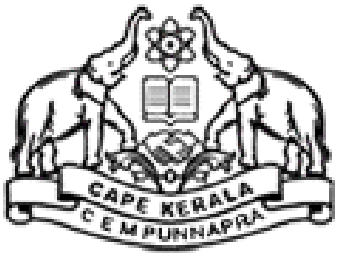
COLLEGE OF ENGINEERING & MANAGEMENT PUNNAPRA

Under Co-operative Academy of Professional Education
Estd. by Govt. of Kerala
VADACKAL(PO), ALAPPUZHA - 688003



LABORATORY RECORD

BTech Computer Science & Engineering

CS 431 Compiler Design Lab

Year 2020-2021

Name : VISHNU SURESH

Semester :S7 Branch :CSE

Roll No :22 KTU ID : PRP17CS026

October 28, 2021

Department of Computer Science & Engineering

COLLEGE OF ENGINEERING & MANAGEMENT PUNNAPRA

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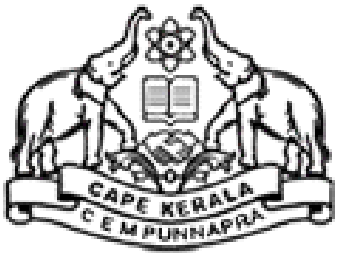
CERTIFICATE



This is to certify that it is a bonafied record of practical work done by Sri/Kum.VISHNU SURESH bearing the KTU ID: PRP17CS026 of 7^{th} Semester B Tech Computer Science & Engineering in the CS 431 Compiler Design laboratory during the academic year 2020-2021 under our supervision.

Staff-in-Charge

Head of Department

Date:

Contents

Program No:1
Date :29/09/2020

1. Lexical Analyzer

Aim

Design and implement lexical analyser for a given language using C and the lexical analyser should ignore redundant spaces, tabs and new lines

Algorithm

```
input: read a c program
output:print wheather the lexemes are digit,keyword,
   identifier,special operators
step1: start the program
step2: declare all the file pointers and variables
step3: read the input program and store it in the file f
step4: seperate each stream
step5: check whether the string is digit,keyword,identifier
    or special symbols
step6: print the numbers,keywords,identifiers and special
   symbols of the input programs
```

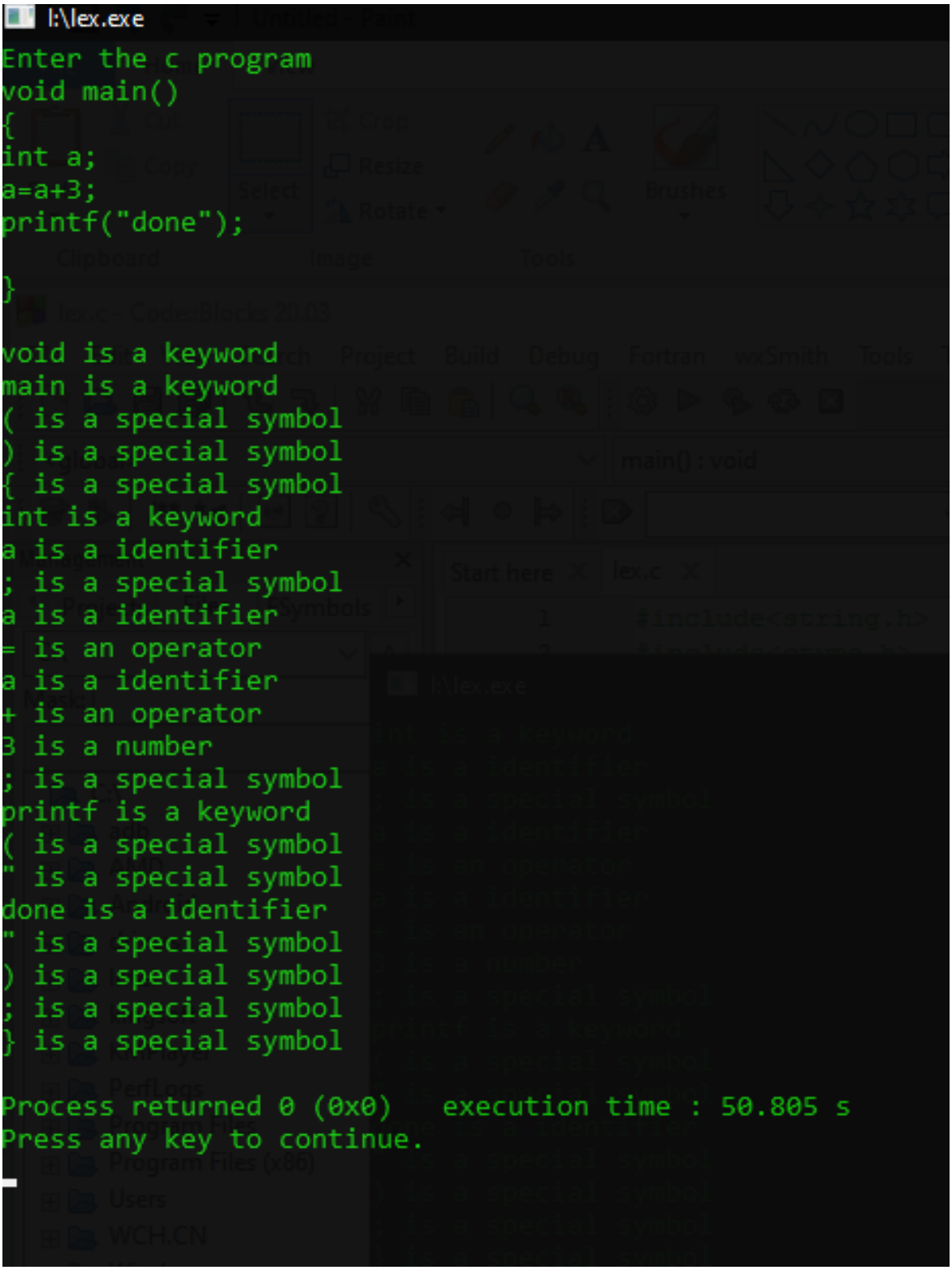
Program

```
#include<string.h>
#include<ctype.h>
#include<stdio.h>
void main()
{
   FILE *f;
   char c,str[10];
   int t=1,n=0,i=0;
   printf("Enter the c program \n");
   f=fopen("input.txt","w");
   while((c=getchar())!=EOF)
   {
      putc(c,f);
   }
   fclose(f);
```

```
f=fopen("input.txt","r");
while((c=getc(f))!=EOF)
{
   if(isdigit(c))
   {
       n=c-48;
       c=getc(f);
       while(isdigit(c))
       {
          n=n*10+(c-48);
          c=getc(f);
       }
       printf("\n%d is a number ",n);
       ungetc(c,f);
   }
   else if(isalpha(c))
   {
       str[i++]=c;
       c=getc(f);
       while(isdigit(c)||isalpha(c)||c=='_'||c=='$')
       {
           str[i++]=c;
           c=getc(f);

       }
       str[i++]='\0';
       if(strcmp("printf",str)==0||strcmp("main",str)
          ==0||strcmp("void",str)==0||strcmp("auto",str)
          ==0||strcmp("break",str)==0||strcmp("case",str)
          ==0||strcmp("char",str)==0||strcmp("const",str)
          ==0||strcmp("continue",str)==0||strcmp("default
          ",str)==0||strcmp("do",str)==0||strcmp("double
          ",str)==0||strcmp("else",str)==0||strcmp("enum
          ",str)==0||strcmp("extern",str)==0||strcmp("
          float",str)==0||strcmp("for",str)==0||strcmp("
          goto",str)==0||strcmp("if",str)==0||strcmp("int
          ",str)==0||strcmp("long",str)==0||strcmp("
          register",str)==0||strcmp("return",str)==0||
          strcmp("short",str)==0||strcmp("signed",str)
```

```
            ==0||strcmp("sizeof",str)==0||strcmp("static",
            str)==0||strcmp("struct",str)==0||strcmp("
            switch",str)==0||strcmp("typedef",str)==0||
            strcmp("union",str)==0||strcmp("unsigned",str)
            ==0||strcmp("void",str)==0||strcmp("volatile",
            str)==0||strcmp("while",str)==0)
           {

              printf("\n%s is a keyword",str);
         }

         else
         {
             printf("\n%s is a identifier",str);
         }
         ungetc(c,f);
         i=0;
     }

     else if(c==' '||c=='\t'||c=='\n')
     {
         t=1;
     }
    else if(c=='+'||c=='-'||c=='*'||c=='/'||c=='='||c
      =='=='||c=='!='||c=='>'||c=='>='||c=='<'||c=='<=')
    {
             printf("\n%c is an operator",c);
    }
     else
     {
         printf("\n%c is a special symbol",c);
     }
  }
  printf("\n");
  fclose(f);
}
```

