Computer Architecture and Programming Languages
Jacobs University Bremen
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Homework 12 - Programming Langauges and Compilation

Problem 12.1

Solution:
Classification of programming languages by generation:

- First: -
- Second: -
- Third: C, C++, Java, Basic, Pascal, B
- Fourth: Ruby, Perl, PHP, Python
- Fifth: Prolog Smalltalk

Classification of programming languages by type:

- Imperative: C, C++, Java, Basic, Pascal, B
- Declarative: Prolog
- Von Neumann: C
- Object-Oriented: Smalltalk, C++, Java, Ruby, PHP, Python
- Scripting: Perl, PHP, Python, Ruby

Problem 12.2

Solution:
Let $T = \{var, +, *, -, /, <, <=, >, >=, ==, !=, =, ?, :, ;, true, false\}$ be the set of terminals and $V = \{trenary, condition, expr1, expr2, expr, relation, operation, rel, op\}$ be the set of variables in the grammar

$$
\begin{aligned}
trenary &\rightarrow var = condition?expr1 : expr2; \\
condition &\rightarrow true|false|var|relation \\
relation &\rightarrow var\ rel\ var \\
rel &\rightarrow < \mid <= \mid > \mid >= \mid == \mid != \\
expr1 &\rightarrow expr \\
expr2 &\rightarrow expr \\
expr &\rightarrow var|operation \\
operation &\rightarrow var\ op\ var \\
op &\rightarrow + \mid - \mid * \mid /
\end{aligned}
$$

Problem 12.3

Solution:

Let $T = \{while, (,), \{, \}, ;, var, <, >, <=, >=, ==, !=, =, +, -, *, /\}$ be the set of terminals and $V = \{whileloop, condition, statements, statement, identifier, constant, rel, expr, operation, op\}$ be the set of variables in the grammar.

$$
\begin{aligned}
whileloop &\rightarrow while(condition)\{statements\} \\
condition &\rightarrow identifier\ rel\ identifier | identifier\ rel\ constant \\
rel &\rightarrow < \mid > \mid <= \mid >= \mid == \mid != \\
statements &\rightarrow statement;\ statements | statement; \\
statement &\rightarrow var = expr \\
expr &\rightarrow var | operation \\
operation &\rightarrow var\ op\ var \\
op &\rightarrow + | - \mid * \mid /
\end{aligned}
$$