SYSTEM PROGRAMMING

PRACTICAL FILE

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Course : B.SC.(H) COMPUTER SCIENCE

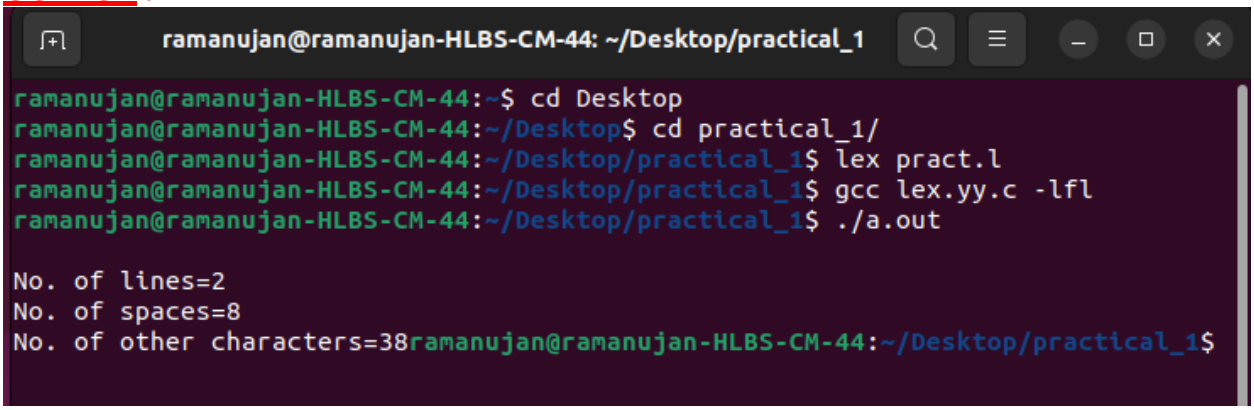
Semester : 5

1. Write a Lex program to count the number of lines andcharacters in the input file.

CODE

```
%{
	#include<stdio.h>
	int lc=0, sc=0, tc=0, ch=0; /*Global variables*/
	%}

	/*Rule Section*/
	%%
	\n lc++; //line counter
	([ ])+ sc++; //space counter
	\t tc++; //tab counter
	. ch++;  //characters counter
	%%

	int main()
	{
		// The function that starts the analysis
		yyin=fopen("abc.txt","r");
		yylex();

		printf("\nNo. of lines=%d", lc);
		printf("\nNo. of spaces=%d", sc);

		printf("\nNo. of other characters=%d", ch);

	}
```

OUTPUT :

