Ex No: 1
Date:

IMPLEMENT CODE TO RECOGNIZE TOKENS IN C

AIM:

To implement the program to identify C keywords, identifiers, operators, end statements like [], {} using the C tool.

ALGORITHM:

- We identify the basic tokens in c such as keywords, numbers, variables, etc.
- Declare the required header files.
- Get the input from the user as a string and it is passed to a function for processing.
- The functions are written separately for each token and the result is returned in the form of bool either true or false to the main computation function.
- Functions are issymbol() for checking basic symbols such as () etc , isoperator() to check for operators like +, -, *, / , isidentifier() to check for variables like a,b, iskeyword() to check the 32 keywords like while etc., isInteger() to check for numbers in combinations of 0-9, isnumber() to check for digits and substring().
- Declare a function detecttokens() that is used for string manipulation and iteration then the result is returned from the functions to the main. If it's an invalid identifier error must be printed.
- Declare main function get the input from the user and pass to detecttokens() function.

PROGRAM:

```
#include <stdbool.h>
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
bool isDelimiter(char ch)
{
        if (ch == ' ' || ch == '+' || ch == '-' || ch == '*' ||
                ch == '/' || ch == ',' || ch == ';' || ch == '>' ||
                ch == '<' || ch == '=' || ch == '(' || ch == ')' ||
                ch == '[' || ch == ']' || ch == '{' || ch == '}')
                return (true);
        return (false);
}
bool isOperator(char ch){
        if (ch == '+' || ch == '-' || ch == '*' ||
```

```
                ch == '/' || ch == '>' || ch == '<' ||
                ch == '=')
                return (true);
        return (false);
}
bool validIdentifier(char* str)
{
        if (str[0] == '0' || str[0] == '1' || str[0] == '2' ||
                str[0] == '3' || str[0] == '4' || str[0] == '5' ||
                str[0] == '6' || str[0] == '7' || str[0] == '8' ||
                str[0] == '9' || isDelimiter(str[0]) == true)
                return (false);
        return (true);
}
bool isKeyword(char* str)
{
        if (!strcmp(str, "if") || !strcmp(str, "else") ||
                !strcmp(str, "while") || !strcmp(str, "do") ||
                !strcmp(str, "break") ||
                !strcmp(str, "continue") || !strcmp(str, "int")
                || !strcmp(str, "double") || !strcmp(str, "float")
                || !strcmp(str, "return") || !strcmp(str, "char")
                || !strcmp(str, "case") || !strcmp(str, "char")
                || !strcmp(str, "sizeof") || !strcmp(str, "long")
                || !strcmp(str, "short") || !strcmp(str, "typedef")
                || !strcmp(str, "switch") || !strcmp(str, "unsigned")
                || !strcmp(str, "void") || !strcmp(str, "static")
                || !strcmp(str, "struct") || !strcmp(str, "goto"))
                return (true);
        return (false);
}
bool isInteger(char* str)
{
        int i, len = strlen(str);

        if (len == 0)
                return (false);
        for (i = 0; i < len; i++) {
                if (str[i] != '0' && str[i] != '1' && str[i] != '2'
                        && str[i] != '3' && str[i] != '4' && str[i] != '5'
                        && str[i] != '6' && str[i] != '7' && str[i] != '8'
```

```
                && str[i] != '9' || (str[i] == '-' && i > 0))
                return (false);
        }
        return (true);
}
bool isRealNumber(char* str)
{
        int i, len = strlen(str);
        bool hasDecimal = false;

        if (len == 0)
                return (false);
        for (i = 0; i < len; i++) {
                if (str[i] != '0' && str[i] != '1' && str[i] != '2'
                        && str[i] != '3' && str[i] != '4' && str[i] != '5'
                        && str[i] != '6' && str[i] != '7' && str[i] != '8'
                        && str[i] != '9' && str[i] != '.' ||
                        (str[i] == '-' && i > 0))
                        return (false);
                if (str[i] == '.')
                        hasDecimal = true;
        }
        return (hasDecimal);
}
char* subString(char* str, int left, int right)
{
        int i;
        char* subStr = (char*)malloc(
                                sizeof(char) * (right - left + 2));

        for (i = left; i <= right; i++)
                subStr[i - left] = str[i];
        subStr[right - left + 1] = '\0';
        return (subStr);
}
void parse(char* str)
{
        int left = 0, right = 0;
        int len = strlen(str);

        while (right <= len && left <= right) {
        if (isDelimiter(str[right]) == false)
                        right++;
```

```
if (isDelimiter(str[right]) == true && left == right) {
                if (isOperator(str[right]) == true)
                        printf("'%c' IS AN OPERATOR\n", str[right]);
                right++;
                        left = right;
                } else if (isDelimiter(str[right]) == true && left != right
                                || (right == len && left != right)) {
                        char* subStr = subString(str, left, right - 1);
                if (isKeyword(subStr) == true)
                                printf("'%s' IS A KEYWORD\n", subStr);
                        else if (isInteger(subStr) == true)
                                printf("'%s' IS AN INTEGER\n", subStr);

                        else if (isRealNumber(subStr) == true)
                                printf("'%s' IS A REAL NUMBER\n", subStr);

                        else if (validIdentifier(subStr) == true
                                        && isDelimiter(str[right - 1]) == false)
                                printf("'%s' IS A VALID IDENTIFIER\n", subStr);

                        else if (validIdentifier(subStr) == false
                                        && isDelimiter(str[right - 1]) == false)
                                printf("'%s' IS NOT A VALID IDENTIFIER\n", subStr);
                        left = right;
                }
        }
        return;
}
int main()
{
   printf("210701300\n ");
        char str[100] = "int a = b + 1c; ";
        parse(str);
        return (0);
}
```

