

Compiler Design Principles The PARSER

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**Grammar (.y) File**

%  
{   package chronicle;   import java.io.\*; %}  
%token ID NUMCONST REALCONST CHARCONST BOOLCONST SHARP\_KW MOD\_KW DIV\_KW MUL\_KW SUB\_KW ADD\_KW SINGLE\_QUOTE\_KW DOT\_KW LTE\_KW GTE\_KW NEQ\_KW EQ\_KW GT\_KW LT\_KW COMMA\_KW CLOSEPARENTHESIS\_KW OPENPARENTHESIS\_KW CLOSEACCOLADE\_KW OPENACCOLADE\_KW CLOSEBRACKET\_KW OPENBRACKET\_KW ASSIGN\_KW COLON\_KW SEMICOLON\_KW NOT\_KW OR\_KW AND\_KW DOWNTO\_KW UPTO\_KW EXIT\_KW RETURN\_KW FOR\_KW WHEN\_KW END\_KW DEFAULT\_KW CASE\_KW SWITCH\_KW WHILE\_KW DO\_KW ELSE\_KW THEN\_KW IF\_KW PROCEDURE\_KW BOOLEAN\_KW CHARACTER\_KW REAL\_KW INTEGER\_KW MAIN\_KW PROGRAM\_KW DIGIT NONZERO\_DIGIT LETTER %code  
{     static PrintStream writer;     public static void main(String args[]) throws IOException, FileNotFoundException  
    {         YYParser yyparser;         final Yylex lexer;         writer = new PrintStream(new File("yacc\_tool\_output.txt"));         lexer = new Yylex(new InputStreamReader(new FileInputStream(".\\Global\_Test\\globalTest2.shl")));         yyparser = new YYParser(new Lexer()  
        {             @Override             public int yylex()  
            {                 int yyl\_return = -1;                 try  
                {                     yyl\_return = lexer.yylex();                 }  
                catch (IOException e)  
                {                     System.err.println("IO error :" + e);                 }  
            return yyl\_return;             }  
            @Override             public void yyerror(String error)  
            {                 System.err.println("Error : " + error);             }  
            @Override             public Object getLVal()  
            {                 return null;             }  
        }  
    );         yyparser.parse();         return;     }  
}  
// Precedences go increasing, so "then" < "else". %nonassoc THEN\_KW %nonassoc ELSE\_KW %% program:

