

Computer Science Language Processors

Rules

- The duration of the test is **3.0 hours**
- Questions will not be answered during the test
- One cannot re-enter the classroom after leaving it
- The answers must be written using a pen (not a pencil)

You shall design a translation from a language of arithmetic expressions to either C, Java or Pascal. The characteristics of the language are the following:

- The operands are variables and integers.
- The arithmetic operators are +, -, *, / with their usual meaning.
- Operators return integer results.
- All operators have the same precedence. Expressions are evaluated from left to right.
- Parentheses cannot be used to group expressions (parentheses are used in the iteration construct introduced below).
- The > operator stores the result of evaluating the expression to the left of the operator in the variable to the right of the operator. If there is no variable to the right of the operator, the evaluated value is lost.
- The iteration construct consists of an arithmetic expression enclosed in [], directly followed by an expression enclosed in (), the value of which indicates the number of iterations.
- Variables are initialised to the value 0.

Example:

$3>A>[2*A-1+b>b](A)$

The value 3 is assigned to the variable A. Then the evaluation of $2*A-1+b$ returns 5 which is assigned to b. This last operation is repeated 3 times (the value of A), therefore, after evaluating the whole expression, the variable b has a value of 15.

An example of an erroneous expression is:

$5>A+2>5+*3$

Error

Questions

1. (1 Point) Define the grammar for the language of arithmetic expressions.
2. (2 Points) Construct the LL(1) parsing table for the language.
3. (3 Points) Construct the SLR(1) parsing table for the language.
4. (1 Point) Do your grammars need any semantic checks? If so, describe them.
5. (3 Points) Write the semantic actions necessary to translate the language of arithmetic expressions to either C, Java or Pascal.