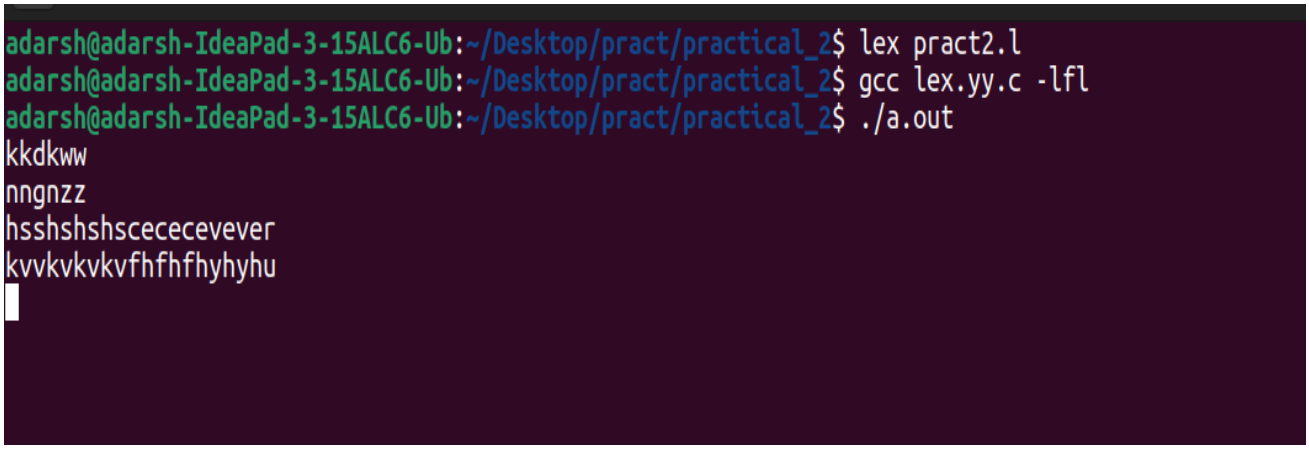


2. Write a Lex program that implements the Caesar cipher. It replaces every letter with the one three letters after in an alphabetical order, wrapping around at Z e.g a is replaced by d ,d bye,and so on z by c.

CODE

```
%{


        %}
        %%
        [A-Wa-w] {printf("%c",yytext[0]+3);}
        [X-Zx-z] {printf("%c",yytext[0]-23);}
        %%
        int main()
        {
        //yyin=fopen("bbc.txt","r");
        //yyout=fopen("kbc.txt","w");
        yylex();


        }
```

OUTPUT



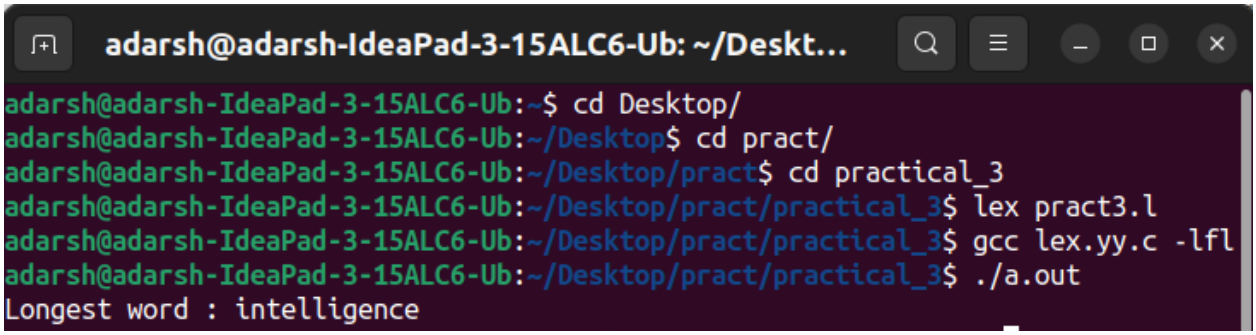
3. Write a Lex program that finds the longest word (defined as acontiguous string of upper and lower case letters in the input.

CODE

```
%{

        #include<stdio.h>

        #include<strings.h>

        // initialising length

        int length=0;

        // char array for storing longest word

        char longestword[50];
```

```
%}

%%
[A-Za-z0-9]+ { if (yyleng > length) {

                length=yyleng;
      // strcpy function to copy current word in yytxt in longest
                strcpy(longestword,yytext);
                }
          }
"." return 1;
%%
int main()
{
yyin=fopen("tbc.txt","r");

yylex();
printf("Longest word : %s\n",longestword);
//printf("Length of Longest word : %s\n",length);

return 0;
}
int yywrap(){
   return 1
```

OUTPUT :



4. Write a Lex program that distinguishes keywords, integers,floats, identifiers, operators and comments in any simple programming language.

