

Assignment 2

Lexical Analysis

1 Introduction

In this assignment we are going to construct a lexical analyzer. Lexical analysis is the process of scanning the source program as a sequence of characters and converting them into sequences of tokens. A program that performs this task is called a lexical analyzer or a lexer or a scanner. For example, if a portion of the source program contains **int x=5;**

The scanner would convert in a sequence of tokens like **<INT><ID,x><ASSIGNOP,=><COST_NUM,5><SEMICOLON>**.

After successfully (!) completing the construction of a simple [symbol table](#), we will construct a scanner for a subset of C language. The task will be performed using a tool named flex (Fast Lexical Analyzer Generator) which is a popular tool for generating scanners.

2 Tasks

You have to perform the following tasks in this assignment.

2.1 Identifying Tokens

2.1.1 Keywords

You have to identify the keywords given in Table 1 and print the token in the output file. For example, you will have to print **<IF>** in case you find the keyword **"if"** in the source program. Keywords will not be inserted in the [symbol table](#).

Keyword	Token	Keyword	Token
if	IF	else	ELSE
for	FOR	while	WHILE
do	DO	break	BREAK
int	INT	char	CHAR
float	FLOAT	double	DOUBLE
void	VOID	return	RETURN
switch	SWITCH	case	CASE
default	DEFAULT	continue	CONTINUE

1.1.1 Constants

For each constant you have to print a token of the format **<Type, Symbol>** in the output file and insert the symbol in the [symbol table](#).

- ❑ **Integer Literals:** One or more consecutive digits form an integer literal. Type of token will be **CONST_INT**. Note that + or - will not be the part of an integer.
- ❑ **Floating Point Literals:** Numbers like 3.14159, 3.14159E-10, .314159 and 314159E10 will be considered as floating point constants. In this case, token type will be **CONST_FLOAT**.
- ❑ **Character Literals:** Character literals are enclosed within single quotes. There will be a single character within the single quotes. For character literals token type will be **CONST_CHAR**.

Note that, you need to convert the detected lexeme to the actual character. For example if you find `'a'`, then you need to print **<CONST_CHAR, a>**. That means we only need the ASCII code, not the quote symbols around it.

1.1.2 Operators and Punctuators

The operator list for the subset of the C language we are dealing with is given in Table 2. A token in the form of **<Type, Symbol>** should be printed in the output token file. You do not need to insert the operators and punctuators in the [symbol table](#).

Symbols	Type
+, -	ADDOP
*, /, %	MULOP
++, - -	INCOP
<, <=, >, >=, ==, !=	RELOP
=	ASSIGNOP
&&,	LOGICOP
!	NOT
(LPAREN
)	RPAREN
{	LCURL
}	RPAREN
[LTHIRD
]	RTHIRD
,	COMMA
;	SEMICOLON

2.1.2 Identifiers

Identifiers are names given to C entities, such as variables, functions, structures etc. An identifier can only have alphanumeric characters (a-z, A-Z, 0-9) and underscore (_). The first character of an identifier can only contain alphabet (a-z, A-Z) or underscore (_). For any identifier encountered in the input file you have to print the token **<ID, Symbol>** and also insert it in the [symbol table](#).

2.1.3 Comments

Comments can be single lined or multiple lined. A single line comment usually starts with `//` symbols. However, a comment started with `//` can be continued to the next line if the first line ends with a `\`. A multiline comment starts with `/*` and terminate with the characters `*/`. If there is any comment in the input file you have to recognize it but not generate any token in the output file.

```
// A single line comment
/** Another multiple
line Comment */
```

2.1.4 White Space

You have to capture the white spaces in the input file, but no actions needed regarding this.

22 Line Count

You should count the number of lines in the source program.

23 Lexical Errors

You should detect lexical errors in the source program and report it along with corresponding line no. You have to detect the following type of errors:

- ☐ Invalid prefix on identifiers such as **12abcd**
- ☐ Ill formed number such as **1E10.7**
- ☐ Empty character constant error
- ☐ Unrecognized character such as \$, `

Also count the total number of errors.

3 Input

The input will be a text file containing a C source program. File name will be given from the command line.

4 Output

In this assignment, there will be two output files. One is a file containing tokens. This file should be named as <YourStudentID>_token (For example 202214001_token.txt). You will output all the tokens in this file.

The other file is a log file named as <YourStudentID>_log.txt. In this file you will output all the actions performed in your program. For example, after detecting any lexeme except one representing white spaces you will print a line containing **Line No. <line_count>: Token <Token> Lexeme <Lexeme> found.** For example, if you find a comment //abcd at line no. 5 in your source code you will print **Line No. 5: Token COMMENT Lexeme //abcd found.** Note that, although you will not print any token in the corresponding token.txt file for comments, you will print it in the log file. [For any insertion into the symbol table, you will print the symbol table in the output log.](#) If a symbol already exists, print an appropriate message. For any detected error print **Line No. 5:<Corresponding error message>**. And at last print number of errors found in the source code.

For more clarification about input output please refer to the sample input output file. You are highly encouraged to produce output exactly like the sample one.

Notes:

Any type of plagiarism is strongly forbidden. -100% marks will be rewarded to the students who will be found to be involved in plagiarism. It does not matter who is the server and who is the client.