Output



Result

Program is executed and output is obtained

Program No:2
Date :05/10/2020

2. ϵ – closure of an NFA

Aim

Write program to find ϵ – closure of all states of any given NFA with ϵ transition should ignore redundant spaces, tabs and new lines

Algorithm

```
Input : Transition's and states of an NFA
Output : Epsilon closure of the given NFA
step1: Start the program
step2: Declare all the file pointers and variables
step3: Fetch the input transition from input.dat and states
step4: Check the transition and states , store them in an
   array
step5: If input state and given transitions match goto step
    5.1 else step6
          step 5.1 : check Epsilon transitions for the
             state , if found
          store in in an array read next
step6: Check the next state until no states left , if next
   state found go to step5 else 7
step 7 : Print the Epsilon closure of the given transitions
    from the array
step 8 : End
```

Program

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

char result[20][20],copy[10],states[20][20];

void add_state(char a[10],int i){
       strcpy(result[i],a);
}
```

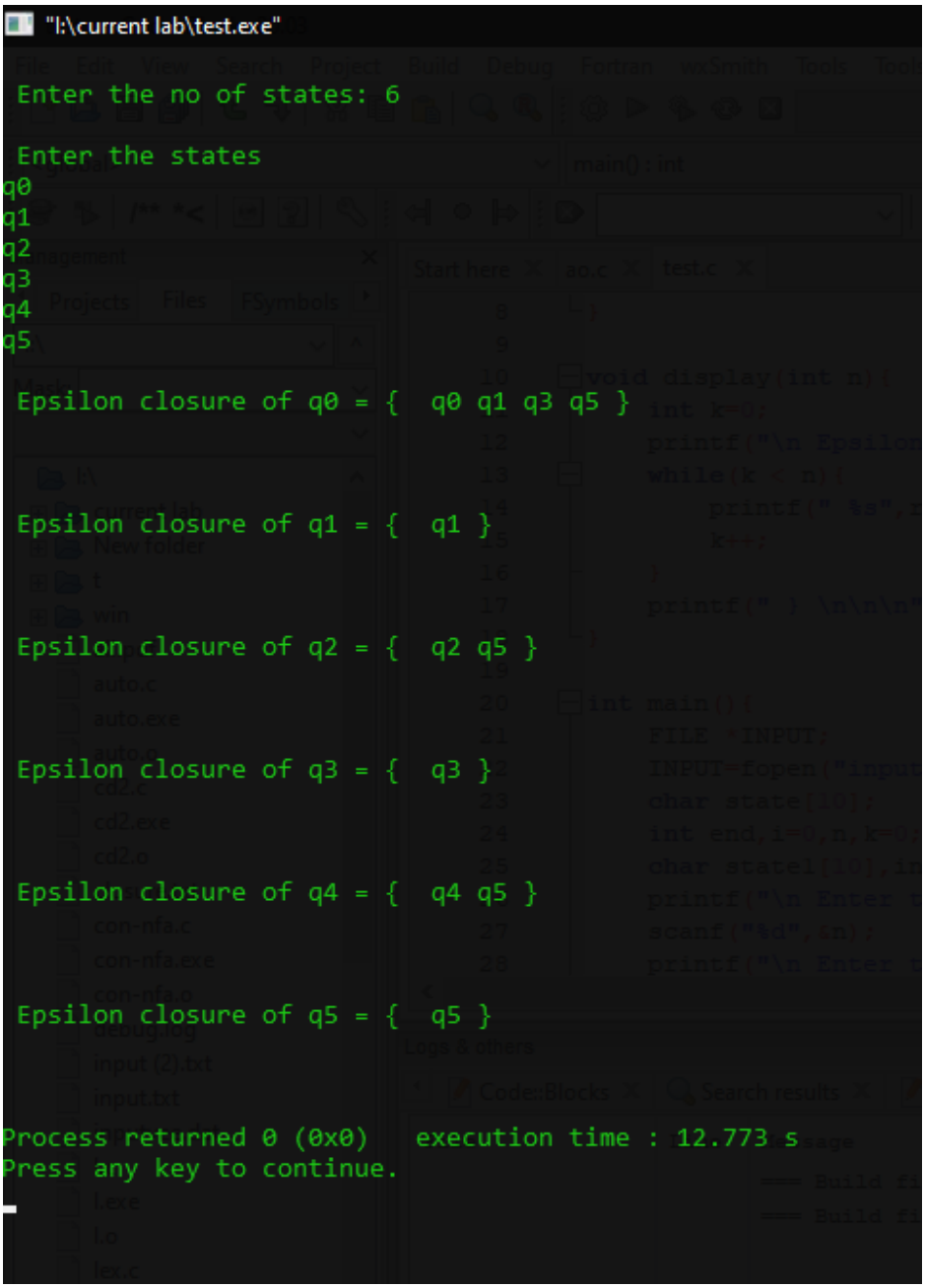
```
void display(int n){
        int k=0;
        printf("\n Epsilon closure of %s = { ",copy);
        while(k < n){
                printf(" %s",result[k]);
                k++;
        }
        printf(" } \n\n\n");
}

int main(){
    FILE *INPUT;
    INPUT=fopen("input.dat","r");
    char state[10];
    int end,i=0,n,k=0;
    char state1[10],input[10],state2[10];
    printf("\n Enter the no of states: ");
    scanf("%d",&n);
    printf("\n Enter the states \n");
    for(k=0;k<n;k++){
                scanf("%s",states[k]);

