PRACTICAL 1

AIM: Implement a lexical analyzer for a subset of C using LEX Implementation should support Errorhandling.

IMPLEMENTATION:

- lex <filename with .l extension>
- gcc <newly created .c file> -o <file name for exe file>
- <filename of exe file>

In this case, create an extra text file named abc.txt which will contain some C code to work as input for lexical analysis.

PROGRAM:

```
%%
"#" {printf("\n %s \t Preprocessor",yytext);}
"main"|"printf"|"scanf" {printf("\n%s\tfunction",yytext);}
"if"|"else"|"int"|"unsigned"|"long"|"char"|"switch"|"case"|"struct"|"do"|"while"|"void"|"for"|"fl
oat"|"continue"|"break"|"include" { printf("\n%s\tKeyword",yytext); }
[_a-zA-Z][_a-zA-Z0-9]* {printf("\n%s\tIdenifier",yytext);}
"+"|"/"|"*"|"-" {printf("\n%s\tOperator",yytext);}
"="|"<"|">"|"!="|"=="|"<="|">=" {printf("\n%s\tRelational Operator",yytext);}
"%d"|"%s"|"%c"|"%f" {printf("\n%s\tTokenizer",yytext);}
"stdio.h"|"conio.h"|"math.h"|"string.h"|"graphics.h"|"dos.h"        {printf("\n%s\tHeader
File",yytext);}
";"|"," {printf("\n%s\tDelimiter",yytext);}
"("|")" {if(strcmp(yytext,"(")==0)
        {
                printf("\n%c\tOpening Parenthesis",yytext[0]);
        }
        else
        {
```

```
                        printf("\n%c\tClosing Parenthesis",yytext[0]);
             }
            ;}
"{" {printf("\n%s\tStart Of Function/Loop",yytext);}
"}" {printf("\n%s\tEnd of Function",yytext);}
%%
int yywrap(void)
{
  return 1;
}
int main()
{
int i;
FILE *fp;
fp=fopen("abc.txt","r");
            if(fp==NULL)
{
            printf("Unable To Open File");
}
else
{

            yyin=fp;
}

yylex();
return 0;
}
```

OUTPUT:

```
D:\Education\SEM 7 PRACTICALS\DLP\Practical 1>gcc lex.yy.c -o prac1
pract1.l: In function 'yylex':
pract1.l:11:5: warning: implicit declaration of function 'strcmp' [-Wimplicit-function-declaration]
 "("|")" {if(strcmp(yytext,"(")==0)
     ^~~~~~
```

```
D:\Education\SEM 7 PRACTICALS\DLP\Practical 1>prac1

 #       Preprocessor
include Keyword

a11     Idenifier
D:\Education\SEM 7 PRACTICALS\DLP\Practical 1>prac1

 #       Preprocessor
include Keyword
<       Relational Operator
stdio.h Header File
>       Relational Operator

void    Keyword
main    function
(       Opening Parenthesis
)       Closing Parenthesis

{       Start Of Function/Loop

int     Keyword
ab      Idenifier
;       Delimiter

printf  function
(       Opening Parenthesis"
hii     Idenifier"
)       Closing Parenthesis
;       Delimiter

}       End of Function
D:\Education\SEM 7 PRACTICALS\DLP\Practical 1>_
```

CONCLUSION:

In this practical, we learnt about lex files and implemented a program for lexical analysis.

PRACTICAL 2

AIM: Implement a lexical analyzer for identification of numbers.

IMPLEMENTATION:

- lex <filename with .l extension>
- gcc <newly created .c file> -o <file name for exe file>
- <filename of exe file>

PROGRAM:

```
bin (0|1)+

char [A-Za-z]+

digit [0-9]

oct [0-7]

dec [0-9]*

float {digit}+("."{digit}+)

exp {digit}+("."{digit}+)?("E"("+"|"-")?{digit}+)?

hex [0-9a-fA-F]+


%%

{bin} {printf("\n %s= it is a binary number",yytext);}

{char} {printf("\n %s=it is a char",yytext);}

{oct} {printf("\n %s=it is a octal number",yytext);}

{digit} {printf("\n %s=it is a digit",yytext);}

{dec} {printf("\n %s=it is a decimal",yytext);}

{float} {printf("\n %s=it is a float",yytext);}

{exp} {printf("\n %s=it is a exp",yytext);}

{hex} {printf("\n %s=it is a hex",yytext);}

%%

int yywrap()
```

