COMPILER DESIGN AND IMPLEMENTATION

Programming Assignment #1

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SELF-STUDY MATERIAL

- Suggested Steps
- Programming Environment
- FLEX
- A Practical Flex Example
- Basics of Bison
- A Practical Bison Example

P1.1

SUGGESTED STEPS FOR DOING ASSIGNMENT #1

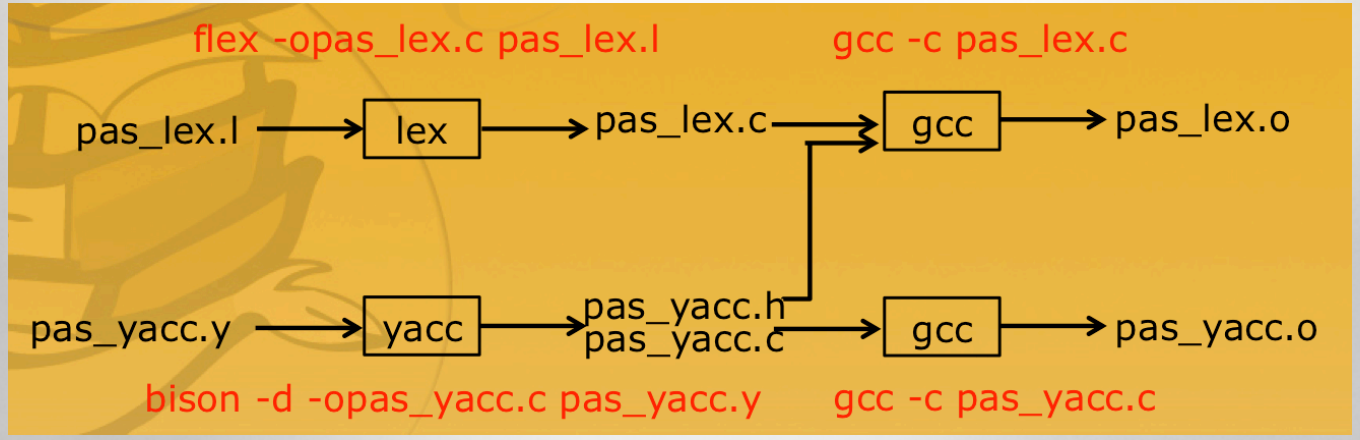
WHAT TO DO

- Write a lex specification **mytiny_lex.l** (see pas_lex.l).
- Write a yacc specification **mytiny_yacc.l** (see pas_yacc.y).
- Write a main function **main.c** (see main.c).
- Write a header file **mytiny.h** (see pascal.h)

