

$$\begin{aligned}
\langle \text{program} \rangle &\rightarrow \langle \text{roots} \rangle \\
\langle \text{roots} \rangle &\rightarrow \langle \text{roots} \rangle \\
&\quad | \quad \langle \text{root} \rangle \langle \text{roots} \rangle \\
\langle \text{root} \rangle &\rightarrow \langle \text{function} \rangle \\
&\quad | \quad \langle \text{dcl} \rangle; \\
\langle \text{dcl} \rangle &\rightarrow \langle \text{type} \rangle \langle \text{var} \rangle \mid \langle \text{type} \rangle \langle \text{assign} \rangle \\
\langle \text{stmts} \rangle &\rightarrow \langle \text{stmt} \rangle \\
&\quad | \quad \langle \text{stmt} \rangle \langle \text{stmts} \rangle \\
\langle \text{stmt} \rangle &\rightarrow \langle \text{assign} \rangle; \\
&\quad | \quad \langle \text{if} \rangle \\
&\quad | \quad \langle \text{while} \rangle \\
&\quad | \quad \langle \text{from} \rangle \\
&\quad | \quad \langle \text{empty} \rangle \\
&\quad | \quad \langle \text{dcl} \rangle; \\
&\quad | \quad \langle \text{functioncall} \rangle; \\
&\quad | \quad \langle \text{switch} \rangle \\
\langle \text{var} \rangle &\rightarrow \langle \text{identifier} \rangle \\
\langle \text{identifier} \rangle &\rightarrow \langle \text{letter} \rangle \\
&\quad | \quad \langle \text{identifier} \rangle \langle \text{letter} \rangle \\
&\quad | \quad \langle \text{identifier} \rangle \langle \text{digit} \rangle \\
\langle \text{letter} \rangle &\rightarrow [\text{a-z}] \\
&\quad | \quad [\text{A-Z}] \\
\langle \text{digit} \rangle &\rightarrow [0-9] \\
\langle \text{assign} \rangle &\rightarrow \langle \text{var} \rangle <-- \langle \text{expr} \rangle \\
\langle \text{expr} \rangle &\rightarrow \langle \text{expr} \rangle + \langle \text{term} \rangle \\
&\quad | \quad \langle \text{expr} \rangle - \langle \text{term} \rangle \\
&\quad | \quad \langle \text{term} \rangle \\
\langle \text{term} \rangle &\rightarrow \langle \text{term} \rangle * \langle \text{factor} \rangle \\
&\quad | \quad \langle \text{term} \rangle / \langle \text{factor} \rangle \\
&\quad | \quad \langle \text{factor} \rangle \\
\langle \text{factor} \rangle &\rightarrow (\langle \text{expr} \rangle) \\
&\quad | \quad \langle \text{var} \rangle \\
\langle \text{switch} \rangle &\rightarrow \text{switch } (\langle \text{expr} \rangle) \text{ begin } \langle \text{cases} \rangle \text{ end}
\end{aligned}$$

$\langle cases \rangle \rightarrow \text{case } \langle expr \rangle : \langle stmts \rangle \langle endcase \rangle$
 $\langle endcase \rangle \rightarrow \langle cases \rangle$
 $\quad | \text{ break;}$
 $\quad | \text{ break; } \langle cases \rangle$
 $\quad | \text{ default: } \langle stmts \rangle \text{ break;}$
 $\quad | \text{ break; default: } \langle stmts \rangle \text{ break;}$
 $\langle from \rangle \rightarrow \text{from } \langle expr \rangle \text{ to } \langle logexpr \rangle \text{ step } \langle expr \rangle \text{ begin } \langle stmts \rangle \text{ end}$
 $\langle while \rangle \rightarrow \text{while}(\langle logexpr \rangle) \text{ begin } \langle stmts \rangle \text{ end}$
 $\langle if \rangle \rightarrow \text{if}(\langle logexpr \rangle) \text{ begin } \langle stmts \rangle \langle endif \rangle$
 $\langle endif \rangle \rightarrow \text{end else } \langle if \rangle$
 $\quad | \text{ end else begin } \langle stmts \rangle \text{ end}$
 $\quad | \text{ end}$
 $\langle logexpr \rangle \rightarrow \langle logexpr \rangle \text{ OR } \langle andcomp \rangle$
 $\quad | \langle andcomp \rangle$
 $\langle andcomp \rangle \rightarrow \langle andcomp \rangle \text{ AND } \langle comp \rangle$
 $\quad | \langle comp \rangle$
 $\langle comp \rangle \rightarrow \langle boolean\text{-operand} \rangle \langle comparison\text{-operator} \rangle \langle boolean\text{-operand} \rangle$
 $\langle boolean\text{-operand} \rangle \rightarrow \langle boolean \rangle$
 $\quad | \text{ !}\langle boolean \rangle \langle boolean \rangle \rightarrow \text{bool}$
 $\quad | \langle expr \rangle$
 $\quad | (\langle logexpr \rangle)$
 $\langle comparison\text{-operator} \rangle \rightarrow >$
 $\quad | <$
 $\quad | <=$
 $\quad | >=$
 $\quad | !=$
 $\quad | =$
 $\langle type \rangle \rightarrow \langle primitive\text{-type} \rangle$
 $\quad | \langle array\text{-type} \rangle$
 $\langle primitive\text{-type} \rangle \rightarrow \langle numeric\text{-type} \rangle$
 $\quad | \text{ bool}$
 $\langle numeric\text{-type} \rangle \rightarrow \langle integral\text{-type} \rangle$
 $\quad | \text{ double}$

$\langle integral\text{-}type \rangle \rightarrow \text{int}$
 | char

$\langle array\text{-}type \rangle \rightarrow \langle type \rangle []$

$\langle function \rangle \rightarrow \text{function } \langle identifier \rangle \text{ returns } \langle type \rangle \text{ using } (\langle type \rangle \langle var \rangle \langle using \rangle)$
 $\text{begin } \langle stmts \rangle \text{ return } \langle expr \rangle \text{ end}$
 | $\text{function } \rightarrow \text{function } \langle identifier \rangle \text{ returns nothing using } (\langle type \rangle \langle var \rangle \langle using \rangle)$
 $\text{begin } \langle stmts \rangle \text{ end}$

$\langle using \rangle \rightarrow , \langle type \rangle \langle var \rangle \langle using \rangle$
 | $\langle empty \rangle$

$\langle functioncall \rangle \rightarrow \text{call } \langle identifier \rangle (\langle using \rangle)$