18CSC304J- COMPILER DESIGN

Record Work

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BONAFIDECERTIFICATE

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Examiner-1 **Examiner-2**

Experiment -1 **Implementation of Symbol Table**

Aim: To write a "C" program for the implementation of symbol table with functions to create, insert, modify, search and display.

Algorithm:

1. Declare the variable in the structure as needed.
2. Create a separate function for each operation and use switch case to execute the function.
3. Inside the function insert, search whether the label is inside the symbol table or not
4. If it is already present, ignore insertion else insert in the symbol table
5. Inside the function search, search for the label and if it is found print success else print failure.
6. Inside the function delete, delete the label specified from the symbol table.
7. Inside the function modify, update the table entry with the new values.
8. Inside the function display, display the content of the symbol table.

Program:

```
#include<stdio.h>
#include<string.h>
#include<stdlib.h>
#define null 0 int
size=0; void Insert();
void Display(); void
Delete(); int
Search(char lab[]);
void Modify(); struct
SymbTab
{
 char label[10],symbol[10];
int addr;
struct SymbTab *next;}; struct
SymbTab *first,*last; void
main()
{  int op,y;
char la[10];
do
 {
  printf("\n\tSYMBOL TABLE IMPLEMENTATION\n");
printf("\n\t1.INSERT\n\t2.DISPLAY\n\t3.DELETE\n\t4.SEARCH\n\t5.MODIFY\n\t
```

```
6.END\n");   printf("\n\tEnter
your option : ");
  scanf("%d",&op);
  switch(op)
  {    case 1:
Insert();
break;    case
2:
Display();
break;    case
3:
Delete();
break;    case
4:
      printf("\n\tEnter the label to be searched : ");
scanf("%s",la);       y=Search(la);
      printf("\n\tSearch Result:");
if(y==1)
    printf("\n\tThe label is present in the symbol table\n");
else
    printf("\n\tThe label is not present in the symbol table\n");
break;    case 5:       Modify();       break;    case 6:
exit(0);
  }
 }while(op<6);
getch(); }
void Insert()
{   int n;
char l[10];
  printf("\n\tEnter the label : ");
scanf("%s",l);   n=Search(l);
if(n==1)
   printf("\n\tThe label exists already in the symbol table\n\tDuplicate can't be
inserted");
  else
   {
    struct SymbTab *p;
p=malloc(sizeof(struct SymbTab));
strcpy(p->label,l);     printf("\n\tEnter
the symbol : ");     scanf("%s",p-
>symbol);     printf("\n\tEnter the
```

```
address : ");     scanf("%d",&p-
>addr);
   p->next=NULL;
if(size==0)
    {
first=p;
last=p;
}    else
    {      last-
>next=p;
last=p;
    }
size++;
  }
  printf("\n\tLabel inserted\n");
} void
Display()
{
 int i;
 struct SymbTab *p;
