VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT

on

COMPILER DESIGN

Submitted by

Yash Gupta (1BM21CS251)

Under the Guidance of

Dr. Latha N.R.
Assistant Professor, BMSCE

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)

BENGALURU-560019

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B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**Compiler Design**" carried out by **Yash Gupta (1BM21CS251)**, 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.

Dr. Latha N.R.
Assistant professor
Department of CSE
BMSCE, Bengaluru

Dr. Jyothi Nayak
Professor and Head
Department of CSE
BMSCE, Bengaluru

B. M. S. COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DECLARATION

I, Yash Gupta (1BM21CS251), 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 Dr. Latha N.R., 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

```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.l

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Give an input:
int sum=1,x=2,y=3;
int-keyword
 sum-Identifier
=-assignment operator
1-digit
,-separator
x-Identifier
=-assignment operator
2-digit
,-separator
y-Identifier
=-assignment operator
3-digit
;-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

```
C:\Adnan BMS\College\Code\Lex Codes>a
Enter a sentence:
Hello World 1234
No of characters and digits are 10 and 4
```

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

```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.1

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a sentence:
Compiler Design
 No of vowels and consonants are 5 and 9
```

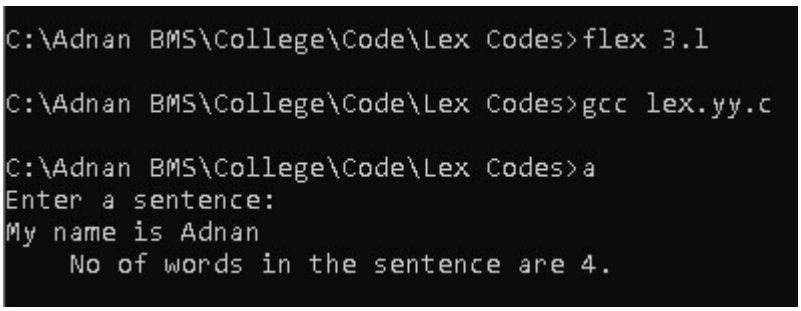
Lab 2

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



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

```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.l

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
HelloWorld
Characters

11234
Digits
```

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

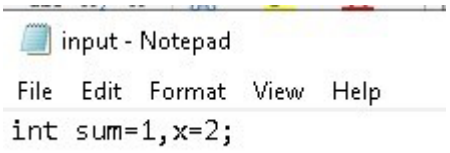
```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.1

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
hello is an identifier.
  world is an identifier.
```

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



```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.l

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>aa
'aa' is not recognized as an internal or external command,
operable program or batch file.