PROGRAM\_KW ID MAIN\_KW  
{     System.out.println("Rule 1.1: " +       "program -> PROGRAM\_KW ID MAIN\_KW");   }  
|     PROGRAM\_KW ID MAIN\_KW block  
{         System.out.println("Rule 1.2: " +             "program -> PROGRAM\_KW ID MAIN\_KW block");     }  
| PROGRAM\_KW ID declarations\_list MAIN\_KW block  
{         System.out.println("Rule 1.3: " +             "program -> PROGRAM\_KW ID declarations\_list MAIN\_KW block");     }  
| PROGRAM\_KW ID procedure\_list MAIN\_KW block  
{         System.out.println("Rule 1.4: " +             "program -> PROGRAM\_KW ID procedure\_list MAIN\_KW block");     }  
| PROGRAM\_KW ID declarations\_list procedure\_list MAIN\_KW block  
{         System.out.println("Rule 1.5: " +             "program -> PROGRAM\_KW ID declarations\_list procedure\_list MAIN\_KW block");     }  
declarations\_list:      declarations\_list declarations  
{         System.out.println("Rule 2.1: " +             "declarations\_list -> declarations\_list declarations");     }  
| declarations  
{         System.out.println("Rule 2.2: " +             "declarations\_list -> declarations");     }  
declarations:     type\_specifiers declarator\_list SEMICOLON\_KW  
{         System.out.println("Rule 3.1: " +             "declarations -> type\_specifiers declarator\_list SEMICOLON\_KW");     }  
type\_specifiers:     INTEGER\_KW  
{         System.out.println("Rule 4.1: " +             "type\_specifiers -> INTEGER\_KW");     }  
| REAL\_KW  
{         System.out.println("Rule 4.2: " +             "type\_specifiers -> REAL\_KW");     }  
| CHARACTER\_KW  
{         System.out.println("Rule 4.3: " +             "type\_specifiers -> CHAR\_KW");     }  
| BOOLEAN\_KW  
{         System.out.println("Rule 4.4: " +             "type\_specifiers -> BOOLEAN\_KW");     }  
declarator\_list:     declarator  
{         System.out.println("Rule 5.1: " +             "declarator\_list -> declarator");     }  
| declarator\_list COMMA\_KW declarator  
{         System.out.println("Rule 5.2: " +             "declarator\_list -> declarator\_list COMMA\_KW declarator");     }  
declarator:      dec  
{         System.out.println("Rule 6.1: " +             "declarator -> dec");     }  
| dec ASSIGN\_KW initializer  
{         System.out.println("Rule 6.2: " +             "declarator -> dec ASSIGN\_KW initializer");     }  
dec:     ID  
{         System.out.println("Rule 7.1: " +             "dec -> ID");     }  
| ID OPENBRACKET\_KW range CLOSEBRACKET\_KW  
{         System.out.println("Rule 7.2: " +             "dec -> ID OPENBRACKET\_KW range CLOSEBRACKET\_KW");     }  
| ID OPENBRACKET\_KW NUMCONST CLOSEBRACKET\_KW  
{         System.out.println("Rule 7.3: " +             "dec -> ID OPENBRACKET\_KW NUMCONST CLOSEBRACKET\_KW");     }  
range:     ID DOT\_KW ID  
{         System.out.println("Rule 8.1: " +             "range -> ID DOT\_KW ID");     }  
| NUMCONST DOT\_KW NUMCONST  
{         System.out.println("Rule 8.2: " +             "range -> NUMCONST DOT\_KW NUMCONST");     }  
| arithmetic\_expressions DOT\_KW arithmetic\_expressions  
{         System.out.println("Rule 8.3: " +             "range -> arithmetic\_expressions DOT\_KW arithmetic\_expressions");     }  
initializer:     constant\_expressions  
{         System.out.println("Rule 9.1: " +             "initializer -> constant\_expressions");     }  
| OPENACCOLADE\_KW initializer\_list CLOSEACCOLADE\_KW  
{         System.out.println("Rule 9.2: " +             "initializer -> OPENACCOLADE\_KW initializer CLOSEACCOLADE\_KW");     }  
initializer\_list:     constant\_expressions COMMA\_KW initializer\_list  
{         System.out.println("Rule 10.1: " +             "initializer\_list -> constant\_expressions COMMA\_KW initializer\_list");     }  
| constant\_expressions  
{         System.out.println("Rule 10.2: " +             "initializer\_list -> constant\_expressions");     }  
procedure\_list:     procedure\_list procedure  
{         System.out.println("Rule 11.1: " +             "procedure\_list -> procedure\_list procedure");     }  
| procedure  
{         System.out.println("Rule 11.2: " +             "procedure\_list -> procedure");     }  
procedure:   PROCEDURE\_KW ID parameters OPENACCOLADE\_KW block CLOSEACCOLADE\_KW SEMICOLON\_KW  
