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Group-51

## Grammar

$\langle \text{program} \rangle \rightarrow \langle \text{moduleDeclarations} \rangle \langle \text{otherModules} \rangle \langle \text{driverModule} \rangle \langle \text{otherModules} \rangle$   
 $\langle \text{moduleDeclarations} \rangle \rightarrow \langle \text{moduleDeclaration} \rangle \langle \text{moduleDeclarations} \rangle \mid \epsilon$   
 $\langle \text{moduleDeclaration} \rangle \rightarrow \text{DECLARE MODULE ID SEMICOL}$   
 $\langle \text{otherModules} \rangle \rightarrow \langle \text{module} \rangle \langle \text{otherModules} \rangle \mid \epsilon$   
 $\langle \text{driverModule} \rangle \rightarrow \text{DRIVERDEF} \cdot \text{DRIVER} \cdot \text{PROGRAM DRIVERENDDER} \langle \text{moduleDef} \rangle$   
 $\langle \text{module} \rangle \rightarrow \text{DEF MODULE ID ENDDER} \cdot \text{TAKES INPUT} \cdot \text{SQBO} \langle \text{inputPLst} \rangle \text{SQBC SEMICOL} \langle \text{ret} \rangle \langle \text{moduleDef} \rangle$   
 $\langle \text{ret} \rangle \rightarrow \text{RETURNS SQBO} \langle \text{outputPLst} \rangle \text{SQBC SEMICOL} \mid \epsilon$   
 $\langle \text{inputPLst} \rangle \rightarrow \text{ID COLON} \langle \text{dataType} \rangle \langle \text{LR1} \rangle$   
 $\langle \text{LR1} \rangle \rightarrow \text{COMMA ID COLON} \langle \text{dataType} \rangle \langle \text{LR1} \rangle \mid \epsilon$   
 $\langle \text{outputPLst} \rangle \rightarrow \text{ID COLON} \langle \text{type} \rangle \langle \text{LR2} \rangle$   
 $\langle \text{LR2} \rangle \rightarrow \text{COMMA ID COLON} \langle \text{type} \rangle \langle \text{LR2} \rangle \mid \epsilon$   
 $\langle \text{dataType} \rangle \rightarrow \text{ARRAY} \cdot \text{SQBO} \langle \text{arrRange} \rangle \text{SQBC OF} \langle \text{type} \rangle$   
 $\langle \text{arrRange} \rangle \rightarrow \langle \text{index} \rangle \text{RANGEOP} \langle \text{index} \rangle$   
 $\langle \text{type} \rangle \rightarrow \text{INTEGER} \mid \text{REAL} \mid \text{BOOLEAN}$   
 $\langle \text{moduleDef} \rangle \rightarrow \text{START} \langle \text{statements} \rangle \text{END}$   
 $\langle \text{statements} \rangle \rightarrow \langle \text{statement} \rangle \langle \text{statements} \rangle \mid \epsilon$   
 $\langle \text{statement} \rangle \rightarrow \langle \text{ioStmt} \rangle \mid \langle \text{simpleStmt} \rangle \mid \langle \text{declareStmt} \rangle \mid \langle \text{ConditionalStmt} \rangle \mid \langle \text{iterativeStmt} \rangle$   
 $\langle \text{ioStmt} \rangle \rightarrow \text{GET-VALUE} \cdot \text{BO ID BC SEMICOL} \mid \text{PRINT BO} \langle \text{var} \rangle \text{BC SEMICOL}$   
 $\langle \text{booleanConst} \rangle \rightarrow \text{TRUE} \mid \text{FALSE}$   
 $\langle \text{varNum} \rangle \rightarrow \text{ID} \langle \text{whichId} \rangle \mid \text{NUM} \mid \text{RNUM}$   
 $\langle \text{var} \rangle \rightarrow \langle \text{varNum} \rangle \mid \langle \text{booleanConst} \rangle$



$\langle \text{whichId} \rangle \rightarrow \text{SQBO} \langle \text{index} \rangle \cdot \text{SQBC} \mid \epsilon$   
 $\langle \text{simpleStmnt} \rangle \rightarrow \langle \text{assignmentStmnt} \rangle \mid \langle \text{moduleReuseStmnt} \rangle$   
 $\langle \text{assignmentStmnt} \rangle \rightarrow \text{ID} \langle \text{whichStmnt} \rangle$   
 $\langle \text{whichStmnt} \rangle \rightarrow \langle \text{lvalueIDStmnt} \rangle \mid \langle \text{lvalueARRStmnt} \rangle$   
 $\langle \text{lvalueIDStmnt} \rangle \rightarrow \text{ASSIGNOP} \langle \text{expression} \rangle \text{SEMICOL}$   
 $\langle \text{lvalueARRStmnt} \rangle \rightarrow \text{SQBO} \langle \text{index} \rangle \cdot \text{SQBC} \text{ ASSIGNOP} \langle \text{expression} \rangle \text{SEMICOL}$