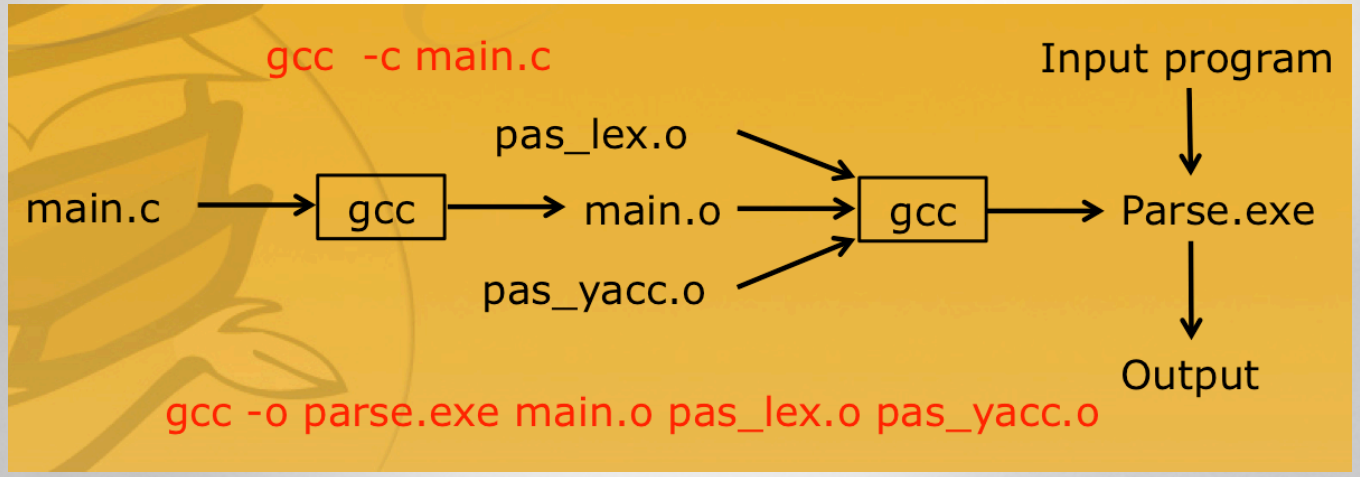
SUGGESTED PROCESS

1. Use bison to compile **mytiny_yacc.y** into mytiny_yacc.c.
   The **-d** switch produces a header file mytiny_yacc.h.
2. Use flex to compile **mytiny_lex.l** into mytiny_lex.c.
3. Use gcc to compile mytiny_lex.c into mytiny_lex.o,
   mytiny_yacc.c into mytiny_yacc.o, and **main.c** into main.o.
4. Use gcc to link main.o, pas_lex.o, and pas_yacc.o into
   parse.exe.

GENERATING C CODE



BUILDING EXECUTABLE



P1.2

PROGRAMMING ENVIRONMENT

SOFTWARE

Software needed

- Flex 2.5.4
- Bison 2.4.1
- MinGW 4.6.2

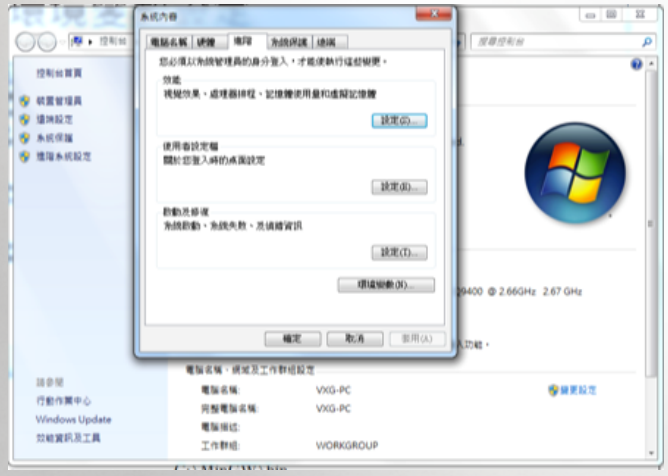
Notes

- DO NOT install both MinGW and DevC.
- Check and set up environment variables.
- Rebooting after installation is suggested.

ENVIRONMENT VARIABLES

- Check whether **`C:\MinGW\bin`** is in **`PATH`**. If not, add it into **`PATH`**, using ; as separators.
- In case of using **`DevC`**, check for **`C:\Dev-Cpp\bin`** instead.

IN WINDOWS



TEST INSTALLATION

P1.2

FLEX

FLEX SPECIFICATION

Char	Meaning
.	Any character except for '\n'
-	The range of characters, e.g., a-z
*	Repeat for 0 or more times
+	Repeat for 1 or more times
?	Appear either 0 or 1 time
^	Negation
A | B	A or B
"sth."	Exactly the characters appeared in parentheses (**`sth.`**)

P1.3

A PRACTICAL FLEX EXAMPLE

FLEX COMPILATION

- **`flex -opas_lex.c pas_lex.l`**
- Translate **`pas_lex.l`** into **`pas_lex.c`**.

(Specify the filename of your own.)

- There is **NO** space between **`-o`** and **`pas_lex.c`**.