p=first;
 printf("\n\tLABEL\t\tSYMBOL\t\tADDRESS\n");
for(i=0;i<size;i++)
  {
   printf("\t%s\t\t%s\t\t%d\n",p->label,p->symbol,p->addr);     p=p-
>next;
  } }
int Search(char lab[])
{  int i,flag=0;
struct SymbTab *p;
p=first;
for(i=0;i<size;i++)
  {
   if(strcmp(p->label,lab)==0)
flag=1;
   p=p->next;
  }  return
flag;
}
void Modify()
```

```
{   char
l[10],nl[10];   int
add,choice,i,s;
  struct SymbTab *p;
p=first;
  printf("\n\tWhat do you want to modify?\n");
  printf("\n\t1.Only the label\n\t2.Only the address\n\t3.Both the label and address\n");
  printf("\tEnter your choice : ");
scanf("%d",&choice);
  switch(choice)
   {      case 1:        printf("\n\tEnter
the old label : ");        scanf("%s",l);
s=Search(l);        if(s==0)
    printf("\n\tLabel not found\n");
else
    {
    printf("\n\tEnter the new label : ");
scanf("%s",nl);
    for(i=0;i<size;i++)
     {
      if(strcmp(p->label,l)==0)
strcpy(p->label,nl);        p=p->next;
     }
    printf("\n\tAfter Modification:\n");
    Display();
   }
break;
case 2:
      printf("\n\tEnter the label where the address is to be modified : ");
scanf("%s",l);        s=Search(l);        if(s==0)
    printf("\n\tLabel not found\n");
else
    {
    printf("\n\tEnter the new address : ");
scanf("%d",&add);
    for(i=0;i<size;i++)
     {
      if(strcmp(p->label,l)==0)         p-
>addr=add;
      p=p->next;
     }
    printf("\n\tAfter Modification:\n");
```

```
    Display();     }     break;     case 3:
printf("\n\tEnter the old label : ");
scanf("%s",l);        s=Search(l);
if(s==0)      printf("\n\tLabel not
found\n");        else
    {
     printf("\n\tEnter the new label : ");
scanf("%s",nl);      printf("\n\tEnter the
new address : ");      scanf("%d",&add);
     for(i=0;i<size;i++)
      {
       if(strcmp(p->label,l)==0)
        {          strcpy(p-
>label,nl);
         p->addr=add;
        }
       p=p->next;
      }
     printf("\n\tAfter Modification:\n");
     Display();
}     break;
    } } void Delete() {
int a;   char l[10];
struct SymbTab *p,*q;
p=first;
printf("\n\tEnter the
label to be deleted : ");
scanf("%s",l);
a=Search(l);   if(a==0)
    printf("\n\tLabel not found\n");
else
    {
    if(strcmp(first->label,l)==0)     first=first-
>next;
    else if(strcmp(last->label,l)==0)
     {
      q=p->next;
      while(strcmp(q->label,l)!=0)
      {
       p=p->next;       q=q-
>next;
      }
```

```
      p->next=NULL;
      last=p;
}     else
     {
      q=p->next;
      while(strcmp(q->label,l)!=0)
      {
       p=p->next;       q=q-
>next;
      }
      p->next=q->next;
    }
size--;
    printf("\n\tAfter Deletion:\n");
    Display();
   }
}
```