OUTPUT:

```
210701292
 'int' IS A KEYWORD
'a' IS A VALID IDENTIFIER
'=' IS AN OPERATOR
'b' IS A VALID IDENTIFIER
'+' IS AN OPERATOR
'1c' IS NOT A VALID IDENTIFIER


=== Code Execution Successful ===
```

RESULT :

Ex No: 2
Date:

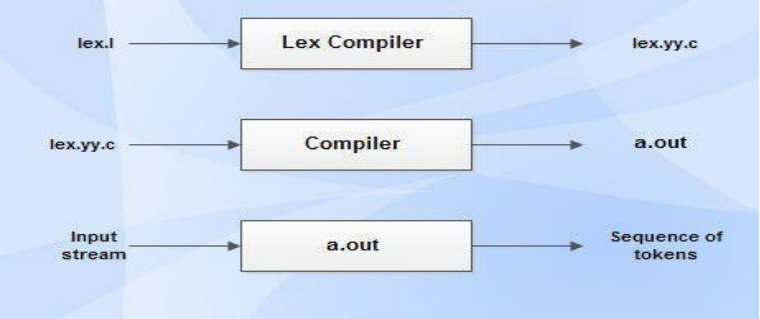
IMPLEMENT A LEXICAL ANALYZER TO COUNT THE NUMBER OF WORDS USING LEX TOOL

AIM:

To implement the program to count the number of words in a string using LEX tool.

STUDY:

Lex is a tool in lexical analysis phase to recognize tokens using regular expression. Lex tool itself is a lex compiler.



- lex.l is an a input file written in a language which describes the generation of lexical analyzer. The lex compiler transforms lex.l to a C program known as lex.yy.c.
- lex.yy.c is compiled by the C compiler to a file called a.out.
- The output of C compiler is the working lexical analyzer which takes stream of input characters and produces a stream of tokens.
- yyval is a global variable which is shared by lexical analyzer and parser to return the name and an attribute value of token.
- The attribute value can be numeric code, pointer to symbol table or nothing.
- Another tool for lexical analyzer generation is Flex.

STRUCTURE OF LEX PROGRAMS:

Lex program will be in following form

declarations

%%

translation rules

%%

auxiliary functions

ALGORITHM:

- Define tokens `let` and `dig` using `%token` directive and lexical rules in `yylex()` to recognize them.
- Define grammar rules in BNF form for `sad` and `recld` in the Bison specification.
- Implement semantic actions to print "accepted" for valid inputs and "rejected" for errors.
- In the `main()` function, call `yyparse()` to initiate parsing and prompt user input with "Enter a variable : ".
- During execution, the program scans input, applies grammar rules, and executes semantic actions.
- Handle errors by triggering the `error` rule and calling `yyerror()` to print "rejected" and exit.

