CSP2348/CSP5243 Data Structures

Solutions to Review 06

(for reference only)

Topic: Binary Tree Data Structure

1. How many leaf nodes does a fully balanced binary tree of depth d = 3 have?

   $L = 2^d = 2^3 = 8$

2. How many nodes does a fully balanced binary tree of depth d = 3 have?

   $N = 2^{d+1} - 1 = 2^{3+1} - 1 = 2^4 - 1 = 15$

3. What is the range of possible depths of a binary tree with 100 nodes?

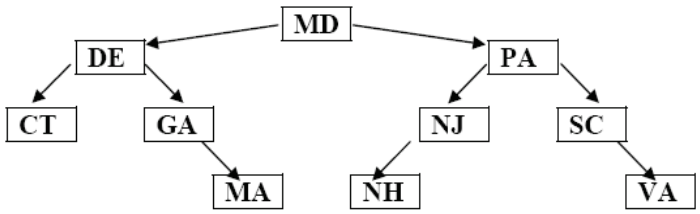
   Minimum depth = *floor*($\log_2 100$) = 6 (Note that $\log_2 64 = 6$, $\log_2 128 = 7$)
   Maximum depth = n –1 = 100 – 1 = 99 (ill-balanced BT)

4. What are the advantages and disadvantages of using a BST?

   The advantage is the efficiency of O($\log_2 n$) that a binary search tree enjoys for insertions and deletions. The disadvantage of a binary search tree is that it may become very unbalanced, in which case searching degenerates into an O(*n*) algorithm.

5. Insert the following 10 states in the US that firstly ratified the US Constitution into a BST. After the insertion, show the results of in-order, pre-order, and postorder visitations of this BST.

   MD, DE, PA, NJ, GA, CT, MA, SC, NH, VA



In-order (l-R-r): CT, DE, GA, MA, MD, NH, NJ, PA, SC, VA
Pre-order (R-l-r): MD, DE, CT, GA, MA, PA, NJ, NH, SC, VA
Post-order (l-r-R): CT, MA, GA, DE, NH, HJ, VA, SC, PA, MD