{    System.out.println("Rule 12.1: " +      "procedure -> PROCEDURE\_KW ID parameters OPENACCOLADE\_KW block CLOSEACCOLADE\_KW SEMICOLON\_KW");   }  
|PROCEDURE\_KW ID parameters OPENACCOLADE\_KW declarations\_list block CLOSEACCOLADE\_KW SEMICOLON\_KW  
{         System.out.println("Rule 12.2: " +             "procedure -> PROCEDURE\_KW ID parameters OPENACCOLADE\_KW declarations\_list block CLOSEACCOLADE\_KW SEMICOLON\_KW");     }  
parameters:     OPENPARENTHESIS\_KW declarations\_list CLOSEPARENTHESIS\_KW  
{         System.out.println("Rule 13.1: " +             "parameters -> OPENPARENTHESIS\_KW declarations\_list CLOSEPARENTHESIS\_KW");     }  
block:     OPENACCOLADE\_KW statement\_list CLOSEACCOLADE\_KW  
{         System.out.println("Rule 14.1: " +             "block -> OPENACCOLADE\_KW statement\_list CLOSEACCOLADE\_KW");     }  
statement\_list:     statement SEMICOLON\_KW  
{         System.out.println("Rule 15.1: " +             "statement\_list -> statement SEMICOLON\_KW");     }  
| statement\_list statement SEMICOLON\_KW  
{         System.out.println("Rule 15.2: " +             "statement\_list -> statement\_list statement SEMICOLON\_KW");     }  
SEMICOLON\_KW  
{         System.out.println("Rule 15.3: " +             "statement\_list -> SEMICOLON\_KW");     }  
| statement\_list SEMICOLON\_KW  
{         System.out.println("Rule 15.4: " +             "statement\_list -> statement\_list SEMICOLON\_KW");     }  
statement:     ID ASSIGN\_KW expressions  
{         System.out.println("Rule 16.1: " +             "statement -> ID ASSIGN\_KW expressions");     }  
| IF\_KW bool\_expressions THEN\_KW statement  
{         System.out.println("Rule 16.2: " +             "statement -> IF\_KW bool\_expressions THEN\_KW statement");     }  
| IF\_KW bool\_expressions THEN\_KW statement ELSE\_KW statement  
{         System.out.println("Rule 16.3: " +             "statement -> IF\_KW bool\_expressions THEN\_KW statement ELSE\_KW statement");     }  
| DO\_KW statement WHILE\_KW bool\_expressions  
{         System.out.println("Rule 16.4: " +             "statement -> DO\_KW statement WHILE\_KW bool\_expressions");     }  
| FOR\_KW ID ASSIGN\_KW counter DO\_KW statement  
{         System.out.println("Rule 16.5: " +             "statement -> FOR\_KW ID ASSIGN\_KW counter DO\_KW statement");     }  
| SWITCH\_KW expressions case\_element default END\_KW  
{         System.out.println("Rule 16.6: " +             "statement -> SWITCH\_KW expressions case\_element default END\_KW");     }  
| ID OPENPARENTHESIS\_KW arguments\_list CLOSEPARENTHESIS\_KW  
{         System.out.println("Rule 16.7: " +             "statement -> ID OPENPARENTHESIS\_KW arguments\_list CLOSEPARENTHESIS\_KW");     }  
| ID OPENBRACKET\_KW expressions CLOSEBRACKET\_KW ASSIGN\_KW expressions  
{         System.out.println("Rule 16.8: " +             "statement -> IDENTIFIER OPENBRACKET\_KW expressions CLOSEBRACKET\_KW ASSIGN\_KW expressions");     }  
| RETURN\_KW expressions  
{         System.out.println("Rule 16.9: " +             "statement -> RETURN\_KW expressions");     }  
| EXIT\_KW WHEN\_KW bool\_expressions  
{         System.out.println("Rule 16.10: " +             "statement -> EXIT\_KW WHEN\_KW bool\_expressions");     }  
| block  
{         System.out.println("Rule 16.11: " +             "statement -> block");     }  
| ID OPENPARENTHESIS\_KW CLOSEPARENTHESIS\_KW  
{         System.out.println("Rule 16.12: " +             "statement -> ID OPENPARENTHESIS\_KW CLOSEPARENTHESIS\_KW");     }  
| SWITCH\_KW expressions case\_element END\_KW  
{         System.out.println("Rule 16.13: " +             "statement -> SWITCH\_KW expressions case\_element END\_KW");     }  
arguments\_list:   multi\_arguments  
{         System.out.println("Rule 17.1: " +             "arguments\_list -> multi\_arguments");     }  
multi\_arguments:     multi\_arguments COMMA\_KW expressions  
{         System.out.println("Rule 18.1: " +             "multi\_arguments -> multi\_arguments COMMA\_KW expressions");     }  
| expressions  
{         System.out.println("Rule 18.2: " +             "multi\_arguments -> expressions");     }  
counter:     NUMCONST UPTO\_KW NUMCONST  
{         System.out.println("Rule 19.1: " +             "counter -> NUMCONST UPTO\_KW NUMCONST");     }  
| NUMCONST DOWNTO\_KW NUMCONST  
