Department of Electrical and Computer Engineering
McGill University

ECSE-322 Computer Engineering

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Problem Set 3

1. Give upper and lower bounds for the average level of a node in:
   (a) a complete binary tree of height N
   (b) a binary tree of height N.

2. Show the result of inserting 3, 7, 4, 6, 9, 3, 5, 8, and 2 into an initially empty binary search tree. Next, extract the items using inorder, preorder and postorder traversal. For the resulting tree,

   (a) What can you tell about the extracted order of each method?
   (b) Is this a full tree?
   (c) Identify the root
   (d) Identify the leaves
   (e) What are the degree and level of 9?
   (f) What is the height of the tree?

3. Design and implement a program for accepting data as it arrives and placing it in a binary tree structure. The data is in the form of integers. The rule to be followed in constructing the tree is that anything smaller than the root gets placed to the left of the root, anything larger is placed to the right.

   (a) The design should include a flowchart and description.
   (b) Implement your design as a program.

4. In placing numbers in a binary tree, the first number received is to be used as the root. If the total number of data items received is n,

      (a)   discuss the effect on the performance of the tree storage algorithm (i.e. the algorithm designed in question (3)if the majority of the numbers (say 80%) are less than the root value.

      (b)   discuss the effect on the performance of the tree storage algorithm if the data is equally distributed around the root value.

      (c)   If the data is of the form given in part (a), how would you rearrange the tree (once data has been stored in it) to achieve the structure which results in part (b)?

5. Compute the time complexity of the operations: insertion and deletion (including search) for each of the following implementations of an ordered list of size N:

(a) Sorted array
(b) Sorted linked list
(c) Binary tree

Which is the most efficient?