Problem Set #10 - Due 04/23/03 Total 100

The purpose of this problem set is to:

- Help you become familiar with ordered binary trees, Depth First Search, Breadth First Search and Creating ordered trees.

Please turn in each problem on a separate page. Each page should have your Name, email id, and the problem number clearly printed/written on it. Keep track of how long time it takes to complete each problem. The time taken for each problem should be printed on the first page. If you use more than one page for one problem, please STAPLE the pages together. You will lose points if you do not document the time taken for each problem, which at the same time means that you will get points for documenting "time taken" A template (in PDF form) is available on the web.

Problem 1 - 50 points

Part a. Write pseudo-code to

- Create an ordered binary tree of integers
- Perform a depth first search on your tree.
- Perform a breadth first search on your tree.

The general idea behind creating an ordered tree is

- store the numbers in an array,
- sort the array in ascending or descending order
- find the middle element, make it the root
- split the array into two parts, 1..middle-1, middle+1..size of array.
- set left child to be middle of the first half, and set right child to middle of the second half of the array
- repeat the algorithm with the left and right children as roots for the array 1 .. middle-1 and middle+1 .. size of array.

Part b. Implement the pseudo-code above in Ada95 i.e. create an .ads and .adb file to implement the pseudo-code you wrote.

Part c. Write a test program

- to accept 20 integers
- create an ordered tree
- traverse the tree using the depth first search algorithm
- traverse the tree using the breadth first search algorithm.

Turn in a **hard copy** of the code listing for **part b and part c,** and turn in **your code** for **part b and part c electronically**. Feel free to reuse any of the code you have written / received so far. If you are reusing material, make a note of it in the header of your program ☺.

Problem 2 - 40 points

Part a. What is a Push Down Automata?

Part b. Let $M = <\{q_1, q_2\}, \{0, 1\}, \{R, B, G\}, \delta, q_1, R, \phi>$ where δ is defined by:

$\delta(q_1, 0, R) = \{(q_1, RB)\}$
$\delta(q_1, 0, G) = \{(q_1, GB)\}$
$\delta(q_1, 0, B) = \{(q_1, BB),(q_2,\varepsilon)\}$
$\delta(q_1, 1, R) = \{(q_1, RG)\}$
$\delta(q_1, 1, B) = \{(q_1, BG)\}$
$\delta(q_1, 1, G) = \{(q_1, GG),(q_2,\varepsilon)\}$
$\delta(q_1,\varepsilon, R) = \{(q_2,\varepsilon)\}$
$\delta(q_2, 0, B) = \{(q_2,\varepsilon)\}$
$\delta(q_2, 1, G) = \{(q_2,\varepsilon)\}$
$\delta(q_2,\varepsilon , R) = \{(q_2,\varepsilon)\}$

What is the language accepted by the PDA? Show the computation of the machine for an input 0110.

Part c. Let the context free grammar *G* have the following rules:

$S \rightarrow aAS$
$S \rightarrow a$
$A \rightarrow SbA$
$A \rightarrow ba$

What is the derivation of the string w = aabbaa?

Problem 3 - 10 points

Part a. Do you have a project plan?

Part b. What is the main timeline for the project? Sketch / explain it.

Part c. Is there anything else you would like to add?