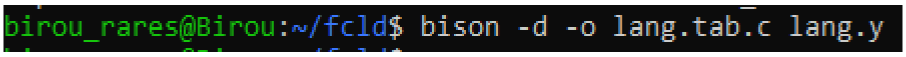
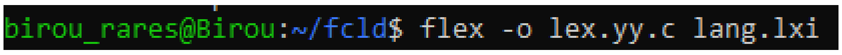
Documentation

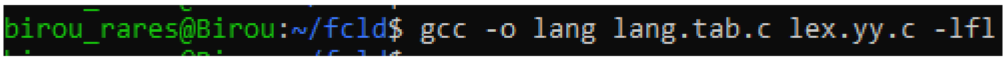
Commands used for running (after installing the packages):

- Generate the parser (it shouldn't print anything if successful)
  - processes the lang.y file
  - **lang.tab.c**: The C source file implementing the parser based on your grammar.
  - **lang.tab.h**: A header file containing token definitions. Used in other parts like lexer (for ex).
  - **-d** generate the header file lang.tab.h
  - **-o lang.tab.c**: Specifies the output filename for the generated C source code (lang.tab.c)
  - 

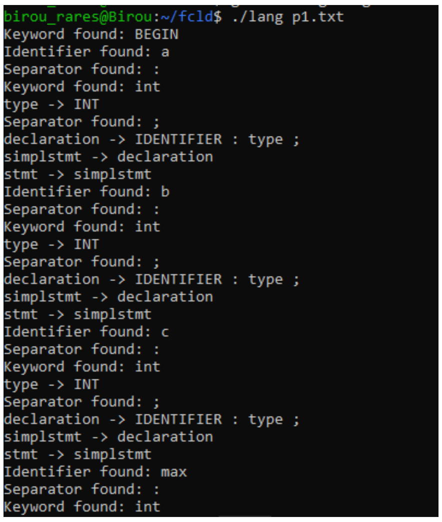
```
birou_rares@Birou:~/fcld$ bison -d -o lang.tab.c lang.y
```

- Generate the lexer (it shouldn't print anything if successful)
  - processes the lang.lxi file (lexical analyzer rules)
  - **lex.yy.c**: A C source file implementing the lexer. This file contains a yylex function that reads input, matches tokens, and passes them to the parser.
  - **-o lex.yy.c**: Specifies the output filename for the generated lexer (lex.yy.c)
  - 

```
birou_rares@Birou:~/fcld$ flex -o lex.yy.c lang.lxi
```

- Compile and link (it shouldn't print anything if successful)
  - compiles and links the parser (lang.tab.c) and lexer (lex.yy.c) into an executable named lang
  - **lang.tab.c** and **lex.yy.c**: Parser source file generated by Bison and lexer source file generated by Flex.
  - **-lfl**: Links the Flex library, which provides required functions like yywrap used by the lexer
  - **-o lang**: the name of the output executable
  - 

```
birou_rares@Birou:~/fcld$ gcc -o lang lang.tab.c lex.yy.c -lfl
```

- Run for your chosen file (Outputs debug information, syntax analysis, or error messages)
  - The lexer (lex.yy.c) tokenizes the input and passes tokens to the parser.
  - The parser (lang.tab.c) processes the tokens based on your grammar rules.
  - Outputs debug information, syntax analysis, or error messages.
  - runs the compiled program (lang) with an input file (p1.txt)
  - 

```
birou_rares@Birou:~/fcld$ ./lang p1.txt
Keyword found: BEGIN
Identifier found: a
Separator found: :
Keyword found: int
type -> INT
Separator found: ;
declaration -> IDENTIFIER : type ;
simplstmt -> declaration
stmt -> simplstmt
Identifier found: b
Separator found: :
Keyword found: int
type -> INT
Separator found: ;
declaration -> IDENTIFIER : type ;
simplstmt -> declaration
stmt -> simplstmt
Identifier found: c
Separator found: :
Keyword found: int
type -> INT
Separator found: ;
declaration -> IDENTIFIER : type ;
simplstmt -> declaration
stmt -> simplstmt
Identifier found: max
Separator found: :
Keyword found: int
```