{

return 1;

}

int main()

{

printf("Enter the

number=");yylex();

return 0;

}

OUTPUT:

```
Microsoft Windows [Version 10.0.19042.1110]
(c) Microsoft Corporation. All rights reserved.

D:\Education\SEM 7 PRACTICALS\DLP\Practical 2>flex pract2.l

D:\Education\SEM 7 PRACTICALS\DLP\Practical 2>gcc lex.yy.c -o prac2

D:\Education\SEM 7 PRACTICALS\DLP\Practical 2>prac2
Enter the number=123

 123=it is a decimal
6

 6=it is a octal number
0

 0= it is a binary number
ab

 ab=it is a char
5F

 5F=it is a hex
1E-9

 1E-9=it is a exp
4.7

 4.7=it is a float
3

 3=it is a octal number

D:\Education\SEM 7 PRACTICALS\DLP\Practical 2>
```

CONCLUSION:

In this practical, we learnt about lexical analysis for numbers and characters.

PRACTICAL 3

AIM: Implement a Calculator using LEX and YACC.

IMPLEMENTATION:

- lex <filename with .l extension>
- yacc <filename with .y extension>
- gcc <newly created .c file from yacc> -o <file name for exe file>
- <filename of exe file>

PROGRAM:

Lex File:

```
DIGIT [0-9]
%option noyywrap
%%
{DIGIT} { yylval=atof(yytext); return NUM;}
\n|. {return yytext[0];}
```

Yacc File:

```
%{
#include<ctype.h> #include<stdio.h>
#define YYSTYPE double
%}
%token NUM
%left '+' '-'
%left '*' '/'
%%
S : S E '\n' { printf("Answer: %g \nEnter:\n", $2); }
| S '\n'

|
| error '\n' { yyerror("Error: Enter once more \n" );yyerrok; }
;
E : E '+' E { $$ = $1 + $3; }
| E'-'E { $$=$1-$3;}
| E'*'E {$$=$1*$3;}
| E'/'E {$$=$1/$3;}
| NUM
;
%%
#include "lex.yy.c" int main()
{
printf("Enter the expression: "); yyparse();
}
yyerror (char * s)
{
printf ("% s \n", s); exit (1);
}
```

OUTPUT:

```
D:\Education\SEM 7 PRACTICALS\DLP\Practical 4>lex c1.l

D:\Education\SEM 7 PRACTICALS\DLP\Practical 4>yacc c1.y

D:\Education\SEM 7 PRACTICALS\DLP\Practical 4>gcc c1.tab.c -o prac4
c1.tab.c: In function 'yyparse':
c1.tab.c:588:16: warning: implicit declaration of function 'yylex' [-Wimplicit-function-declaration]
 # define YYLEX yylex ()
                ^~~~~
c1.tab.c:1248:16: note: in expansion of macro 'YYLEX'
       yychar = YYLEX;
                ^~~~~
c1.y:16:7: warning: implicit declaration of function 'yyerror'; did you mean 'yyerrok'? [-Wimplicit-function-declaration
]
 | error '\n' { yyerror("Error: Enter once moren" );yyerrok; }
       ^~~~~~~
       yyerrok
c1.y: At top level:
c1.y:35:1: warning: return type defaults to 'int' [-Wimplicit-int]
 yyerror (char * s)
 ^~~~~~~

D:\Education\SEM 7 PRACTICALS\DLP\Practical 4>prac4
Enter the expression: 5+6
Answer: 11
Enter:
8/2
Answer: 4
Enter:
4*3
Answer: 12
Enter:
9-7
Answer: 2
```

CONCLUSION:

In this practical, we learnt implemented a calculator using lex and yacc which takes expression as input and perform basic arithmetic operations.

PRACTICAL 4

AIM: Implement a program to identify keywords and identifiers using finite automata.