        }

        for( k=0;k<n;k++){
                i=0;
                strcpy(state,states[k]);
                strcpy(copy,state);
                add_state(state,i++);
                while(1){
                        end = fscanf(INPUT,"%s%s%s",state1,
                           input,state2);
                        if (end == EOF ){
                                break;
                        }

                        if( strcmp(state,state1) == 0 ){
                                if( strcmp(input,"e") == 0 ) {
```

```
                                        add_state(state2,i++);

                                }
                        }

                }
                display(i);
                rewind(INPUT);
        }

    return 0;
}
```

input.dat

```
q0 e q1
q0 e q3
q0 e q5
q1 a q2
q2 e q5
q3 b q4
q4 e q5
```

Output



Result

Program is executed and output is obtained

Program No:4
Date :20/10/2020

3. Operator Precedence Parser

Aim

Develop an operator precedence parser for a given language

Algorithm

```
Input : An expression
Output : Whether the given expression is accepted or not
step1 : Start
Step2 : Allocate the needed variables and stack
step3 : Scan the precedence parsing table which is defined
   in our program , Record the grammar symbols according to
    their possibility.
step4 : Read the expression and add $ to the end
step5 : do steps until string is completely processed
step6 : Now scan the input string from left right until the
    > is encountered
step7 : Scan towards left over all the equal precedence
   until the first left most < is encountered
step8 : Make sure that everything between left most < and
   right most > is a handle , else go to step5
step9 : End of do
step10 : $ element $ means parsing is successful, print "
   Accepted" else print "Not Accepted"
step11 : End
```

Program

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

char *input;
int i=0;
char lasthandle[6],stack[50],handles[][5]={")E(","E*E","E+E
   ","i","E^E"};
```

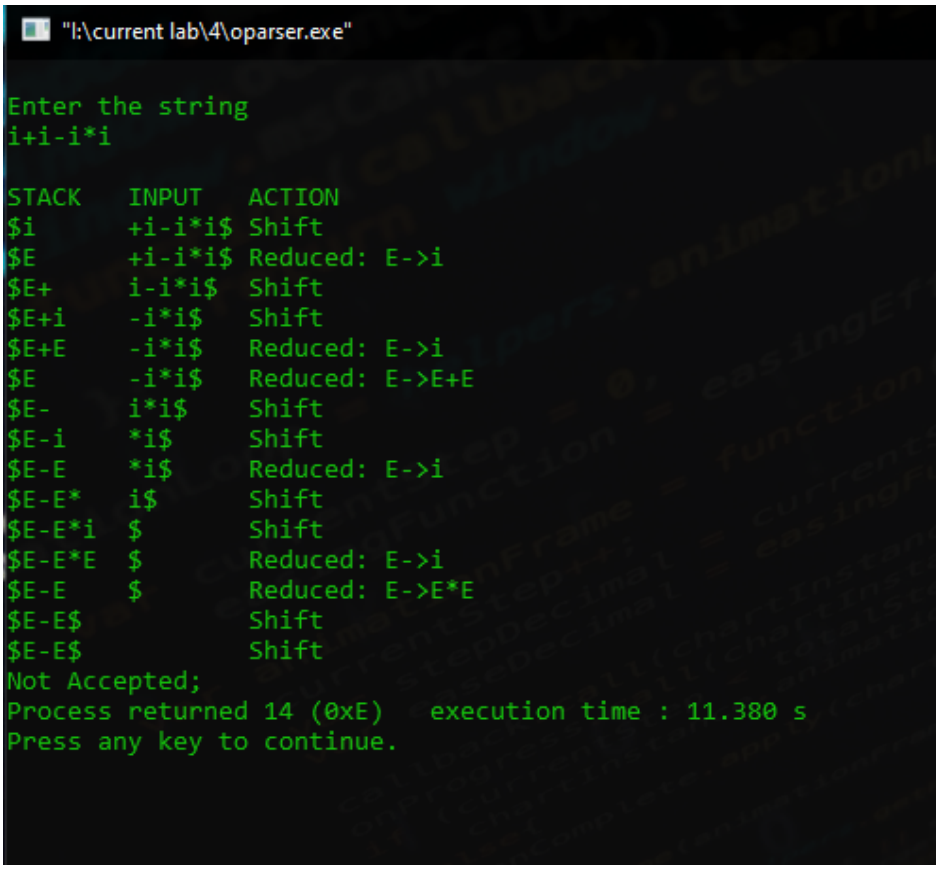
```
int top=0,l;
char prec[9][9]={
           // Parsing table defanition
            /*stack + - * / ^ i ( ) $ */

           /* + */ '>', '>','<','<','<','<','<','>','>',

           /* - */ '>', '>','<','<','<','<','<','>','>',

           /* * */ '>', '>','>','>','<','<','<','>','>',

           /* / */ '>', '>','>','>','<','<','<','>','>',

           /* ^ */ '>', '>','>','>','<','<','<','>','>',

           /* i */ '>', '>','>','>','>','e','e','>','>',

           /* ( */ '<', '<','<','<','<','<','<','>','e',

           /* ) */ '>', '>','>','>','>','e','e','>','>',

           /* $ */ '<', '<','<','<','<','<','<','<','>',

               };
int getindex(char c)
{
switch(c)
    {
    case '+':return 0;
    case '-':return 1;
    case '*':return 2;
    case '/':return 3;
    case '^':return 4;
    case 'i':return 5;
    case '(':return 6;
    case ')':return 7;
    case '$':return 8;
    }
```

```
}


int shift()
{
stack[++top]=*(input+i++);
stack[top+1]='\0';
}


int reduce()
{
int i,len,found,t;
for(i=0;i<5;i++)
    {
    len=strlen(handles[i]);
    if(stack[top]==handles[i][0]&&top+1>=len)
        {
        found=1;
        for(t=0;t<len;t++)
            {
            if(stack[top-t]!=handles[i][t])
                {
                found=0;
                break;
                }
            }
        if(found==1)
            {
            stack[top-t+1]='E';
            top=top-t+1;
            strcpy(lasthandle,handles[i]);
            stack[top+1]='\0';
            return 1;
            }
        }
   }
return 0;
}
```

```
void dispstack()
{
int j;
for(j=0;j<=top;j++)
    printf("%c",stack[j]);
}



void dispinput()
{
int j;
for(j=i;j<l;j++)
    printf("%c",*(input+j));
}



void main()
{
int j;

input=(char*)malloc(50*sizeof(char));
printf("\nEnter the string\n");
scanf("%s",input);
input=strcat(input,"$");
l=strlen(input);
strcpy(stack,"$");
printf("\nSTACK\tINPUT\tACTION");
while(i<=l)
       {
       shift();
       printf("\n");
       dispstack();
       printf("\t");
       dispinput();
```

```
        printf("\tShift");
        if(prec[getindex(stack[top])][getindex(input[i])
           ]=='>')
                {
                while(reduce())
                        {
                        printf("\n");
                        dispstack();
                        printf("\t");
                        dispinput();
                        printf("\tReduced: E->%s",lasthandle)
                           ;
                        }
                }
        }

if(strcmp(stack,"$E$")==0)
    printf("\nAccepted;");
else
    printf("\nNot Accepted;");
}

\begin{lstlisting}
```

