

# SYSTEM SOFTWARE LAB MANUAL

## (LEX PROGRAMS)

1. Program to count the number of vowels and consonants in a given string.

```
% {
    #include<stdio.h>
    int vowels=0;
    int cons=0;
% }
%%
[aeiouAEIOU] {vowels++;}
[a-zA-Z] {cons++;}
%%
int yywrap()
{
    return 1;
}
main()
{
    printf("Enter the string.. at end press ^d\n");
    yylex();
    printf("No of vowels=%d\nNo of consonants=%d\n",vowels,cons);
}
```

2. Program to count the number of characters, words, spaces, end of lines in a given input file.

```
% {
    #include<stdio.h>
    Int c=0, w=0, s=0, l=0;
% }
WORD [^ \t\n,\.:]+
EOL [\n]
BLANK [ ]
%%
{WORD} {w++; c=c+yy leng;}
{BLANK} {s++;}
{EOL} {l++;}
. {c++;}
%%
int yywrap()
{
    return 1;
}
main(int argc, char *argv[])
{
    If(argc!=2)
    {
        printf("Usage: <./a.out> <sourcefile>\n");
        exit(0);
    }
    yyin=fopen(argv[1], "r");
    yylex();
    printf("No of characters=%d\nNo of words=%d\nNo of
spaces=%d\n No of lines=%d", c, w, s, l);
}
```

### 3. Program to count no of:

- a) +ve and -ve integers
- b) +ve and -ve fractions

```
% {
    #include<stdio.h>
    int posint=0, negint=0, posfraction=0, negfraction=0;
% }
%%
[-][0-9]+ {negint++;}
[+]?[0-9]+ {posint++;}
[+]?[0-9]*\.[0-9]+ {posfraction++;}
[-][0-9]*\.[0-9]+ {negfraction++;}
%%
int yywrap()
{
    return 1;
}

main(int argc, char *argv[])
{
    If(argc!=2)
    {
        printf("Usage: <./a.out> <sourcefile>\n");
        exit(0);
    }
    yyin=fopen(argv[1], "r");
    yylex();
    printf("No of +ve integers=%d\n No of -ve integers=%d\n No of
+ve
fractions=%d\n No of -ve fractions=%d\n", posint, negint,
posfraction, negfraction);
}
```

4. Program to count the no of comment line in a given C program. Also eliminate them and copy that program into separate file

```
% {
    #include<stdio.h>
    int com=0;
% }
% s COMMENT
% %
“/*”[.]”*/” {com++;}
“/*” {BEGIN COMMENT ;}
<COMMENT>”*/” {BEGIN 0; com++ ;}
<COMMENT>\n {com++ ;}
<COMMENT>. {;}
.|\n {fprintf(yyout,”%s”,yytext);
% %
int yywrap()
{
    return 1;
}

main(int argc, char *argv[])
{
    If(argc!=2)
    {
        printf(“Usage: <./a.out> <sourcefile> <destn file>\n”);
        exit(0);
    }
    yyin=fopen(argv[1],”r”);
    yyout=fopen(argv[2],”w”);
    yylex();
    printf(“No of comment lines=%d\n”,com);
}
```

5. Program to count the no of 'scanf' and 'printf' statements in a C program. Replace them with 'readf' and 'writef' statements respectively.

```
% {
    #include<stdio.h>
    int pc=0, sc=0;
% }
%%
“printf” { fprintf(yyout,”writef”); pc++;}
“scanf” { fprintf(yyout,”readf”); sc++;}
%%
int yywrap()
{
    return 1;
}

main(int argc, char *argv[])
{
    if(argc!=2)
    {
        printf(“Usage: <./a.out> <sourcefile> <destn file>\n”);
        exit(0);
    }
    yyin=fopen(argv[1],”r”);
    yyout=fopen(argv[2],”w”);
    yylex();
    printf(“No of printf statements = %d\n No of scanf
statements=%d\n”, pc, sc);
}
```