IMPLEMENTATION:

- lex <filename with .l extension>
- yacc <filename with .y extension>
- gcc <newly created .c file from yacc> -o <file name for exe file>
- <filename of exe file>

PROGRAM:

Lex File:

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

// Define keywords
char *keywords[] = {"int", "float", "if", "else", "while", "for", "return"};

// Function to check if a string is a keyword
int isKeyword(char *str) {
    for (int i = 0; i < sizeof(keywords) / sizeof(keywords[0]); i++) {
        if (strcmp(keywords[i], str) == 0) {
            return 1; // It's a keyword
        }
    }
    return 0; // It's not a keyword
}

int main() {
    char input[1000];
    printf("Enter C code:\n");
    fgets(input, sizeof(input), stdin);

    char token[100];
    int i = 0, j = 0;

    while (input[i] != '\0') {
        if (input[i] == ' ' || input[i] == '\n' || input[i] == '\t') {
            // Whitespace, end current token and check if it's a keyword
            token[j] = '\0';
            if (j > 0 && isKeyword(token)) {
                printf("Keyword: %s\n", token);
            } else if (j > 0) {
                printf("Identifier: %s\n", token);
            }
            j = 0; // Reset token
        } else {
```

```
            // Add character to the current token
            token[j] = input[i];
            j++;
        }
        i++;
    }

    return 0;
}
```

OUTPUT:

```
Enter C code:
int main() {
    int x = 5;
    float y = 3.14;
    if (x > 0) {
        printf("Positive");
    } else {
        printf("Non-positive");
    }
    return 0;
}

int main() {

    int x = 5;

    float y = 3.14;

    if (x > 0) {

        printf("Positive");

    } else {

        printf("Non-positive");

    }

    return 0;

}


Keyword: int
Identifier: main()
Identifier: {
```

CONCLUSION:

In this practical, we learnt implemented a calculator using lex and yacc which takes expression as input and perform basic arithmetic operations.

PRACTICAL 5

AIM: Write an ambiguous CFG to recognize an infix expression and implement a parser that recognizes the infix expression using YACC.

IMPLEMENTATION:

• yacc <filename with .y extension>
• gcc <newly created .c file> -o <file name for exe file>
• <filename of exe file>

PROGRAM:

```
%{
/*** Auxiliary declarations section ***/


#include<stdio.h> #include<stdlib.h> #include<string.h>

/* Custom function to print an operator*/ void print_operator(char op);

/* Variable to keep track of the position of the number in the input */ int pos=0;
char p;
%}


/*** YACC Declarations section ***/
%token NUM
%left '+'
%left '*'

%%


/*** Rules Section ***/
start : expr '\n'    {exit(1);}
;


expr: expr '+' expr         {print_operator('+');}
| expr '*' expr     {print_operator('*');}
| '(' expr ')'
| NUM    {printf("%c ",p);}
;


%%



/*** Auxiliary functions section ***/
```

```
void print_operator(char c){ switch(c){
case '+' : printf("+ "); break;
case '*' : printf("* "); break;
}
return;
}


yyerror(char const *s)
{
printf("yyerror %s",s);

}


yylex(){ char c;
c = getchar(); p=c; if(isdigit(c)){
pos++; return NUM;
}
else if(c == ' '){
yylex();  /*This is to ignore whitespaces in the input*/
}
else {
return c;
}
}
```

OUTPUT:

```
D:\Education\SEM 7 PRACTICALS\DLP\Practical 3>yacc infix.y

D:\Education\SEM 7 PRACTICALS\DLP\Practical 3>gcc infix.tab.c -o prac3
infix.tab.c: In function 'yyparse':
infix.tab.c:589:16: warning: implicit declaration of function 'yylex' [-Wimplicit-function-declaration]
 # define YYLEX yylex ()
                ^~~~~
infix.tab.c:1249:16: note: in expansion of macro 'YYLEX'
       yychar = YYLEX;
                ^~~~~
infix.tab.c:1403:7: warning: implicit declaration of function 'yyerror'; did you mean 'yyerrok'? [-Wimplicit-function-declaration]
       yyerror (YY_("syntax error"));
       ^~~~~~~
       yyerrok
infix.y: At top level:
infix.y:47:1: warning: return type defaults to 'int' [-Wimplicit-int]
 yyerror(char const *s)
 ^~~~~~~
infix.y:52:1: warning: return type defaults to 'int' [-Wimplicit-int]
 yylex(){
 ^~~~~
infix.y: In function 'yylex':
infix.y:56:8: warning: implicit declaration of function 'isdigit' [-Wimplicit-function-declaration]
     if(isdigit(c)){
        ^~~~~~~
infix.y: At top level:
infix.y:68:1: warning: return type defaults to 'int' [-Wimplicit-int]
 main()
 ^~~~
```