Result: "C" program for the implementation of symbol table with functions to create, insert, modify, search and display is done successfully.

Experiment -2 **Develop a Lexical Analyser**

Aim: To write a program to implement Lexical Analysis using C.

Algorithm:

1. Start the program.
2. Declare all the variables and file pointers.
3. Display the input program.
4. Separate the keyword in the program and display it.
5. Display the header files of the input program
6. Separate the operators of the input program and display it.
7. Print the punctuation marks.
8. Print the constant that are present in input program.
9. Print the identifiers of the input program.

Program:

```
#include <fstream>
#include <iostream>
#include <stdlib.h>
#include <string.h> #include
<ctype.h>


using namespace std;
bool isPunctuator(char ch)                                    //check if the given
character is a punctuator or not
{
   if (ch == ' ' || ch == '+' || ch == '-' || ch == '*' ||
ch == '/' || ch == ',' || ch == ';' || ch == '>' ||
ch == '<' || ch == '=' || ch == '(' || ch == ')' ||
ch == '[' || ch == ']' || ch == '{' || ch == '}' ||
ch == '&' || ch == '|')
       {
          return true;
       }
   return false;
}
bool validIdentifier(char* str)                                    //check if the given
identifier is valid or not
{
```

```
    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' || isPunctuator(str[0]) == true)
        {
            return false;
        }                                                   //if first character of string
is a digit or a special character, identifier is not valid
    int i,len = strlen(str);
if (len == 1)
    {
        return true;
    }                                                       //if length is one,
validation is already completed, hence return true
    else
{
    for (i = 1 ; i < len ; i++)                             //identifier cannot
contain special characters
    {
        if (isPunctuator(str[i]) == true)
        {
            return false;
        }
    }
}
    return true;
}
bool isOperator(char ch)                                    //check if the given
character is an operator or not
{
    if (ch == '+' || ch == '-' || ch == '*' ||
ch == '/' || ch == '>' || ch == '<' ||
ch == '=' || ch == '|' || ch == '&')
    {
       return true;
    }
    return false;
}
                                                            //check if the given
bool isKeyword(char *str)
substring is a keyword or not {
```

```
    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, "long") || !strcmp(str, "short")
        || !strcmp(str, "typedef") || !strcmp(str, "switch")
        || !strcmp(str, "unsigned") || !strcmp(str, "void")
        || !strcmp(str, "static") || !strcmp(str, "struct")
        || !strcmp(str, "sizeof") || !strcmp(str,"long")
        || !strcmp(str, "volatile") || !strcmp(str, "typedef")
        || !strcmp(str, "enum") || !strcmp(str, "const")
        || !strcmp(str, "union") || !strcmp(str, "extern")
        || !strcmp(str,"bool"))
        {
            return true;
        }
else    {
       return false;
    }
}

bool isNumber(char* str)                              //check if the given
substring is a number or not
{
    int i, len = strlen(str),numOfDecimal = 0;
if (len == 0)
    {
        return false;
    }
    for (i = 0 ; i < len ; i++)
    {
        if (numOfDecimal > 1 && str[i] == '.')
        {
            return false;
        } else if (numOfDecimal <= 1)
        {
            numOfDecimal++;
        }
```

```
        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;
}

char* subString(char* realStr, int l, int r)                    //extract the required
substring from the main string
{
   int i;

   char* str = (char*) malloc(sizeof(char) * (r - l + 2));

   for (i = l; i <= r; i++)
   {        str[i - l] =
realStr[i];        str[r - l +
1] = '\0';
   }
   return str;
}


void parse(char* str)                                           //parse the expression
{     int left = 0, right =
0;     int len =
strlen(str);
   while (right <= len && left <= right) {
       if (isPunctuator(str[right]) == false)   //if character is a digit or an alphabet
            {
               right++;
            }

       if (isPunctuator(str[right]) == true && left == right)  //if character is a
punctuator
            {
            if (isOperator(str[right]) == true)
            {
```

```
              std::cout<< str[right] <<" IS AN OPERATOR\n";
          }
right++;
left = right;
          } else if (isPunctuator(str[right]) == true && left != right
                || (right == len && left != right))                              //check if parsed
substring is a keyword or identifier or number
          {
          char* sub = subString(str, left, right - 1);   //extract substring

          if (isKeyword(sub) == true)
                    {
                       cout<< sub <<" IS A KEYWORD\n";
                    }
          else if (isNumber(sub) == true)
                    {
                       cout<< sub <<" IS A NUMBER\n";
                    }
          else if (validIdentifier(sub) == true
                  && isPunctuator(str[right - 1]) == false)
                  {
                     cout<< sub <<" IS A VALID IDENTIFIER\n";
                  }
          else if (validIdentifier(sub) == false
                  && isPunctuator(str[right - 1]) == false)
                  {
                     cout<< sub <<" IS NOT A VALID IDENTIFIER\n";
                  }

          left = right;
          }
}
return; }

int main() {
   char c[100] = "int a = b * c";
   parse(c);
return 0; }
```

Result: The implementation of lexical analyser in C++ was compiled, executed and verified successfully.

Experiment -3 **Conversion from NFA to DFA**

Aim: : To write a program for converting NFA to DFA.

Algorithm:
1. Start
2. Get the input from the user
3. Set the only state in SDFA to “unmarked”.
4. while SDFA contains an unmarked state do:
5. Let T be that unmarked state
6. b. for each a in % do S = e-Closure(MoveNFA(T,a)) c. if S is not in SDFA already then, add S to SDFA (as an “unmarked” state) d. Set MoveDFA(T,a) to S.
7. For each S in SDFA if any s & S is a final state in the NFA then, mark S an a final state in the DFA
8. Print the result.
9. Stop the program.