$\langle \text{index} \rangle \rightarrow \text{NUM} \mid \text{ID}$   
 $\langle \text{moduleReuseStmnt} \rangle \rightarrow \langle \text{optional} \rangle \text{USE MODULE ID WITH PARAMETERS} \langle \text{idList} \rangle \text{SEMICOL}$

$\langle \text{optional} \rangle \rightarrow \text{SQBO} \langle \text{idList} \rangle \text{SQBC ASSIGNOP} \mid \epsilon$

$\langle \text{idList} \rangle \rightarrow \text{ID} \langle \text{LR3} \rangle$

$\langle \text{LR3} \rangle \rightarrow \text{COMMA ID} \langle \text{LR3} \rangle \mid \epsilon$

$\langle \text{expression} \rangle \rightarrow \langle \text{arithBoolExpr} \rangle \mid \langle \text{unaryExpr} \rangle$

$\langle \text{unaryExpr} \rangle \rightarrow \langle \text{unaryOp} \rangle \langle \text{NT} \rangle$

$\langle \text{NT} \rangle \rightarrow \text{BO} \langle \text{arithmeticExpr} \rangle \cdot \text{BC} \mid \langle \text{varNum} \rangle$

$\langle \text{unaryOp} \rangle \rightarrow \text{PLUS} \mid \text{MINUS}$

$\langle \text{arithBoolExpr} \rangle \rightarrow \langle \text{arbitraryTerm} \rangle \langle \text{LR6} \rangle$

$\langle \text{LR6} \rangle \rightarrow \langle \text{logicalOp} \rangle \langle \text{arbitraryTerm} \rangle \langle \text{LR6} \rangle \mid \epsilon$

$\langle \text{arbitraryTerm} \rangle \rightarrow \langle \text{arithmeticExpr} \rangle \langle \text{LR7} \rangle \mid \langle \text{booleanConst} \rangle \langle \text{LR7} \rangle$

$\langle \text{LR7} \rangle \rightarrow \langle \text{relationalOp} \rangle \langle \text{arithmeticExpr} \rangle \langle \text{LR7} \rangle \mid \epsilon$

$\langle \text{arithmeticExpr} \rangle \rightarrow \langle \text{term} \rangle \langle \text{LR4} \rangle$

$\langle \text{LR4} \rangle \rightarrow \langle \text{opLower} \rangle \langle \text{term} \rangle \langle \text{LR4} \rangle \mid \epsilon$

$\langle \text{term} \rangle \rightarrow \langle \text{factor} \rangle \langle \text{LR5} \rangle$

$\langle \text{LR5} \rangle \rightarrow \langle \text{opHigher} \rangle \langle \text{factor} \rangle \langle \text{LR5} \rangle \mid \epsilon$

$\langle \text{factor} \rangle \rightarrow \text{BO} \langle \text{arithmeticExpr} \rangle \text{BC}$

$\langle \text{factor} \rangle \rightarrow \langle \text{varNum} \rangle$



<op Lower>  $\rightarrow$  PLUS | MINUS  
<op Higher>  $\rightarrow$  MUL | DIV

<logical Op>  $\rightarrow$  AND | OR

<relational Op>  $\rightarrow$  LT | LE | GT | GE | EQ | NE

<declare Stmt>  $\rightarrow$  DECLARE <id list> COLON <dataType>  
SEMICOLON

<conditional Stmt>  $\rightarrow$  SWITCH BO ID BC START <case Stmt>  
<default> END

<case Stmt>  $\rightarrow$  CASE <value> COLON <statements> BREAK  
SEMICOLON <LRB>

<LRB>  $\rightarrow$  CASE <value> COLON <statements> BREAK  
SEMICOLON <LRB> |  $\epsilon$

<value>  $\rightarrow$  NUM | TRUE | FALSE

<default>  $\rightarrow$  DEFAULT COLON <statements> BREAK  
SEMICOLON |  $\epsilon$

<iterative Stmt>  $\rightarrow$  FOR BO ID IN <range> BC START  
<statements> END | WHILE BO <arith Bool Expr>  
BC START <statements> END