Output



Result

Program is executed and output is obtained

Program No:6
Date :17/11/2020

4. Recursive Descent parser

Aim

Construct Recursive Descent parser for an expression

Algorithm

```
Input: Expression to be evaluated
Output: Expression in accepted or rejected


Main function


Step1: Set all required variables
Step2: Read the input expression
Step3: Call function E and return value here
Step4: If the expression is fully processed and flag value
   is 0 go to step5 else goto step6
Step5:Print Expression is accepted goto step 7
Step6: Print Expression is rejected
Step7: End


Function E


Step1: Call function T and return value here
Step2: Call function Tdash and return value here
Step3: Return value to the caller
Step4: End


Function Edash
```

```
Step1: If current input value pointed by the pointer is +
   then goto step2 else goto step5
Step2: Increment the pointing value
Step3: Call function T
Step4: Call function Edash
Step5: Return value to the caller
Step6: End


Function T


Step1: Call function F
Step2: Call function Tdash
Step3: Return value to the caller
Step4: End


Function Tdash


Step1: If current input value pointed by the pointer is *
   then goto step2 else goto step5
Step2: Increment the pointing value
Step3: Call function F
Step4: Call function Tdash
Step5: Return value to the caller
Step6: End


Function F


Step1: If current input value pointed by the pointer is a
   then goto step2 else goto step 8
Step2: Increment the pointing value goto step
Step3: If current input value pointed by the pointer is (
   then goto step4 else goto step 8
Step4: Increment the pointing value call Function E
```

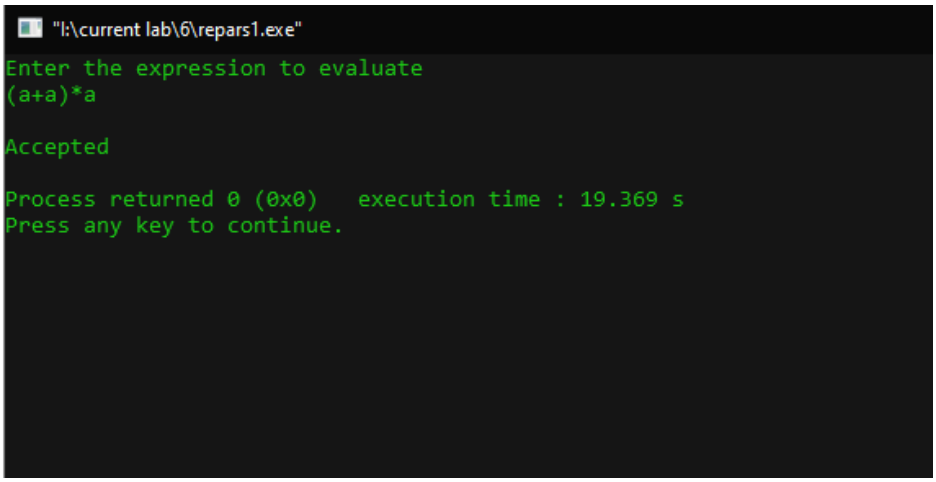
Step5: If current input value pointed by the pointer is)
then goto step4 else goto step7
Step6: Increment the pointing value
Step7: Set flag as 1
Step8: Set flag as1
Step9: End

Program

```
#include<stdio.h>
#include<string.h>
#include<ctype.h>
char input[10];
int i,flag;
void E();
void T();
void Edash();
void Tdash();
void F();
main()
{
 i=0;
 flag=0;
 printf("Enter the expression to evaluate \n");
 gets(input);
 E();
 if(strlen(input)==i&&flag==0)
    printf("\nAccepted\n");
 else
    printf("\nRejected\n");
}
void E()
{
     T();
     Edash();
}
void Edash()
{
     if(input[i]=='+')
     {
```

```
      i++;
      T();
      Edash();
    }
}
void T()
{
    F();
    Tdash();
}
void Tdash()
{
    if(input[i]=='*')
    {
       i++;
       F();
       Tdash();
    }
}
void F()
{
  if(input[i]=='a')
    i++;
  else if(input[i]=='(')
   {
    i++;
    E();
    if(input[i]==')')
      i++;
    else flag=1;
   }
  else
    flag=1;
}
```

Output



Result

Program is executed and output is obtained

Program No:7
Date :15/12/2020

5. Shift Reduce Parser

Aim

Construct a shift reduce parser for a given language

Algorithm

```
Algorithm:Shift Reduce Parser
Input: Read an arithmetic expression.
Output: Print whether the expression is accepted or not.
Step1: Start the program.
Step2: Declare all the variables,input buffer,stack.
Step3: Read the expression and store it in an input buffer.
Step4: Move symbols from input buffer to stack one at a
   time.
Step5: If stack contain symbols matching production rules
   then reduce.
Step6: Print the Stack,Input Buffer,Action at each step.
Step7: Continue steps 4-6 until input buffer is empty.
Step8: Check if stack contain E at last.
Step9: If so print Accepted else Not Accepted.
Step10: Stop.
```

