



Software tool for course Semantics of programming languages

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Motivation



Semantics of programming languages is very important for the development of correct software systems, in particular for verification the correctness of systems or at least some of desired aspects of their behavior.

Expressions are parts of commands and calculations, so they also play an important role in programming. That is why we consider it important in the course of Semantics of programming languages to pay attention to the analysis of expressions. The learning software illustrates and visualizes important techniques of formal methods grounded in semantics.

The developed software seems very fruitful in the education process.

Solution



Creating the application that can process mathematical expressions, their syntactic analysis, output in the form of a postfix notation and the abstract syntax tree, to identify incorrectly entered expressions (implementation of error recovery) and interactive user intervention during entering data with subsequent evaluation of the results.

Tools and technologies



- Java SE 8;
- Swing API;
- "JUNG" (Java Universal Network/Graph Framework) software library;
- FreeHEP PDF Driver v.2.1.1.

Description of innovation



The developed software:

- checks the input expression and recognizes the type (arithmetic or Boolean one);
- realizes the error recovery;
- allows a user to input the values for particular variables identified in the expression entered;
- evaluates the whole expression with input values (can be possibly changed interactively, in any time);
- produces the postfix form of an input expression;
- draws the abstract syntax tree for an input expression in three versions (only variable names or only values or variable names with values respectively);
- stores the output in vector format to a PDF file.

Conclusions



Arithmetic or Boolean expression

The application is part of the software package for the teaching of Semantics of programming languages and helps:

- to make learning more attractive;
- to understand the formal methods;
- to explain the study materials.

The screenshot shows the 'Semantics' application window. The 'Analysis' section contains the input expression 'a1+a2*(-a3*a4-10)'. Below it, the 'Postfix form' is 'a1 a2 a3 - a4 * 10 - * +'. The 'Variables' section has a table:

Name	Value
a1	10
a2	7
a3	15
a4	3

The 'Result' is 255. The 'AST' section shows a tree structure for the expression. A separate window shows a more detailed AST with labels like 'a1:10', 'a2:7', 'a4:-3', and 'a3:15'.