# CSE 326
Autumn 2005
Assignment 4
Due 10/26/05

For all algorithm and data structure design problems please provide elegant pseudocode and an adequate explanation of your methods. If is often helpful to include small examples demonstrating the method. Put your name at the top of each sheet of paper that you turn in.

1. Design an algorithm for an iterative procedure that prints out a tree in row-by-row order. For example, given the following tree:
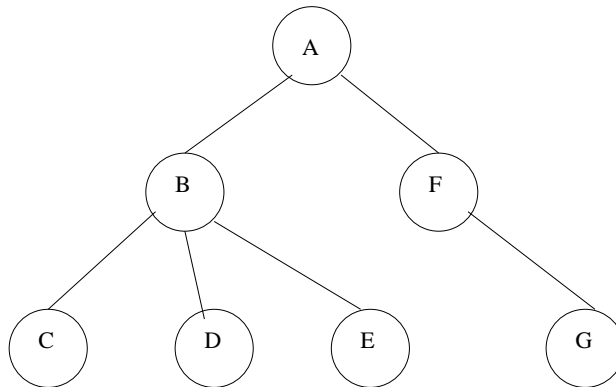
   your function should print A B F C D E G. Assume the tree is represented using the first-child/next-sibling approach. Important hint: your program should make use of a FIFO (first-in, first-out) queue. You should decide on a way to represent the queue, and include this in your pseudocode. It is up to you whether you want to define the queue as an explicit data type using its own set of access functions, or whether you simply implement the queue as part of the overall printing procedure.

2. Consider the task of printing a range of values that are stored in a binary search tree. For example, for the following tree:

8

3   16

1   4   10   30

9   13   24   32
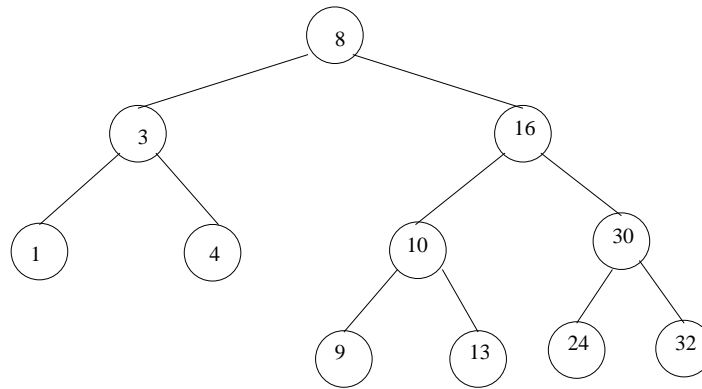
a call to PrintRange(root, 4, 24) would print 4 8 9 10 13 16 24. Present pseudocode for an efficient recursive implementation of PrintRange(root: node pointer, low: integer, high: integer) You may assume that the values low and high actually appear in the tree.

Analyze your algorithm, and prove that if the tree is complete (perfectly balanced) it runs in time $O(k + \log n)$ where n is the number of nodes in the tree, and k is the number of values printed out.