Program:
```
#include<stdio.h>
#include<string.h> #include<math.h>

int ninputs; int
dfa[100][2][100] = {0}; int
state[10000] = {0}; char
ch[10], str[1000]; int
go[10000][2] = {0}; int
arr[10000] = {0};

int main()
{
    int st, fin, in;
int f[10];
    int i,j=3,s=0,final=0,flag=0,curr1,curr2,k,l;
int c;

    printf("\nFollow the one based indexing\n");

    printf("\nEnter the number of states::");
scanf("%d",&st);

    printf("\nGive state numbers from 0 to %d",st-1);
```

```
    for(i=0;i<st;i++)
           state[(int)(pow(2,i))] = 1;

    printf("\nEnter number of final states\t");
scanf("%d",&fin);

    printf("\nEnter final states::");
for(i=0;i<fin;i++)
    {
         scanf("%d",&f[i]);
    }

    int p,q,r,rel;

    printf("\nEnter the number of rules according to NFA::");
scanf("%d",&rel);

    printf("\n\nDefine transition rule as \"initial state input symbol final state\"\n");



    for(i=0; i<rel; i++)
    {
         scanf("%d%d%d",&p,&q,&r);
         if (q==0)
dfa[p][0][r] = 1;
         else
           dfa[p][1][r] = 1;
    }

    printf("\nEnter initial state::");
scanf("%d",&in);      in =
pow(2,in);

    i=0;

    printf("\nSolving according to DFA");

    int x=0;
for(i=0;i<st;i++)
    {
           for(j=0;j<2;j++)
```

```
            {
                int stf=0;
for(k=0;k<st;k++)                   {
                        if(dfa[i][j][k]==1)
stf = stf + pow(2,k);
                }



                go[(int)(pow(2,i))][j] = stf;
printf("%d-%d-->%d\n",(int)(pow(2,i)),j,stf);
                if(state[stf]==0)
arr[x++] = stf;
state[stf] = 1;
            }

    }



    //for new states
    for(i=0;i<x;i++)
    {
          printf("for %d ---- ",arr[x]);
for(j=0;j<2;j++)
            {
int new=0;
                for(k=0;k<st;k++)
                {
                        if(arr[i] & (1<<k))
                        {
                                int h = pow(2,k);

if(new==0)
new = go[h][j];
                                new = new | (go[h][j]);


                        }
                }

                if(state[new]==0)
                {
                    arr[x++] = new;
state[new] = 1;
                }
```

```
        }
    }

    printf("\nThe total number of distinct states are::\n");

    printf("STATE     0   1\n");

    for(i=0;i<10000;i++)
    {
        if(state[i]==1)
        {
            //printf("%d**",i);
int y=0;                    if(i==0)
printf("q0 ");

else
            for(j=0;j<st;j++)
            {
int x = 1<<j;
if(x&i)                          {
                        printf("q%d       ",j);
y                  =                     y+pow(2,j);
//printf("y=%d  ",y);
                        }
            }
            //printf("%d",y);
            printf("       %d   %d",go[y][0],go[y][1]);
            printf("\n");
        }
    }

        j=3;
while(j--)
{
        printf("\nEnter string");
scanf("%s",str);            l =
strlen(str);            curr1 = in;
        flag = 0;
        printf("\nString takes the following path-->\n");
printf("%d-",curr1);

        for(i=0;i<l;i++)
        {
           curr1 = go[curr1][str[i]-'0'];
```

```
        printf("%d-",curr1);
      }

      printf("\nFinal state - %d\n",curr1);

      for(i=0;i<fin;i++)
      {
          if(curr1 & (1<<f[i]))
          {
flag = 1;
break;
          }
      }
      if(flag)
        printf("\nString Accepted");
else
        printf("\nString Rejected");

   }


   return 0; }
```


Input/Output-

Follow the one based indexing
Enter the number of states::3
Give state numbers from 0 to 2
Enter number of final states 1
Enter final states::4
Enter the number of rules according to NFA::4
Define transition rule as "initial state input symbol final state"
1 0 1
Solving according to DFA1-0-->0
1- 1-->0
2- 0-->6
2-1-->2
4-0-->0
4-1-->0

for 0 ---- for 0 ----
The total number of distinct states are::
STATE 0 1 q0 0 0 q0 0 0 q1 6 2 q2 0 0
q1 q2 0 0

Result: The implementation of converting NFA to DFA in C was compiled, executed and verified successfully.

Experiment -4 **Conversion from Regular Expression to NFA**

Aim: To write a program for converting Regular Expression to NFA. **Algorithm:**

1. Start
2. Get the input from the user
3. Initialize separate variables and functions for Postfix , Display and NFA
4. Create separate methods for different operators like +,*, .
5. By using Switch case Initialize different cases for the input
6. For ' . ' operator Initialize a separate method by using various stack functions do the same for the other operators like ' * ' and ' + '.
7. Regular expression is in the form like a.b (or) a+b
8. Display the output
9. Stop

