CMSC 341 Data Structures
General Tree Review

October 26, 2010

These questions are intended to assist you when studying for the exams. They are by no means a comprehensive set of all possible exam questions.

1   General Trees

1. Define *tree*

2. Define *k-ary tree*

3. For any tree, T, define the following

   (a) path in T
   (b) length of a path in T
   (c) height of a node in T
   (d) depth of a node in T
   (e) height of T
   (f) depth of T
   (g) external node
   (h) internal node
   (i) leaf

4. Given the drawing of an arbitrary tree, draw the first-child, next-sibling represntation of th tree

5. Given the first-child, next-sibling represenation of a tree, draw the tree.

6. Prove that there n - 1 edges in any tree with n nodes

7. What is the worst-case big-O performance for the insert, find and remove operations in a general tree? Why is this so?

8. Write a recursive member function of the "static K-ary" tree class that counts the number of nodes in the tree.

2 Binary Trees

1. Define *binary tree*, *full* binary tree, *complete* binary tree and *perfect* binary tree.

2. Define internal path length and external path length

3. Prove that a perfect binary tree of height h has 2^h leaf nodes.

4. Prove that a perfect binary tree of height h has 2^{h+1} - 1 nodes.

5. Prove that a full binary tree with n internal nodes has n + 1 leaf nodes.

6. Prove that in any binary tree with n nodes there are n + 1 "null pointers".

7. Suppose you have the following two traversals from the same binary tree. Draw the tree
   pre-order: A D F G H K L P Q R W Z
   in-order: G F H K D L A W R Q P Z

8. Write a recursive member function of the BinaryTree class that counts the number of nodes in the tree.

9. Write a recursive member function of the BinaryTree class that counts the number of leaves in the tree.

10. Given the following binary tree containing integers, list the output from a *pre-order traversal*, an *in-order traversal*, a *post-order traversal* and a *level-order traversal* of the tree.

Pre-order: 87, 56, 93, 39, 42, 114, 66, 123, 29, 17

In-order: 93, 39, 56, 42, 87, 114, 29, 123, 66, 17

Post-order: 39, 93, 42, 56, 29, 123, 17, 66, 114, 87

Level-order: 87, 56, 114, 93, 42, 66, 39, 123, 17, 29