Program

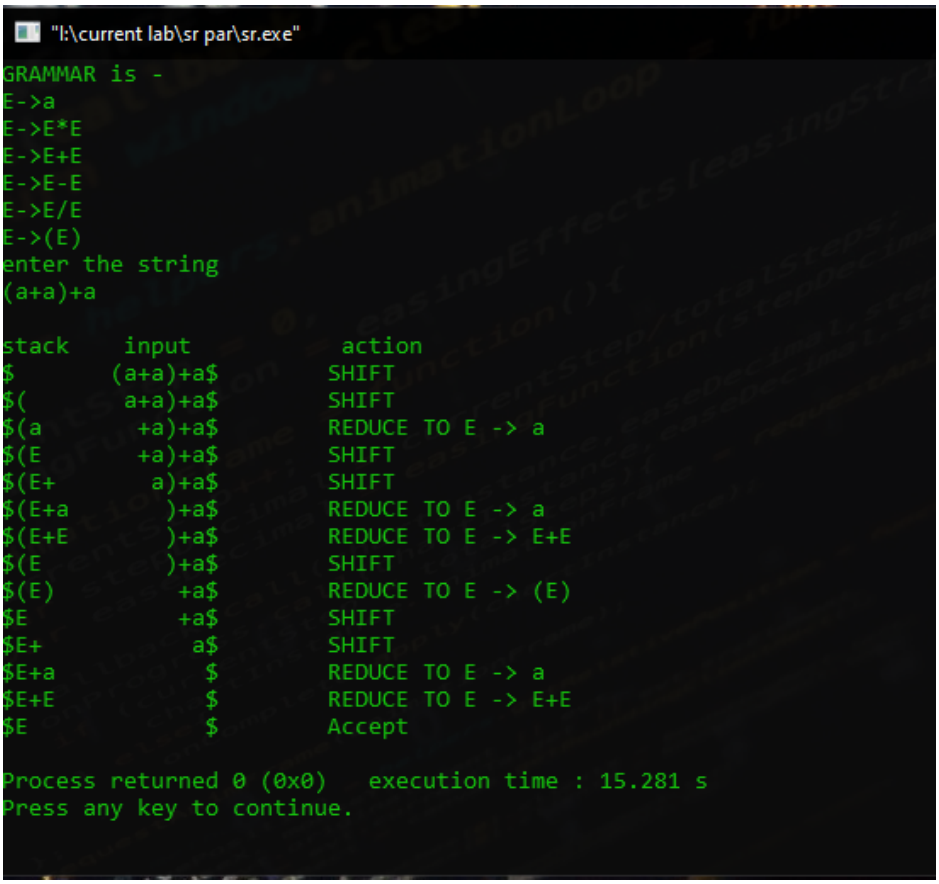
```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
int z = 0, i = 0, j = 0, c = 0;
char a[16], h1[20], stack[15], h2[10];
void check()
{
    strcpy(h1,"REDUCE TO E -> ");
    for(z=0;z<c;z++)
    {
        if(stack[z] == 'a')
```

```
    {
        printf("%sa", h1);
        stack[z] = 'E';
        stack[z + 1] = '\0';
        printf("\n$%s\t%s$\t", stack, a);
    }
}
for(z=0;z<c;z++)
{
    if(stack[z] == '(' && stack[z + 1] == 'E' && stack[
       z + 2] == ')')
    {
        printf("%s(E)", h1);
        stack[z]='E';
        stack[z + 1]='\0';
        stack[z + 1]='\0';
        printf("\n$%s\t%s$\t", stack, a);
        i = i - 2;
    }
}
for(z=0;z<c;z++)
{
    if(stack[z] == 'E' && stack[z + 1] == '*' && stack[
       z + 2] == 'E')
    {
        printf("%sE*E", h1);
        stack[z] = 'E';
        stack[z + 1] = '\0';
        stack[z + 2] = '\0';
        printf("\n$%s\t%s$\t", stack, a);
        i = i - 2;
    }

}

for(z=0;z<c;z++)
{
    if(stack[z] == 'E' && stack[z + 1] == '+' && stack[
       z + 2] == 'E')
```

```
        {
            printf("%sE+E", h1);
            stack[z]='E';
            stack[z + 1]='\0';
            stack[z + 1]='\0';
            printf("\n$%s\t%s$\t", stack, a);
            i = i - 2;
        }
    }
    for(z=0;z<c;z++)
    {
        if(stack[z] == 'E' && stack[z + 1] == '-' && stack[
           z + 2] == 'E')
        {
            printf("%sE-E", h1);
            stack[z]='E';
            stack[z + 1]='\0';
            stack[z + 1]='\0';
            printf("\n$%s\t%s$\t", stack, a);
            i = i - 2;
        }
    }
    for(z=0;z<c;z++)
    {
        if(stack[z] == 'E' && stack[z + 1] == '/' && stack[
           z + 2] == 'E')
        {
            printf("%sE/E", h1);
            stack[z]='E';
            stack[z + 1]='\0';
            stack[z + 1]='\0';
            printf("\n$%s\t%s$\t", stack, a);
            i = i - 2;
        }
    }

    return ;
}
int main()
```

```
{
    printf("GRAMMAR is -\nE->a \nE->E*E \nE->E+E \nE->E-E \
       nE->E/E \nE->(E)\n");
    printf("enter the string\n");
    gets(a);
    c=strlen(a);
    strcpy(h2,"SHIFT");
    printf("\nstack \t input \t\t action");
    printf("\n$\t%s$\t", a);
    for(i = 0; j < c; i++,j++)
    {
        printf("%s", h2);
        stack[i] = a[j];
        stack[i + 1] = '\0';
        a[j]=' ';
        printf("\n$%s\t%s$\t", stack, a);
        check();

    }
    if(stack[0] == 'E' && stack[1] == '\0')
        printf("Accept\n");
    else
        printf("Reject\n");
}
```

Output



Result

Program is executed and output is obtained

Program No:9
Date :24/11/2020

6. Constant Propagation

Aim

Write a program to perform constant propagation.

Algorithm

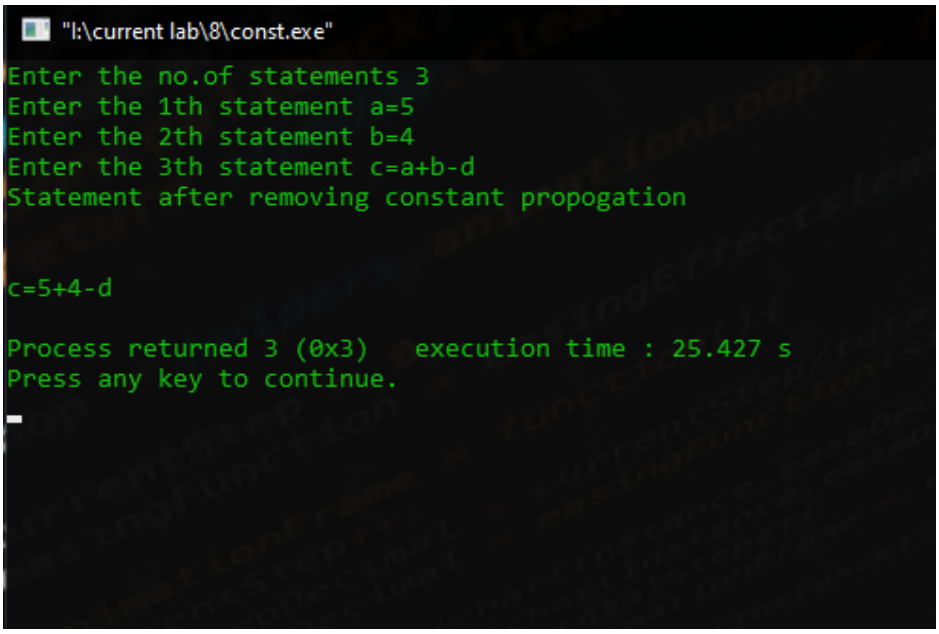
```
Algorithm : Constant Propagation
Input:Read an input expressions
Output:Perform constant propagation and print the result

Step 1:Start the program
Step 2:Declare the variable and two dimensional array
Step 3:Read no:of expression and repeat the step4 to step 8
    until all the expression are processed
Step 4:Read each expression and checks whether the RHS of a
    expression is a digit or not
Step 5: If it is a digit then store that digit into a
   variable 'f' and the variable name into 't'
Step 6:If the next expression variable name is same as the
   previous then ignore that expression
Step 7:Check whether the next expression matches with the
   value in the variable 'f' then replace that with 't'
   otherwise process till the expression is completed then
   print the expression itself.
Step 8: Stop
```