Program:

```
#include<stdio.h>
#include<string.h> int
main()
{
        char reg[20]; int q[20][3],i=0,j=1,len,a,b;
for(a=0;a<20;a++) for(b=0;b<3;b++) q[a][b]=0;
scanf("%s",reg);
        printf("Given regular expression: %s\n",reg);
        len=strlen(reg);
        while(i<len)
        {
  if(reg[i]=='a'&&reg[i+1]!='|'&&reg[i+1]!='*')     {    q[j][0]=j+1;    j++;    }
if(reg[i]=='b'&&reg[i+1]!='|'&&reg[i+1]!='*')     {    q[j][1]=j+1;    j++;    }
if(reg[i]=='e'&&reg[i+1]!='|'&&reg[i+1]!='*')     {    q[j][2]=j+1;    j++;    }
if(reg[i]=='a'&&reg[i+1]=='|'&&reg[i+2]=='b')
                {
                 q[j][2]=((j+1)*10)+(j+3); j++;
                 q[j][0]=j+1; j++;
        q[j][2]=j+3; j++;
q[j][1]=j+1; j++;
q[j][2]=j+1; j++;
                        i=i+2;
                }
                if(reg[i]=='b'&&reg[i+1]=='|'&&reg[i+2]=='a')
                {
                        q[j][2]=((j+1)*10)+(j+3); j++;
                q[j][1]=j+1; j++;
q[j][2]=j+3; j++;                   q[j][0]=j+1; j++;
```

```
                    q[j][2]=j+1; j++;
                    i=i+2;
               }
               if(reg[i]=='a'&&reg[i+1]=='*')
               {
                    q[j][2]=((j+1)*10)+(j+3); j++;
q[j][0]=j+1; j++;                    q[j][2]=((j+1)*10)+(j-1);
j++;
               }
               if(reg[i]=='b'&&reg[i+1]=='*')
               {
                    q[j][2]=((j+1)*10)+(j+3); j++;
q[j][1]=j+1; j++;                    q[j][2]=((j+1)*10)+(j-1);
j++;
               }
               if(reg[i]==')'&&reg[i+1]=='*')
               {
                    q[0][2]=((j+1)*10)+1;
                    q[j][2]=((j+1)*10)+1;
                    j++;
               }
               i++;
          }
          printf("\n\tTransition Table \n");
          printf("_____________________________________________\n");
printf("Current State |\tInput |\tNext State");
printf("\n_____________________________________________\n");
for(i=0;i<=j;i++)
          {
                if(q[i][0]!=0) printf("\n  q[%d]\t      |   a   |  q[%d]",i,q[i][0]);
               if(q[i][1]!=0) printf("\n  q[%d]\t      |   b   |  q[%d]",i,q[i][1]);
               if(q[i][2]!=0)
               {
   if(q[i][2]<10) printf("\n  q[%d]\t     |   e   |  q[%d]",i,q[i][2]);    else printf("\n  q[%d]\t
|   e   |  q[%d] , q[%d]",i,q[i][2]/10,q[i] [2]%10);
               }
          }
          printf("\n_____________________________________________\n");
return 0;
}
```

Input: (a|b)*a **Output:**

Given regular expression: (a|b)*a

Transition Table

Current State | Input | Next State

---

q[0] | e | q[7] , q[1]
q[1] | e | q[2] , q[4]
q[2] | a | q[3] q[3]
| e | q[6] q[4] | b
| q[5] q[5] | e |
q[6] q[6] | e | q[7] ,
q[1] q[7] | a | q[8]

Result: The implementation of converting Regular Expression to NFA in C was compiled, executed and verified successfully.

Experiment -5 **First and Follow**

Aim: To write a program to implement Lexical Analysis using C.

Algorithm:

First:

To find the first() of the grammar symbol, then we have to apply the following set of rules to the given grammar:- • If X is a terminal, then First(X) is {X}.

- If X is a non-terminal and X tends to aα is production, then add 'a' to the first of X. if X->ε, then add null to the First(X).
- If X_>YZ then if First(Y)=ε, then First(X) = { First(Y)-ε} U First(Z).
- If X->YZ, then if First(X)=Y, then First(Y)=teminal but null then First(X)=First(Y)=terminals.

Follow:

To find the follow(A) of the grammar symbol, then we have to apply the following set of rules to the given grammar:• $ is a follow of 'S'(start symbol).

- If A->αBβ,β!=ε, then first(β) is in follow(B).
- If A->αB or A->αBβ where First(β)=ε, then everything in Follow(A) is a Follow(B).

