

Homework 12

Problem 12.1

Solution:

Classification of programming languages by generation:

Generation	Languages
1 st	
2 nd	
3 rd	C, C++, Java, Basic, Pascal, B
4 th	Ruby, Perl, PHP, Python
5 th	Prolog, Smalltalk

Classification of programming languages by type:

Type	Languages
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:

$\text{ternary} \rightarrow \text{var} = \text{condition} ? \text{expr1} : \text{expr2};$
 $\text{condition} \rightarrow \text{true} \mid \text{false} \mid \text{var} \mid \text{relation}$
 $\text{relation} \rightarrow \text{var} \text{ rel } \text{var}$
 $\text{rel} \rightarrow < \mid <= \mid > \mid >= \mid == \mid !=$
 $\text{expr1} \rightarrow \text{expr}$
 $\text{expr2} \rightarrow \text{expr}$
 $\text{expr} \rightarrow \text{var} \mid \text{operation}$
 $\text{operation} \rightarrow \text{var op var}$
 $\text{op} \rightarrow + \mid - \mid * \mid /$

Terminals: $T = \{\text{var}, +, *, -, /, <, <=, >, >=, ==, !=, ?, :, ;, \text{true}, \text{false}\}.$

Variables of the grammar: $V = \{\text{ternary}, \text{condition}, \text{expr1}, \text{expr2}, \text{expr}, \text{relation}, \text{operation}, \text{rel}, \text{op}\}.$

Problem 12.3

Solution:

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

Terminals: $T = \{\text{while}, (,), \{, \}, ;, \text{var}, <, >, <=, >=, ==, !=, =, +, -, *, /\}$

Variables: $V = \{\text{whileloop}, \text{condition}, \text{statements}, \text{statement}, \text{identifier}, \text{constant}, \text{rel}, \text{expr}, \text{operation}, \text{op}\}$