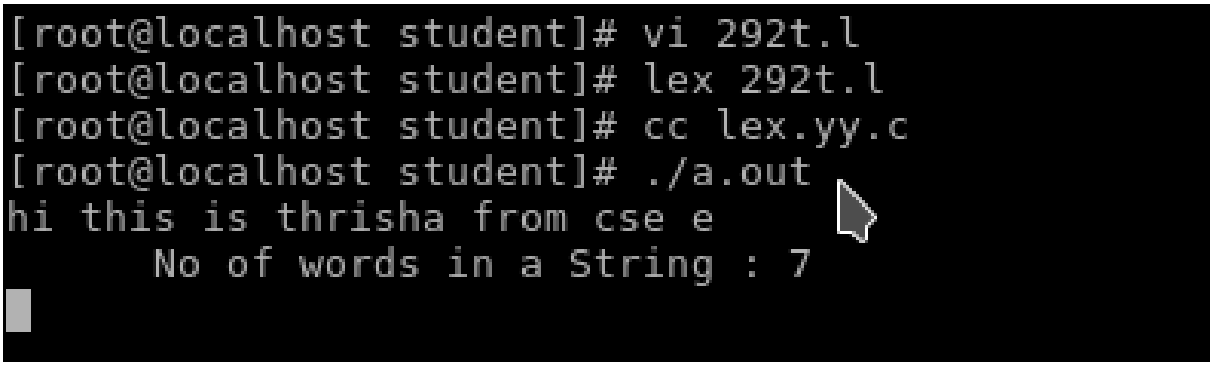
PROGRAM:

```
%{
#include<stdio.h>
#include<ctype.h>
#include<stdlib.h>
%}
%token let dig
%%
sad : let recld '\n' {printf("accepted\n"); exit(0);}
| let '\n' {printf("accepted\n"); exit(0);}
|
|error {yyerror("rejected\n");exit(0);}
;

recld : let recld
| dig recld
```

```
| let
| dig
;
%%
yylex(){
char ch;
while((ch=getchar())==' ');
if(isalpha(ch))
return let;
if(isdigit(ch))
return dig;
return ch;
}
yyerror(char *s){
printf("%s\n",s);
exit(0);
}
main(){
printf("Enter a variable : ");
yyparse();
}
```

OUTPUT:



RESULT:

Ex No: 3
Date:

DEVELOP A LEXICAL ANALYZER TO RECOGNIZE TOKENS USING LEX TOOL

AIM:

To implement the program to identify C keywords, identifiers, operators, end statements like [], {} using LEX tool.

ALGORITHM:

- Configure lexer options with `%option noyywrap`.
- Define regular expressions for tokens like `letter`, `digit`, and `id`.
- Initialize a counter variable `n` to track line count.
- Define rules to identify language constructs such as keywords, function names, identifiers, numbers, operators, and preprocessor directives.
- Increment the line count for each newline character encountered.
- In the `main()` function, open the file "sample.c", perform lexical analysis with `yylex()`, and print the total number of lines processed.
-

PROGRAM:

```
%option noyywrap
letter [a-zA-Z]
digit [0-9]
id [_|a-zA-Z]
AO [+|-|/|%|*]
RO  [<|>|<=|>=|==]
pp [#]
%{
int n=0;
%}

%%
"void"                          printf("%s return type\n",yytext);
{letter}*[(][)]                 printf("%s  Function\n",yytext);
"int"|"float"|"if"|"else"       printf("%s keywords\n",yytext);
"printf"                        printf("%s keywords\n",yytext);
{id}({id}|{digit})*             printf("%s Identifier\n",yytext);
{digit}{digit}*                 printf("%d Numbers\n",yytext);
```

```
{AO}                                    printf("%s Arithmetic
Operators\n",yytext);
{RO}                                    printf("%s Relational
Operators\n",yytext);
{pp}{letter}*[<]{letter}*[.]{letter}[>] printf("%s processor
                                                    Directive\n",yytext);
[\n]                                    n++;
"."|","|"}"|"{"|";"                     printf("%s others\n",yytext);
%%
int main()
{
        yyin=fopen("sample.c","r");
        yylex();
        printf("No of Lines %d\n",n);
}
```

OUTPUT:

```
[root@localhost student]# vi sample.c
[root@localhost student]# vi 292.l
[root@localhost student]# lex 292.l
[root@localhost student]# cc lex.yy.c
[root@localhost student]# ./a.out
#include<conio.h> processor Directive
void return type
 main() Function
{ others
int keywords
 a Identifier
, others
b Identifier
, others
c Identifier
; others
} others
No of Lines 5
[root@localhost student]#
```

RESULT:

Ex No: 4
Date:

DESIGN A DESK CALCULATOR USING LEX TOOL

AIM:

To create a calculator that performs addition, subtraction, multiplication and division using lex tool.