CODE

```
%{
        %}
        %%
        [0-9]* {printf("Integer\n");}
        [0-9]+\.[0-9]+ {printf("Float\n"); }
        int|float|if|else|printf|main|exit|switch {printf("Keyword\n");}
        [+|*|/|%|&] {printf("Operators\n");}
        "-" {printf("Operators\n");}
        "/*".*"*/" {printf("comment\n");}
        [_a-zA-Z][_a-zA-Z0-9]{0,30} {printf("Identifier\n");}
        . {printf("Invalid\n");}
        %%
        int main()
        {
        yyin=fopen("code.c","r");
        yyout=fopen("kmd.txt","w");
        yylex();
        }
```

OUTPUT :

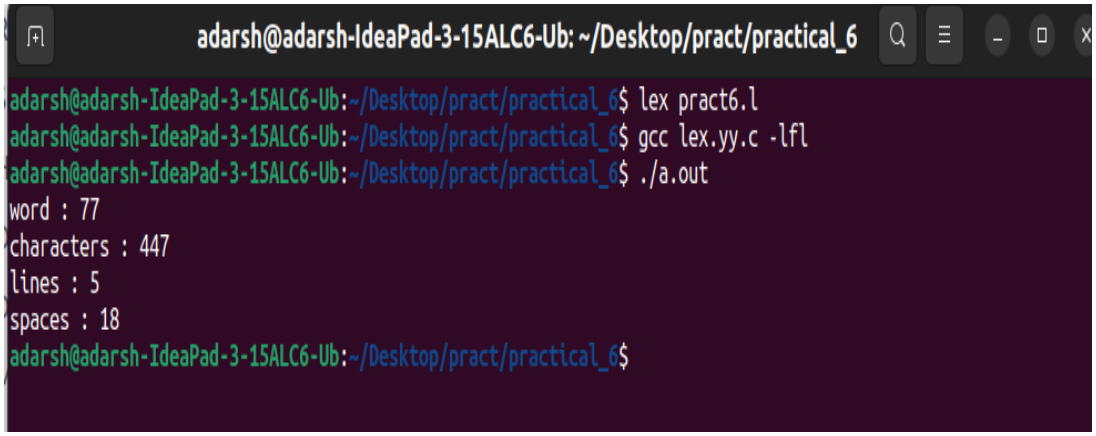
```
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~$ cd Desktop/
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop$ cd pract/
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract$ cd practical_4
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_4$ lex prac4.l
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_4$ gcc lex.yy.c -lfl
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_4$ ./a.out
Invalid
Identifier
Invalid
Invalid
Identifier
Invalid
Identifier
Invalid
Invalid
Invalid
Keyword
Invalid
Keyword
Invalid
Invalid
Invalid
Invalid
Invalid
Invalid
Invalid
Invalid
Invalid
Invalid
Invalid
Keyword
Invalid
Identifier
Invalid
Invalid
Identifier
Invalid
Invalid
Operators
Operators
Invalid
Identifier
Invalid
Identifier
Invalid
Identifier
```

5. Write a Lex program to count the number of identifiers in a C file.

CODE

```
%{
        #include<stdio.h>
        int word=0,character=0,space=0,lines=0;
        %}
        %%
        [A-Za-z|0-9]+ {word++;character=character+strlen(yytext);}
        . {character++;}
        \n {lines++;character++;}
        [ \n\t\r]+ {space++;}
        %%
        int main(int agrc,char **argv)
        {
        yyin=fopen("pla.txt","r");
        yylex();
        printf("word : %d\n",word);
        printf("characters : %d\n",character);
        printf("lines : %d\n",lines);
        printf("spaces : %d\n",space);
```

OUTPUT :