FOR YOUR ASSIGNMENT

- Write your own mytiny.lex according to the description of mytiny lexicons.
- `flex -omytiny_lex.c mytiny_lex.l`

GCC COMPILATION

- **`gcc -c -o pas_lex.o pas_lex.c`**
- **`gcc -c -o main.o main.c`**
- **`gcc -o scanner.exe pas_lex.o main.o`**
- There **IS** a space between **`-o`** and **`pas_lex.o`**.

EXECUTION

- **`scanner.exe input.pas`**
- **`input.pas`** can be some other test file names given by TA.
- According the environment setup, you may need to use command as follows in some cases.

`./scanner.exe input.pas`

P1.5

BASICS OF BISON

A BISON SPECIFICATION

EXAMPLE: DEFINITIONS

```
1  %{
2      #include <stdio.h>
3      #include <stdlib.h>
4      #include <string.h>
5      #include "pascal.h"
6  %}
7  %token PROG PROC BG END INT BOOL TRUE
8  %token LP RP LSP RSP FALSE CC
9  %token DOT SEMI VAR ARRAY OF DOTDOT
10 %token IF THEN READ WRITE WHILE DO
11 %token ELSE ASSIGN COMMA COLON ID NUM
12 %left OR AND
13 %left NOT
14 %left EQ NE LT GT LE GE
15 %left ADD MINUS
16 %left DIV TIMES
17 %expect 1
18
19 %%
```

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EXAMPLE: RULE

```
19  %%
20  prog    :   PROG ID SEMI block DOT {printf("prog => PROG ID SEMI block DOT \n********
21          |   {printf("********Parsing failed! \n");}
22          ;
23
24  block   :   vardecs prodecs stmts {printf("block=>vardecs prodecs stmts \n");}
25          ;
26
27  vardecs :   VAR vardec SEMI morevd {printf("vardecs => VAR vardec SEMI morevd \n");}
28          |   {printf("vardecs => Null \n");}
29          ;
30
31  morevd  :   vardec SEMI morevd  {printf("morevd => vardec SEMI morevd \n");}
32          |   {printf("morevd => Null \n");}
33          ;
34
35  vardec  :   ID moreid COLON type {printf("vardec => ID moreid COLON type\n");}
36          ;
37
38  moreid  :   COMMA ID moreid {printf("moreid =>  COMMA ID moreid \n");}
39          |   {printf("moreid => Null \n");}
40          ;
41
```

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P1.6

A PRACTICAL BISON EXAMPLE

COMMANDS USED

- Bison

bison -d -o pas_yacc.c pas_yacc.y

- Flex

flex -opas_lex.c pas_lex.l

- GCC

gcc -c pas_lex.c

gcc -c pas_yacc.c

gcc -c main.c

gcc -o parse.exe pas_lex.o main.o pas_yacc.o

EXECUTION

- To run your parser:

