

Compilers (221)

Exercises – Semantic Analysis

Check your answers with the tutorial helpers during tutorials and with each other on Piazza.

1.	<p>Consider the following errors that might be present in a Java-like program:</p> <ul style="list-style-type: none"> (i) undefined variable (ii) access to a non-existing element of an array (iii) integer overflow (iv) incompatible type (v) unmatched ‘)’ (vi) non-terminating loop <p>For each error, indicate when the error can be detected and briefly describe what the detection involves. If specific cases of an error are detected at different times describe the specific cases.</p>	L2
2.	<p>For each of the following statements:</p> <ul style="list-style-type: none"> a) <code>if expr then statement [else statement] fi</code> b) <code>for id = expr (to downto) expr do statement od</code> c) <code>switch expr { case (int default) : StatementSeq } endswitch</code> <p>Write the ASTnode class for these statements including syntactic and semantic attributes as well a semantic check method. Your method for <code>for</code> should work integer, character and boolean expressions. You can assume that there is a function <code>scalartype</code> that tests if a given type is of a particular standard type, e.g. <code>int</code>, <code>char</code>, <code>boolean</code>.</p>	L5
3.	<p>Give an AST class for a return statement, e.g.</p> <pre>ReturnStatement → return return Expression</pre> <p>Your class should include syntactic and any semantic attributes as well a <i>check</i> method that reports as many semantic errors as possible. You can assume that there is a function <i>Get_Enclosing_Method</i> that returns a reference to the method object for the method that encloses the return statement, or null if there is no enclosing method.</p>	L3
4.	<p>Develop an AST class for a class declaration, e.g.</p> <pre>ClassDeclaration → class classid [extends superclassid] { Block }</pre> <p>Your class should include syntactic and any semantic attributes as well a check method that reports as many semantic errors as possible. You may wish to use the following type for the semantic attribute:</p> <pre>class CLASS extends TYPE {CLASS superclass, SymbolTable locals}</pre>	L5
5.	<p>Write an AST class for a new expression, e.g.</p> <pre>NewExpr → new classid ‘(’ Expressionlist ‘)’</pre> <p>Your class should include syntactic and semantic attributes as well as a check method that reports as many semantic errors as possible. Assume that classes have at most one constructor i.e. ignore constructor overloading.</p>	L4

6.	<p>Most object-oriented languages allow method overloading, for example:</p> <pre> void Apply (int) void Apply (boolean) void Apply () void Apply (int, int) int Apply (String) </pre> <p>What compilation issues does this feature present?</p>	L3
7.	<p>Some languages allow the programmer to omit variable declarations entirely. Other languages require the programmer to declare all variables, but not to declare their types. Still other languages require the programmer to declare both variables and their types. Give a short argument in favour of each of three approaches. Which argument do you find most convincing? Why?</p>	L3