6. Program to recognize a valid arithmetic expression and identify the identifiers and operators present. Print them separately.

```
% {
    #include<stdio.h>
    #include<string.h>
    int noprt=0, nopnd=0, valid=1, top=-1, m, l=0, j=0;
    char opnd[10][10], oprt[10][10], a[100];
% }
%%
“(“ { top++; a[top]='(' ; }
“{“ { top++; a[top]='{' ; }
“[“ { top++; a[top]='[' ; }
“)” { if(a[top]!='(')
    {
        valid=0; return;
    }
    else
        top--;
}
“}” { if(a[top]!='{')
    {
        valid=0; return;
    }
    else
        top--;
}
“]” { if(a[top]!='[')
    {
        valid=0; return;
    }
    else
        top--;
}
“+”|”-“|”*”|”/” {    noprt++;
                        strcpy(oprt[l], yytext);
                        l++;
}
[0-9]+|[a-zA-Z][a-zA-Z0-9_]* { nopnd++;
```

```

        strcpy(opnd[j],yytext);
        j++;
    }

%%
int yywrap()
{
    return 1;
}

main()
{
    int k;
    printf("Enter the expression.. at end press ^d\n");
    yylex();
    if(valid==1 && i==-1 && (nopnd-noprnt)==1)
    {
        printf("The expression is valid\n");
        printf("The operators are\n");
        for(k=0;k<l;k++)
            Printf("%s\n",oprnt[k]);
        for(k=0;k<l;k++)
            Printf("%s\n",opnd[k]);
    }
    else
        Printf("The expression is invalid");
}

```

7. Program to recognize whether a given sentence is simple or compound.

```
%{
    #include<stdio.h>
    Int is_simple=1;
%}
%%
[ \t\n]+[aA][nN][dD][ \t\n]+ {is_simple=0;}
[ \t\n]+[oO][rR][ \t\n]+ {is_simple=0;}
[ \t\n]+[bB][uU][tT][ \t\n]+ {is_simple=0;}
• {;}
%%
int yywrap()
{
    return 1;
}

main()
{
    int k;
    printf("Enter the sentence.. at end press ^d");
    yylex();
    if(is_simple==1)
    {
        Printf("The given sentence is simple");
    }
    else
    {
        Printf("The given sentence is compound");
    }
}
```



8. Program to recognize and count the number of identifiers in a given input file.

```
% {
    #include<stdio.h>
    int id=0;
% }
%%
[a-zA-Z][a-zA-Z0-9_]* { id++ ; ECHO; printf("\n");}
•+ { ;}
\n { ;}
%%
int yywrap()
{
    return 1;
}

main (int argc, char *argv[])
{
    if(argc!=2)
    {
        printf("Usage: <./a.out> <sourcefile>\n");
        exit(0);
    }
    yyin=fopen(argv[1],"r");
    printf("Valid identifiers are\n");
    yylex();
    printf("No of identifiers = %d\n",id);
}
```

## YACC PROGRAMS

1. Program to test the validity of a simple expression involving operators +, -, \* and /

### Yacc Part

```
%token NUMBER ID NL
%left '+' '-'
%left '*' '/'
%%
stmt : exp NL { printf("Valid Expression"); exit(0); }
      ;
exp :  exp '+' exp
      | exp '-' exp
      | exp '*' exp
      | exp '/' exp
      | '(' exp ')'
      | ID
      | NUMBER
      ;
%%
int yyerror(char *msg)
{
    printf("Invalid Expression\n");
    exit(0);
}
main ()
{
    printf("Enter the expression\n");
    yyparse();
}
```

## Lex Part

```
%{  
    #include "y.tab.h"  
%}  
%%  
[0-9]+ { return DIGIT; }  
[a-zA-Z][a-zA-Z0-9_]* { return ID; }  
\n { return NL ;}  
• { return yytext[0]; }  
%%
```

2. Program to recognize nested IF control statements and display the levels of nesting.

### Yacc Part

```
%token IF RELOP S NUMBER ID
%{
    int count=0;
%}
%%
stmt : if_stmt { printf("No of nested if statements=%d\n",count); exit(0);}
      ;
if_stmt : IF '(' cond ')' if_stmt {count++;}
        | S;
        ;
cond : x RELOP x
      ;
x : ID
  | NUMBER
  ;
%%
int yyerror(char *msg)
{
    printf("Invalid Expression\n");
    exit(0);
}
main ()
{
    printf("Enter the statement");
    yyparse();
}
```

## Lex Part

```
% {  
    #include "y.tab.h"  
% }  
%%  
"if" { return IF; }  
[sS][0-9]* { return S; }  
"<"| ">"| "=="| "!="| "<="| ">=" { return RELOP; }  
[0-9]+ { return NUMBER; }  
[a-zA-Z][a-zA-Z0-9_]* { return ID; }  
\n { ; }  
• { return yytext[0]; }  
%%
```