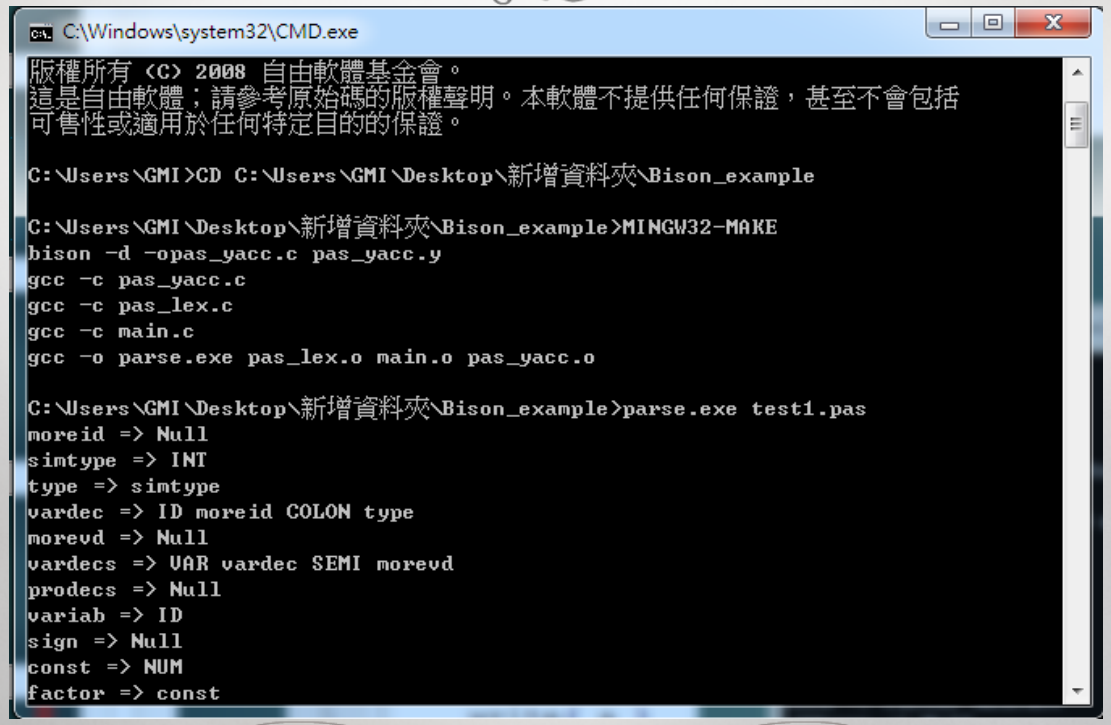
parser.exe input.pas

FOR YOUR ASSIGNMENT

- Write a mytiny.y according to the MyTiny grammar.
- Build a mytiny.exe and run

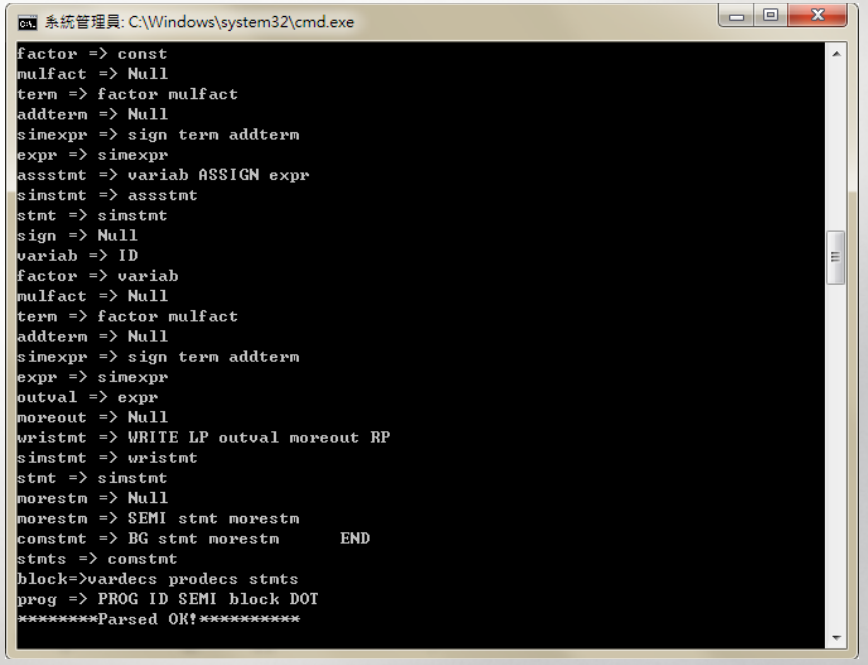
```
./mytiny.exe test.t
```

BUILDING EXECUTABLE



EXECUTING YOUR PROGRAM

```
1  program test1;
2  var a: integer;
3  begin
4      a := 3;
5      write( a )
6  end.
```



REFERENCES

- http://www.mingw.org/
- http://flex.sourceforge.net/
- http://www.gnu.org/software/bison/
- http://sourceforge.net/projects/gnuwin32

Now,

START DOING YOUR OWN ASSIGNMENT