C:\Adnan BMS\College\Code\Lex Codes>a
Printed in output.txt
```

output - Notepad

File Edit Format View Help

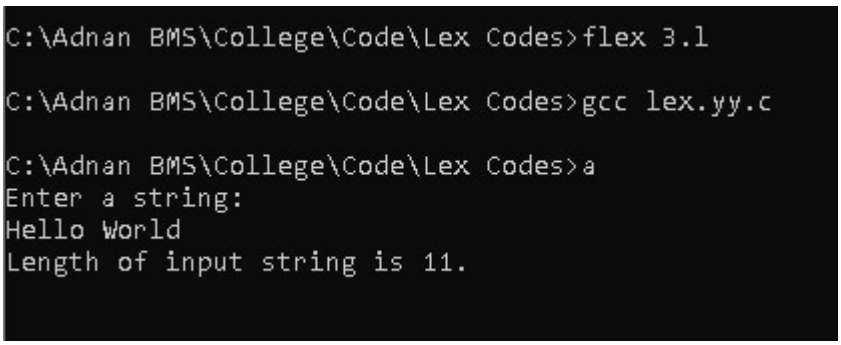
```
int is a keyword.
 sum is an identifier.
= is an assignment operator.
1 is/are digit(s).
, is a separator.
x is an identifier.
= is an assignment operator.
2 is/are digit(s).
; is a delimiter.
```

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



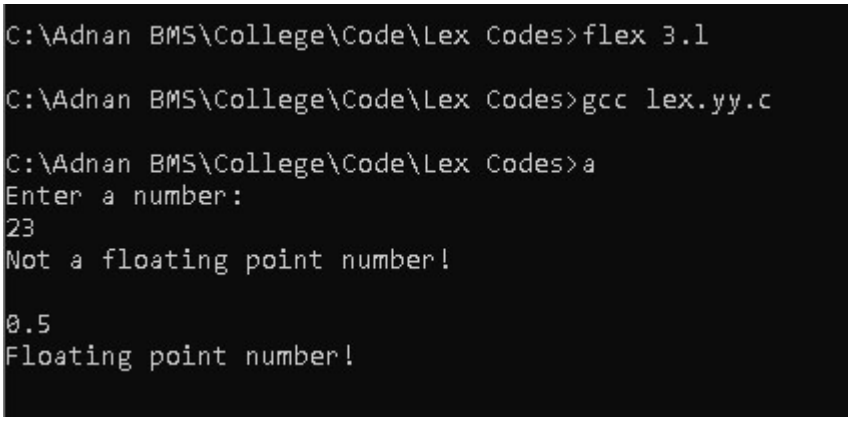
Lab 3

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

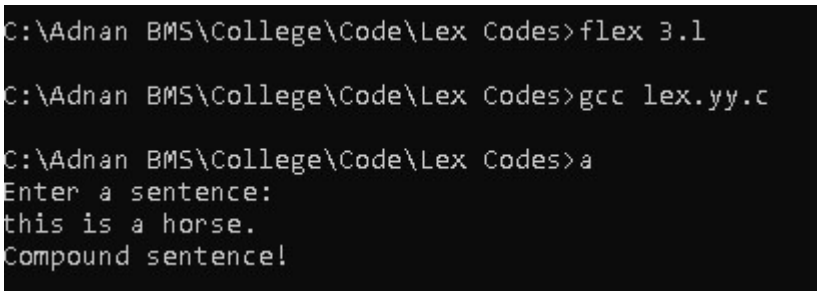


3.2 Read and input sentence, and check if it is compound or simple. If a sentence has the word- and , or ,but ,because ,if ,then ,nevertheless then it is compound else it is simple.

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



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

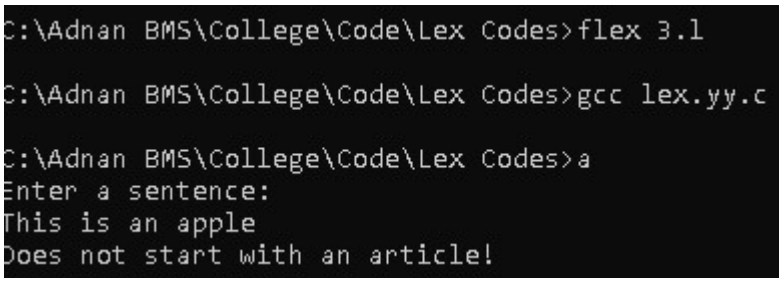
```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.1