ALGORITHM:

● In the headers section declare the variables that is used in the program including header files if necessary.
● In the definitions section assign symbols to the function/computations we use along with REGEX expressions.
● In the rules section assign dig() function to the dig variable declared.
● In the definition section increment the values accordingly to the arithmetic functions respectively.
● In the user defined section convert the string into a number using atof() function.
● Define switch case for different computations.
● Define the main () and yywrap() function.

PROGRAM:

```
%{
int op = 0,i;
float a, b;
%}
dig [0-9]+|([0-9]*)"."([0-9]+)
add "+"
sub "-"
mul "*"
div "/"
pow "^"
ln \n
%%
{dig} {digi();}
{add} {op=1;}
{sub} {op=2;}
{mul} {op=3;}
{div} {op=4;}
{pow} {op=5;}
```

```
{ln} {printf("\n The Answer :%f\n\n",a);}
%%
digi()
{
if(op==0)
a=atof(yytext);
else
{
b=atof(yytext);
switch(op)
{
case 1:a=a+b;
break;
case 2:a=a-b;
break;
case 3:a=a*b;
break;
case 4:a=a/b;
break;
case 5:for(i=a;b>1;b--)
a=a*i;
break;
}
op=0;
}
}
main(int argv,char *argc[])
{
yylex();
}
yywrap()
{
return 1;
}
```

OUTPUT:

```
[student@localhost ~]$ su
Password:
[root@localhost student]# vi 210701292.l
[root@localhost student]# lex 210701292.l
[root@localhost student]# cc lex.yy.c
210701292.l: In function ‘yylex’:
210701292.l:14:2: warning: implicit declaration of function ‘digi’; did you mean ‘div’? [-Wimplicit-function-declaration]
 {dig} {digi();}
  ^~~~
  div
210701292.l: At top level:
210701292.l:23:1: warning: return type defaults to ‘int’ [-Wimplicit-int]
 {
 ^
210701292.l:54:1: warning: return type defaults to ‘int’ [-Wimplicit-int]
 {
 ^
210701292.l:59:1: warning: return type defaults to ‘int’ [-Wimplicit-int]
 {
 ^
[root@localhost student]# ./a.out
1+9

 The Answer :10.000000
```

RESULT:

Ex No: 5
Date:

RECOGNIZE AN ARITHMETIC EXPRESSION USING LEX AND YACC

AIM:

To check whether the arithmetic expression using lex and yacc tool.

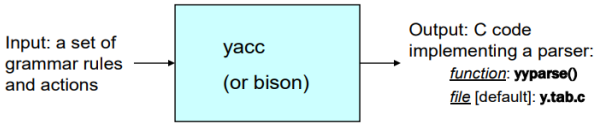
ALGORITHM:

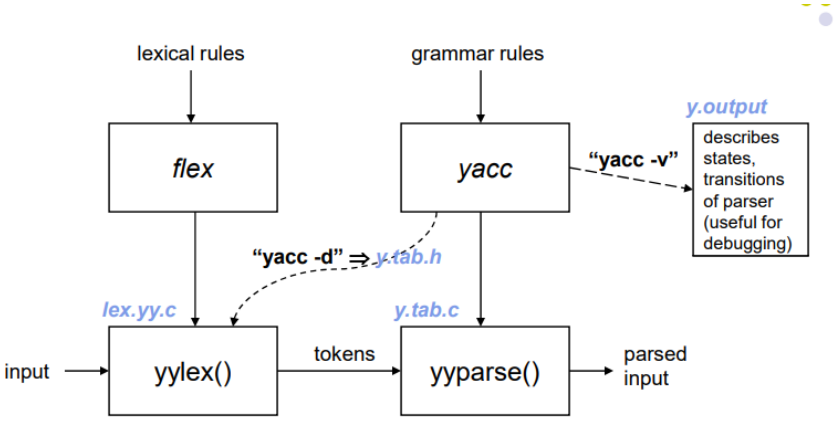
- Using the flex tool, create lex and yacc files.
- In the C include section define the header files required.
- In the rules section define the REGEX expressions along with proper definitions.
- In the user defined section define yywrap() function.
- Declare the yacc file inside it in the C definitions section declare the header files required along with an integer variable valid with value assigned as 1.
- In the Yacc declarations declare the format token num id op.
- In the grammar rules section if the starting string is followed by assigning operator or identifier or number or operator followed by a number or open parenthesis followed by an identifier. The x could be an operator followed by an identifier or operator or no operator then declare that as valid expressions by making the valid stay in 1 itself.
- In the user definition section if the valid is 0 print as Invalid expression in yyerror() and define the main function.