```
D:\Education\SEM 7 PRACTICALS\DLP\Practical 3>prac3
(1 + 2) * 3
1 2 + 3 *
D:\Education\SEM 7 PRACTICALS\DLP\Practical 3>
```

CONCLUSION:

In this practical, we learnt about yacc and performed infix to postfix conversion.

PRACTICAL 6

AIM: Implement a C program to find FIRST and FOLLOW set of given grammar.

IMPLEMENTATION:
• yacc <filename with .y extension>
• gcc <newly created .c file> -o <file name for exe file>
• <filename of exe file>

PROGRAM:

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

#define MAX_RULES 10
#define MAX_SYMBOLS 10
#define MAX_FIRST_SET 10
#define MAX_FOLLOW_SET 10

char grammar[MAX_RULES][MAX_SYMBOLS];
char nonTerminals[MAX_RULES];
int numRules;
int numNonTerminals;

typedef struct {
    char symbol;
    char firstSet[MAX_FIRST_SET];
    int numFirst;
    char followSet[MAX_FOLLOW_SET];
    int numFollow;
} NonTerminalInfo;

NonTerminalInfo nonTerminalInfo[MAX_RULES];

// Function to add a symbol to a set
void addToSet(char set[], int *num, char symbol) {
    for (int i = 0; i < *num; i++) {
        if (set[i] == symbol) {
            return;
        }
    }
    set[*num] = symbol;
    (*num)++;
}

// Function to calculate FIRST set
void calculateFirstSet(char nonTerminal) {
    for (int i = 0; i < numRules; i++) {
```

```
            if (grammar[i][0] == nonTerminal) {
                // If the production starts with the non-terminal
                if (islower(grammar[i][3])) {
                    // If the production has a terminal symbol
                    addToSet(nonTerminalInfo[nonTerminal - 'A'].firstSet,
                            &nonTerminalInfo[nonTerminal - 'A'].numFirst, grammar[i][3]);
                } else if (grammar[i][3] != nonTerminal) {
                    // If the production has another non-terminal
                    calculateFirstSet(grammar[i][3]);
                    int j;
                    for (j = 0; j < nonTerminalInfo[grammar[i][3] - 'A'].numFirst; j++) {
                        addToSet(nonTerminalInfo[nonTerminal - 'A'].firstSet,
                                &nonTerminalInfo[nonTerminal - 'A'].numFirst,
                                nonTerminalInfo[grammar[i][3] - 'A'].firstSet[j]);
                    }
                    if (j == nonTerminalInfo[grammar[i][3] - 'A'].numFirst) {
                        addToSet(nonTerminalInfo[nonTerminal - 'A'].firstSet,
                                &nonTerminalInfo[nonTerminal - 'A'].numFirst, '#');
                    }
                }
            }
        }
    }

    // Function to calculate FOLLOW set
    void calculateFollowSet(char nonTerminal) {
        if (nonTerminal == grammar[0][0]) {
            addToSet(nonTerminalInfo[nonTerminal - 'A'].followSet,
                    &nonTerminalInfo[nonTerminal - 'A'].numFollow, '$');
        }
        for (int i = 0; i < numRules; i++) {
            int j;
            for (j = 3; grammar[i][j] != '\0'; j++) {
                if (grammar[i][j] == nonTerminal) {
                    // If nonTerminal appears in a production
                    for (int k = j + 1; grammar[i][k] != '\0'; k++) {
                        if (isupper(grammar[i][k])) {
                            // If a non-terminal follows
                            int l;
