

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.



## LAB REPORT

on

## COMPILER DESIGN

*Submitted by*

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*Under the Guidance of*

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*in partial fulfilment for the award of the degree of*

**BACHELOR OF ENGINEERING**

in

**COMPUTER SCIENCE AND ENGINEERING**



**B.M.S. COLLEGE OF ENGINEERING**

(Autonomous Institution under VTU)

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Department of Computer Science and Engineering**



**CERTIFICATE**

This is to certify that the Lab work entitled “**Compiler Design**” carried out by Haaaid Qazi (**1BM21CS070**), who is bonafide student of **B. M. S. College of Engineering**. It is in partial fulfilment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2023-24.

The Lab report has been approved as it satisfies the academic requirements in respect of **Compiler Design- (22CS5PCCPD)** work prescribed for the said degree.

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***DECLARATION***

I, Haaid Qazi (1BM21CS070), student of 5th Semester, B.E, Department of Computer Science and Engineering, B. M. S. College of Engineering, Bangalore, here by declare that, this lab report entitled " **Compiler Design**" has been carried out by me under the guidance of Prof. Prameetha Pai, Assistant Professor, Department of CSE, B. M. S. College of Engineering, Bangalore during the academic semester November-2023-February-2024.

I also declare that to the best of my knowledge and belief, the development reported here is not from part of any other report by any other students.

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# Lab 1

## 1.1 Write a program in LEX to recognize different tokens: Keywords, Identifiers, Constants, Operators and Punctuation symbols.

### Code:

```
%{
#include<stdio.h>

%}

%%

printf[for|void|main|while|do|switch|case|int|char|float|double|if|else {printf(“%s-keyword\n”,yytext);
, {printf(“%s-separator\n”,yytext);}
; {printf(“%s-delimiter\n”,yytext);}

[a-zA-Z_][a-zA-Z0-9_]* {printf(“%s-Identifier\n”,yytext);}

">"|"<"|">="|"<="|"==" {printf(“%s- Relational operator\n”,yytext);}

"=" {printf(“%s-assignment operator\n”,yytext);}


[0-9]+ {printf(“%s-digit\n”,yytext);}

%%

void main()
{
printf("Give an input:\n");
yylex();
}

int yywrap()
{
return 1;
}
```

### Output



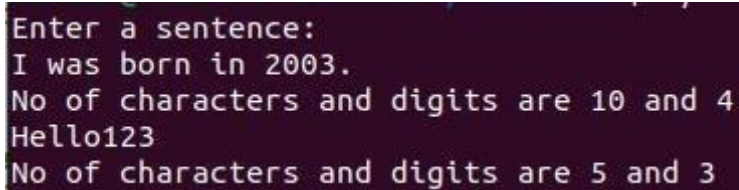
```
Give an input:
int sum,x=2,y=3,z;
int-keyword
sum-Identifier
,-separator
x-Identifier
=-assignment operator
2-digit
,-separator
y-Identifier
=-assignment operator
3-digit
,-separator
z-Identifier
;-delimiter
```

## 1.2 Write a program in LEX to count the number of characters and digits in a string.

### Code

```
% {
#include<stdio.h>
int d=0,c=0;
% }
%%
[a-zA-Z] {c++;}
[0-9] {d++;}
. ;
\n {printf("No of characters and digits are %d and %d\n",c,d),c=0,d=0;}
%%
void main()
{
printf("Enter a sentence:\n");
yylex();
}
int yywrap()
{
return 1;
}
```

### Output



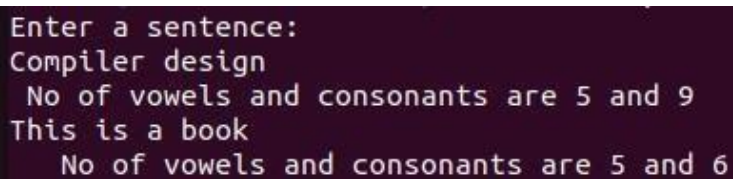
```
Enter a sentence:
I was born in 2003.
No of characters and digits are 10 and 4
Hello123
No of characters and digits are 5 and 3
```

### 1.3 Write a program in LEX to count the number of vowels and consonants in a string.

#### Code

```
% {  
#include<stdio.h>  
int v=0,c=0;  
% }  
  
%%  
  
[AEIOUaeiou] {v++;}  
[A-Za-z] {c++;}  
  
\n {printf("No of vowels and consonants are %d and %d\n",v,c),v=0,c=0;}  
%%  
  
void main()  
{  
printf("Enter a sentence:\n");  
yylex();  
}  
  
int yywrap()  
{  
return 1;  
}
```