Program

```
#include<stdio.h>
#include<string.h>
void main()
{
        int n,i,j,k,f;
        char s[10][10],t;
        printf("Enter the no.of statements ");
        scanf("%d",&n);
```

```
        for(i=0;i<n;i++)
        {
                printf("Enter the %dth statement ",i+1);
                scanf("%s",s[i]);
        }
        for(i=0;i<n;i++)
        {
                if(isdigit(s[i][2]) && s[i][3]=='\0')
                {
                        f=s[i][2];
                        t=s[i][0];
                        s[i][0]='\0';
                        for(j=i+1;j<n;j++)
                        {

                                if(s[j][0]==t)
                                {
                                        s[j][0]='\0';
                             break;
                                }
                                k=2;
                                while(s[j][k]!='\0')
                                {
                                        if(s[j][k]==t)
                                        {
                                                s[j][k]=f;
                                        }
                                        k=k+1;
                                }
                        }
                }
        }
        printf("Statement after removing constant
           propogation\n");
        for(i=0;i<n;i++)
        {
                printf("%s\n",s[i]);
        }
}
```

Output



Result

Program is executed and output is obtained

Program No:10
Date : 12/01/2021

7. Intermediate code generation

Aim

Implement intermediate code generation for simple expressions

Algorithm

Input: Input the expression
Output: Print the intermediate code of the expression
Step1 : Start.
Step2 : Input the expression and store it in an array 'a'.
Step3 : Find the length of the expression and store it in 'n'.
Step4 : Initialize j=0
Step5 : if j¡n goto step 6 else goto step 25.
Step6 : Initialize i=0
Step7 : If i¡n goto step 8 else goto step 15
Step8 : If a[i] is equal to '*' or a[i] is equal to '/' goto step 9 else goto step 7.
Step9 : Assign d=i-1
Step10 : If(a[d]is equal to ' ' then goto step 11 else goto step12.
Step11 : decrement d by 1 and goto step 10.
Step12 : Print the values stored in c equal to the values in a[d],a[i],a[i+1].
Step13 : Replace the value in a[d] by c , a[i] by space, a[i+1] by space and increment c.
Step14 : Increment i by 1 and goto step 7.
Step15 : Initialize i=0.
Step16 : If i¡n goto step 17 else goto step 15.
Step17 : If a[i] is equal to '+' or a[i] is equal to '-' goto step 18 else goto step 16.
Step18 : Assign d=i-1.
Step19 : If(a[d]is equal to ' ' then goto step 20 else goto step21.
Step20 : decrement d by 1 and goto step 19.
Step21 : Print as the values stored in c equal to the values in a[d],a[i],a[i+1].
Step22 : Replace the value in a[d] by c , a[i] by space, a[i+1] by space and increment c.

Step23 : Increment i by 1 and goto step 16.
Step24 : Increment j by 1 and goto step 5.
Step25 : Stop.

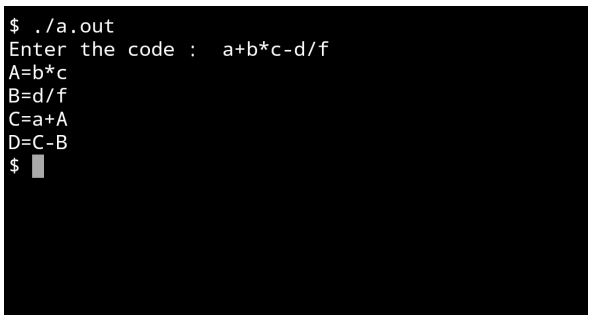
Program

```
#include<stdio.h>
#include<string.h>
void main()
{
    int j=0,i=0,n=0,d=0;
    char a[20],c='A';
    printf("Enter the code : ");
    scanf("%s",a);
    while(a[i]!='\0')
    {

        n=n+1;
        i=i+1;

    }
    for(j=0;j<n;j++)
    {

        for(i=0;i<n;i++)
        {

            if(a[i]=='*'||a[i]=='/')
            {
                d=i-1;
                while(a[d]==' ')
                {

                    d=d-1;

                }
                if(d!=(i-1))
                {
                    printf("%c=%c%c%c\n",c,a[d],a[i],a[i+1]);
```

```
            a[d]=c;
            a[i]=' ';
            a[i+1]=' ';
            c=c+1;
            continue;
        }
        else if(d==(i-1))
        {
            printf("%c=%c%c%c\n",c,a[i-1],a[i],a[i
               +1]);
            a[i-1]=c;
            a[i]=' ';
            a[i+1]=' ';
            c=c+1;
            continue;
        }
    }
}
 for(i=0;i<n;i++)
{

    if(a[i]=='+'||a[i]=='-')
    {
        d=i-1;
        while(a[d]==' ')
        {

            d=d-1;

        }
        if(d!=(i-1))
        {
            printf("%c=%c%c%c\n",c,a[d],a[i],a[i+1]);
            a[d]=c;
            a[i]=' ';
            a[i+1]=' ';
            c=c+1;
            continue;
        }
```

```
                else if(d==(i-1))
                {
                    printf("%c=%c%c%c\n",c,a[i-1],a[i],a[i
                       +1]);
                    a[i-1]=c;
                    a[i]=' ';
                    a[i+1]=' ';
                    c=c+1;
                    continue;
                }
            }
        }

    }
}
```

Output



Result

The program is executed and the output is obtained and verified.

Program No:13
Date : 12/01/2021

8. Conversion from three address code to 8086 assembly language instructions

Aim

Write a c program to implement the back end of the compiler to take the three address code and produced 8086 assembly language instructions that can be assembled and the run using an assembler. The target assembly instructions can be simple mov, add etc

Algorithm

Input: Input the three address code
Output: Print the corresponding 8086 assembly language instruction
Step1 : Start.
Step2 : Input the three address code and store it in 'a'.
Step3 : Store a[3] in 'ch'
Step4 : If 'ch is equal to '+' then print MOV R0 a[2] , ADD R0 a[4] , MOV a[0] R0 and goto step 9.
Step5 : If 'ch is equal to '-' then print MOV R0 a[2] , SUB R0 a[4] , MOV a[0] R0 and goto step 9.
Step6 : If 'ch is equal to '*' then print MOV R0 a[2] , MUL R0 a[4] , MOV a[0] R0 and goto step 9.
Step7 : If 'ch is equal to '/' then print MOV R0 a[2] , DIV R0 a[4] , MOV a[0] R0 and goto step 9.
Step8 : Print INVALID
Step9 : Stop.