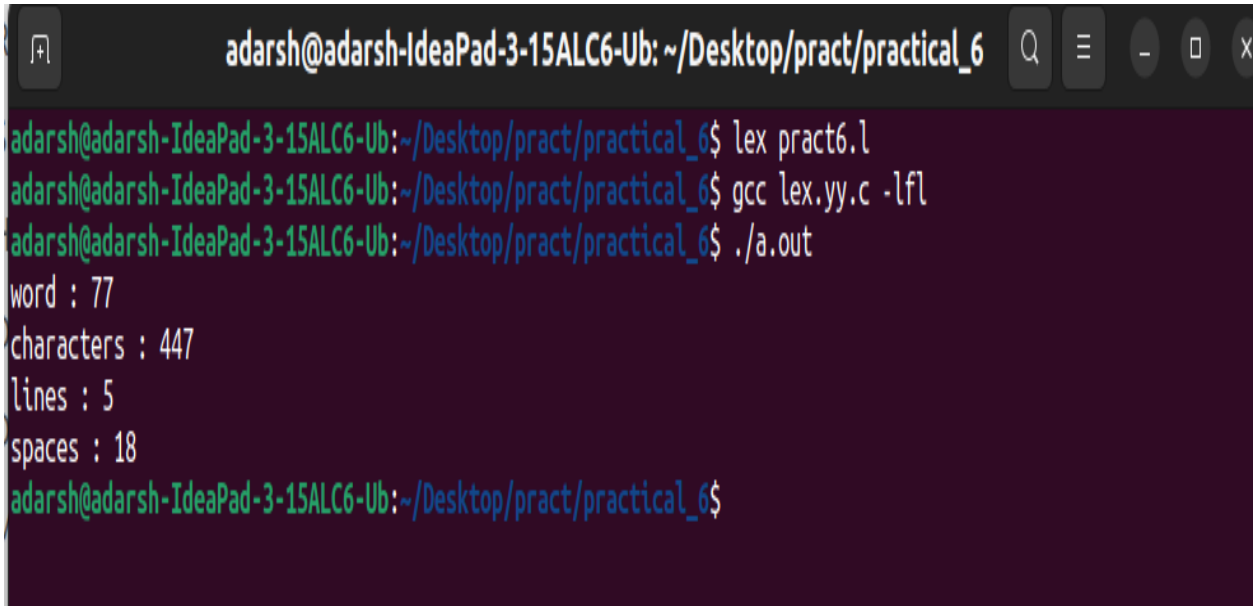


6. Write a Lex program to count the number of words,characters, blank spaces and lines in a C file.

CODE

```
%{
        #include<stdio.h>
        int word=0,character=0,space=0,lines=0;
        %}
        %%
        [A-Za-z|0-9]+ {word++;character=character+strlen(yytext);}
        . {character++;}
        \n {lines++;character++;}
        [ \n\t\r]+ {space++;}
        %%
        int main(int agrc,char **argv)
        {
        yyin=fopen("pla.txt","r");
        yylex();
        printf("word : %d\n",word);
        printf("characters : %d\n",character);
        printf("lines : %d\n",lines);
        printf("spaces : %d\n",space);
        }
```

OUTPUT :



7. Write a Lex specification program that generates a C programwhich takes a string “abcd” and prints the following output.