#### Output

A screenshot of a terminal window with a dark background and light-colored text. It shows the execution of the LEX program. The user enters "Compiler design" and "This is a book". The program outputs the count of vowels and consonants for each input string.

```
Enter a sentence:  
Compiler design  
No of vowels and consonants are 5 and 9  
This is a book  
No of vowels and consonants are 5 and 6
```



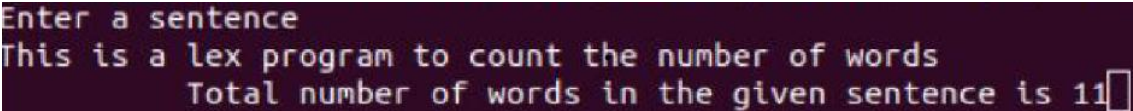
## Lab 2

### 2.1 Write a program in lex to count the number of words in a sentence.

#### Code

```
% {  
#include<stdio.h>  
  
int words;  
  
% }  
%%  
[^\t\n ]+ { words++;}  
  
\n {printf("No of words in the sentence are %d.\n",words),words=0;}  
  
%%  
  
void main()  
{  
printf("Enter a sentence:\n");  
yylex();  
}  
  
int yywrap()  
{  
return 1;  
}
```

#### Output



```
Enter a sentence  
This is a lex program to count the number of words  
Total number of words in the given sentence is 11
```

### 2.2 Write a program in lex to demonstrate regular definition.

## Code

```
% {  
#include<stdio.h>  
% }  
  
alpha [a-zA-Z0-9]  
%%  
  
[a-zA-Z]+ {printf("Characters\n");}  
[0-9]+ {printf("Digits");}  
{alpha}+ {printf("Invalid input!\n");}  
%%  
  
void main()  
{  
printf("Enter a string:\n");  
yylex();  
}  
  
int yywrap()  
{  
return 1;  
}
```

## Output

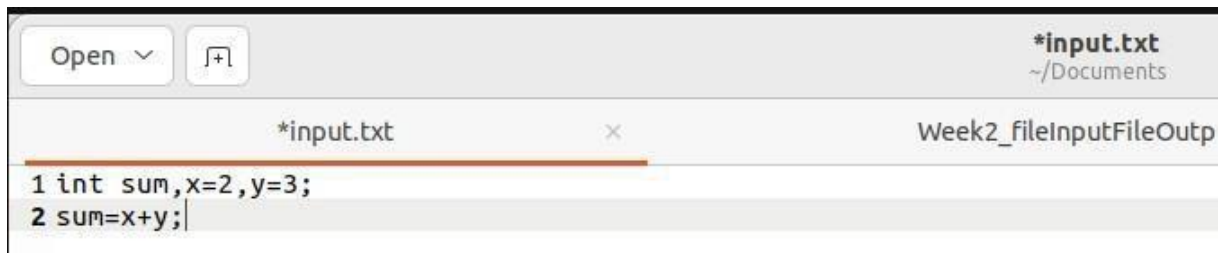
```
Enter a string:  
HelloWorld  
Characters  
  
1234  
Digits  
Hello123  
Invalid input!
```

**2.3 Write a program in lex to identify tokens in a program by taking input from a file and printing the output on the terminal.**

## Code

```
% {  
#include<stdio.h>  
  
% }  
%%  
  
char|int|float {printf("%s is a keyword.\n",yytext);}   
[a-zA-Z][a-zA-Z0-9]* {printf("%s is an identifier.\n",yytext);}   
, {printf("%s is a separator.\n",yytext);}   
; {printf("%s is a delimiter.\n",yytext);}   
"=" {printf("%s is an assignment operator.\n",yytext);}   
"+"|"-"|"*"|"/" {printf("%s is a binary operator.\n",yytext);}   
[0-9]+ {printf("%s is/are digit(s).\n",yytext);}   
  
\n ;  
%%  
  
void main()  
{  
yyin=fopen("input.txt","r");  
yylex();  
fclose(yyin);  
}  
  
int yywrap()  
{  
return 1;  
}
```

## Output



```
int is a keyword.  
sum is an identifier.  
, is a separator.  
x is an identifier.  
= is an assignment operator.  
2 is/are digit(s).  
, is a separator.  
y is an identifier.  
= is an assignment operator.  
3 is/are digit(s).  
; is a delimiter.  
sum is an identifier.  
= is an assignment operator.  
x is an identifier.  
+ is a binary operator.  
y is an identifier.  
; is a delimiter.
```

**2.4 Write a program in lex to identify tokens in a program by taking input from a file and printing the output in another file.**

