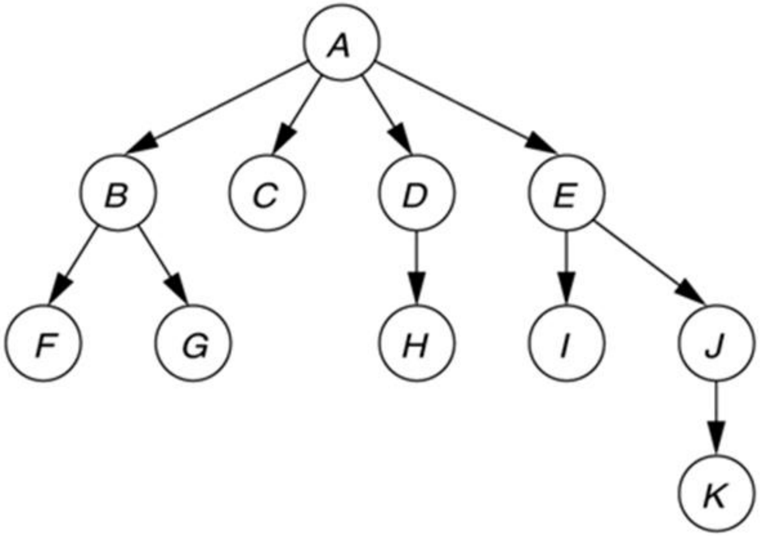


CSSE 230 Day 6

Intro to Trees

After today, you should be able to…

…use tree terminology

…write recursive tree functions

Checkout **BinarySearchTree** from SVN

Pay careful attention to the ACM Code of Ethics essay

- Part of Homework 3
  - Examine the Code of Ethics of the ACM
    - Focus on property rights
  - Write a reaction (1 page single-spaced)
  - Details are in the assignment

- Context for writing efficient code
  - Correct and maintainable, does it need to be fast?
  - Other constraints like space
  - Completing your work ethically
  - Be a team player (next)

Thoughts on Teaming

Two Key Rules

- No prima donnas
  - Working way ahead, finishing on your own, or changing the team’s work without discussion:
    - harms the education of your teammates
- No laggards
  - Coasting by on your team’s work:
    - harms your education
- Both extremes
    - are selfish
    - may result in a failing grade for you on the project

Grading of Team Projects

- I'll assign an overall grade to the project
- Grades of individuals will be adjusted up or down based on team members' assessments

- At the end of the project each of you will:
  - Rate each member of the team, including yourself
  - Write a short Performance Evaluation of each team member with evidence that backs up the rating
    - Positives
    - Key negatives

Ratings

Excellent—Consistently went above and beyond: tutored teammates, carried more than his/her fair share of the load

Very good—Consistently did what he/she was supposed to do, very well prepared and cooperative

Satisfactory—Usually did what he/she was supposed to do, acceptably prepared and cooperative

Ordinary—Often did what he/she was supposed to do, minimally prepared and cooperative

Marginal—Sometimes failed to show up or complete tasks, rarely prepared

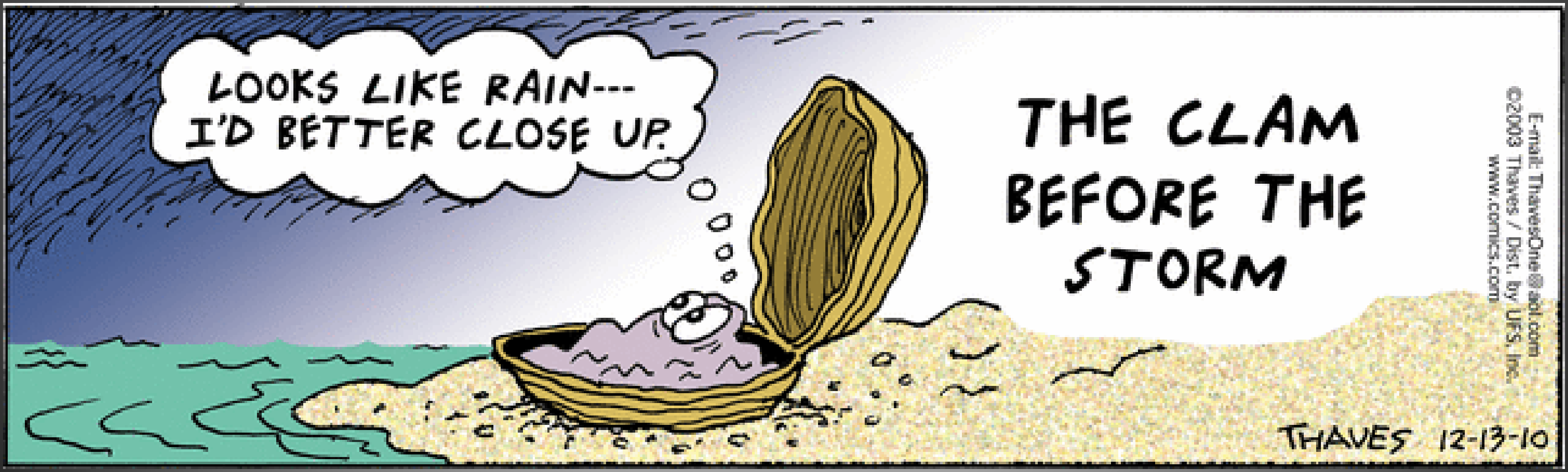
Deficient—Often failed to show up or complete tasks, rarely prepared