                            for (l = 0; l < nonTerminalInfo[grammar[i][k] - 'A'].numFirst; l++) {
                                addToSet(nonTerminalInfo[nonTerminal - 'A'].followSet,
                                        &nonTerminalInfo[nonTerminal - 'A'].numFollow,
                                        nonTerminalInfo[grammar[i][k] - 'A'].firstSet[l]);
                            }
                            if (l == nonTerminalInfo[grammar[i][k] - 'A'].numFirst) {
                                addToSet(nonTerminalInfo[nonTerminal - 'A'].followSet,
                                        &nonTerminalInfo[nonTerminal - 'A'].numFollow, '#');
                            }
                        } else {
                            // If a terminal symbol follows
                            addToSet(nonTerminalInfo[nonTerminal - 'A'].followSet,
```

```
                        &nonTerminalInfo[nonTerminal - 'A'].numFollow, grammar[i][k]);
                    break;
                }
            }
            if (grammar[i][k] == '\0') {
                // If nonTerminal appears at the end of a production
                for (int l = 0; nonTerminals[l] != '\0'; l++) {
                    if (nonTerminals[l] == grammar[i][0]) {
                        continue;
                    }
                    for (int m = 0; m < nonTerminalInfo[nonTerminals[l] - 'A'].numFollow;
                         m++) {
                        addToSet(nonTerminalInfo[nonTerminal - 'A'].followSet,
                                 &nonTerminalInfo[nonTerminal - 'A'].numFollow,
                                 nonTerminalInfo[nonTerminals[l] - 'A'].followSet[m]);
                    }
                }
            }
        }
    }
  }
}

int main() {
    printf("Enter the number of rules: ");
    scanf("%d", &numRules);
    printf("Enter the grammar rules (e.g., S->AB): \n");
    for (int i = 0; i < numRules; i++) {
        scanf("%s", grammar[i]);
        nonTerminals[i] = grammar[i][0];
        nonTerminals[i + 1] = '\0';
    }
    numNonTerminals = strlen(nonTerminals);

    // Initialize FIRST and FOLLOW sets
    for (int i = 0; i < numNonTerminals; i++) {
        nonTerminalInfo[nonTerminals[i] - 'A'].symbol = nonTerminals[i];
        nonTerminalInfo[nonTerminals[i] - 'A'].numFirst = 0;
        nonTerminalInfo[nonTerminals[i] - 'A'].numFollow = 0;
    }

    // Calculate FIRST sets
    for (int i = 0; i < numNonTerminals; i++) {
        calculateFirstSet(nonTerminals[i]);
    }

    // Calculate FOLLOW sets
    for (int i = 0; i < numNonTerminals; i++) {
        calculateFollowSet(nonTerminals[i]);
    }
```

```
    // Print FIRST and FOLLOW sets
    printf("\nFIRST and FOLLOW sets:\n");
    for (int i = 0; i < numNonTerminals; i++) {
        printf("Non-terminal %c\n", nonTerminalInfo[i].symbol);
        printf("FIRST: { ");
        for (int j = 0; j < nonTerminalInfo[i].numFirst; j++) {
            printf("%c ", nonTerminalInfo[i].firstSet[j]);
        }
        printf("}\n");

        printf("FOLLOW: { ");
        for (int j = 0; j < nonTerminalInfo[i].numFollow; j++) {
            printf("%c ", nonTerminalInfo[i].followSet[j]);
        }
        printf("}\n\n");
    }

    return 0;
}
```