**Code**

```

% {
#include<stdio.h>

% }

%%

char|int|float {fprintf(yyout,"%s is a keyword.\n",yytext);}
[a-zA-Z][a-zA-Z0-9]* {fprintf(yyout,"%s is an identifier.\n",yytext);}
, {fprintf(yyout,"%s is a separator.\n",yytext);}
; {fprintf(yyout,"%s is a delimiter.\n",yytext);}
"=" {fprintf(yyout,"%s is an assignment operator.\n",yytext);}
"+"|"-"|"*"|"|" "/" {fprintf(yyout,"%s is a binary operator.\n",yytext);}
[0-9]+ {fprintf(yyout,"%s is/are digit(s).\n",yytext);}

\n ;

%%

void main()
{
yyin=fopen("input.txt","r");
yyout=fopen("output.txt","w");
yylex();
printf("Printed in output.txt\n");
fclose(yyin);
fclose(yyout);
}

int yywrap()
{
return 1;
}

```

## Output

```
Open ▾ [icon] *input.txt ~/Documents
*input.txt × Week2_fileInputFileOutp
1 int sum,x=2,y=3;
2 sum=x+y;
```

```
Open ▾ [icon] *output.txt ~/Documents
input.txt × Week2_fileInputFileOut
1 int is a keyword.
2 sum is an identifier.
3 , is a separator.
4 x is an identifier.
5 = is an assignment operator.
6 2 is/are digit(s).
7 , is a separator.
8 y is an identifier.
9 = is an assignment operator.
10 3 is/are digit(s).
11 ; is a delimiter.
12 sum is an identifier.
13 = is an assignment operator.
14 x is an identifier.
15 + is a binary operator.
16 y is an identifier.
17 ; is a delimiter.
```

## 2.5 Write a program in lex to find the length of the input string.

### Code

```
%{
#include<stdio.h>
%}
%%
```

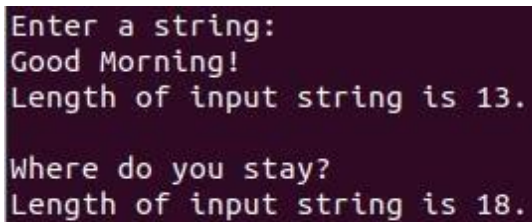
```
[a-zA-Z0-9.,!? \t]+ {printf("Length of input string is %d.\n",yyleng);}

%%

void main()
{
printf("Enter a string:\n");
yylex();
}

int yywrap()
{
return 1;
}
```

## Output

A terminal window with a dark purple background and light green text. It shows the program's output for two different inputs. The first input is "Good Morning!", which has a length of 13. The second input is "Where do you stay?", which has a length of 18.

```
Enter a string:
Good Morning!
Length of input string is 13.

Where do you stay?
Length of input string is 18.
```

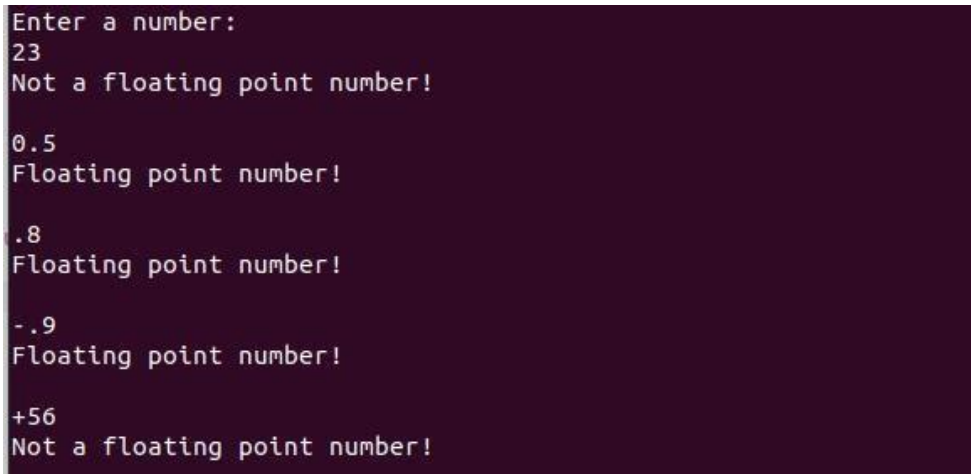
## Lab 3

### 3.1 Write a program in LEX to recognize Floating Point Numbers.

#### Code

```
% {  
#include<stdio.h>  
%  
%%  
[+-]?[0-9]*[.][0-9][0-9]* {printf("Floating point number!\n");};  
[+-]?[0-9][0-9]* {printf("Not a floating point number!\n");};  
%%  
int yywrap()  
{  
return 1;  
}  
void main()  
{  
printf("Enter a number:\n");  
yylex();  
}
```

#### Output



```
Enter a number:  
23  
Not a floating point number!  
  
0.5  
Floating point number!  
  
.8  
Floating point number!  
  
-.9  
Floating point number!  
  
+56  
Not a floating point number!
```