Unsatisfactory—Consistently failed to show up or complete tasks, unprepared

Superficial—Practically no participation

No show—No participation at all

Questions?


LOOKS LIKE RAIN---
I'D BETTER CLOSE UP.
THE CLAM
BEFORE THE
STORM
E-mail: ThavesOne@aol.com
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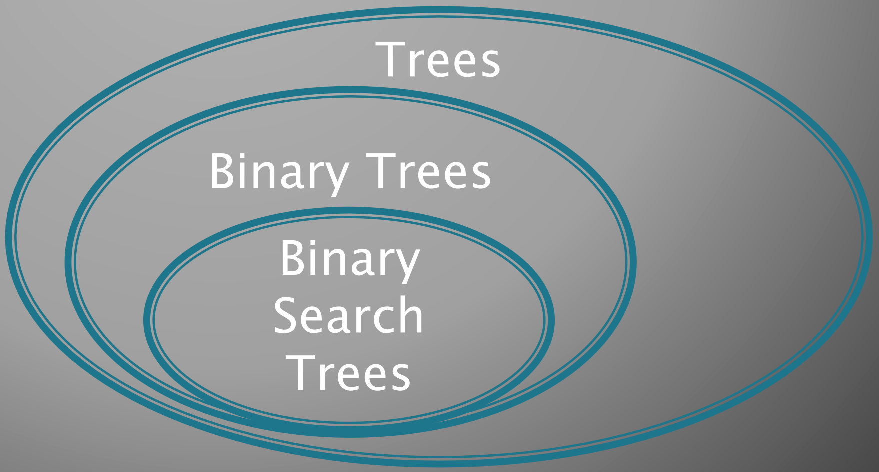
Next:

- an implementation that offers interesting benefits, but is more complex to code than arrays…

- … Trees!

Trees

Introduction and terminology for three types

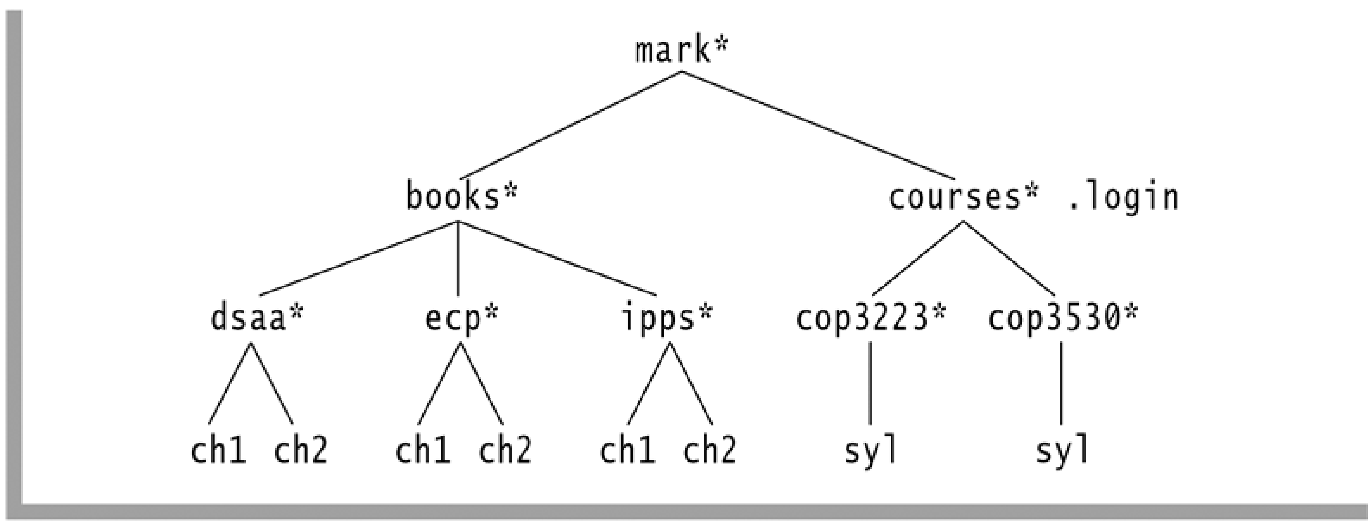


Trees in everyday life

- Class hierarchy tree (single inheritance only)
- Directory tree in a file system