LEX AND YACC WORKING :

Parser generator:

- Takes a specification for a context-free grammar.
- Produces code for a parser.





PROGRAM:

validexp.l:

```
%{
#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;
}
```

validexp.y:

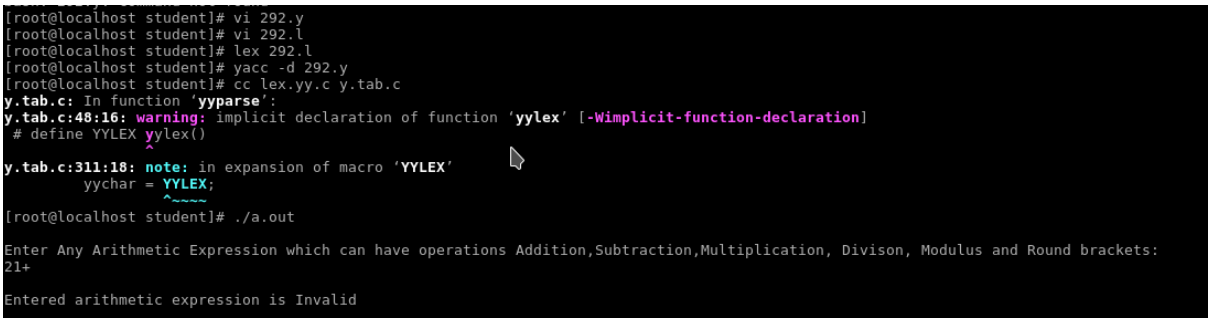
```
 %{
   #include<stdio.h>
%}
%token NUMBER
%token VARIABLE

%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:



RESULT:

Ex No: 6

Date:

RECOGNIZE A VALID VARIABLE WITH LETTERS AND DIGITS USING LEX AND YACC

AIM:

To recognize a valid variable which starts with a letter followed by any number of letters or digits.

ALGORITHM:

- Include necessary headers and declarations within `%{ %}` in the lexer file.
- Define rules to match identifiers (starting with a letter or underscore, followed by letters, digits, or underscores) and return token `letter`.
- Define a rule to match digits (single digit) and return token `digit`.
- Define a rule to match any other character and return it.
- Define a rule to match newline character and return 0 to indicate end of input.
- Implement `yywrap()` function to return 1, indicating end of input.
- In the parser file, include necessary headers and declarations within `%{ %}`.
- Define tokens `digit` and `letter`.
- Specify grammar rules for parsing identifiers recursively.
- Implement `yyerror()` function to handle parsing errors, setting `valid` flag to 0.
- In `main()` function, prompt the user to enter a name to test for an identifier.
- Call `yyparse()` to initiate parsing.
- If `valid` flag is set, print "It is an identifier", else print "It is not an identifier".

PROGRAM:

variable.l:

```
%{
   #include "y.tab.h"
%}
%%
[a-zA-Z_][a-zA-Z_0-9]* return letter;
[0-9]                  return digit;
.                    return yytext[0];
\n                    return 0;
```

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

variable.y:

```
%{
   #include<stdio.h>
   int valid=1;
%}
%token digit letter
%%
start : letter s
s :     letter s
      | digit s
      |
      ;
%%
int yyerror()
{
   printf("\nIts not an identifier!\n");
   valid=0;
   return 0;
}
int main() {
   printf("\nEnter a name to test for an identifier: ");
   yyparse();
   if(valid) {
      printf("\nIt is an identifier!\n");
   } }
```

OUTPUT:

```
[student@localhost ~]$ su
Password:
[root@localhost student]# vi 292thrisha.y
[root@localhost student]# yacc -d 292thrisha.y
[root@localhost student]# cc y.tab.c
292thrisha.y:20:1: warning: return type defaults to ‘int’ [-Wimplicit-int]
 yylex(){
 ^~~~~
292thrisha.y:29:1: warning: return type defaults to ‘int’ [-Wimplicit-int]
 yyerror(char *s){
 ^~~~~~
292thrisha.y:33:1: warning: return type defaults to ‘int’ [-Wimplicit-int]
 main(){
 ^~~~
[root@localhost student]# ./a.out
Enter a variable : v
accepted
[root@localhost student]#
```

RESULT:

Ex No: 7

Date:

EVALUATE EXPRESSION THAT TAKES DIGITS, *, + USING LEX AND YACC

AIM:

To perform arithmetic operations that takes digits,*, + using lex and yacc.

ALGORITHM:

- Using the flex tool, create lex and yacc files.
- In the definition section of the lex file, declare the required header files along with an external integer variable yylval.
- In the rule section, if the regex pertains to digit convert it into integer and store yylval. Return the number.
- In the user definition section, define the function yywrap()
- In the definition section of the yacc file, declare the required header files along with the flag variables set to zero. Then define a token as number along with left as '+' , '-'

, 'or' , '*' , '/' , '%' or '(' ')'

- In the rules section, create an arithmetic expression as E. Print the result and return zero.
- Define the following:
  - E: E '+' E (add)
  - E: E '-' E (sub)
  - E: E '*' E (mul)
  - E: E '/' E (div)

  If it is a single number, return the number.
- In driver code, get the input through yyparse(); which is also called as main function.
- Declare yyerror() to handle invalid expressions and exceptions.
- Build lex and yacc files and compile.

PROGRAM:

evaluate.l:

```
%{
#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;
}
```

evaluate.y:

```
%{
        #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 which can have operations
Addition,        Subtraction, Multiplication, Divison, Modulus and Round
brackets:\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:

```
[user@localhost ~]$ vi 292.l
[user@localhost ~]$ vi 292.y
[user@localhost ~]$ lex 292.l
[user@localhost ~]$ yacc -d 292.y
[user@localhost ~]$ cc lex.yy.c y.tab.h
[user@localhost ~]$ ./a.out

Enter Any Arithmetic Expression which can have operations Addition, Subtraction,
Multiplication, Division, Modulus and Round brackets:
5 + (3 * 2)

Result=11
Entered arithmetic expression is Valid
[user@localhost ~]$
```

RESULT :

Ex No: 8
Date:

GENERATE THREE ADDRESS CODES

AIM:

To generate three address code using C program.

ALGORITHM:

- Get address code sequence.
- Determine current location of 3 using address (for 1st operand).
- If the current location does not already exist, generate move (B, O).
- Update address of A (for 2nd operand).
- If the current value of B and () is null, exist.
- If they generate operator () A, 3 ADPR.
- Store the move instruction in memory.