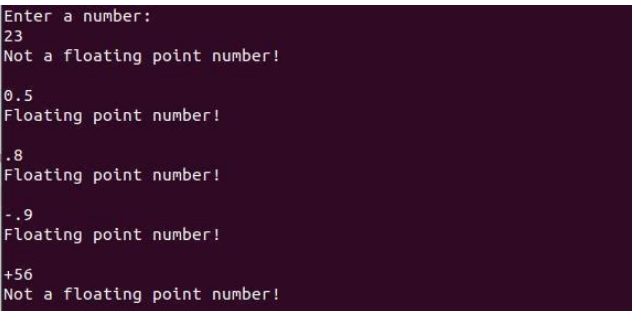
**3.2 Read and input sentence, and check if it is compound or simple. If a sentence has the word- and , or ,but ,because ,if ,then ,nevertheless then it is compound else it is simple.**



## Code

```
% {  
  
#include<stdio.h>  
  
int flag=0;  
  
% }  
%%  
  
if[then|but|because|nevertheless|and|or {flag=1;}  
  
. ;  
  
\n {return 0;}  
  
%%  
  
int yywrap()  
{  
return 1;  
}  
  
void main()  
{  
printf("Enter a sentence:\n");  
yylex();  
if(flag==1)  
printf("Compound sentence!\n");  
else  
printf("Simple sentence!\n");  
}
```

## Output




```
Enter a number:  
23  
Not a floating point number!  
  
0.5  
Floating point number!  
  
.8  
Floating point number!  
  
-.9  
Floating point number!  
  
+56  
Not a floating point number!
```

### 3.3 Write a program to check if the input sentence ends with any of the following punctuation marks ( ? , fullstop , ! )

#### Code

```
% {  
#include<stdio.h>  
int flag=0;  
% }  
  
%%  
.*[?!|.]$ {flag=1;}  
.* {flag=0;}  
\n {return 0;}  
%%  
int yywrap()  
{  
return 1;  
}  
void main()  
{  
printf("Enter a sentence:\n");  
yylex();  
if(flag==1)  
printf("Ends with a punctuation!\n");  
else  
printf("Does not end with punctuation!\n");  
}
```

#### Output

A screenshot of a terminal window with a dark purple background and light purple text. It shows the output of the program: "Enter a sentence:", followed by the user input "Is this yours?", and finally the program output "Ends with a punctuation!".

```
Enter a sentence:  
Is this yours?  
Ends with a punctuation!
```

### 3.4 Write a program to read an input sentence and to check if the sentence begins with English articles (A, a,AN,An,THE and The).

#### Code

```
% {
#include<stdio.h>
int flag=0;
% }
%%

^(an|An|The|the|A|a)[ " ].* {flag=1;}

.* {flag=0;}

\n {return 0;}

%%

int yywrap()
{
return 1;
}

void main()
{
printf("Enter a sentence:\n");
yylex();
if(flag==1)
printf("Starts with an article!\n");
else
printf("Does not start with an article!\n");
}
```

## Output

```
Enter a sentence:  
This is a good idea.  
Does not start with an article!
```

**3.5 Lex program to count the number of comment lines (multi line comments or single line) in a program. Read the input from a file called input.txt and print the count in a file called output.txt.**

### Code

```
%{
#include<stdio.h>

int c=0;

%}

%%

"\\"*"[^"]*"\\*+([\\/*][^"]*"\\*+)*\\ / {c++;}
"/".* {c++;}

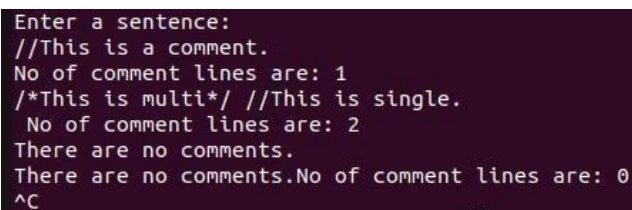
.ECHO;

%%

int yywrap()
{
return 1;
}

void main()
{
yyin=fopen("input.txt","r");
yyout=fopen("output.txt","w");
yylex();
printf("The number of comments are:%d\\n",c);
fclose(yyin);
fclose(yyout);
}
```

### Output



```
Enter a sentence:
//This is a comment.
No of comment lines are: 1
/*This is multi*/ //This is single.
No of comment lines are: 2
There are no comments.
There are no comments.No of comment lines are: 0
^C
```

### 3.6 Write a program to read and check if the user entered number is signed or unsigned using appropriate meta character.