Program

```
#include<stdio.h>
#include<string.h>
void main()
{
 char a[10],ch;
 printf("Enter the three address code:\n");
 gets(a);
```

```
 ch=a[3];
 switch(ch)
 {
     case '+' :
              printf("\nMOV R0,%c",a[2]);
              printf("\nADD R0,%c",a[4]);
              printf("\nMOV %c,R0\n",a[0]);
              break;
     case '-' :
              printf("\nMOV R0,%c",a[2]);
              printf("\nSUB R0,%c",a[4]);
              printf("\nMOV %c,R0\n",a[0]);
              break;
     case '*' :
              printf("\nMOV R0,%c",a[2]);
              printf("\nMUL R0,%c",a[4]);
              printf("\nMOV %c,R0\n",a[0]);
              break;
     case '/' :
              printf("\nMOV R0,%c",a[2]);
              printf("\nDIV R0,%c",a[4]);
              printf("\nMOV %c,R0\n",a[0]);
              break;
     default : printf("INVALID\n") ;
 }

}
```

Output

```
$ ./a.out
enter the three address code:
s=q*w

MOV R0,q
MUL R0,w
MOV s,R0
$
```

Result

The program is executed and the output is obtained and verified.

Program No:11
Date :14/01/2021

9. Lexical analyser using Lex tool

Aim

Implementation of lexical analyser using Lex tool

Algorithm

```
Algorithm:Lexical analyser using Lex Tool
Input: A C-program
Output: Print the lexemes
Step1 : Start.
Step2 : Define the definition section if any.
Step3 : Define the rule section with regular expression for
preprocessor,keyword,identifier,function,operators etc.
Step4 : Define the subroutine part.
Step5 : Store the file containing the C program to a file
   pointer.
Step6 : Store it to yyin.
Step7 : call yylex().
Step8 : invoke yywrap() to check end of the file.
Step9 : Stop
```

Program

```
identifier [a-zA-Z][a-zA-Z0-9]*
%%
#.* { printf("\n%s is a PREPROCESSOR DIRECTIVE",yytext);}
int |
float |
char |
double |
while |
for |
do |
if |
break |
continue |
```

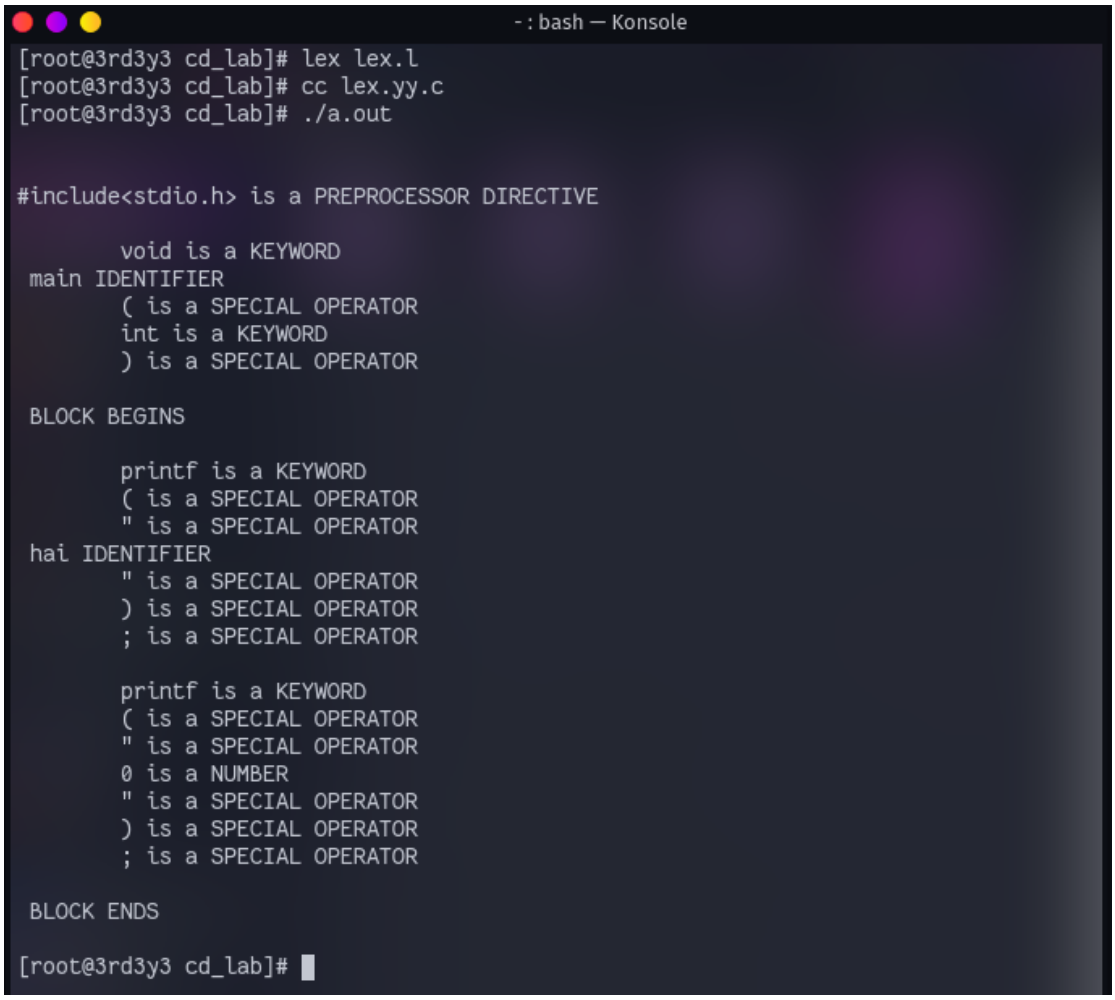
```
void |
switch |
case |
long |
struct |
const |
typedef |
return |
else |
printf |
goto {printf("\n\t%s is a KEYWORD",yytext);}
{identifier}\(\) {printf("\n\nFUNCTION\n\t%s",yytext);}
\{ { printf("\n BLOCK BEGINS");}
\} { printf("\n BLOCK ENDS");}
{identifier}(\[[0-9]*\])? { printf("\n %s IDENTIFIER",
   yytext);}
[0-9]+ {printf("\n\t%s is a NUMBER",yytext);}
= {printf("\n\t%s is an ASSIGNMENT OPERATOR",yytext);}
\<= |
\>= |
\< |
== |
\!= |
\> { printf("\n\t%s is a RELATIONAL OPERATOR",yytext);}
\+ |
\- |
\* |
\% |
\/ {printf("\n\t%s is a ARITHMETIC OPERATOR",yytext);}
\; |
\: |
\, |
\" |
\\ |
\( |
\) |
\' {printf("\n\t%s is a SPECIAL OPERATOR",yytext);}
\\n |
\\t |
```

```
\\0 {printf("\n\t%s is a ESCAPE SEQUENCE",yytext);}
\%s |
\%f |
\%d |
\%c {printf("\n\t%s is a FORMAT SPECIFIER",yytext);}
%%
int main()
{
 FILE *file;
 file = fopen("prg.c","r");
 if(!file)
 {
  printf("could not open file \n");
  exit(0);
 }
 yyin = file;

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

}
```

prg.c

```
#include<stdio.h>
void main(int)
{
        printf("hai");
    printf("0");
}
```

Output



Result

Program is executed and output is obtained

Program No: 12.a
Date :15/01/2021

10. Validate arithmetic expression using LEX and YACC tool

Aim

Write a program to recognise a valid arithmetic expression that use the operator +, -, * and / using LEX and YACC tool.