OUTPUT:

```
Enter the number of rules: 4
Enter the grammar rules (e.g., S->AB):
S->aBC
B->b
B->#
C->c
```

```
FIRST and FOLLOW sets:
Non-terminal S
FIRST: { a }
FOLLOW: { c }

Non-terminal B
FIRST: { b # }
FOLLOW: { a }

Non-terminal C
FIRST: { c }
FOLLOW: { b # }

Non-terminal a
FIRST: { a }
FOLLOW: { c }

Non-terminal b
FIRST: { b }
FOLLOW: { a c }

Non-terminal c
FIRST: { c }
FOLLOW: { a c }

Non-terminal #
FIRST: { # }
FOLLOW: { a c }
```

CONCLUSION:
In this practical we implemented a C program to find FIRST and FOLLOW set of given grammar.

PRACTICAL 7

AIM: Write a program to remove the Left Recursion from a given grammar.

IMPLEMENTATION:
yacc <filename with .y extension>
• gcc <newly created .c file> -o <file name for exe file>
• <filename of exe file>

PROGRAM:

In this practical we implemented a C program to find FIRST and FOLLOW set of given grammar.

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

#define MAX_RULES 10
#define MAX_SYMBOLS 10

char grammar[MAX_RULES][MAX_SYMBOLS];
int numRules;

void removeLeftRecursion(char nonTerminal) {
    int i, j, k;
    char newGrammar[MAX_RULES][MAX_SYMBOLS];

    for (i = 0; i < numRules; i++) {
        if (grammar[i][0] == nonTerminal) {
            // A production with left recursion
            int m = 0;
            for (j = 1; j < strlen(grammar[i]); j++) {
                if (grammar[i][j] == '|') {
                    newGrammar[numRules + m][0] = nonTerminal;
                    newGrammar[numRules + m][1] = '\'';
                    newGrammar[numRules + m][2] = '\0';
                    strcat(newGrammar[numRules + m], &grammar[i][j + 1]);
                    m++;
                    j++;
                }
            }
            newGrammar[numRules + m][0] = '#'; // ε (empty production)
            newGrammar[numRules + m][1] = '\0';
            numRules += m + 1;

            for (k = i; k < numRules - m; k++) {
                strcpy(grammar[k], newGrammar[k - i]);
            }
        }
    }
```

```
}

int main() {
    printf("Enter the number of rules: ");
    scanf("%d", &numRules);
    printf("Enter the grammar rules (e.g., S->a|A): \n");
    for (int i = 0; i < numRules; i++) {
        scanf("%s", grammar[i]);
    }

    // Iterate through non-terminals and remove left recursion
    for (int i = 0; i < numRules; i++) {
        removeLeftRecursion(grammar[i][0]);
    }

    // Print the modified grammar
    printf("\nGrammar after removing left recursion:\n");
    for (int i = 0; i < numRules; i++) {
        printf("%s\n", grammar[i]);
    }

    return 0;
}
```

OUTPUT:

```
Enter the number of rules: 3
Enter the grammar rules (e.g., S->a|A):
S->Sa|b|A
A->Ac|d
B->Ba|f
```

```
Grammar after removing left recursion:
S->bS'|A
S'->aS'|ε
A->dA'|ε
A'->cA'|ε
B->fB'|ε
B'->aB'|ε
```

CONCLUSION:

In this practical we implemented a program to remove the Left Recursion from a given grammar.

PRACTICAL 8

AIM: Implementation of Context Free Grammar.

IMPLEMENTATION:

• gcc <our .c file> -o <file name for exe file>
• <filename of exe file>

In this case, create a syntax.txt file as input for the executable which will contain following statements.

S aBaA S AB
A Bc B c

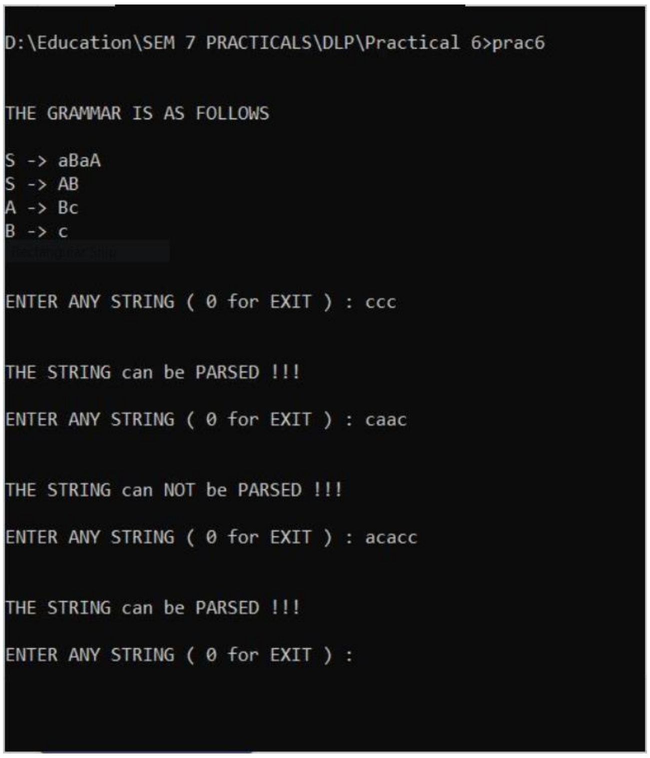
PROGRAM:

```
//CFG


#include<stdio.h> #include<string.h> #include<conio.h>

int i,j,k,l,m,n=0,o,p,nv,z=0,t,x=0;
char str[10],temp[20],temp2[20],temp3[20];


struct prod
{
char lhs[10],rhs[10][10]; int n;
}pro[10];


void findter()

