

Analysis of Binary Trees and Multiway Trees

4-8-2002

Opening Discussion

- What did we talk about last class?
- Do you have any questions about assignments?
- Has anyone looked at the code that I provided on the web for reading in your binary tree from the file? Do you have any questions about it?
- What is the sum of the depths of the nodes in a "average" binary tree?

Look at Code

- I have finished the code that we started in the last class to write a sorted binary tree. Let's go look at that code to see what it does and how it does it.

Finding the Kth Element

- One operation we might want to be able to do is to find the Kth element of a tree, much like we might get an element from an array.
- This can be done in $O(\log n)$ time with a tree if we store the size of each node in it. In this case we do a traversal, but make the decision of which side to branch to based on the node sizes.

Average Depth of Elements

- With most of the operations on a binary tree what we are really interested in is how many nodes we have to visit to get to the one we want. This has a worst case of $O(n)$ as with a linked list, but it turns out that such a configuration is rare.
- The average depth of a binary tree is $1.38 \log_2(n)$. While this is slightly larger than the $\log_2(n)-1$ for a balanced tree it is still quite good.

Multiway Trees

- At times it is also advantageous to have more than two children for each node. This is especially true for special solutions to specific problems.
- For our problem the magic number is 26. For numeric data having 10 children can be helpful. Certain geometric problems lend themselves to other numbers of nodes. Often only leaves contain data.

Examples of Multiway Trees

- Quadtrees and octrees are examples of geometric trees with more than 2 children per node. They divide elements spatially in a 2-D or 3-D manner.
- We are interested in a tree with 26 children per node where each child corresponds to a letter of the alphabet and another letter in the substrings that sit below it.

Code

- As time allows we will now write a 10-way tree that is used for sorting numeric data with the data in the leaves, much like the 26-way tree you need to write for assignment #5.

Minute Essay

- We are basically down to 3 weeks left in the semester (9 class meetings for this class). What are your thoughts on the class? What things can be altered to make the closing stretch more useful for you?
- The 6th and final quiz will be at the beginning of next class.