{         System.out.println("Rule 19.2: " +             "counter -> NUMCONST DOWNTO\_KW NUMCONST");     }  
case\_element:     CASE\_KW NUMCONST SEMICOLON\_KW block  
{         System.out.println("Rule 20.1: " +             "case\_element -> CASE\_KW NUMCONST SEMICOLON\_KW block");     }  
| case\_element CASE\_KW NUMCONST SEMICOLON\_KW block  
{         System.out.println("Rule 20.2: " +             "case\_element -> case\_element CASE\_KW NUMCONST SEMICOLON\_KW block");     }  
default:     DEFAULT\_KW SEMICOLON\_KW block  
{         System.out.println("Rule 21.1: " +             "default -> DEFAULT\_KW SEMICOLON\_KW block");     }  
expressions:     constant\_expressions  
{         System.out.println("Rule 22.1: " +             "expressions -> constant\_expressions");     }  
| bool\_expressions  
{         System.out.println("Rule 22.2: " +             "expressions -> bool\_expressions");     }  
| arithmetic\_expressions  
{         System.out.println("Rule 22.3: " +             "expressions -> arithmetic\_expressions");     }  
| ID  
{         System.out.println("Rule 22.4: " +             "expressions -> ID");     }  
| ID OPENBRACKET\_KW expressions CLOSEBRACKET\_KW  
{         System.out.println("Rule 22.5: " +             "expressions -> ID OPENBRACKET\_KW expressions CLOSEBRACKET\_KW");     }  
| ID OPENPARENTHESIS\_KW arguments\_list CLOSEPARENTHESIS\_KW  
{         System.out.println("Rule 22.6: " +             "expressions -> ID OPENPARENTHESIS\_KW arguments\_list CLOSEPARENTHESIS\_KW");     }  
| OPENPARENTHESIS\_KW expressions CLOSEPARENTHESIS\_KW  
{         System.out.println("Rule 22.7: " +             "expressions -> OPENPARENTHESIS\_KW expressions CLOSEPARENTHESIS\_KW");     }  
| ID OPENPARENTHESIS\_KW CLOSEPARENTHESIS\_KW  
{         System.out.println("Rule 22.8: " +             "expressions -> ID OPENPARENTHESIS\_KW CLOSEPARENTHESIS\_KW");     }  
constant\_expressions:     NUMCONST  
{         System.out.println("Rule 23.1: " +             "constant\_expressions -> NUMCONST");     }  
| REALCONST  
{         System.out.println("Rule 23.2: " +             "constant\_expressions -> REALCONST");     }  
| CHARCONST  
{         System.out.println("Rule 23.3: " +             "constant\_expressions -> CHARCONST");     }  
| BOOLEAN\_KW  
{         System.out.println("Rule 23.4: " +             "constant\_expressions -> BOOLEAN\_KW");     }  
bool\_expressions:     LT\_KW pair  
{         System.out.println("Rule 24.1: " +             "bool\_expressions -> LT\_KW pair");     }  
| LTE\_KW pair  
{         System.out.println("Rule 24.2: " +             "bool\_expressions -> LTE\_KW pair");     }  
| GT\_KW pair  
{     System.out.println("Rule 24.3: " +       "bool\_expressions -> GT\_KW pair");   }  
| GTE\_KW pair  
{     System.out.println("Rule 24.4: " +       "bool\_expressions -> GTE\_KW pair");   }  
| EQ\_KW pair  
{     System.out.println("Rule 24.5: " +       "bool\_expressions -> EQ\_KW pair");   }  
| NEQ\_KW pair  
{     System.out.println("Rule 24.6: " +       "bool\_expressions -> NEQ\_KW pair");   }  
| AND\_KW THEN\_KW pair  
{         System.out.println("Rule 24.7: " +             "bool\_expressions -> AND\_KW THEN\_KW pair");     }  
| OR\_KW ELSE\_KW pair  
{         System.out.println("Rule 24.8: " +             "bool\_expressions -> OR\_KW ELSE\_KW pair");     }  
arithmetic\_expressions:     ADD\_KW pair  
{         System.out.println("Rule 25.1: " +             "arithmetic\_expressions -> ADD\_KW pair");     }  
| SUB\_KW pair  
{         System.out.println("Rule 25.2: " +             "arithmetic\_expressions -> SUB\_KW pair");     }  
| MUL\_KW pair  
{         System.out.println("Rule 25.3: " +             "arithmetic\_expressions -> MUL\_KW pair");     }  
| DIV\_KW pair  
{         System.out.println("Rule 25.4: " +             "arithmetic\_expressions -> DIV\_KW pair");     }  
| MOD\_KW pair  
{         System.out.println("Rule 25.5: " +             "arithmetic\_expressions -> MOD\_KW pair");     }  
| SUB\_KW expressions  
{         System.out.println("Rule 25.6: " +             "arithmetic\_expressions -> SUB\_KW expressions");     }  
pair:     OPENPARENTHESIS\_KW expressions COMMA\_KW expressions CLOSEPARENTHESIS\_KW  
{         System.out.println("Rule 26.1: " +             "pair: OPENPARENTHESIS\_KW expressions COMMA\_KW expressions CLOSEPARENTHESIS\_KW");     }

