

Program  $\rightarrow \epsilon \mid$  Program Function

Function  $\rightarrow$  function ident SEMICOLON begin\_params Declaration end\_params begin\_locals  
Declaration end\_locals begin\_body Statements end\_body  
 $\mid$  function ident error begin\_params Declaration end\_params begin\_locals Declaration  
end\_locals begin\_body Statements end\_body

Declaration  $\rightarrow \epsilon \mid$  Declaration DeclarationDef SEMICOLON  $\mid$  Declaration DeclarationDef error

DeclarationDef  $\rightarrow$  identifier colon integer  
 $\mid$  identifier colon array L\_SQUARE\_BRACKET number R\_SQUARE\_BRACKET of integer  
 $\mid$  identifier error integer  
 $\mid$  identifier error ARRAY L\_SQUARE\_BRACKET number R\_SQUARE\_BRACKET  
of integer

Identifier  $\rightarrow$  ident  $\mid$  identifier COMMA ident  $\mid$  identifier error ident

Statement  $\rightarrow$  StatementDef SEMICOLON  
 $\mid$  Statement StatementDef SEMICOLON  
 $\mid$  StatementDef error  
 $\mid$  Statement StatementDef error

StatementDef  $\rightarrow$  Var ASSIGN Expression  
 $\mid$  if Bool-Exp then Statement endif  
 $\mid$  if Bool-Exp then Statement else Statement endif  
 $\mid$  while Bool\_Exp beginloop Statement endloop  
 $\mid$  do beginloop Statement end loop while Bool-Exp  
 $\mid$  read Var\_loop  
 $\mid$  write Var\_loop  
 $\mid$  break  
 $\mid$  return Expression  
 $\mid$  Var error Expression  
 $\mid$  For Var error Number error Bool-Exp error Var error Expression beginloop  
Statement endloop

Var\_loop  $\rightarrow$  Var  
 $\mid$  Var\_loop COMMA Var

Var  $\rightarrow$  identifier  
 $\mid$  identifier L\_SQUARE\_BRACKET Expression R\_SQUARE\_BRACKET

Bool-Exp  $\rightarrow$  Relation-And-Expr  
 $\mid$  Bool-Exp or Relation-And-Expr

Relation-And-Expr  $\rightarrow$  Relation-Expr  
 $\mid$  Relation-And-Expr and Relation-Expr

Relation-Expr -> Expression Comp Expression

- | not Expression Comp Expression
- | true
- | not true
- | false
- | not false
- | L\_PAREN Bool-Expr R\_PAREN
- | not L\_PAREN Bool-Expr R\_PAREN
- | Expression error Expression
- | not Expression error Expression

Comp -> EQ

- | NEQ
- | LT
- | GT
- | LTE
- | GTE

Expression -> Multiplicative-Expr

- | Expression ADD Multiplicative-Expr
- | Expression SUB Multiplicative-Expr

Multiplicative-Expr -> Term

- | Multiplicative-Expr MULT Term
- | Multiplicative-Expr DIV Term
- | Multiplicative-Expr MOD Term

Term -> Var

- | SUB Var
- | number
- | SUB number
- | L\_PAREN Expression R\_PAREN
- | SUB L\_PAREN Expression R\_PAREN
- | identifier L\_PAREN Expression R\_PAREN
- | identifier L\_PAREN R\_PAREN

Expression-loop -> Expression

- | Expression-loop COMMA Expression
- | Expression-loop error Expression