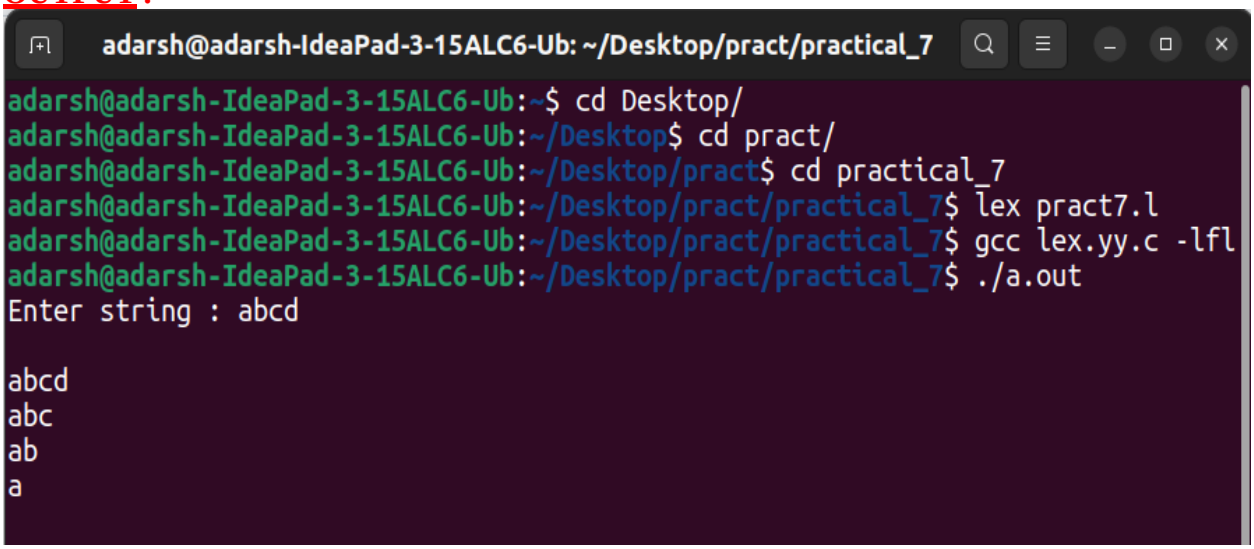
abcd
abc
ab
a

CODE

```
%{
        %}
        %%
        [A-Za-z]+ {int len=yyleng;
                int i=len;
                printf("\n");
                while(i>=0)
                {
                 int j=0;
                 while(j<i)
                 {
                      printf("%c",yytext[j]);
```

```
                j++;
            }
            printf("\n");
            i--;
          }
        }
%%
int main()
{
printf("Enter string : ");
yylex();
}
```

OUTPUT :



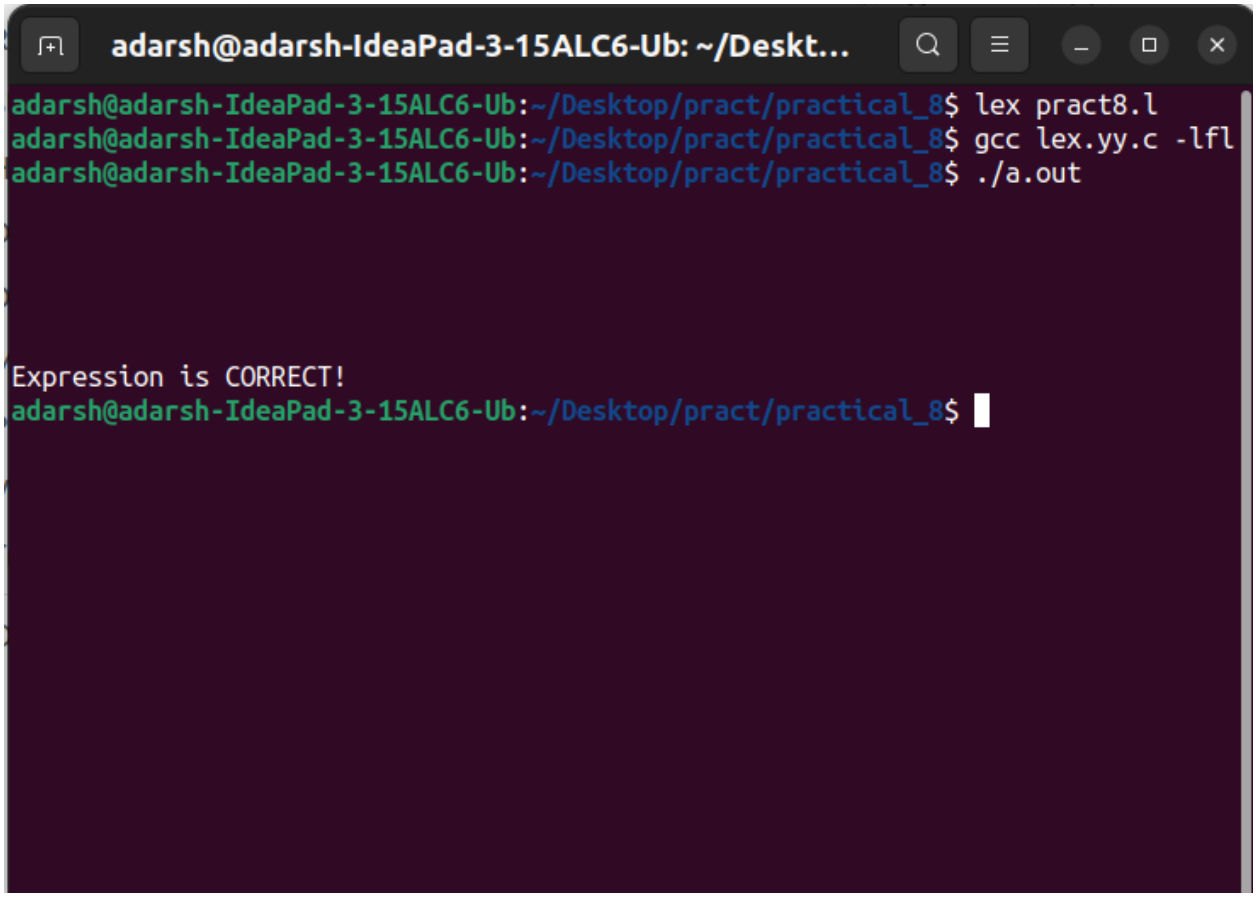
8. A program in Lex to recognize a valid arithmetic expression.