#### Code

```
%{
#include<stdio.h>

%}


%%
[0-9]+ {printf("Unsigned number!\n");}

%%

int yywrap()
{
return 1;
}

void main()
{
printf("Enter a number:\n");
yylex();
}
```

#### Output



```
Enter a number:
123
Unsigned number!

-123
Signed number!

+123
Signed number!

^C
```

## Lab 4

**4.1 Write a LEX program that copies a file, replacing each nonempty sequence of white spaces by a single blank.**

### Code

```
% {  
#include<stdio.h>  
  
% }  
%%  
[ \t]+ {fprintf(yyout," ");}  
.\n {fprintf(yyout,"%s",yytext);}  
%%  
  
void main()  
{  
yyin=fopen("text.txt","r");  
yyout=fopen("print.txt","w");  
yylex();  
fclose(yyin);  
fclose(yyout);  
printf("Printed!\n");  
}  
  
int yywrap()  
{  
return 1;  
}
```

## Output



The image shows two windows. The top window is a text editor titled '\*text.txt' with a close button. It contains two lines of text: '1 Hello World' and '2 Welcome to programming'. The bottom window is a terminal with a dark background, showing the text 'Printed!' in white.

```
*text.txt
1 Hello World
2 Welcome to programming

Printed!
```





**4.2 Write a LEX program to recognize the following tokens over the alphabets {0,1,...,9}**

**4.2.1 The set of all string ending in 00.**

**Code**

```
% {  
#include<stdio.h>  
int flag=0;  
% }  
%%
```

```

[0-9]+[00] {flag=1;}

. ;

\n {return 0;}

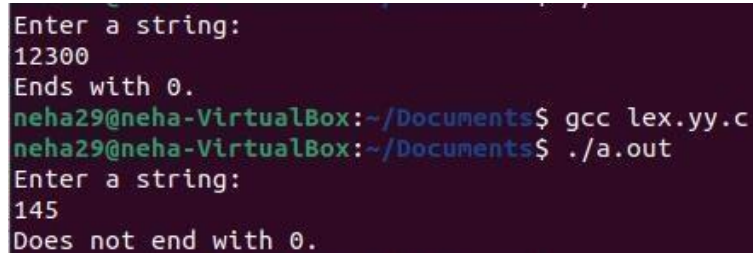
%%

void main()
{
printf("Enter a string:\n");
yylex();
if(flag==1)
printf("Ends with 0.\n");
else
printf("Does not end with 0.\n");
}

int yywrap()
{
return 1;
}

```

## Output



```

Enter a string:
12300
Ends with 0.
neha29@neha-VirtualBox:~/Documents$ gcc lex.yy.c
neha29@neha-VirtualBox:~/Documents$ ./a.out
Enter a string:
145
Does not end with 0.

```

## 4.2.2 The set of all strings with three consecutive 222's.

### Code

```

%{
#include<stdio.h>

int flag=0;

%}

%%

[0-9]*[2][2][2][0-9]* {flag=1;}

```

```

.;
\n {return 0;}

%%

void main()
{
printf("Enter a string:\n");
yylex();
if(flag==1)
printf("Has 3 consecutive 2's.\n");
else
printf("Does not have 3 consecutive 2's.\n");
}

int yywrap()
{
return 1;
}

```

## Output

```

Enter a string:
2322
Does not have 3 consecutive 2's.

```

### 4.2.3 The set of all string such that every block of five consecutive symbols contains at least two 5's.

#### Code

```

% {
#include<stdio.h>
int i,count=0,flag;
% }

%%

.{1,5} {flag=0;

```

```

for(i=0;i<5;i++)
{
    int c=yytext[i]-'0';
    if(c==5)
    {
        count++;
        if(count==2)
        {
            flag=1;
            break;
        }
    }
    count=0;
    printf("yytext:%s,flag(1 if no of 5 is atleast 2):%d\n",yytext,flag);
    if(flag!=1)
    {
        printf("Not a valid string!\n");
        return 0;
    }
}

```

```

\n {return 0;}

```

```

%%

```

```

void main()

```

```

{

```

```

printf("Enter a string:\n");

```

```

yylex();

```

```

if(flag==1)

```

```

printf("Valid string.\n");

```

```

}

```

```

int yywrap()

```

```

{

```

```

return 1;

```

```
}
```

## Output

```
Enter a string:
1525558566
yytext:15255,flag(1 if no of 5 is atleast 2):1
yytext:58566,flag(1 if no of 5 is atleast 2):1
Valid string.
```

### 4.2.4 The set of all strings beginning with a 1 which, interpreted as the binary representation of an integer, is congruent to zero modulo 5.