**Test Program (Coded by ourselves)**

program globaltest  
int a;  
int b:=#3;  
real f;  
real k:=#0.4;  
real l:=#3.5000;  
char c:='w';  
char h;  
bool s;  
bool g:=true;  
int array[#2]:={#1,#7};  
char chars [0..2]:={'c','d','7'};  
procedure p ( int w , char t){  
    switch w  
    case #10 :{  
        w:=+(w,w);  
        w:=-(+(\*(w,w),w),w);  
          
    }  
    case #20:{  
        t:= and (t,t);  
        w:= or(w,w);  
        do  
        for i:=#1 upto #10 do  
        w:=%(w,#32);  
        while <>(w,#1);  
    }  
    case #30:{  
        if not =(w,#4) then w:=5; else w:=#9;  
    }  
    default :{  
        if and (t,t) and then or(t,#0)  
        then w:=-w;  
    }  
    end;  
};  
main{  
    array [#2] := array [#2] - (char [#2] = 'd');  
    k := and (or else (+(\*(#2,k),false),true), array[#1]),#1);  
    return -(l,k);  
    exit when not(>(array[#2],#0));  
}

**Final Results (Parser Output)**

Rule 4.1: type\_specifiers -> INTEGER\_KW

Rule 7.1: dec -> ID

Rule 6.1: declarator -> dec

Rule 5.1: declarator\_list -> declarator

Rule 7.1: dec -> ID

Rule 23.1: constant\_expressions -> NUMCONST

Rule 9.1: initializer -> constant\_expressions

Rule 6.2: declarator -> dec ASSIGN\_KW initializer

Rule 5.2: declarator\_list -> declarator\_list COMMA\_KW declarator

Rule 7.1: dec -> ID

Rule 23.1: constant\_expressions -> NUMCONST

Rule 9.1: initializer -> constant\_expressions

Rule 6.2: declarator -> dec ASSIGN\_KW initializer

Rule 5.2: declarator\_list -> declarator\_list COMMA\_KW declarator

Rule 8.2: range -> NUMCONST DOT\_KW NUMCONST

Rule 7.2: dec -> ID OPENBRACKET\_KW range CLOSEBRACKET\_KW

Rule 23.1: constant\_expressions -> NUMCONST

Rule 23.1: constant\_expressions -> NUMCONST

Rule 23.1: constant\_expressions -> NUMCONST

Rule 10.2: initializer\_list -> constant\_expressions

Rule 10.1: initializer\_list -> constant\_expressions COMMA\_KW initializer\_list

Rule 10.1: initializer\_list -> constant\_expressions COMMA\_KW initializer\_list