CODE

```
%{
    #include<strings.h>
    int opcount=0,intcount=0,check=1,top=0;
    %}
    %%
```

```
['('] {check=0;}
[')'] {check=1;}
[+|*|/|-] {opcount++;}
[0-9]+ {intcount++;}
. {printf("Invalid Input only digits and +|-|*|/ is valid\n");}
%%
int main()
{



yyin=fopen("abd.txt","r");
yylex();
if(intcount=opcount+1)
{
 if(check==1)
 {
    printf("Expression is CORRECT!\n");
 }
 else{
    printf("')' bracket missing from expression\n");
 }
}
else{
   printf("Expression is INCORRECT!\n");
}
}
```

OUTPUT :



9. Write a YACC program to find the validity of a given expression (for operators +-* and/).

CODE (L file)

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

        %%
        [a-zA-Z]+ return VARIABLE;
        [0-9]+ return NUMBER;
        [\t] ;
        [\n] return 0;
        . return yytext[0];
```

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

CODE (Y file)

```
%{
   #include<stdio.h>
%}
%token NUMBER
%token VARIABLE

%left '+' '-'
%left '*' '/' '%'
%left '(' ')'

%%

S: VARIABLE'='E {
     printf("\nEntered arithmetic expression is Valid\n\n");
     return 0;
    }
E:E'+'E
 |E'-'E
 |E'*'E
 |E'/'E
 |E'%'E
 |'('E')'
```

```
        | NUMBER
        | VARIABLE
        ;

%%

void main()
{
   printf("\nEnter Any Arithmetic Expression which can have operations Addition, Subtraction, Multiplication, Divison, Modulus and Round brackets:\n");
   yyparse();
}

void yyerror()
{
   printf("\nEntered arithmetic expression is Invalid\n\n");

}
```

OUTPUT :

10. A Program in YACC which recognizes a valid variable whichstarts with a letter followed by a digit. The letter should be in lowercase only.

CODE (L file)

```
%{
        #include "y.tab.h"
        %}
        %%
        [0-9]+ {return DIGIT;}
        [a-z]+ {return LETTER;}
        [ \t] {;}
        \n { return 0;}
        . {return yytext[0];}
        %%
```

CODE (Y file)

```
%{
        #include<stdio.h>
        #include<stdlib.h>
        %}
        %token DIGIT LETTER
        %%
        stmt:A
            ;
        A: LETTER B
         ;
        B: LETTER B
         | DIGIT B
         | LETTER
         | DIGIT
         ;
        %%
        void main(){
        printf("enter string \n");
        yyparse();
        printf("valid \n");
        exit(0);
        }
        void yyerror()
        {
        printf("invalid \n");
```