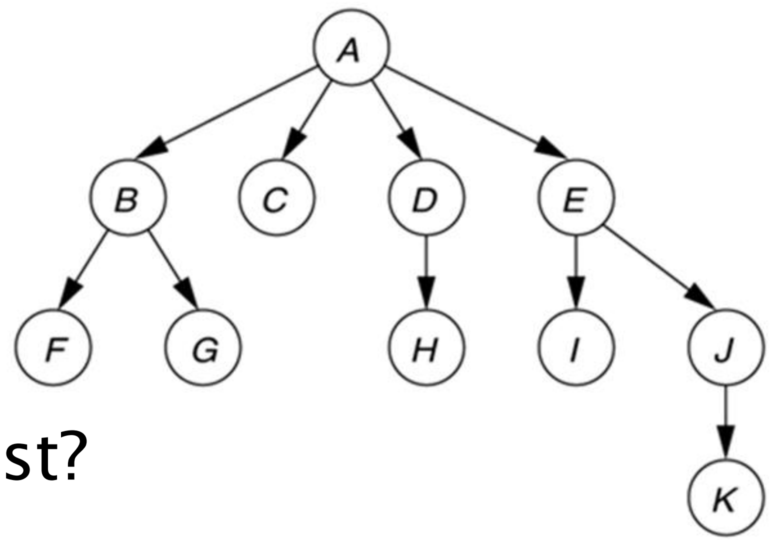
figure 18.4

A Unix directory



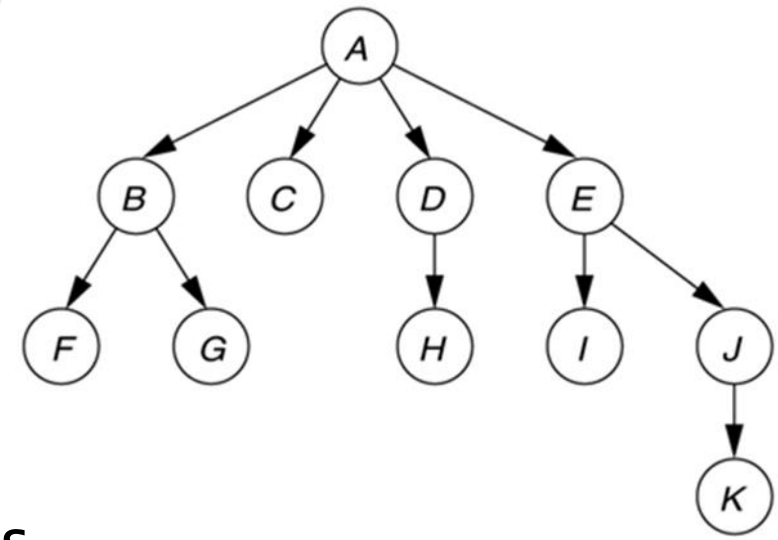
A General Tree—Global View

- A collection of nodes
- Nodes are connected by directed edges.
  - One special root node has no incoming edges
  - All other nodes have exactly one incoming edge
- One way that Computer Scientists are odd is that our trees usually have their root at the top!



- How are trees like a linked list?
- How are they different?

