

Slide 1

Administrivia

- Reminder: Homework 6 code due today.

Slide 2

Trees — Mathematical Definition

- One definition —
 - Set of nodes, one called root.
 - Set of edges (directed connections between nodes).
 - Root has no incoming edges; all other nodes have exactly one (from parent).
 - Each node can have 0 or more outgoing edges (to children — if none, leaf node).
- Another, recursive definition — tree is one node connected by edges to 0 or more subtrees.
- This is a general tree — e.g., to represent hierarchy such as filesystem.

Implementing Trees

Slide 3

- Define `Node` data structure, analogous to linked list, with reference to data and references to children (array or linked list or ...).
- Easier if number of children is limited to two, and this turns out to be sufficiently useful in practice — “binary tree”. Then `Node` consists of pointers to data and left and right subtrees.

Tree Traversals

Slide 4

- For linked lists we defined a way to visit all elements — “iterator”. Is there something analogous for trees?
- Well — three orders that are easy to define and implement:
 - Preorder — root first.
 - Postorder — root last.
 - Inorder — leftmost subtree first, then root, then remaining subtrees. (Admittedly a little weird for non-binary trees.)
- (Sketch some code for at least one of these.)

Sorted Binary Trees (Binary Search Trees)

Slide 5

- Key property — everything in the left subtree is smaller than the root, and everything in the right is bigger.
- Why is this useful? If you want a data structure to hold a collection that will be searched frequently, what are the choices? and how fast is each to search? to modify (insert/remove)? Compare approximate times for arrays (sorted and unsorted), linked lists (sorted and unsorted), sorted binary tree.
- (Sketch some code for `add` and `find`. `remove` is trickier ...)

Minute Essay

Slide 6

- None — quiz.