Rule 9.2: initializer -> OPENACCOLADE\_KW initializer CLOSEACCOLADE\_KW

Rule 6.2: declarator -> dec ASSIGN\_KW initializer

Rule 5.2: declarator\_list -> declarator\_list COMMA\_KW declarator

Rule 22.4: expressions -> ID

Rule 23.1: constant\_expressions -> NUMCONST

Rule 22.1: expressions -> constant\_expressions

Rule 23.1: constant\_expressions -> NUMCONST

Rule 22.1: expressions -> constant\_expressions

Rule 26.1: pair: OPENPARENTHESIS\_KW expressions COMMA\_KW expressions CLOSEPARENTHESIS\_KW

Rule 25.3: arithmetic\_expressions -> MUL\_KW pair

Rule 22.3: expressions -> arithmetic\_expressions

Rule 26.1: pair: OPENPARENTHESIS\_KW expressions COMMA\_KW expressions CLOSEPARENTHESIS\_KW

Rule 25.2: arithmetic\_expressions -> SUB\_KW pair

Rule 22.4: expressions -> ID

Rule 23.1: constant\_expressions -> NUMCONST

Rule 22.1: expressions -> constant\_expressions

Rule 22.4: expressions -> ID

Rule 26.1: pair: OPENPARENTHESIS\_KW expressions COMMA\_KW expressions CLOSEPARENTHESIS\_KW

Rule 25.4: arithmetic\_expressions -> DIV\_KW pair

Rule 22.3: expressions -> arithmetic\_expressions

Rule 26.1: pair: OPENPARENTHESIS\_KW expressions COMMA\_KW expressions CLOSEPARENTHESIS\_KW

Rule 25.1: arithmetic\_expressions -> ADD\_KW pair

Rule 8.3: range -> arithmetic\_expressions DOT\_KW arithmetic\_expressions

Rule 7.2: dec -> ID OPENBRACKET\_KW range CLOSEBRACKET\_KW

Rule 6.1: declarator -> dec

Rule 5.2: declarator\_list -> declarator\_list COMMA\_KW declarator

Rule 7.3: dec -> ID OPENBRACKET\_KW NUMCONST CLOSEBRACKET\_KW

Rule 6.1: declarator -> dec

Rule 5.2: declarator\_list -> declarator\_list COMMA\_KW declarator

Rule 3.1: declarations -> type\_specifiers declarator\_list SEMICOLON\_KW

Rule 2.2: declarations\_list -> declarations

Rule 4.1: type\_specifiers -> INTEGER\_KW

Rule 7.1: dec -> ID

Rule 23.1: constant\_expressions -> NUMCONST

Rule 9.1: initializer -> constant\_expressions

Rule 6.2: declarator -> dec ASSIGN\_KW initializer

Rule 5.1: declarator\_list -> declarator

Rule 3.1: declarations -> type\_specifiers declarator\_list SEMICOLON\_KW

Rule 2.1: declarations\_list -> declarations\_list declarations

Rule 4.2: type\_specifiers -> REAL\_KW

Rule 7.1: dec -> ID

Rule 23.1: constant\_expressions -> NUMCONST

Rule 9.1: initializer -> constant\_expressions

Rule 6.2: declarator -> dec ASSIGN\_KW initializer

Rule 5.1: declarator\_list -> declarator

Rule 7.1: dec -> ID

Rule 6.1: declarator -> dec

Rule 5.2: declarator\_list -> declarator\_list COMMA\_KW declarator

Rule 7.1: dec -> ID

Rule 23.1: constant\_expressions -> NUMCONST

Rule 9.1: initializer -> constant\_expressions

Rule 6.2: declarator -> dec ASSIGN\_KW initializer

Rule 5.2: declarator\_list -> declarator\_list COMMA\_KW declarator

Rule 3.1: declarations -> type\_specifiers declarator\_list SEMICOLON\_KW

Rule 2.1: declarations\_list -> declarations\_list declarations

Rule 4.3: type\_specifiers -> CHAR\_KW

Rule 7.1: dec -> ID

Rule 23.3: constant\_expressions -> CHARCONST

Rule 9.1: initializer -> constant\_expressions

Rule 6.2: declarator -> dec ASSIGN\_KW initializer

Rule 5.1: declarator\_list -> declarator

Rule 7.1: dec -> ID

Rule 1.