Data Structures

Fall 2020, Homework #2

Date: Oct. 26, 2020

1. (40 pts) An expression is called the *prefix expression* if the operator appears in the expression before the operands, i.e., of the form (operator operand1 operand2). For example, $*+AB-CD$ represents $(A+B)*(C-D)$.

   (1) (15 pts) Given prefix expression $-*+AB-CD/EF$, convert it into an infix expression (with parentheses if needed) using a stack. To this end, read symbols in the prefix expression from right to left. Show the contents of the stack when each of the symbols is being read and processed.

   (2) (15 pts) Design an algorithm to convert Infix to Prefix. If needed, you may use the Infix-to-Post conversion discussed in class as a subroutine.

   (3) (10 pts) Apply your algorithm in (2) to the following Infix Expression:
   A + (B * C - (D / E - F) * G) * H
   Show the steps of your conversion in detail. That is, show the output as well as the contents of the stack when a character is read.

2. (20 pts) *Trees*

   (a) (10 pts) Draw all binary trees of 4 nodes.

   (b) (10 pts) Draw all ordered (not necessarily binary) trees of 4 nodes.

3. (20 pts) *Tree Traversal*

   (a) (10 pts) Is it possible to construct a unique binary tree from its inorder and preorder traversal sequences? How?

   (b) (10 pts) Apply your method to the following:
   Inorder: D B E A F C
   Preorder: A B D E C F

4. (20 pts) Suppose that we have numbers between 1 and 1000 in a binary search tree and want to search for the number 363. Which of the following sequences could **NOT** be the sequence of nodes examined and why?

   (a) 2, 252, 401, 398, 330, 344, 397, 363

   (b) 924, 220, 911, 244, 898, 258, 362, 363

   (c) 925, 202, 911, 240, 912, 245, 363

   (d) 2, 399, 387, 219, 266, 382, 381, 278, 363

   (e) 935, 278, 347, 621, 299, 392, 358, 363