{
for(k=0;k<n;k++)
{
if(temp[i]==pro[k].lhs[0])
{
for(t=0;t<pro[k].n;t++)
{
for(l=0;l<20;l++) temp2[l]='\0';
for(l=i+1;l<strlen(temp);l++) temp2[l-i-1]=temp[l];
for(l=i;l<20;l++) temp[l]='\0';
for(l=0;l<strlen(pro[k].rhs[t]);l++)
temp[i+l]=pro[k].rhs[t][l]; strcat(temp,temp2); if(str[i]==temp[i])
return;
else if(str[i]!=temp[i] && temp[i]>=65 && temp[i]<=90) break;
}
break;
}
}
if(temp[i]>=65 && temp[i]<=90) findter();
}
```

```
int main()
{

FILE *f;
//clrscr();


for(i=0;i<10;i++) pro[i].n=0;

f=fopen("input.txt","r"); while(!feof(f))
{
fscanf(f,"%s",pro[n].lhs); if(n>0)
{
if( strcmp(pro[n].lhs,pro[n-1].lhs) == 0 )
{
pro[n].lhs[0]='\0';
fscanf(f,"%s",pro[n-1].rhs[pro[n-1].n]); pro[n-1].n++;
continue;
}
}
fscanf(f,"%s",pro[n].rhs[pro[n].n]); pro[n].n++;
n++;
}
n--;


printf("\n\nTHE GRAMMAR IS AS FOLLOWS\n\n"); for(i=0;i<n;i++)
for(j=0;j<pro[i].n;j++)
printf("%s -> %s\n",pro[i].lhs,pro[i].rhs[j]);



while(1)
{
for(l=0;l<10;l++) str[0]=NULL;

printf("\n\nENTER ANY STRING ( 0 for EXIT ) : "); scanf("%s",str);
if(str[0]=='0')
printf("Exit");
//          exit(1); for(j=0;j<pro[0].n;j++)
{
for(l=0;l<20;l++) temp[l]=NULL;
strcpy(temp,pro[0].rhs[j]); m=0;
for(i=0;i<strlen(str);i++)
{
if(str[i]==temp[i]) m++;
else if(str[i]!=temp[i] && temp[i]>=65 && temp[i]<=90)
{
findter(); if(str[i]==temp[i])
```

```
m++;
}
else if( str[i]!=temp[i] && (temp[i]<65 || temp[i]>90) ) break;
}



if(m==strlen(str) && strlen(str)==strlen(temp))
{
printf("\n\nTHE STRING can be PARSED !!!"); break;
}
}
if(j==pro[0].n)
printf("\n\nTHE STRING can NOT be PARSED !!!");
}
getch();
}
```

OUTPUT:



CONCLUSION:
In this practical, we learnt about Context Free Grammar and implemented the concept using C.

PRACTICAL 9

AIM:

Implementation of code generator.

IMPLEMENTATION:

- gcc <our .c file> -o <file name for exe file>
- <filename of exe file>

Content of Input1.txt:

a=b+c;

d=n+s;

p=q;

PROGRAM:

// Pgm for Code generation by using simple code generation algorithm

```
#include<stdio.h>
#include<string.h>
struct table{
char op1[2];
char op2[2];
char  opr[2];
char res[2];
}tbl[100];

void add(char *res,char *op1, char *op2,char *opr)
{
        FILE *ft;
        char string[20];
        char sym[100];
        ft=fopen("result.asm","a+");
```

```
	if(ft==NULL)
		ft=fopen("result.asm","w");
	printf("\nUpdating Assembly Code for the Input File : File : Result.asm ; Status [ok]\n");
	//sleep(2);
	strcpy(string,"mov r0,");
	strcat(string,op1);
	if(strcmp(opr,"&")==0)
	{
		//do nothing
	}
	else
	{
		strcat(string,"\nmov r1,");
		strcat(string,op2);
	}

	fputs(string,ft);
	if(strcmp(opr,"+")==0)
		strcpy(string,"\nadd r0,r1\n");
	else if(strcmp(opr,"-")==0)
		strcpy(string,"\nsub r0,r1\n");
	else if(strcmp(opr,"/")==0)
		strcpy(string,"\ndiv r0,r1\n");
	else if(strcmp(opr,"*")==0)
		strcpy(string,"\nmul r0,r1\n");
	else if(strcmp(opr,"&")==0)
		strcpy(string,"\n");
	else
		strcpy(string,"\noperation r0,r1\n");
	fputs(string,ft);
	strcpy(string,"mov ");
```