PROGRAM:

```
#include<stdio.h>
#include<string.h>
#include<ctype.h>
 typedef struct
{
char var[10]; int alive;
}
regist;
regist preg[10];
void substring(char exp[],int st,int end)
{
int i,j=0;
char dup[10]="";
for(i=st;i<end;i++)
dup[j++]=exp[i];
dup[j]='0';

strcpy(exp,dup);
}
```

```
int getregister(char var[])
{
int i; for(i=0;i<10;i++)
{
if(preg[i].alive==0)
{
strcpy(preg[i].var,var);
break;
}
}
return(i);
}
void getvar(char exp[],char v[])
{
int i,j=0;
char var[10]="";
for(i=0;exp[i]!='\0';i++)
if(isalpha(exp[i]))
var[j++]=exp[i];
else
break;
strcpy(v,var);
}
void main()
{
char basic[10][10],var[10][10],fstr[10],op;
int i,j,k,reg,vc,flag=0;
printf("\nEnter the Three Address Code:\n");

for(i=0;;i++)
{
gets(basic[i]);
if(strcmp(basic[i],"exit")==0)
break;
}
```

```
printf("\nThe Equivalent Assembly Code is:\n");
for(j=0;j<i;j++)
{
getvar(basic[j],var[vc++]);
strcpy(fstr,var[vc-1]);
substring(basic[j],strlen(var[vc-1])+1,strlen(basic[j]));
getvar(basic[j],var[vc++]);
reg=getregister(var[vc-1]);
if(preg[reg].alive==0)
{
printf("\nMov R%d,%s",reg,var[vc-1]);
preg[reg].alive=1;
}
op=basic[j][strlen(var[vc-1])];
substring(basic[j],strlen(var[vc-1])+1,strlen(basic[j]));
getvar(basic[j],var[vc++]);
switch(op)
{
case '+':
printf("\nAdd");
break; case '-':
printf("\nSub");
break;
case '*':
printf("\nMul");
break;
case '/':
printf("\nDiv");
break;
}
flag=1;
for(k=0;k<=reg;k++)
{
if(strcmp(preg[k].var,var[vc-1])==0)
{
printf("R%d, R%d",k,reg);
```

```
preg[k].alive=0;
flag=0;
break;
}
}
if(flag)
{
printf(" %s,R%d",var[vc-1],reg);
printf("\nMov %s,R%d",fstr,reg);
}
strcpy(preg[reg].var,var[vc-3]);
}
}
```

OUTPUT:

```
210701292
Enter the Three Address Code:
a = b + c
exit

The Equivalent Assembly Code is:
Mov R0,b
Mov R1,c
Add R0, R1
Mov a,R0
```

RESULT:

Ex No:9

Date:

IMPLEMENT CODE OPTIMIZATION TECHNIQUES CONSTANT FOLDING

AIM:

To write a C program to implement Constant Folding (Code optimization Technique).

ALGORITHM:

- The desired header files are declared.
- The two file pointers are initialized one for reading the C program from the file and one for writing the converted program with constant folding.
- The file is read and checked if there are any digits or operands present.
- If there is, then the evaluations are to be computed in switch case and stored.
- Copy the stored data to another file.
- Print the copied data file.

PROGRAM:

```
#include<stdio.h>
#include<string.h>
void main() {
        char s[20];
        char flag[20]="//Constant";
        char result,equal,operator;
        double op1,op2,interrslt;
        int a,flag2=0;
        FILE *fp1,*fp2;

        fp1 = fopen("input.txt","r");
        fp2 = fopen("output.txt","w");

        fscanf(fp1,"%s",s);
        while(!feof(fp1)) {
                if(strcmp(s,flag)==0) {
                        flag2 = 1;
                }
                if(flag2==1) {
```

```
                fscanf(fp1,"%s",s);
                result=s[0];
                equal=s[1];
                if(isdigit(s[2])&& isdigit(s[4])) {
                        if(s[3]=='+'||'-'||'*'||'/') {
                                operator=s[3];
                                switch(operator) {
                                        case '+':
                                                interrslt=(s[2]-48)+(s[4]-48);
                                                break;
                                        case '-':
                                                interrslt=(s[2]-48)-(s[4]-48);
                                                break;
                                        case '*':
                                                interrslt=(s[2]-48)*(s[4]-48);
                                                break;
                                        case '/':
                                                interrslt=(s[2]-48)/(s[4]-48);
                                                break;
                                        default:
                                                interrslt = 0;
                                                break;
                                }
                                fprintf(fp2,"/*Constant Folding*/\n");
                                fprintf(fp2,"%c = %lf\n",result,interrslt);
                                flag2 = 0;
                        }
                } else {
                        fprintf(fp2,"Not Optimized\n");
                        fprintf(fp2,"%s\n",s);
                }
        } else {
                fprintf(fp2,"%s\n",s);
        }
        fscanf(fp1,"%s",s);
    }
    fclose(fp1);
    fclose(fp2);
}
```

OUTPUT:

```
a = 5 + 3
//Constant
b = 7 * 2
c = 6 - 4
//Constant
d = 8 / 4
e = 9 + a
```

```
21070292
a = 8
/*Constant Folding*/
b = 14
/*Constant Folding*/
c = 2
/*Constant Folding*/
d = 2
Not Optimized
e = 9 + a
```

RESULT:

Ex No: 10

Date:

IMPLEMENT CODE OPTIMIZATION TECHNIQUES DEAD CODE AND COMMON SUB EXPRESSION ELIMINATION

AIM:

To write a C program to implement the dead code elimination and common sub expression elimination (code optimization) techniques.

