```
program : program_head routine DOT
program_head : PROGRAM ID SEMI
routine : routine_head routine_body
sub_routine : routine_head routine_body

routine_head : label_part const_part type_part var_part routine_part
label_part : ε
const_part : CONST const_expr_list | ε
const_expr_list : const_expr_list ID EQUAL const_value SEMI
                | ID EQUAL const_value SEMI
const_value : INTEGER | REAL | CHAR | STRING | SYS_CON
type_part : TYPE type_decl_list | ε
type_decl_list : type_decl_list type_definition | type_definition
type_definition : ID EQUAL type_decl SEMI
type_decl : simple_type_decl | array_type_decl | record_type_decl
simple_type_decl : SYS_TYPE | ID | LP name_list RP
                 | const_value DOTDOT const_value
                 | MINUS const_value DOTDOT const_value
                 | MINUS const_value DOTDOT MINUS const_value
                 | ID DOTDOT ID
array_type_decl : ARRAY LB simple_type_decl RB OF type_decl
record_type_decl : RECORD field_decl_list END
field_decl_list : field_decl_list field_decl | field_decl
field_decl : name_list COLON type_decl SEMI
name_list : name_list COMMA ID | ID
var_part : VAR var_decl_list | ε
var_decl_list : var_decl_list var_decl | var_decl
var_decl : name_list COLON type_decl SEMI

routine_part: routine_part function_decl | routine_part procedure_decl
            | function_decl | procedure_decl | ε
function_decl : function_head SEMI sub_routine SEMI
function_head : FUNCTION ID parameters COLON simple_type_decl
procedure_decl : procedure_head SEMI sub_routine SEMI
procedure_head : PROCEDURE ID parameters
parameters : LP para_decl_list RP | ε
para_decl_list : para_decl_list SEMI para_type_list | para_type_list
para_type_list : var_para_list COLON simple_type_decl
               | val_para_list COLON simple_type_decl
var_para_list : VAR name_list
val_para_list : name_list

routine_body : compound_stmt
compound_stmt : BEGIN stmt_list END
```

```
stmt_list ： stmt_list stmt SEMI | ε
stmt ： INTEGER COLON non_label_stmt | non_label_stmt
non_label_stmt ： assign_stmt | proc_stmt | compound_stmt | if_stmt | repeat_stmt | while_stmt
                | for_stmt | case_stmt | goto_stmt
assign_stmt ： ID ASSIGN expression
             | ID LB expression RB ASSIGN expression
             | ID DOT ID ASSIGN expression
proc_stmt ： ID
           | ID LP args_list RP
           | SYS_PROC
           | SYS_PROC LP expression_list RP
           | READ LP factor RP
if_stmt ： IF expression THEN stmt else_clause
else_clause ： ELSE stmt | ε
repeat_stmt ： REPEAT stmt_list UNTIL expression
while_stmt ： WHILE expression DO stmt
for_stmt ： FOR ID ASSIGN expression direction expression DO stmt
direction ： TO | DOWNTO
case_stmt ： CASE expression OF case_expr_list END
case_expr_list ： case_expr_list case_expr | case_expr
case_expr ： const_value COLON stmt SEMI
           | ID COLON stmt SEMI
goto_stmt ： GOTO INTEGER
expression_list ： expression_list COMMA expression | expression
expression ： expression GE expr | expression GT expr | expression LE expr
           | expression LT expr | expression EQUAL expr
           | expression UNEQUAL expr | expr
expr ： expr PLUS term | expr MINUS term | expr OR term | term
term ： term MUL factor | term DIV factor | term MOD factor
      | term AND factor | factor
factor ： ID | ID LP args_list RP | SYS_FUNCT |
      SYS_FUNCT LP args_list RP | const_value | LP expression RP
      | NOT factor | MINUS factor | ID LB expression RB
      | ID DOT ID
args_list ： args_list COMMA expression | expression
```

说明：

LP 为“(”	PLUS 为“+”
RP 为“)”	MINUS 为“－”
LB 为“[”	ID 为标识符
RB 为“]”	GE 为“ >=”
DOT 为“•”	GT 为“ >”
COMMA 为“；”	LE 为“ <=”
COLON 为“，”	LT 为“ <”

MUL 为“*”	EQUAL 为“ =”
DIV 为“/”	ASSIGN 为“ :=

单词分类：

SYS_CON: "false", "maxint", "true"

SYS_FUNCT: "abs", "chr", "odd", "ord", "pred", "sqr", "sqrt", "succ"

SYS_PROC: "write", "writeln"

SYS_TYPE: "boolean", "char", "integer", "real",