<range>  $\rightarrow$  NUM RANGE OP NUM



# on-Terminal

	First	Follow
<program>	DECLARE	\$
<module Declarations>	DECLARE	DEF, DRIVERDEF, \$
<module Declaration>	DECLARE	DECLARE, DEF, DRIVERDEF, \$
<other Modules>	DEF, E	DRIVERDEF, \$
<driver Module>	DRIVERDEF	<del>DRIVERDEF</del> , DEF, \$
<module>	DEF	DRIVERDEF, \$
<ret>	RETURNS	START
<input Plist>	ID	SQBC
<LRL>	COMMA	SQBC
<output Plist>	ID, <del>DEF</del>	SQBC
<LR2>	COMMA; E	SQBC
<dataType>	ARRAY	SQBC, SEMICOL
<data Range>	NUM, ID	SQBC
<type>	INTEGER, REAL, BOOLEAN	SQBC, <del>SEMICOL</del> , SEMICOL
<module Def>	START	DRIVERDEF, \$
<statements>	GET_VALUE, PRINT, ID, SQBO, <del>DEF</del> , DECLARE, SWITCH, FOR, WHILE, E	END, BREAK
<statement>	GET_VALUE, PRINT, ID, SQBO, <del>DEF</del> , DECLARE, SWITCH, FOR, WHILE	<del>END, BREAK</del> GET_VALUE, PRINT, ID, SQBO, DECLARE, SWITCH, FOR, WHILE
<SO Stmt>	GET-VALUE, PRINT	GET-VALUE, PRINT, ID, SQBO, <del>DEF</del> , <del>DECLARE</del> , <del>SWITCH</del> , <del>FOR</del> , <del>WHILE</del>
<boolean Cond>	TRUE, FALSE	BC
<var Num>	ID, NUM, RNUM	BC, SEMICOL
<var>	ID, NUM, RNUM, TRUE, FALSE	BC



<whichId>	SQBO, E	BC, SEMICOL
<SimpleStmnt>	ID, SQBO, USE	END, BREAK
<AssignmentStmnt>	ID	END, BREAK
<whichStmnt>	ASSIGNOP, SQBO	END, BREAK
<lvalueIDStmnt>	ASSIGNOP	END, BREAK
<l <sup>APP</sup> valueARRStmnt>	SQBO	END, BREAK
<index>	NUM, ID	RANGEOP, SQBC
<moduleReuseStmnt>	SQBO, USE	END, BREAK
<optional>	SQBO, <del>USE</del> E	USE
<idList>	ID	SEMICOL, SQBC, COLON
<LR3>	COMMA, E	SEMICOL, SQBC, COLON
<expression>	ID, NUM, RNUM, BO, TRUE, FALSE, PLUS, MINUS	SEMICOL
<unary Expr>	PLUS, MINUS	SEMICOL
<NT>	BO, ID, NUM, RNUM	SEMICOL
<unaryOp>	PLUS, MINUS	SEMICOL
<arithBoolExpr>	BO, ID, NUM, RNUM, TRUE, FALSE	SEMICOL, BC
<LR6>	AND, OR, E	SEMICOL, BC
<arbitraryTerm>	BO, ID, NUM, RNUM, TRUE, FALSE	SEMICOL, BC
<LR7>	LT, LE, GT, GE, EQ, NE, E	SEMICOL, BC

<arithmeticExpr>	BO, ID, NUM, RNUM	SEMICOL, BC, NE
<LR4>	PLUS, MINUS, E	LT, GE, LE, GT, EQ
<term>	BO, ID, NUM, RNUM	BC, SEMICOL, LT, LE, GE, NE, EQ, GT
<LR5>	MUL, DIV, E	PLUS, MINUS, BC, LT, LE, GT, GE, EQ, NE, SEMICOL, BC
	PLUS, MINUS, BC, LT, LE, GE, GT, SEMICOL, EQ, NE	



< factor >	BO, ID, NUM, RNUM	MUL, DIV, PLUS, MINUS, BC, LT, LE, GT, GE, EQ, NE, SEMICOL, BC
< op lower >	PLUS, MINUS	BO, ID, RNUM, NUM
< op higher >	MUL, DIV	BO, ID, RNUM, NUM
< logical Op >	AND, OR	BO, ID, NUM, RNUM, TRUE, FALSE
< relational Op >	LT, LE, GE, GT, EQ, NE	BO, ID, NUM, RNUM
< declare Stmt >	DECLARE	GET-VALUE, PRINT, ID, SQBO, DECLARE, SWITCH, FOR, WHILE
<del>&lt; switch Stmt &gt;</del>	<del>SWITCH</del>	GET-VALUE, PRINT, ID, SQBO, DECLARE, SWITCH, FOR, WHILE
< conditional Stmt >	SWITCH	DEFAULT, END
< case Stmt >	CASE	DEFAULT
< LRB >	CASE, E	
< value >	NUM, TRUE, FALSE	COLON
< default >	DEFAULT, E	END.
< iterative Stmt >	FOR, WHILE	<del>END, BREAK</del>
< range >	NUM	BC
< iterative Stmt >	<del>FOR, WHILE</del> FOR, WHILE	GET-VALUE, PRINT, ID, SQBO, DECLARE, SWITCH, FOR, WHILE