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a sentence:
Hello!
Ends with a punctuation!
```

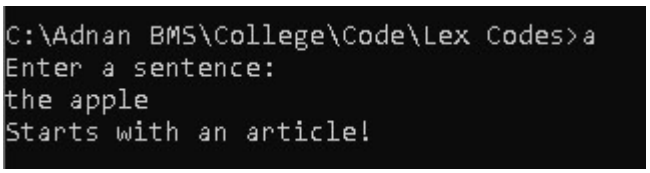
3.4 Write a program to read an input sentence and to check if the sentence begins with English articles (A, a,AN,An,THE and The).

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



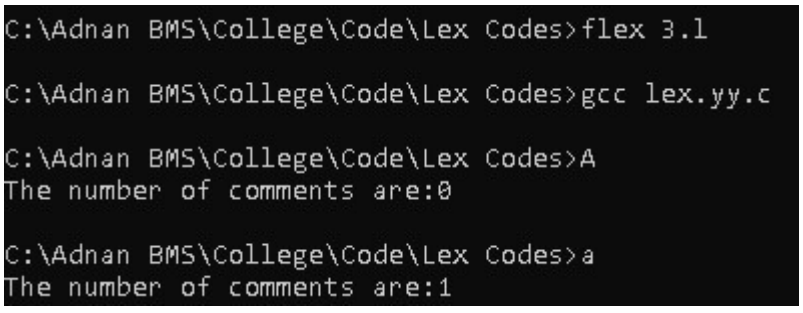


3.5 Lex program to count the number of comment lines (multi line comments or single line) in a program. Read the input from a file called input.txt and print the count in a file called output.txt.

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

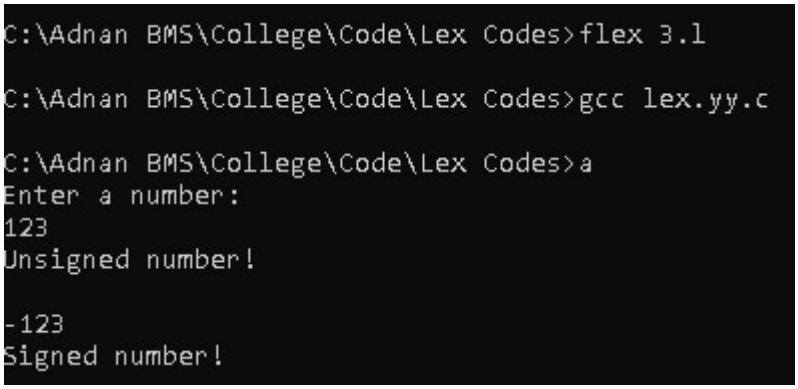


3.6 Write a program to read and check if the user entered number is signed or unsigned using appropriate meta character.

Code

```
%{
#include<stdio.h>
%}
%%
[+|-][0-9]+ {printf("Signed number!\n");}
[0-9]+ {printf("Unsigned number!\n");}
%%
int yywrap()  {
return 1; }
void main()
{
printf("Enter a number:\n");
yylex(); }
```

Output



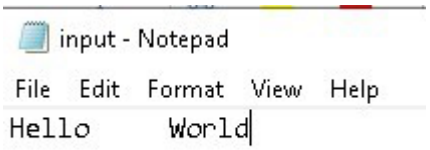
Lab 4

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

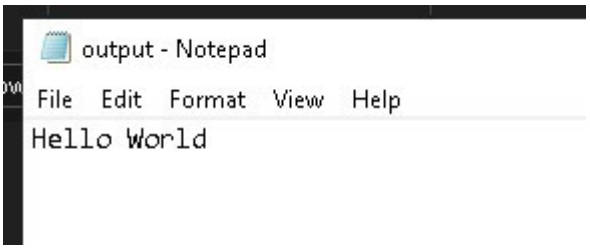
Code

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

Output




```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.l

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
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

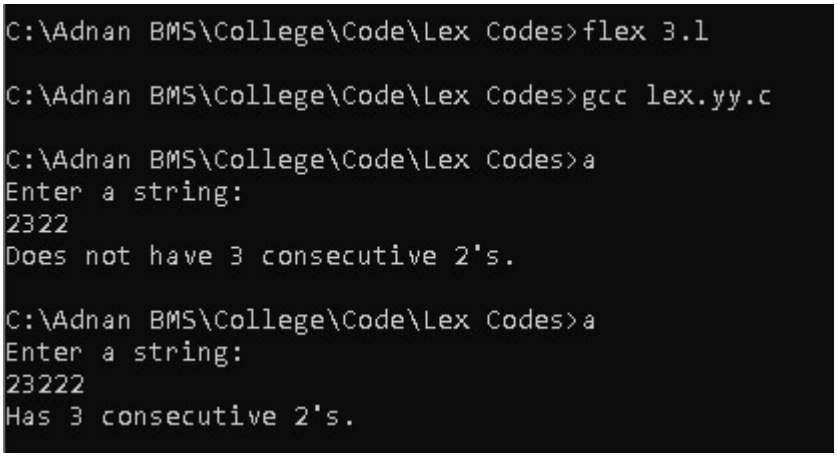
```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.l

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
123
Does not end with 0.

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
1230
Ends 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



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

```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.l

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
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=yyleng-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

```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.l

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
1010
Decimal representation:10
Congruent to modulo 5.

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
101
Decimal representation:5
Congruent to modulo 5.

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
111
Decimal representation:7
Not congruent to modulo 5.

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
123
Not a binary number.
```

