CS W3137 Hmwk 3. Written DUE: Tues., March 10 in class. Programming DUE March 24.

Written section (5 points each - half credit for sane answers with errors, no credit for missing or completely off tack responses.)

As before, the homework should be submitted via github.

Create a new directory named homework 3 in the same format as the homework 2 directory.

1. Give a formal proof using induction that the number of leaf nodes in a perfect binary tree is 2^k.
2. Give a formal proof using induction that the number of interior nodes in a perfect binary tree of height K is $2^k - 1$
3. Weiss book 4.6
4. Weiss book 4.8
5. Weiss 4.27
6. Weiss 4.31c
7. Weiss 4.46
8. Given a binary tree T, devise a method to output the tree to a file so it can be read in again by another program. Outline briefly how the file may be read into the correct tree structure. Note: You MAY NOT use the Java serializable class to do this.
9. The preorder traversal of a binary tree is ”A B C D E F G H I” and inorder traversal is ”C D E B F A I H G”. Draw the tree

Programming Problem (55 points)

Note that up to 10% of your points may be deducted for failing to make it easy to understand and run your submission. This means a) documenting the expected behavior and needed libraries in a readme file, and b) submitting a build script if compilation is more complicated than simply invoking the javac compiler.

1. You will create a program that will read in a legal infix arithmetic expression and output an expression tree for the infix expression. The infix input string can include integers, the operator set of +,-,*,/,^ and parentheses.
What you need to do:
(a) (5 pts) Create an input text area in a GUI to allow the user to type in the infix expression.

(b) (20 pts) Create a button to convert the infix to postfix format, and print the postfix out in another text area of the GUI.

(c) (20 pts) Create a button to convert the postfix expression into an expression tree, and display the expression tree in the GUI.

(d) (5 pts) Create a button to traverse the expression tree to evaluate the expression's value and output the value in the GUI.

(e) (5 pts) Create a button to traverse the expression tree and output in another text area of the GUI a fully parenthesized version of the expression in infix form.

Extra credit (4 pts): Have your program accept legal infix expressions with a unitary minus operator such as -3*(5-3)+(-5). You can see what is legal by running the Unix calculator program bc and seeing if it accepts your input.