```
exit(0);
}
```

OUTPUT :

```
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_10$ yacc -d pract10.y
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_10$ lex pract10.l
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_10$ cc lex.yy.c y.tab.c -ll
y.tab.c: In function ‘yyparse’:
y.tab.c:1014:16: warning: implicit declaration of function ‘yylex’ [-Wimplicit-function-declaration]
 1014 |       yychar = yylex ();
      |                ^~~~~
y.tab.c:1149:7: warning: implicit declaration of function ‘yyerror’; did you mean ‘yyerrok’? [-Wimplicit-function-declaration]
 1149 |       yyerror (YY_("syntax error"));
      |       ^~~~~~~
      |       yyerrok
pract10.y: At top level:
pract10.y:23:6: warning: conflicting types for ‘yyerror’; have ‘void()’
   23 | void yyerror()
      |      ^~~~~~~
y.tab.c:1149:7: note: previous implicit declaration of ‘yyerror’ with type ‘void()’
 1149 |       yyerror (YY_("syntax error"));
      |       ^~~~~~~
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_10$ ./a.out
enter string
a1
valid
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_10$ ./a.out
enter string
54a
invalid
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_10$ ./a.out
enter string
q9
valid
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_10$
```

11. A Program in YACC to evaluate an expression (simple calculator program for addition and subtraction, multiplication,division).

CODE (L file)

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

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

CODE (Y file)

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

%}
%token NUMBER


%left '+' '-'
%left '*' '/' '%'
%left '(' ')'
%%
ArithmeticExpression: E{
        printf("\nResult=%d\n",$$);
        return 0;
       }
E:E'+'E {$$=$1+$3;}
 |E'-'E {$$=$1-$3;}
 |E'*'E {$$=$1*$3;}
 |E'/'E {$$=$1/$3;}
 |E'%'E {$$=$1%$3;}
 |'('E')' {$$=$2;}
 | NUMBER {$$=$1;}
;
%%


void main()
{
  printf("\nEnter Any Arithmetic Expression :\n");
  yyparse();
 if(flag==0)
  printf("\nEntered arithmetic expression is Valid\n\n");
```

```
}
void yyerror()
{
  printf("\nEntered arithmetic expression is Invalid\n\n");
  flag=1;
}
```

OUTPUT :

```
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ yacc -d pract11.y
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ lex pract11.l
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ cc lex.yy.c y.tab.c
y.tab.c: In function ‘yyparse’:
y.tab.c:1026:16: warning: implicit declaration of function ‘yylex’ [-Wimplicit-function-declaration]
 1026 |       yychar = yylex ();
      |                ^~~~~
y.tab.c:1212:7: warning: implicit declaration of function ‘yyerror’; did you mean ‘yyerrok’? [-Wimplicit-function-declaration]
 1212 |       yyerror (YY_("syntax error"));
      |       ^~~~~~~
      |       yyerrok
pract11.y: At top level:
pract11.y:34:6: warning: conflicting types for ‘yyerror’; have ‘void()’
   34 | void yyerror()
      |      ^~~~~~~
y.tab.c:1212:7: note: previous implicit declaration of ‘yyerror’ with type ‘void()’
 1212 |       yyerror (YY_("syntax error"));
      |       ^~~~~~~
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ ./a.out

Enter Any Arithmetic Expression :
4+6-9

Result=1

Entered arithmetic expression is Valid

adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ ./a.out

Enter Any Arithmetic Expression :
a+b

Entered arithmetic expression is Invalid

adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ ./a.out

Enter Any Arithmetic Expression :
(45+6)-(21*2)

Result=9

Entered arithmetic expression is Valid
```