lang.lxi

```
%{
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include "lang.tab.h"
int line_num = 1;
%}

%option noyywrap
%option caseless

DIGIT [0-9]
LETTER [a-zA-Z]
SYMBOLS [!#%^*+-/<=>_.,:;]
IDENTIFIER ({LETTER}|_)+({LETTER}|{DIGIT})*
INVALID_IDENTIFIER ({DIGIT}+{LETTER}+|{DIGIT}+_)
INTEGER_CONSTANT [+-]?{DIGIT}+
STRING_CONSTANT \"({LETTER}|{DIGIT}|{SYMBOLS})*\"

%%

"BEGIN" { printf("Keyword found: %s\n", yytext); return BEGIN_BLOCK; }
"END" { printf("Keyword found: %s\n", yytext); return END_BLOCK; }
"if" { printf("Keyword found: %s\n", yytext); return IF; }
"else" { printf("Keyword found: %s\n", yytext); return ELSE; }
"while" { printf("Keyword found: %s\n", yytext); return WHILE; }
"read" { printf("Keyword found: %s\n", yytext); return READ; }
"write" { printf("Keyword found: %s\n", yytext); return WRITE; }
"int" { printf("Keyword found: %s\n", yytext); return INT; }
"string" { printf("Keyword found: %s\n", yytext); return STRING; }
"char" { printf("Keyword found: %s\n", yytext); return CHAR; }
```

```
"boolean" { printf("Keyword found: %s\n", yytext); return BOOLEAN; }
"real" { printf("Keyword found: %s\n", yytext); return REAL; }

"+" { printf("Operator found: %s\n", yytext); return PLUS; }
"-" { printf("Operator found: %s\n", yytext); return MINUS; }
"*" { printf("Operator found: %s\n", yytext); return TIMES; }
"/" { printf("Operator found: %s\n", yytext); return DIVIDE; }
"%" { printf("Operator found: %s\n", yytext); return MODULO; }
"=" { printf("Operator found: %s\n", yytext); return ASSIGN; }
"==" { printf("Operator found: %s\n", yytext); return EQ; }
"!=" { printf("Operator found: %s\n", yytext); return NEQ; }
"<" { printf("Operator found: %s\n", yytext); return LESS; }
"<=" { printf("Operator found: %s\n", yytext); return LESSEQ; }
">" { printf("Operator found: %s\n", yytext); return GREATER; }
">=" { printf("Operator found: %s\n", yytext); return GREATEREQ; }

"{" { printf("Separator found: %s\n", yytext); return BRACEOPEN; }
"}" { printf("Separator found: %s\n", yytext); return BRACECLOSE; }
"(" { printf("Separator found: %s\n", yytext); return PARENOPEN; }
")" { printf("Separator found: %s\n", yytext); return PARENCLOSE; }
"[" { printf("Separator found: %s\n", yytext); return SQBRACKETOPEN; }
"]" { printf("Separator found: %s\n", yytext); return SQBRACKETCLOSE; }
":" { printf("Separator found: %s\n", yytext); return COLON; }
";" { printf("Separator found: %s\n", yytext); return SEMICOLON; }

{IDENTIFIER} { printf("Identifier found: %s\n", yytext); return IDENTIFIER; }
{INTEGER_CONSTANT} { printf("Integer constant found: %s\n", yytext); return INTCONSTANT; }
{STRING_CONSTANT} { printf("String constant found: %s\n", yytext); return STRINGCONSTANT; }
{INVALID_IDENTIFIER} { printf("Invalid identifier: %s at line %d\n", yytext, line_num); return INVALID; }


[ \t]+  { /* Skip whitespace */ }
```

```
"//".*  { /* Skip comments */ }
\n { ++line_num; }
. { printf("Unrecognized token: %s at line %d\n", yytext, line_num); exit(1); }
%%
```