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][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

```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.1

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
1123455533434
10th symbol from right is 1.

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
324234234234234
10th symbol from right is not 1.

C:\Adnan BMS\College\Code\Lex Codes>_
```

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

```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.l

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
6300
The sum of digits is 9.

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
3331
The sum of digits is not 9.

C:\Adnan BMS\College\Code\Lex Codes>a
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

```
C:\Adnan BMS\College\Code\Lex Codes>flex 3.1

C:\Adnan BMS\College\Code\Lex Codes>gcc lex.yy.c

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
1234
The digits are in ascending order.

C:\Adnan BMS\College\Code\Lex Codes>a
Enter a string:
4313
The digits are not in ascending order.
```

LAB 5

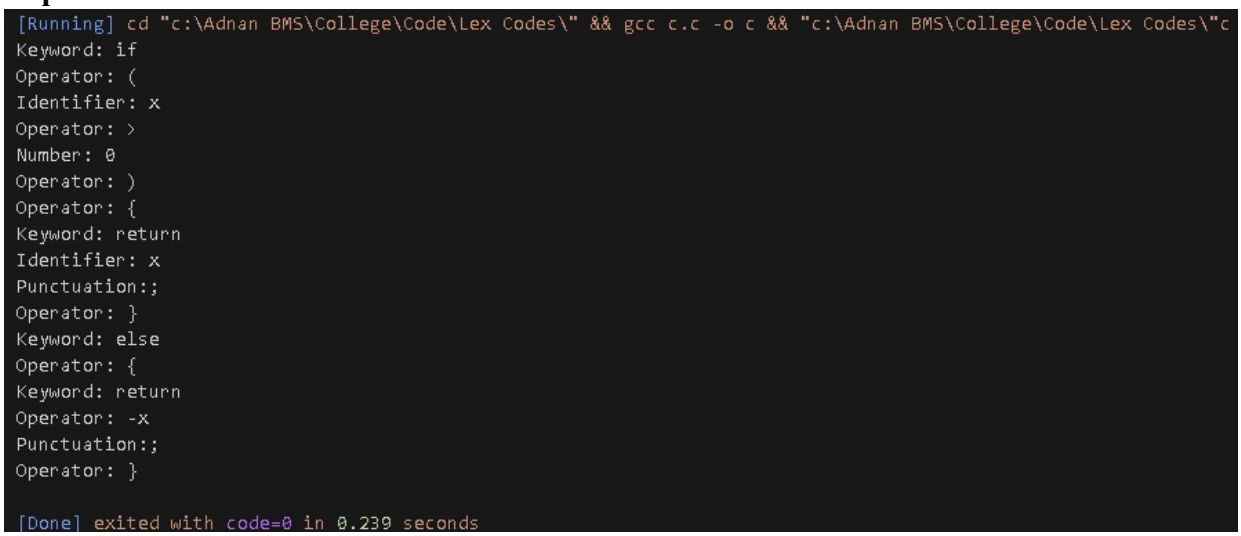
Write a C program to design lexical analysis to recognize any five keywords, identifiers, numbers, operators and punctuations.

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



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

```
1. S -> cAd
2. A -> ab/a
This is a parser for the above grammar:
Enter any string: caaad
String is not accepted by the grammar
```