```
        strcat(string,res);
        strcat(string,", r0\n");
        fputs(string,ft);
        fclose(ft);
        string[0]='\0';
        sym[0]='\0';
}
main()
{
        int res,op1,op2,i,j,opr;
        FILE *fp;
        char filename[50];
        char s,s1[10];
        system("clear");
        remove("result.asm");
        remove("result.sym");
        res=0;op1=0;op2=0;i=0;j=0;opr=0;
        printf("\n Enter the Input Filename with no white spaces:");
        scanf("%s",filename);
        fp=fopen(filename,"r");
        if(fp==NULL)
        {
                printf("\n cannot open the input file !\n");
                return(0);
        }
        else
        {
                while(!feof(fp))
                {
                        s=fgetc(fp);
```

```
if(s=='=')
{
        res=1;
        op1=op2=opr=0;
        s1[j]='\0';
        strcpy(tbl[i].res,s1);
        j=0;
}
else if(s=='+'||s=='-'||s=='*'||s=='/')
{
        op1=1;
        opr=1;
        s1[j]='\0';
        tbl[i].opr[0]=s;
        tbl[i].opr[1]='\0';
        strcpy(tbl[i].op1,s1);
        j=0;
}
else if(s==';')
{

        if(opr)         // for 3 operand format ex: a=b+c;
        {
                op2=1;
                s1[j]='\0';
                strcpy(tbl[i].op2,s1);
        }
        else if(!opr)   // for 2 operand format ex: d=a;
        {
                op1=1;
```

```
                    op2=0;
                    s1[j]='\0';
                    strcpy(tbl[i].op1,s1);
                strcpy(tbl[i].op2,"&");// simplifying the
expr
                strcpy(tbl[i].opr,"&");          //-------"--"---------
-
                }
                add(tbl[i].res,tbl[i].op1,tbl[i].op2,tbl[i].opr);
                i++;
                j=0;
                opr=op1=op2=res=0;
            }
            else
            {
                s1[j]=s;
                j++;
            }
        }
    system("clear");
}
    return 0;
}
```

OUTPUT:

C:\Windows\System32\cmd.exe - x

```
 Enter the Input Filename with no white spaces:input1.txt

Updating Assembly Code for the Input File : File : Result.asm ; Status [ok]

Updating Assembly Code for the Input File : File : Result.asm ; Status [ok]

Updating Assembly Code for the Input File : File : Result.asm ; Status [ok]
```

result.asm

```
mov r0,b
mov r1,c
add r0,r1
mov a, r0
mov r0,n
mov r1,s
add r0,r1
mov
d, r0
mov r0,q
mov
p, r0

```

CONCLUSION:

In this practical, we learnt about code generation and implemented the same using C.

PRACTICAL 10

AIM: Implementation of code optimization for Common sub-expression elimination, Loop invariant code movement.

IMPLEMENTATION:
yacc <filename with .y extension>
• gcc <newly created .c file> -o <file name for exe file>
• <filename of exe file>

PROGRAM:

```
#include <stdio.h>


int main() {
    int i, sum = 0;


    for (i = 1; i <= 10; i++) {
        int square = i * i;
        sum += square;
    }


    printf("Sum of squares: %d\n", sum);


    return 0;
}
```

In this code, the expression int square = i * i; is computed inside the loop. However, this calculation is loop-invariant because it doesn't depend on the loop variable i. We can optimize the code by moving this calculation outside the loop:

```
#include <stdio.h>


int main() {
    int i, sum = 0;


    int square; // Declare outside the loop
```

```
    for (i = 1; i <= 10; i++) {
        square = i * i; // Calculate once
        sum += square;
    }

    printf("Sum of squares: %d\n", sum);

    return 0;
}
```

By moving the calculation of square outside the loop, we avoid redundant calculations and potentially improve the code's efficiency. This is a simple example of loop-invariant code movement.

CONCLUSION:
In this practical we learnt about Loop invariant code movement.