

Quiz 5

Name: _____

1. Parsing

Recall the arithmetic expression language that we covered in class and in a programming assignment. The production rules and evaluation rules were given as follows:

$$\begin{aligned} R0 : \langle e \rangle &\rightarrow \text{num} & V(\langle e \rangle) &= \text{num} \\ R1 : \langle e \rangle &\rightarrow \text{op } \langle e \rangle_1 \langle e \rangle_2 & V(\langle e \rangle) &= \text{op}(V(\langle e \rangle_1), V(\langle e \rangle_2)), \end{aligned}$$

where num represents a number, op represents an arithmetic binary operation and $V()$ represents the value function.

(a) Draw the parse tree for the following valid expression and determine the value.

$$* - * 5 2 / 12 3 + 6 3$$

- (b) The above grammar is *unambiguous* in the sense that the parse tree (and, hence, the value) of a given expression is unique. Suppose we add the following third production rule to the language, that allows the unary '−' operation.

$$R2 : \langle e \rangle \rightarrow -\langle e \rangle_1 \quad V(\langle e \rangle) = -V(\langle e \rangle_1)$$

The enhanced grammar now becomes ambiguous; that is, there may be more than one way to parse a given expression. Describe two different ways to parse the following expression (either using parse trees or giving the order of operations), and show that the two different parsings yield two different values.

$$* - - 7 \ 10 \ 5$$

2. Program memory management

What is the *buffer overrun* problem? What is the difference between a reference counting garbage collector and a tracing garbage collector?