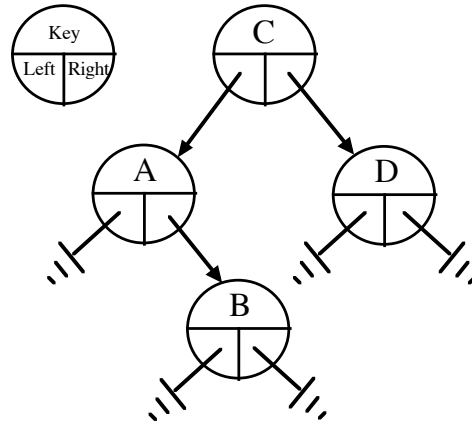
Binary tree

Mandatory

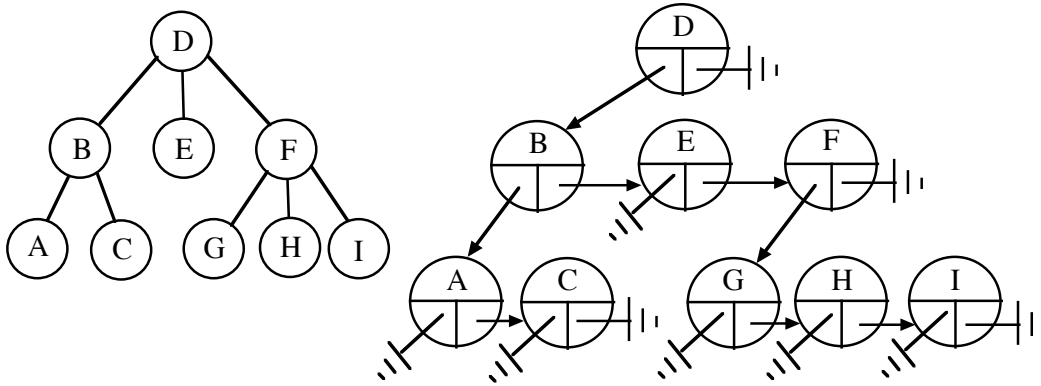
Left  
Right

Optional

Parent  
Key  
Data



Rooted tree with linked siblings



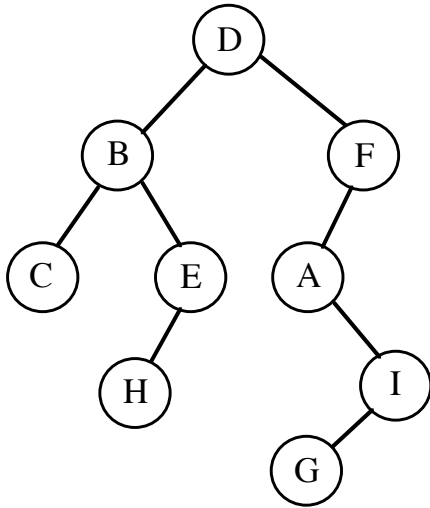
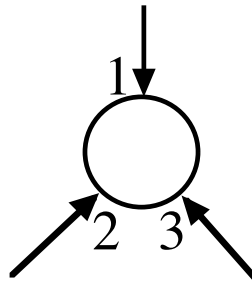
Mandatory

First Child  
Right Sibling

Optional

Last Child  
Left Sibling  
Parent  
Key  
Data

## Binary Tree Traversals (review)

1<sup>st</sup> Visit – Preorder2<sup>nd</sup> Visit – Inorder3<sup>rd</sup> Visit – Postorder

Preorder

D B C E H F A I G

Inorder

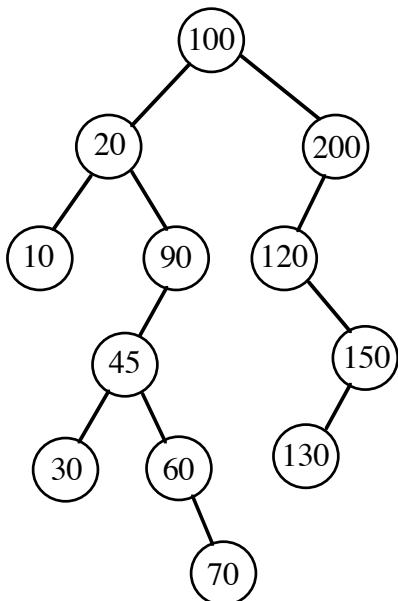
C B H E D A G I F

Postorder

C H E B G I A F D

## Binary Search Trees

Basic property – Go left for smaller keys. Go right for larger keys.

*Which traversal lists the keys in ascending order?*

(Use of sentinel)

Operations:

1. Search
2. Minimum in tree
3. Maximum in tree
4. Successor of a node
5. Predecessor of a node
6. Insert
7. Deletion of key and associated data is contained in:
  - a. Leaf
  - b. Node with one child
  - c. Node with two children
    1. Find node's successor (convention)
    2. Move key and data (but not pointer values) from successor node to node of deletion.
    3. Successor has either
      - a. Zero children – leaf is removed (7.a)
      - b. One child (right) – point around successor node to remove (7.b)

May also use *tombstones* and periodically recycle garbage.

*Time for operations?*