

AVL Trees

4-27-2011

Opening Discussion

- Do you have any questions about the quiz?
- Minute essay comments:
 - Relationship of a “script” with programming. Not directly related to actors.

Balanced BSTs

- The critical flaw of BSTs is that they can become unbalanced leading to $O(n)$ behavior instead of $O(n \log n)$.
- There are approaches to keeping trees balanced where you alter the structure of the tree occasionally.
- It has to be $O(\log n)$ or else it isn't worth it.

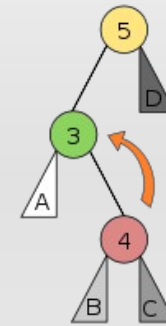
AVL Trees

- One approach to maintaining balance is the AVL tree.
- Each node should keep track of its height. The height of the left and right children should not differ by more than one. If it does, a modification is made to bring it back into balance.
- This can be done by running back up through the nodes to the root on an add or remove and doing rotations when things aren't balanced.

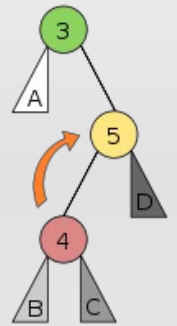
Rotations

- Depending on the structure in the imbalance, you do either a single or double rotation. Tall outer grandchild is single, tall inner grandchild is double.
- Image from Wikimedia Commons, AVL tree entry.

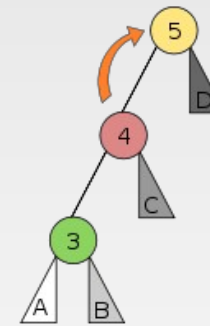
Left Right Case



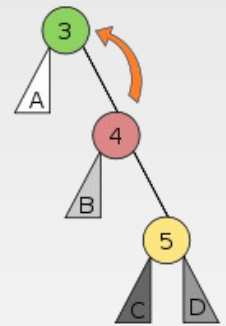
Right Left Case



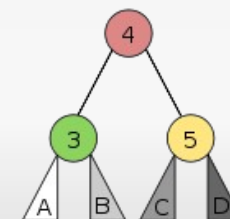
Left Left Case



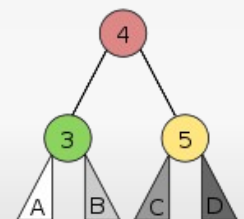
Right Right Case



Balanced



Balanced



Functional Trees

- You can do AVL trees in a non-functional way by keeping track of parents so you can walk back up.
- You can also do them functionally with immutable nodes by rebuilding altered nodes and the path back to the root.

Minute Essay

- Any final requests before the last class?