3. Program to check the syntax of a simple expression involving operators  
+, -, \* and /

### Yacc Part

```
%token NUMBER ID NL
%left '+' '-'
%left '*' '/'
%%
stmt : exp NL { printf("Valid Expression"); exit(0); }
      ;
exp :   exp '+' exp
      | exp '-' exp
      | exp '*' exp
      | exp '/' exp
      | '(' exp ')'
      | ID
      | NUMBER
      ;
%%
int yyerror(char *msg)
{
    printf("Invalid Expression\n");
    exit(0);
}
main ()
{
    printf("Enter the expression\n");
    yyparse();
}
```

## Lex Part

```
%{  
    #include "y.tab.h"  
%}  
%%  
[0-9]+ { return NUMBER; }  
[a-zA-Z][a-zA-Z0-9_]* { return ID; }  
\n { return NL ;}  
• { return yytext[0]; }  
%%
```

4. Program to recognize a valid variable, which starts with a letter, followed by any number of letters or digits.

#### Yacc Part

```
%token DIGIT LETTER NL UND
%%
stmt : variable NL { printf("Valid Identifiers\n"); exit(0); }
      ;

variable : LETTER alphanumeric
          ;

alphanumeric: LETTER alphanumeric
              | DIGIT alphanumeric
              | UND alphanumeric
              | LETTER
              | DIGIT
              | UND
              ;
%%
int yyerror(char *msg)
{
    printf("Invalid Expression\n");
    exit(0);
}
main ()
{
    printf("Enter the variable name\n");
    yyparse();
}
```



## Lex Part

```
% {  
    #include "y.tab.h"  
%}  
%%  
[a-zA-Z] { return LETTER ;}  
[0-9] { return DIGIT ; }  
[\n] { return NL ;}  
[_] { return UND; }  
• { return yytext[0]; }  
%%
```

5. Program to evaluate an arithmetic expression involving operating +, -, \* and /.

### Yacc Part

```
%token NUMBER ID NL
%left '+' '-'
%left '*' '/'
%%
stmt : exp NL { printf("Value = %d\n",$1); exit(0); }
      ;
exp :  exp '+' exp { $$=$1+$3; }
      | exp '-' exp { $$=$1-$3; }
      | exp '*' exp { $$=$1*$3; }
      | exp '/' exp { if($3==0)
                      {
                        printf("Cannot divide by 0");
                        exit(0);
                      }
                      else
                        $$=$1/$3;
                      }
      | '(' exp ')' { $$=$2; }
      | ID { $$=$1; }
      | NUMBER { $$=$1; }
      ;
%%
int yyerror(char *msg)
{
    printf("Invalid Expression\n");
    exit(0);
}
main ()
{
    printf("Enter the expression\n");
    yyparse();
}
```

## Lex Part

```
% {  
    #include "y.tab.h"  
    extern int yylval;  
% }  
%%  
[0-9]+ { yylval=atoi(yytext); return NUMBER; }  
\n { return NL ;}  
• { return yytext[0]; }  
%%
```

6. Program to recognize strings 'aaab', 'abbb', 'ab' and 'a' using grammar  $(a^n b^n, n \geq 0)$

### Yacc Part

```
%token A B NL
%%
stmt : s NL { printf("Valid String\n"); exit(0) ;}
      ;
s : A s B
  |
  ;
%%
int yyerror(char *msg)
{
    printf("Invalid String\n");
    exit(0);
}
main ()
{
    printf("Enter the String\n");
    yyparse();
}
```

### Lex Part

```
{
    #include "y.tab.h"
}
%%
[aA] { return A; }
[bB] { return B; }
\n { return NL ;}
. { return yytext[0]; }
%%
```

7. Program to recognize the grammar ( $a^n b$ ,  $n \geq 10$ )

```
%token A B NL
%%
stmt : A A A A A A A A A A s B NL
      {
          Printf("Valid"); exit(0);
      }
      ;
s : s A
  |
  ;
int yyerror(char *msg)
{
    printf("Invalid String\n");
    exit(0);
}
main ()
{
    printf("Enter the String\n");
    yyparse();
}
```

### Lex Part

```
{
    #include "y.tab.h"

}
%%
[aA] { return A; }
[bB] { return B; }
\n { return NL ;}

• { return yytext[0]; }
%%
```

Steps to Execute Lex Program:

```
lex <pgm name>  
cc lex.yy.c -ll  
./a.out
```

Steps to execute YACC program:

```
yacc -d <yacc_pgm name>  
lex <lex_pgm_name>  
cc y.tab.c lex.yy.c -ly -ll  
./a.out
```