```
1. S -> cAd
2. A -> ab/a
This is a parser for the above grammar:
Enter any string: cad
String is accepted by the grammar
```

LAB 7

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

Code

LEX

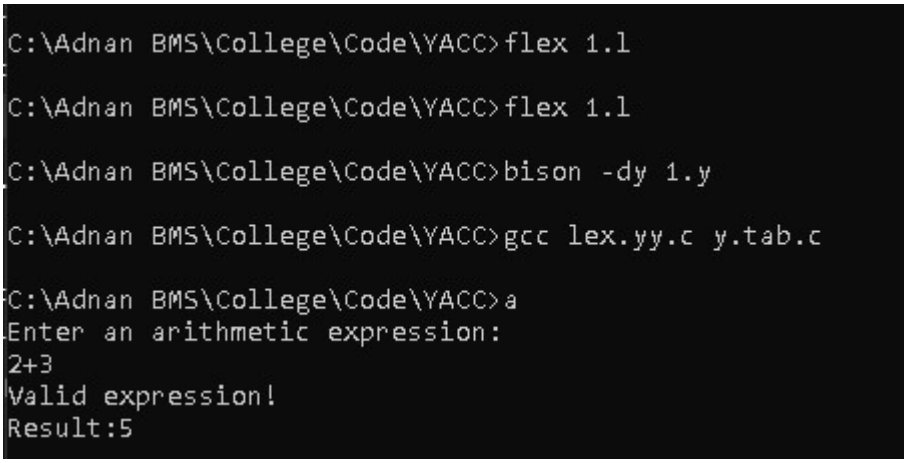
```
%{
#include<stdio.h>
#include<stdlib.h>
#include   "y.tab.h"
extern int yylval;
%}
%%
[0-9]+ {yylval=atoi(yytext);return num;}
[\t ] ;
\n {return 0;}
. {return yytext[0];}
%%
int yywrap()
{
}
```

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>=5}.

Code

LEX

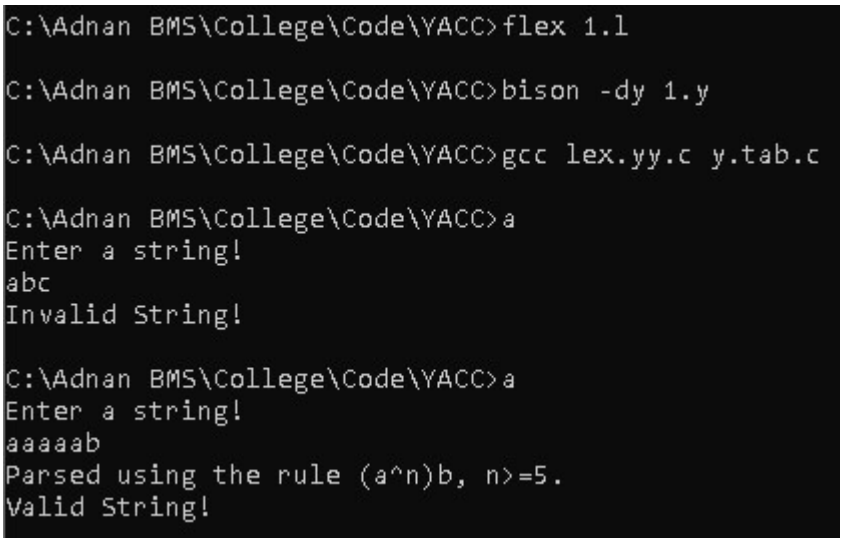
```
%{
#include<stdio.h>
#include<stdlib.h>
#include   "y.tab.h"
extern int yylval;
%}
%%
[aA] {yylval=yytext[0];return A;}  [bB]
{yylval=yytext[0];return B;}
\n {return NL;}
. {return yytext[0];}
%%
int yywrap()
{ return
1; }
```

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



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 yylval;
%}
%%
[0-9]+ {yylval=atoi(yytext);return digit;}
[\t] ;
[\n] return 0;
. return yytext[0];
%%
int yywrap()
{ return
1; }
```