#### Code

```
% {
#include<stdio.h>
int c,i,flag=1,sum=0,power=1;
% }
%%
^1[01]* {for(i=yytext-1;i>=0;i--)
```

```

        {
            c=yytext[i]-'0';
            sum+=c*power;
            power*=2;
        }

        printf("Decimal representation:%d\n",sum);
        if(sum%5!=0)
        {
            printf("Not congruent to modulo 5.\n");
            sum=0;
            power=1;
        }
        else
        {
            printf("Congruent to modulo 5.\n");
            sum=0;
            power=1;
        }
    }

    .* {printf("Not a binary number.\n");}

\n {return 0;}

%%

void main()
{
    printf("Enter a string:\n");
    yylex();
}

int yywrap()
{
    return 1;
}

```

## Output

```

Enter a string:
1010
Decimal representation:10
Congruent to modulo 5.

```

#### **4.2.5 The set of all strings such that the 10th symbol from the right end is 1.**

##### **Code**

```
% {  
#include<stdio.h>  
int flag=0;  
% }  
%%  
[0-9]*1[0-9][0-9][0-9][0-9][0-9][0-9][0-9][0-9] {flag=1;}  
.;
```

```

\n {return 0;}

%%

void main()
{
printf("Enter a string:\n");
yylex();
if(flag==1)
printf("10th symbol from right is 1.\n");
else
printf("10th symbol from right is not 1.\n");
}

int yywrap()
{
return 1;
}

```

## Output

```

Enter a string:
11234345236
10th symbol from right is 1.

```

### 4.2.6 The set of all four digits numbers whose sum is 9.

#### Code

```

%{
#include<stdio.h>

int sum=0,i,flag=0;

%}

%%

[0-9][0-9][0-9][0-9] {for(i=0;i<yyleng;i++)
    {

```



```

        sum+=yytext[i]-'0';
    }
    if(sum==9)
    {
        flag=1;
        sum=0;
    }
    else
    {
        flag=0;
        sum=0;
    }
}

\n {return 0;}


%%

void main()
{
    printf("Enter a string:\n");
    yylex();
    if(flag==1)
        printf("The sum of digits is 9.\n");
    else
        printf("The sum of digits is not 9.\n");
}

int yywrap()
{
    return 1;
}

```

## Output



```

Enter a string:
2340
The sum of digits is 9.

```

**4.2.7 The set of all four digital numbers, whose individual digits are in ascending order from left to right.**

**Code**

```
% {  
#include<stdio.h>  
int c,i,flag=1;  
% }  
%%  
[0-9][0-9][0-9][0-9] {for(i=0;i<yyleng-1;i++)
```

```

        {
            if(yytext[i]>=yytext[i+1])
            {
                flag=0;
                break;
            }
        }
    }

\n {return 0;}

%%

void main()
{
    printf("Enter a string:\n");
    yylex();
    if(flag==1)
        printf("The digits are in ascending order.\n");
    else
        printf("The digits are not in ascending order.\n");
}

int yywrap()
{
    return 1;
}

```

## Output

```

Enter a string:
1235
The digits are in ascending order.

```

## Lab 5

**Write a C program to design lexical analysis to recognize any five keywords, identifiers, numbers, operators and punctuations.**

### Code

```
#include <stdio.h>
#include <string.h>
#include <ctype.h>
```

```
void lexicalAnalyzer(char input_code[]) {
```

```

char *keywords[] = {"if", "else", "while", "for", "return"};
char *operators[] = {"+", "-", "*", "/", "=", "==", "<", ">", "<=", ">="};
char *punctuations[] = {"", ";", "(", ")", "{", "}";

char *token = strtok(input_code, "\t\n");

while (token != NULL) {
    if (isdigit(token[0])) {
        printf("Number: %s\n", token);
    } else if (isalpha(token[0]) || token[0] == '_') {
        int isKeyword = 0;
        for (int i = 0; i < sizeof(keywords) / sizeof(keywords[0]); i++) {
            if (strcmp(token, keywords[i]) == 0) {
                printf("Keyword: %s\n", token);
                isKeyword = 1;
                break;
            }
        }
        if (!isKeyword) {
            printf("Identifier: %s\n", token);
        }
    } else if (strchr("+-*/=<>(){}[]", token[0]) != NULL) {
        printf("Operator: %s\n", token);
    }
    else if (strchr(";", token[0]) != NULL)
    {
        printf("Punctuation:%s\n",token);
    }

    token = strtok(NULL, "\t\n");
}

int main() {

```

```
char input_code[] = "if ( x > 0 ) { return x ; } else { return -x ; }";  
lexicalAnalyzer(input_code);  
  
return 0;  
}
```

## Output

```
Keyword: if  
Operator: (  
Identifier: x  
Operator: >  
Number: 0  
Operator: )  
Operator: {  
Keyword: return  
Identifier: x  
Punctuation;;  
Operator: }  
Keyword: else  
Operator: {  
Keyword: return  
Operator: -x  
Punctuation;;  
Operator: }
```

## Lab 6

Write a program to perform recursive descent parsing on the following grammar:

**S->cAd**

**A->ab | a**

### Code

```
#include <stdio.h>  
  
#include<stdlib.h>  
  
char input[100];
```

```

int ind = 0;
void match(char expected)
{
    if (input[ind] == expected)
    {
        ind++;
    }
}
void A();
void S()
{
    match('c');
    A();
    match('d');
}
void A()
{
    if (input[ind] == 'a')
    {
        printf("Hello\n");
        match('a');
        match('b');
    } /*else if (input[ind] == 'a')
    {
        printf("Hi!\n");
        match('a');
    } */
    else
    {
        printf("Parsing failed.\n", ind);
        exit(1);
    }
}
int main() {

```

```

printf("Enter the input string:\n");
scanf("%s", input);

S();

if (input[ind] == '$') {
    printf("Parsing successful.\n");
} else {
    printf("Parsing failed. Extra characters found.\n");
}

return 0;
}

```

## Output

```

Enter a string:
cad$
Valid string!

```

## Lab 7

**7.1 Write a program in YACC to design a suitable grammar for evaluation of arithmetic expression having +, -, \* and /.**

### Code

#### LEX

```

%{
#include<stdio.h>
#include<stdlib.h>

```



```

#include "y.tab.h"

extern int yylval;

% }

%%

[0-9]+ {yylval=atoi(yytext);return num;}

[\t ] ;

\n {return 0;}

. {return yytext[0];}

%%

int yywrap()

{

}

```

## YACC

```

% {

#include<stdio.h>

#include<stdlib.h>

int yyerror(const char *s);

int yylex(void);

% }

%token num;

%left '+' '-'

%left '*' '/'

%left ')'

%left '('

%%

s:e {printf("Valid expression!\n");

    printf("Result:%d\n",$$);

    exit(0);

}

;

e:e+'e' {$$=$1+$3;}

|e-'e' {$$=$1-$3;}

|e'*e' {$$=$1*$3;}

```

```

|e/'e' {$$=$1/$3;}
|('e') {$$=$2;}
|num {$$=$1;}
;
%%
void main()
{
printf("Enter an arithmetic expression:\n");
yyparse();
}
int yyerror(const char *s)
{
printf("Invalid expression!\n");
return 0;
}

```

## Output

**7.2 Write a program in YACC to recognize strings of the form  $\{(a^n)b, n \geq 5\}$ .**

## Code

```

Enter an arithmetic expression:
2+3*4
Valid expression!
Result:14

```

## LEX

```

%{
#include<stdio.h>
#include<stdlib.h>
#include "y.tab.h"
extern int yylval;
%}

```

```

%%
[aA] {yylval=yytext[0];return A;}
[bB] {yylval=yytext[0];return B;}
\n {return NL;}
. {return yytext[0];}
%%

int yywrap()
{
return 1;
}

YACC

%{
#include<stdio.h>
#include<stdlib.h>
int yyerror(char *s);
int yylex(void);
%}

%token A
%token B
%token NL

%%

smtr:A A A A A S B NL {printf("Parsed using the rule (a^n)b, n>=5.\nValid String!\n");}

;

S:S A

|

;

%%

void main()
{
printf("Enter a string!\n");
yyparse();
}

int yyerror(char *s)
{

```

```
printf("Invalid String!\n");  
return 0;  
}
```

## Output

```
Enter a string!  
aaaaaaaab  
Parsed using the rule (a^n)b, n>=5.  
Valid String!  
ab  
Invalid String!
```

## 7.3 Write a program in YACC to generate syntax tree for a given arithmetic expression.

### Code

#### LEX

```
% {  
  
#include<stdio.h>  
  
#include<stdlib.h>  
  
#include "y.tab.h"  
  
extern int yyval;  
  
% }
```

```

%%
[0-9]+ {yylval=atoi(yytext);return digit;}
[t] ;
[\n] return 0;
. return yytext[0];
%%

int yywrap()
{
return 1;
}

```

## YACC

```

%{
#include <math.h>
#include<ctype.h>
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
int yyerror(char *s);
int yylex(void);
struct tree_node
{
char val[10];
int lc;
int rc;
};
int ind;
struct tree_node syn_tree[100];
void my_print_tree(int cur_ind);
int mknode(int lc,int rc,char *val);
%}

%token digit

%%

S:E {my_print_tree($1);}

;

```

```

E:E+'T' { $$=mknode($1,$3,"+");}

|T { $$=$1;}

;

T:T'*'F { $$= mknode($1,$3,"*");}

|F { $$=$1;}

;

F:'(E)' { $$=$2;}

|digit { char buf[10];sprintf(buf,"%d", yyval);$$ = mknode(-1,-1,buf);}

;

%%

int main()

{

ind=0;

printf("Enter an expression:\n");

yyparse();

return 0;

}

int yyerror(char *s)

{

printf("NITW Error\n");

return 0;

}

int mknode(int lc,int rc,char val[10])

{

strcpy(syn_tree[ind].val,val);

syn_tree[ind].lc = lc;

syn_tree[ind].rc = rc;

ind++;

return ind-1;

}

/*my_print_tree function to print the syntax tree in DLR fashion*/

void my_print_tree(int cur_ind)

{

if(cur_ind== -1) return;