Algorithm

```
Input: Read an arithmetic expression
Output: Print whether the expression is valid or not.
Step1 : Start.
Step2 : Define the definition section of lex and yacc if
   any.
Step3 : Define the rule section of lex with numbers.
%%
[0-9]+ {
         yylval=atoi(yytext);
         return NUMBER;

      }
%%
Step4 : Define the rule section of yacc with arithmetic
   operators.
%%
 A:E{}
 E:E'+'E
|E'-'E
|E'*'E
|E'/'E
|'('E')'
| NUMBER
;
%%
```

```
Step5 : Define the main function in yacc such that, print
   valid if the expression is valid.
Step6 : Call yyerror() in yacc if the expression is invalid
   .
Step7 : call yyparse().
Step8 : Invoke yywrap() in lex to check end of the file.
Step9 : Stop
```

Program

expval.l

```
%{
    /* Definition section*/
    #include "y.tab.h"
    extern yylval;
%}

%%
[0-9]+ {
         yylval=atoi(yytext);
         return NUMBER;

       }

[\t]+ ;

\n { return 0; }
. { return yytext[0]; }

%%
int yywrap()

{

return 1;

}
```

expval.y

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

%token NUMBER
%left '+' '-'
%left '*' '/'
%%
 A:E{}
 E:E'+'E
|E'-'E
|E'*'E
|E'/'E
|'('E')'
| NUMBER

;
%%

    int main()
 {
    printf("Enter the expression\n");
    yyparse();
    if(valid==0)
     printf("\nValid expression!\n");

 }
 int yyerror()

{
    valid=1;
    printf("\nInvalid expression!\n");
    return 0;

}
```

Output

Result

The program is executed and the output is obtained and verified.

Program No: 12.b
Date :15/01/2021

11. Vaildate variable using LEX and YACC tool

Aim

Write a program to recognise a valid variable which starts with letter followed by any number of letters and digits.

Algorithm

```
Input: Read an input variable.
Output: Print whether the variable is valid or not.
Step1 : Start.
Step2 : Define the definition section of lex and yacc if
   any.
Step3 : Define the rule section of lex with alphabet
   followed by digits or alphabets.
%%
[a-zA-Z_][a-zA-Z_0-9]* return letter;
%%
Step4 : Define the rule section of yacc with letter from
   the lex.
%%
start : s
s : letter ;
%%
Step5 : Define the main function in yacc such that, print
   variable if the variable is valid.
Step7 : Call yyparse().
Step6 : Call yyerror() in yacc if the variable is invalid.
Step8 : Invoke yywrap() in lex to check the end .
Step9 : Stop
```

Program

validvar.l

```
%{
```

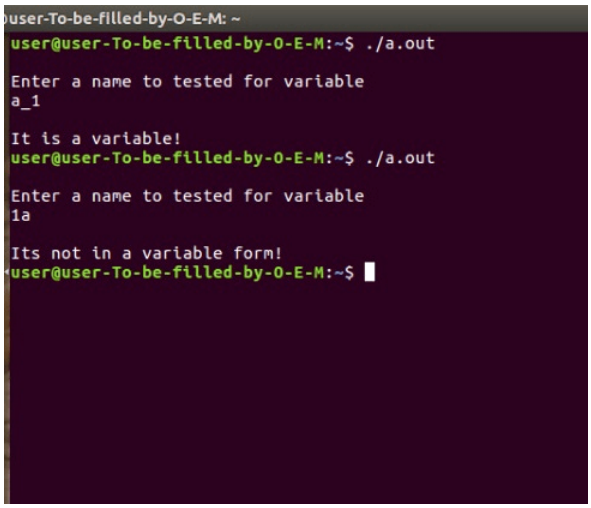
```
    #include "y.tab.h"
%}

%%
[a-zA-Z_][a-zA-Z_0-9]* return letter;
. return yytext[0];
\n return 0;
%%
int yywrap()
{
return 1;
}
```

validvar.y

```
%{

    #include<stdio.h>

    int valid=1;

%}

%token letter

%%

start : s

s : letter ;

%%

int yyerror()
{
    printf("\nIts not in a variable form!\n");
    valid=0;
    return 0;
}
```

```
int main()
{
    printf("\nEnter a name to tested for variable \n");
    yyparse();
    if(valid)

    {
        printf("\nIt is a variable!\n");
    }
}
```

Output



Result

The program is executed and the output is obtained and verified.

Program No: 12.c
Date :14/01/2021

12. Calculator using LEX and YACC tool

Aim

Write a program to implement a calculator using LEX and YACC tool.

Algorithm

```
Input: Read an arithmetic expression
Output: Print whether the expression is valid or not.
Step1 : Start.
Step2 : Define the definition section of lex and yacc if
   any.
Step3 : Define the rule section of lex with numbers.
%%
[0-9]+ {
         yylval=atoi(yytext);
         return NUMBER;
       }
%%
Step4 : Define the rule section of yacc with arithmetic
   operators and print the result by performing the
   operation.
%%
A:E
{
       printf("\nResult=%d\n", $$);
}
E:E'+'E {$$=$1+$3;}
|E'-'E {$$=$1-$3;}
|E'*'E {$$=$1*$3;}
|E'/'E {$$=$1/$3;}
|E'%'E {$$=$1%$3;}
|'('E')' {$$=$2;}
| NUMBER {$$=$1;}
;
```

```
%%
Step5 : Define the main function in yacc and call yyparse()
   .
Step6 : Call yyerror() in yacc if the expression is invalid
   .
Step7 : Invoke yywrap() in lex to check the end.
Step8 : Stop
```

Program

cal.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;
}
```

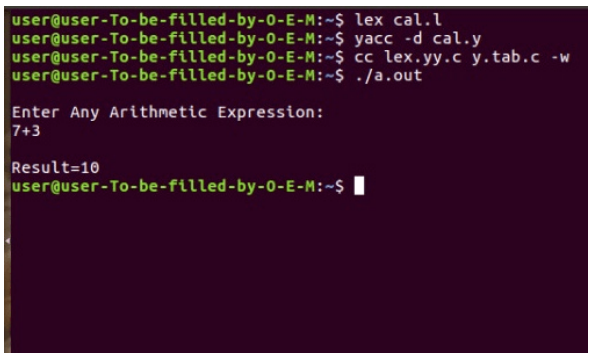
cal.y

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

```
%token NUMBER

%left '+' '-'

%left '*' '/' '%'

%left '(' ')'
%%

A: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();

}
```

```
void yyerror()
{
  printf("\nInvalid\n");
}
```

Output



Result

The program is executed and the output is obtained and verified.