12. A Program in YACC to recognise the strings “ab” , “abab” , “ababab”_____ of the language ($a^n b^n$, n>=1).

CODE (L file)

```
%{
        #include "y.tab.h"
        %}
        alpha [Aa]
        beta [Bb]
        newline [\n]
        %%
        {alpha} { return alpha ;}
        {beta} {return beta;}
        {newline} { return newline ;}
        . { printf("Invalid Expression\n");exit(0); }
        %%CODE (Y file)
```

CODE (Y file)

```
%{
        #include<stdio.h>
        #include<stdlib.h>
        #include<strings.h>
        %}
        %token alpha beta newline
        %%
        line : term newline {printf("Input is Valid\n"); exit(0);};
        term: alpha term beta | ;
        %%

        int yyerror(char *msg)
        {
        printf("Invalid Input\n");
        exit(0);
        }

        int main ()
        {
        printf("Enter the expresssion: ");
        yyparse();
        }
```

OUTPUT :

```
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ yacc -d pract11.y
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ lex pract11.l
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ cc lex.yy.c y.tab.c -ll
y.tab.c: In function ‘yyparse’:
y.tab.c:1018:16: warning: implicit declaration of function ‘yylex’ [-Wimplicit-function-declaration]
 1018 |       yychar = yylex ();
      |                ^~~~~
y.tab.c:1159:7: warning: implicit declaration of function ‘yyerror’; did you mean ‘yyerrok’? [-Wimplicit-function-declaration]
 1159 |       yyerror (YY_("syntax error"));
      |       ^~~~~~~
      |       yyerrok
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ ./a.out
Enter the expresssion: ab
Input is Valid
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ aabb
aabb: command not found
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ ./a.out
Enter the expresssion: aabb
Input is Valid
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ ./a.out
Enter the expresssion: aaabbb
Input is Valid
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ ./a.out
Enter the expresssion: a
Invalid Input
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$ ./a.out
Enter the expresssion: iii
Invalid Expression
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_11$
```

13. A Program in YACC to recognize the language ($a^n b$, n>=10). (Output to say input is valid or not).

CODE (L file)

```
%{
        #include "y.tab.h"
        %}
        alpha [a]{10,}
        beta [b]
        newline [\n]
        %%
        {alpha} { return alpha ;}
        {beta} {return beta;}
        {newline} { return newline ;}
        . { printf("Invalid Expression\n");exit(0); }
        %%
```

CODE (Y file)

```
%{

        #include<stdio.h>

        #include<stdlib.h>

        #include<strings.h>

        %}

        %token alpha beta newline

        %%

        line : term beta newline {printf("Input is Valid\n"); exit(0);};

        term: alpha term |;

        %%


        int yyerror(char *msg)

        {

        printf("Invalid Input\n");

        exit(0);

        }


        int main ()

        {
```

```
    printf("Enter the expresssion: ");
    yyparse();
    }
```

OUTPUT :

```
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$ yacc -d pract13.y
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$ lex pract13.l
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$ cc lex.yy.c y.tab.c -ll
y.tab.c: In function ‘yyparse’:
y.tab.c:1018:16: warning: implicit declaration of function ‘yylex’ [-Wimplicit-function-declaration]
 1018 |       yychar = yylex ();
      |                ^~~~~
y.tab.c:1159:7: warning: implicit declaration of function ‘yyerror’; did you mean ‘yyerrok’? [-Wimplicit-function-declaration]
 1159 |       yyerror (YY_("syntax error"));
      |       ^~~~~~~
      |       yyerrok
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$ ./a.out
Enter the expresssion: aab
Invalid Expression
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$ aaaaaaaaab
aaaaaaaaab: command not found
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$ ./a.out
Enter the expresssion: aaaaaaaaab
Input is Valid
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$ ./a.out
Enter the expresssion: aaaaaaaaaaaaaaaaaaaaaaaaab
Input is Valid
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$ ./a.out
Enter the expresssion: vbvv
Invalid Expression
adarsh@adarsh-IdeaPad-3-15ALC6-Ub:~/Desktop/pract/practical_13$
```