6.897
L6.1
Feb. 17, 2005

Pointer machine model — more general than BST

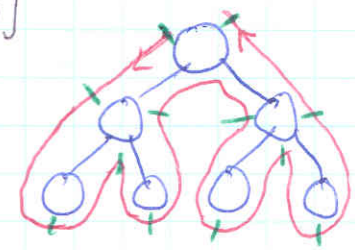
- nodes with O(1) pointers & O(1) fields (integers, etc.)
- machine has O(1) "fingers" to nodes
- ops:
  - copy finger
  - follow pointer: $f \leftarrow f.p5$
  - get/set fields $f.f5$

Augmenting link-cut trees

- can maintain aggregates on paths of tree
  ↳ Σ, min, max, etc.

  e.g. can compute shortest-path length from root to any v (even with weights)
- key: link-cut trees store paths
- important for fast network flow algorithms

Euler-tour trees [Henzinger & King – STOC 1995]



- simple dynamic trees DS
- only supports aggregates on subtrees
- Euler tour = walk around tree
  - visit each edge exactly twice
- each node in represented tree stores pointers to first & last visit by Euler tour
- represent tree by a balanced BST storing Euler tour (one node per visitation by Euler tour)
- cut(v)
  - split v's BST before first visit to v & after last visit to v
  - concatenate the first & last tree (before & after)
- link(v, w)
  - split w's BST after first visit to w
  - paste v's BST in there by two concatenates
- findroot(v)
  - walk up
- O(lg n)/operation