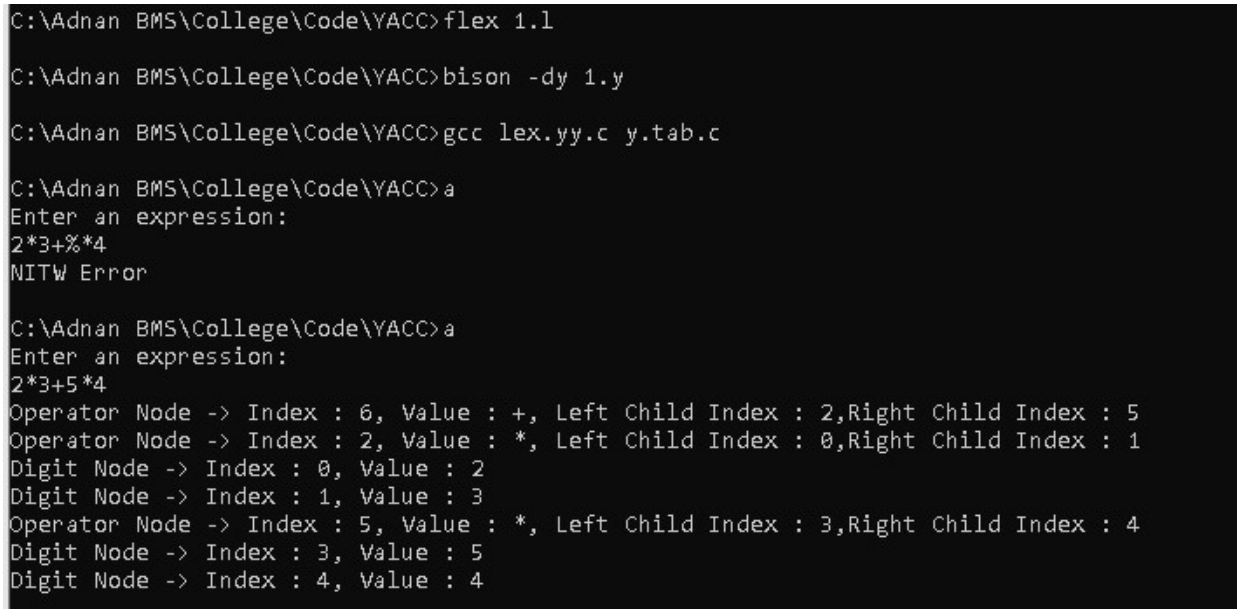
YACC

```
%{
#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')' {$$=$2;}
|digit {char buf[10];sprintf(buf,"%d", yylval);$$ = 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



Lab 8

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

Code

LEX

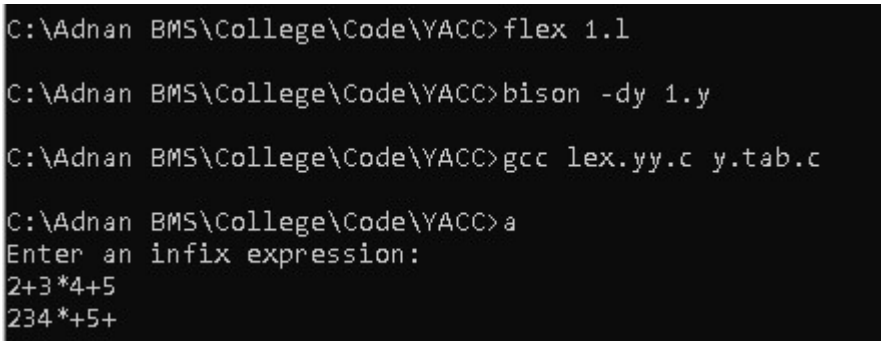
```
%{
#include<stdio.h>
#include<stdlib.h>
#include   "y.tab.h"
extern int yylval;
%}
%%
[0-9]+ {yylval=atoi(yytext);return num;}
[\t ] ;
\n {return 0;}
. {return yytext[0];}
%%
int yywrap()
{
}
```

YACC

```
%{
#include<stdio.h>
#include<stdlib.h> int
yyerror(const char *s); int
yylex(void);  %}
%token num
%left '+' '-'
%left '*' '/'
%left ')' %left
'('
%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



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

```
C:\Adnan BMS\College\Code\YACC>flex 1.l

C:\Adnan BMS\College\Code\YACC>bison -dy 1.y

C:\Adnan BMS\College\Code\YACC>gcc lex.yy.c y.tab.c
1.l: In function 'yylex':
1.l:12:3: warning: implicit declaration of function 'strcpy' [-Wimplicit-function-declaration]
   12 | {a} { strcpy(iden,yytext); yylval=1; return id;}
      |   ^~~~~~
1.l:12:3: warning: incompatible implicit declaration of built-in function 'strcpy'
1.l:12:1: note: include '<string.h>' or provide a declaration of 'strcpy'
   11 | {d} { yylval=atoi(yytext); return digit; }
  +++ |+#include <string.h>
   12 | {a} { strcpy(iden,yytext); yylval=1; return id;}

C:\Adnan BMS\College\Code\YACC>a
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
```