ALGORITHM:

- Start
- Create the input file which contains three address code.
- Open the file in read mode.
- If the file pointer returns NULL, exit the program else go to 5.
- Scan the input symbol from left to right.
- Store the first expression in a string.
- Compare the string with the other expressions in the file.
- If there is a match, remove the expression from the input file.
- Perform these steps 5-8 for all the input symbols in the file.
- Scan the input symbol from the file from left to right.
- Get the operand before the operator from the three address code.
- Check whether the operand is used in any other expression in the three address codes.
- If the operand is not used, then eliminate the complete expression from the three-address code else go to 14.
- Perform steps 11 to 13 for all the operands in the three address code till the end of the file is reached.
- Stop.

PROGRAM:

```
#include<stdio.h>

#include<conio.h>

#include<string.h>

 struct op
{
   char l;
   char r[20];
```

```
 }
op[10], pr[10];

void main()
{
  int a, i, k, j, n, z = 0, m, q;
  char * p, * l;
  char temp, t;
  char * tem;
  clrscr();
  printf("enter no of values");
  scanf("%d", & n);
  for (i = 0; i < n; i++)
{
    printf("\tleft\t");
    op[i].l = getche();
    printf("\tright:\t");
    scanf("%s", op[i].r);
  }
  printf("intermediate Code\n");
  for (i = 0; i < n; i++)
{
    printf("%c=", op[i].l);
    printf("%s\n", op[i].r);
  }
  for (i = 0; i < n - 1; i++)
{
    temp = op[i].l;
    for (j = 0; j < n; j++)
{
      p = strchr(op[j].r, temp);
      if (p)
{
        pr[z].l = op[i].l;
        strcpy(pr[z].r, op[i].r);
        z++;

      }
    }
  }
  pr[z].l = op[n - 1].l;
  strcpy(pr[z].r, op[n - 1].r);
  z++;
```

```
 printf("\nafter dead code elimination\n");
 for (k = 0; k < z; k++)
{
  printf("%c\t=", pr[k].l);
  printf("%s\n", pr[k].r);
 }

 //sub expression elimination
 for (m = 0; m < z; m++)
{
  tem = pr[m].r;
  for (j = m + 1; j < z; j++)
{
    p = strstr(tem, pr[j].r);
    if (p)
{
      t = pr[j].l;
      pr[j].l = pr[m].l;
      for (i = 0; i < z; i++)
{
        l = strchr(pr[i].r, t);
        if (l) {
          a = l - pr[i].r;
          //printf("pos: %d",a);
          pr[i].r[a] = pr[m].l;
        }
      }
    }
  }
 }
 printf("eliminate common expression\n");
 for (i = 0; i < z; i++) {
  printf("%c\t=", pr[i].l);
  printf("%s\n", pr[i].r);
 }
 // duplicate production elimination
 for (i = 0; i < z; i++)
{
  for (j = i + 1; j < z; j++)
{
    q = strcmp(pr[i].r, pr[j].r);
    if ((pr[i].l == pr[j].l) && !q)
```

```
    {
      pr[i].l = '\0';
      strcpy(pr[i].r, '\0');
    }
   }
  }
  printf("optimized code");
  for (i = 0; i < z; i++) {
   if (pr[i].l != '\0') {
     printf("%c=", pr[i].l);
     printf("%s\n", pr[i].r);
   }    }   getch();
}
```

OUTPUT:

```
enter no of values    // Assuming the user inputs 5 here
        left    a
        right:  9
        left    b
        right:  c+d
        left    e
        right:  c+d
        left    f
        right:  b+e
        left    r
        right:  f
intermediate Code
a=9
b=c+d
e=c+d
f=b+e
r=f

after dead code elimination
b       =c+d
e       =c+d
f       =b+e
r       =f
eliminate common expression
b       =c+d
b       =c+d
f       =b+b
r       =f
optimized code
b=c+d
f=b+b
r=f
```

RESULT:

INDEX