Tree Terminology

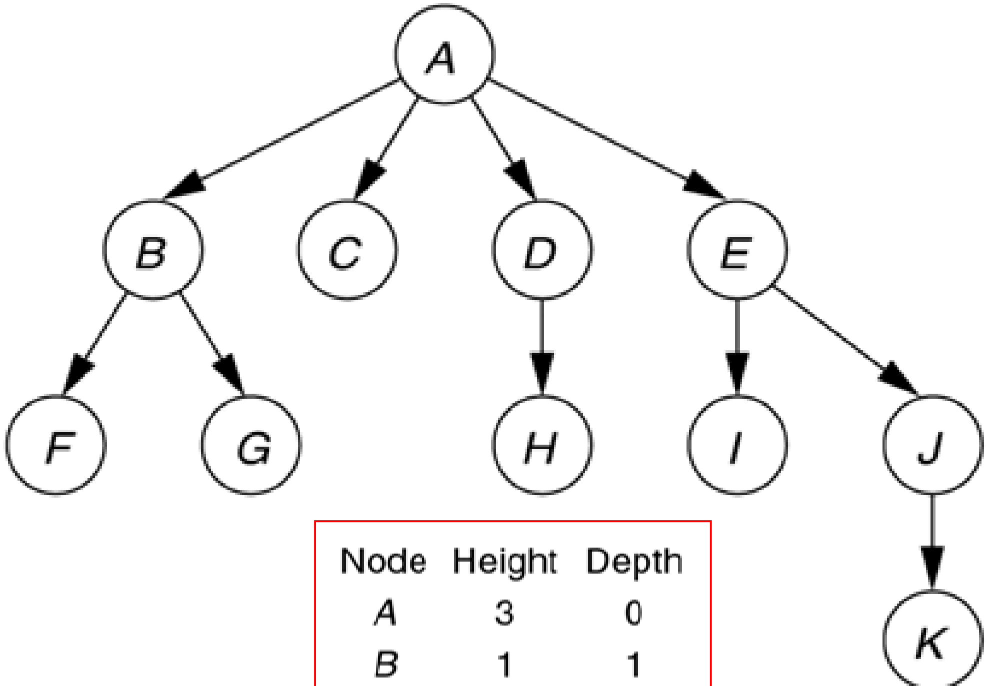


- Parent
- Child
- Grandparent
- Sibling
- Ancestors and descendants
- Proper ancestors, proper descendants
- Subtree
- Leaf, interior node
- Depth and height of a node
- Height of a tree

Node height and depth examples

figure 18.1

A tree, with height and depth information



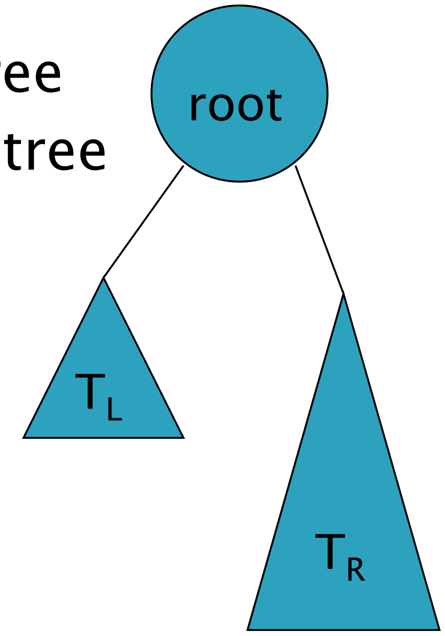
Node	Height	Depth
A	3	0
B	1	1
C	0	1
D	1	1
E	2	1
F	0	2
G	0	2
H	0	2
I	0	2
J	1	2
K	0	3

The **height of a tree** is the height of its root node.

Which is larger, the sum of the heights or the sum of the depths of all nodes in a tree?

Binary Tree: Recursive definition

- A **Binary** Tree is either
  - empty,   or
  - consists of:
    - a distinguished node called the root, which contains an element, and
    - A left subtree T_L, which is a binary tree
    - A right subtree T_R, which is a binary tree



- **Binary** trees contain at most 2 children

Binary Search Trees (BST)

- Q: What property enables us to search BSTs efficiently?
- A: Every element in the left subtree is smaller than the root, and every element in the right subtree is larger than the root. And this is true at **every node**, not just the root.

Connections with Linked Lists

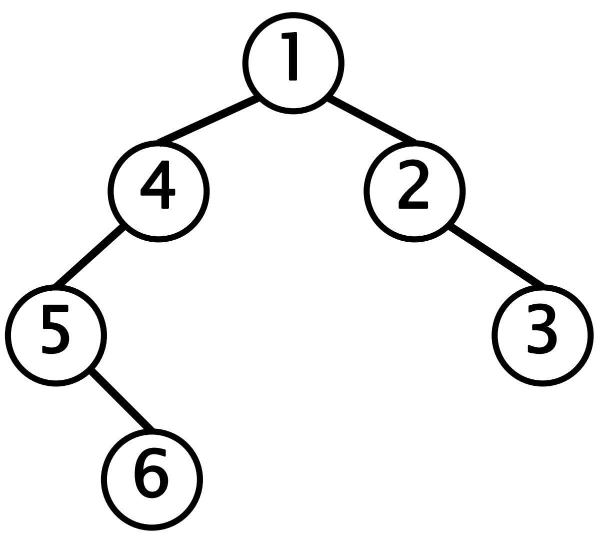
- Write size() for linked list
  - Non-recursively
  - Recursively

- Write size() for a tree
  - Recursively
  - Non-recursively (later)

Growing Trees

- Let's start the BinarySearchTrees assignment: implement a `BinaryTree<T>` class

Test tree:



A single tiny recursive method for size will touch **every node in the tree.** Let's write, then watch in debugger.