

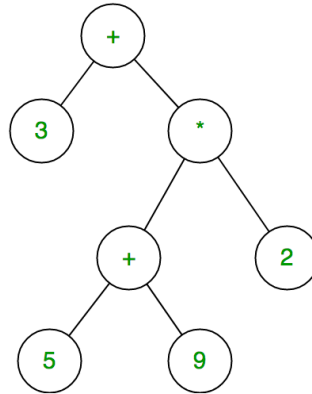
DSA (SE) Assignment 2– Fall 22

Deadline: 5 December, 2022

CLO 4 Assessment [10 Marks]

Background:

The expression tree is a binary tree in which each internal node corresponds to the operator and each leaf node corresponds to the operand so for example expression tree for $3 + ((5+9)*2)$ would be:



Inorder traversal of expression tree produces infix version of given postfix expression (same with postorder traversal it gives postfix expression).

- The operator present in the depth of the tree is always at the highest priority.
- The operator, which is not much at the depth in the tree, is always at the lowest priority compared to the operators lying at the depth.
- The operand will always present at a depth of the tree; hence it is considered the highest priority among all the operators.
- In short, we can summarize it as the value present at a depth of the tree is at the highest priority compared with the other operators present at the top of the tree.
- The main use of these expression trees is that it is used to evaluate, analyze and modify the various expressions.
- It is also used to find out the associativity of each operator in the expression.
- For example, the + operator is the left-associative and / is the right-associative.
- The dilemma of this associativity has been cleared by using the expression trees.

Deliverables:

Your task is to implement the following functionality:

1. an algorithm to convert infix expression into an expression tree.
2. an algorithm to display the expression tree.
3. an algorithm to evaluate expression tree. Should display the values of all variables and final result.
4. a menu-driven implementation to use the above three.

You will need an algorithm to convert an infix expression into postfix before building express trees. Variable names in the expression can be any small letter (a-z). Use random number generator to assign value to variable names while evaluating.

Every node of expression tree will have two attributes to hold the variable name (a-z) and the value of the variable (randomly generated integer value before evaluation) along with pointers needed to main tree structure.

Penalty for Plagiarism: F grade will be assigned in the course as per university regulations.

Readings:

- Expression Tree - GeeksforGeeks
- Section 4.2.2 of Mark Allen Weiss Book (Fourth Edition, Data Structures and Algorithm Analysis in C++)
- Lecture Notes on Expression Tree (Provided as a separate PDF)