Homework 6: Trees

Data Structures

Write pseudo-code for problems requiring code. Do not write Java, Python or C++. You are responsible for the appropriate level of detail. For the questions asking for justification, please provide a detailed mathematically oriented discussion. A proof is not required.

1. How many ancestors does a node at level n in a binary tree have? Provide justification.
2. Prove that a strictly binary tree (regular binary tree) with n leaves contains 2n-1 nodes. Provide justification.
3. Explain in detail that if m pointer fields are set aside in each node of a general m-ary tree to point to a maximum of m child nodes, and if the number of nodes in the tree is n, the number of null child pointer fields is n\*(m-1)+1.
4. Define the Fibonacci binary tree of order n as follows: If n=0 or n=1, the tree consists of a single node. If n>1, the tree consists of a root, with the Fibonacci tree of order n-1 as the left subtree and the Fibonacci tree of order n-2 as the right subtree. Write a method that builds a Fibonacci binary tree of order n and returns a pointer to it.
5. Answer the following questions about Fibonacci binary tree defined in the previous problem.
   1. Is such a tree strictly binary?
   2. What is the number of leaves in the Fibonacci tree of order n?
   3. What is the depth of the Fibonacci tree of order n?