

## VEN Language: Abstract Syntax

<program> ::= <block>

Program  $\leftarrow$  Program(Block)

<block> ::= **begin** <declaration-seq> <command-seq> **end**

Block  $\leftarrow$  Block(DecSeq, ComSeq)

<declaration-seq> ::= <declaration> | <declaration-seq> <declaration>

<declaration-seq> ::= <declaration> {<declaration>}

DecSeq  $\leftarrow$  Declaration<sup>+</sup> SB  $\epsilon$

<declaration> ::= <type> <name-list> |

**proc** <name> = <command> |

**proc** <name> (<parameter-list>) = <command>

<declaration> ::= <type> <name-list> |

**proc** <name> [(<parameter-list>)] = <command>

Declaration  $\leftarrow$  var(type, Ids) | proc(Id, Paras?, command)

<type> ::= **integer** | **Boolean**

type  $\leftarrow$  integer | Boolean

<parameter-list> ::= <type> <name-list> | <parameter-list> ; <type> <name-list>

<parameter-list> ::= <type> <name-list> { ; <type> <name-list> }

Paras  $\leftarrow$  Paras(type, Ids)<sup>+</sup> SB ;

$\langle \text{name-list} \rangle ::= \langle \text{name} \rangle \mid \langle \text{name-list} \rangle , \langle \text{name} \rangle$

$\langle \text{name-list} \rangle ::= \langle \text{name} \rangle \{ , \langle \text{name} \rangle \}$

$\text{Ids} \leftarrow \text{Id}^+ \text{SB},$

$\langle \text{command-seq} \rangle ::= \langle \text{command} \rangle \mid \langle \text{command-seq} \rangle ; \langle \text{command} \rangle$

$\langle \text{command-seq} \rangle ::= \langle \text{command} \rangle \{ ; \langle \text{command} \rangle \}$

$\text{ComSeq} \leftarrow \text{command}^+ \text{SB};$

$\langle \text{command} \rangle ::= \langle \text{name} \rangle := \langle \text{expr} \rangle \mid$   
    **read**  $\langle \text{name} \rangle \mid$   
    **write**  $\langle \text{expr} \rangle \mid$   
    **if**  $\langle \text{expr} \rangle$  **then**  $\langle \text{command-seq} \rangle$  **end if**  $\mid$   
    **if**  $\langle \text{expr} \rangle$  **then**  $\langle \text{command-seq} \rangle$  **else**  $\langle \text{command-seq} \rangle$  **end if**  $\mid$   
    **while**  $\langle \text{expr} \rangle$  **do**  $\langle \text{command-seq} \rangle$  **end while**  $\mid$   
    **call**  $\langle \text{name} \rangle \mid$   
    **call**  $\langle \text{name} \rangle (\langle \text{name-list} \rangle) \mid$   
     $\langle \text{block} \rangle$

$\langle \text{command} \rangle ::= \langle \text{name} \rangle := \langle \text{expr} \rangle \mid$   
    **read**  $\langle \text{name} \rangle \mid$   
    **write**  $\langle \text{expr} \rangle \mid$   
    **if**  $\langle \text{expr} \rangle$  **then**  $\langle \text{command-seq} \rangle$  [**else**  $\langle \text{command-seq} \rangle$ ] **end if**  $\mid$   
    **while**  $\langle \text{expr} \rangle$  **do**  $\langle \text{command-seq} \rangle$  **end while**  $\mid$   
    **call**  $\langle \text{name} \rangle [(\langle \text{name-list} \rangle)] \mid$   
     $\langle \text{block} \rangle$

$\text{Command} \leftarrow \text{Assign}(\text{Id} , \text{Expr}) \mid$   
     $\text{Read}(\text{Id}) \mid$   
     $\text{Write}(\text{Id}) \mid$   
     $\text{IfThenElse}(\text{Expr} , \text{ComSeq} , \text{ComSeq}?) \mid$   
     $\text{While}(\text{Expr} , \text{ComSeq}) \mid$   
     $\text{Call}(\text{Id} , \text{Ids}?) \mid$   
     $\text{Block}$

$\langle \text{expr} \rangle ::= \langle \text{expr1} \rangle \mid \langle \text{expr} \rangle \text{ or } \langle \text{expr1} \rangle$

$\langle \text{expr} \rangle ::= \langle \text{expr1} \rangle \{ \text{or } \langle \text{expr1} \rangle \}$

$\text{Expr} \leftarrow \text{Expr1}^+ \text{ SB or}$

$\langle \text{expr1} \rangle ::= \langle \text{expr2} \rangle \mid \langle \text{expr1} \rangle \text{ and } \langle \text{expr2} \rangle$

$\langle \text{expr1} \rangle ::= \langle \text{expr2} \rangle \{ \text{and } \langle \text{expr2} \rangle \}$

$\text{Expr1} \leftarrow \text{Expr2}^+ \text{ SB and}$

$\langle \text{expr2} \rangle ::= \langle \text{expr3} \rangle \mid \text{not } \langle \text{expr} \rangle$

$\text{Expr2} \leftarrow \text{Expr3} \mid \text{Not}(\text{Expr})$

$\langle \text{expr3} \rangle ::= \langle \text{expr4} \rangle \mid \langle \text{expr3} \rangle \langle \text{relation} \rangle \langle \text{expr4} \rangle$

$\langle \text{expr3} \rangle ::= \langle \text{expr4} \rangle \{ \langle \text{relation} \rangle \langle \text{expr4} \rangle \}$

$\text{Expr3} \leftarrow \text{Expr4}^+ \text{ SB relation}$

$\langle \text{expr4} \rangle ::= \langle \text{term} \rangle \mid \langle \text{expr4} \rangle \langle \text{weak op} \rangle \langle \text{term} \rangle$

$\langle \text{expr4} \rangle ::= \langle \text{term} \rangle \{ \langle \text{weak op} \rangle \text{ term} \}$

$\text{Expr4} \leftarrow \text{Term}^+ \text{ SB w\_op}$

$\langle \text{term} \rangle ::= \langle \text{element} \rangle \mid \langle \text{term} \rangle \langle \text{strong op} \rangle \langle \text{element} \rangle$

$\langle \text{term} \rangle ::= \langle \text{element} \rangle \{ \langle \text{strong op} \rangle \langle \text{element} \rangle \}$

$\text{Term} \leftarrow \text{Element}^+ \text{ SB s\_op}$

$\langle \text{element} \rangle ::= \langle \text{numeral} \rangle \mid \langle \text{name} \rangle \mid (\langle \text{expr} \rangle) \mid -\langle \text{element} \rangle$

$\text{Element} \leftarrow \text{Number} \mid \text{Id} \mid \text{Expr} \mid -(\text{Element})$

$\langle \text{relation} \rangle ::= < \mid <= \mid <> \mid = \mid > \mid >=$

$\langle \text{weak op} \rangle ::= + \mid -$

$\langle \text{strong op} \rangle ::= * \mid /$