```

```

if(syn_tree[cur_ind].lc==-1&&syn_tree[cur_ind].rc==-1)

printf("Digit Node -> Index : %d, Value : %s\n",cur_ind,syn_tree[cur_ind].val);

else

printf("Operator Node -> Index : %d, Value : %s, Left Child Index : %d,Right Child Index : %d\n",cur_ind,syn_tree[cur_ind].val, syn_tree[cur_ind].lc,syn_tree[cur_ind].rc);

my_print_tree(syn_tree[cur_ind].lc);

my_print_tree(syn_tree[cur_ind].rc);

}

```

## Output

```

Enter an expression:
2*3+5*4
Operator Node -> Index : 6, Value : +, Left Child Index : 2,Right Child Index : 5
Operator Node -> Index : 2, Value : *, Left Child Index : 0,Right Child Index : 1
Digit Node -> Index : 0, Value : 2
Digit Node -> Index : 1, Value : 3
Operator Node -> Index : 5, Value : *, Left Child Index : 3,Right Child Index : 4
Digit Node -> Index : 3, Value : 5
Digit Node -> Index : 4, Value : 4

```

## Lab 8

### 8.1 Write a program in YACC to convert infix to postfix expression.

#### Code

##### LEX

```

%{

#include<stdio.h>

#include<stdlib.h>

#include "y.tab.h"

```

```

extern int yyval;

% }

%%

[0-9]+ {yyval=atoi(yytext);return num;}

[t ] ;

\n {return 0;}

. {return yytext[0];}

%%

int yywrap()
{
}

```

## YACC

```

% {
#include<stdio.h>
#include<stdlib.h>

int yyerror(const char *s);

int yylex(void);

% }

%token num

%left '+' '-'

%left '*' '/'

%left ')'

%left '('

%right '^'

%%

s:e {printf("\n");}

;

e:e+'t' {printf("+");}

|e-'t' {printf("-");}

|t

;

t:t'*'h {printf("*");}

|t/'h {printf("/");}

|h

```



```


;
h:f^h {printf("^");}
|f
;
f:('e')
|num {printf("%d", $1);}
;
%%

void main()
{
printf("Enter an infix expression:\n");
yyparse();
}

int yyerror(const char *s)
{
printf("Invalid infix expression!\n");
return 0;
}

```

## Output



```

Enter an infix expression:
2+3*8/4^3-3
238*43^/+3-

```

## Lab 9

### 9.1 Write a program in YACC to generate three address code for a given expression.

#### Code

#### LEX

```

%{
#include<stdio.h>
#include<stdlib.h>
#include"y.tab.h"

```

```

extern int yylval;
extern char iden[20];

% }

d [0-9]+
a [a-zA-Z]+

%%

{d} { yylval=atoi(yytext); return digit; }
{a} { strcpy(iden,yytext); yylval=1; return id;}

[ \t] {;}

\n return 0;

. return yytext[0];

%%

```

```

int yywrap()
{
return 1;
}

```

## YACC

```

% {

#include <math.h>
#include<ctype.h>
#include<stdio.h>

int yyerror(char *s);
int yylex(void);
int var_cnt=0;
char iden[20];

% }

%token id
%token digit

%%

S:id '=' E {printf("%s=t%d\n",iden,var_cnt-1);}

E:E '+' T { $$=var_cnt; var_cnt++; printf("t%d = t%d + t%d;\n", $$, $1, $3 );}

|E '-' T { $$=var_cnt; var_cnt++; printf("t%d = t%d - t%d;\n", $$, $1, $3 );}

|T { $$=$1;}

;

```

```

T:T '*' F {$$=var_cnt; var_cnt++; printf("t%d = t%d * t%d;\n", $$, $1, $3 );}

|T '/' F {$$=var_cnt; var_cnt++; printf("t%d = t%d / t%d;\n", $$, $1, $3 );}

|F {$$=$1;}

;

F:P '^' F {$$=var_cnt; var_cnt++; printf("t%d = t%d ^ t%d;\n", $$, $1, $3 );}

|P {$$ = $1;}

;

P: '(' E ')' {$$=$2;}

|digit {$$=var_cnt; var_cnt++; printf("t%d = %d;\n",$$,$1);}

;

%%

int main()
{
var_cnt=0;

printf("Enter an expression:\n");

yyparse();

return 0;

}

int yyerror(char *s)
{
printf("Invalid expression!");

return 0;

}

```

## Output

```

Enter an expression:
a=2*3/6-4
t0 = 2;
t1 = 3;
t2 = t0 * t1;
t3 = 6;
t4 = t2 / t3;
t5 = 4;
t6 = t4 - t5;
a=t6

```