lang.y

```
%{
#include "lexer.h"
#include <stdio.h>
#include <stdlib.h>

#define YYDEBUG 1

int yyerror(const char *s);
%}

%token BEGIN_BLOCK END_BLOCK IF ELSE WHILE READ WRITE INT STRING CHAR BOOLEAN REAL
%token PLUS MINUS TIMES DIVIDE MODULO ASSIGN EQ NEQ LESS LESSEQ GREATER GREATEREQ
%token BRACEOPEN BRACECLOSE PARENOPEN PARENCLOSE SQBRACKETOPEN SQBRACKETCLOSE
%token COLON SEMICOLON IDENTIFIER INTCONSTANT STRINGCONSTANT
%token INVALID

%start program

%%

program : BEGIN_BLOCK stmtlist END_BLOCK {
   printf("program -> BEGIN_BLOCK stmtlist END_BLOCK\n");
}
;
```

```
stmtlist : stmt {
    printf("stmtlist -> stmt\n");
}
| stmt stmtlist {
    printf("stmtlist -> stmt stmtlist\n");
}
;

stmt : simplstmt {
    printf("stmt -> simplstmt\n");
}
| structstmt {
    printf("stmt -> structstmt\n");
}
;

simplstmt : declaration {
    printf("simplstmt -> declaration\n");
}
| assignstmt {
    printf("simplstmt -> assignstmt\n");
}
| iostmt {
    printf("simplstmt -> iostmt\n");
}
;

declaration : IDENTIFIER COLON type SEMICOLON {
    printf("declaration -> IDENTIFIER : type ;\n");
}
;
```

```
type : INT {
    printf("type -> INT\n");
}
| STRING {
    printf("type -> STRING\n");
}
| CHAR {
    printf("type -> CHAR\n");
}
| BOOLEAN {
    printf("type -> BOOLEAN\n");
}
| REAL {
    printf("type -> REAL\n");
}
;

assignstmt : IDENTIFIER ASSIGN expression SEMICOLON {
    printf("assignstmt -> IDENTIFIER = expression ;\n");
}
;

expression : term {
    printf("expression -> term\n");
}
| term PLUS expression {
    printf("expression -> term + expression\n");
}
| term MINUS expression {
    printf("expression -> term - expression\n");
}
```

```
;

term : IDENTIFIER {
   printf("term -> IDENTIFIER\n");
}
| INTCONSTANT {
   printf("term -> INTCONSTANT\n");
}
| STRINGCONSTANT {
   printf("term -> STRINGCONSTANT\n");
}
;

iostmt : READ PARENOPEN IDENTIFIER PARENCLOSE SEMICOLON {
   printf("iostmt -> READ ( IDENTIFIER ) ;\n");
}
| WRITE PARENOPEN expression PARENCLOSE SEMICOLON {
   printf("iostmt -> WRITE ( expression ) ;\n");
}
;

structstmt : ifstmt {
   printf("structstmt -> ifstmt\n");
}
| whilestmt {
   printf("structstmt -> whilestmt\n");
}
;

ifstmt : IF condition BRACEOPEN stmtlist BRACECLOSE {
   printf("ifstmt -> IF condition { stmtlist }\n");
}
```

```
| IF condition BRACEOPEN stmtlist BRACECLOSE ELSE BRACEOPEN stmtlist BRACECLOSE {
    printf("ifstmt -> IF condition { stmtlist } ELSE { stmtlist }\n");
}
;

whilestmt : WHILE condition BRACEOPEN stmtlist BRACECLOSE {
    printf("whilestmt -> WHILE condition { stmtlist }\n");
}
;

condition : expression LESS expression {
    printf("condition -> expression < expression\n");
}
| expression LESSEQ expression {
    printf("condition -> expression <= expression\n");
}
| expression GREATER expression {
    printf("condition -> expression > expression\n");
}
| expression GREATEREQ expression {
    printf("condition -> expression >= expression\n");
}
| expression EQ expression {
    printf("condition -> expression == expression\n");
}
| expression NEQ expression {
    printf("condition -> expression != expression\n");
}
;

%%
```

```
int yyerror(const char *s) {
    printf("Error: %s\n", s);
    return 0;
}

extern FILE *yyin;

int main(int argc, char **argv) {
    if (argc > 1) {
        yyin = fopen(argv[1], "r");
        if (!yyin) {
            perror("Failed to open file");
            return 1;
        }
    }
    if (!yyparse()) {
        printf("Parsing completed successfully.\n");
    } else {
        printf("Parsing failed.\n");
    }
    return 0;
}
```