Program:

```
// C program to calculate the First and
// Follow sets of a given grammar
#include<stdio.h>
#include<ctype.h>
#include<string.h>

// Functions to calculate Follow
void followfirst(char, int, int);  void
follow(char c);
```

```
// Function to calculate First  void
findfirst(char, int, int);  int count,
n = 0;

// Stores the final result
// of the First Sets  char
calc_first[10][100];

// Stores the final result  //
of the Follow Sets  char
calc_follow[10][100];  int
m = 0;

// Stores the production rules
char production[10][10];  char
f[10], first[10];
int k;  char
ck;  int e;

int main(int argc, char **argv)
{
        int jm = 0;
int km = 0;
int i, choice;
char c, ch;    count =
8;

        // The Input grammar
strcpy(production[0], "E=TR");
strcpy(production[1], "R=+TR");
strcpy(production[2], "R=#");
strcpy(production[3], "T=FY");
strcpy(production[4], "Y=*FY");
strcpy(production[5], "Y=#");
strcpy(production[6], "F=(E)");
        strcpy(production[7], "F=i");

        int kay;
        char done[count];
        int ptr = -1;

        // Initializing the calc_first array  for(k
        = 0; k < count; k++) {  for(kay = 0;
```

```
        kay < 100; kay++) {
                calc_first[k][kay] = '!';
                }
        }
        int point1 = 0, point2, xxx;

        for(k = 0; k < count; k++)
        {
                c = production[k][0];
                point2 = 0;
        xxx = 0;

                // Checking if First of c has
        // already been calculated
for(kay = 0; kay <= ptr; kay++)
        if(c == done[kay])
                        xxx = 1;

        if (xxx == 1)
                continue;

                // Function call
        findfirst(c, 0, 0);
ptr += 1;

                // Adding c to the calculated list
done[ptr] = c;
                printf("\n First(%c) = { ", c);
                calc_first[point1][point2++] = c;

                // Printing the First Sets of the grammar
                for(i = 0 + jm; i < n; i++) {
                int lark = 0, chk = 0;

                        for(lark = 0; lark < point2; lark++) {

                                if (first[i] == calc_first[point1][lark])
                                {
                                        chk = 1;
                        break;
                                }
```

```
                        }  if(chk ==
                        0)
                        {
                                printf("%c, ", first[i]);
                                calc_first[point1][point2++] = first[i];
                        }
                }  printf("}\n");
                jm = n;
                point1++;
        }
        printf("\n");
        printf("-----------------------------------------------\n\n");
        char donee[count];
        ptr = -1;

        // Initializing the calc_follow array
    for(k = 0; k < count; k++) {
    for(kay = 0; kay < 100; kay++) {
                        calc_follow[k][kay] = '!';
                }
        }
        point1 = 0;             int
    land = 0;       for(e = 0; e <
    count; e++)
        {
                ck = production[e][0];
        point2 = 0;
    xxx = 0;

                // Checking if Follow of ck
        // has alredy been calculated
    for(kay = 0; kay <= ptr; kay++)
        if(ck == donee[kay])
                                xxx = 1;

        if (xxx == 1)
                        continue;
    land += 1;

                // Function call
        follow(ck);
    ptr += 1;
```

```
            // Adding ck to the calculated list
            donee[ptr] = ck;  printf("
            Follow(%c) = { ", ck);
            calc_follow[point1][point2++] = ck;

            // Printing the Follow Sets of the grammar  for(i
            = 0 + km; i < m; i++) {
                    int lark = 0, chk = 0;
                    for(lark = 0; lark < point2; lark++)
                    {
                            if (f[i] == calc_follow[point1][lark])
                            {
                                    chk = 1;
                                    break;
                            }
                    }
                    if(chk == 0)
                    {
                            printf("%c, ", f[i]);
                            calc_follow[point1][point2++] = f[i];
                    }
            }
            printf(" }\n\n");
            km = m;
            point1++;
    }
}

void follow(char c)
{
    int i, j;

    // Adding "$" to the follow
// set of the start symbol
if(production[0][0] == c) {
            f[m++] = '$';
    }
    for(i = 0; i < 10; i++)
    {
            for(j = 2;j < 10; j++)
            {
```

```
                if(production[i][j] == c)
                {
                    if(production[i][j+1] != '\0')
                    {
                        // Calculate the first of the next
                        // Non-Terminal in the production
                        followfirst(production[i][j+1], i, (j+2));
                    }

                    if(production[i][j+1]=='\0' && c!=production[i][0])  {
                        // Calculate the follow of the Non-Terminal
                        // in the L.H.S. of the production
                follow(production[i][0]);
                    }
                }
            }
        }
}

void findfirst(char c, int q1, int q2)
{
        int j;

        // The case where we
// encounter a Terminal
if(!(isupper(c))) {
            first[n++] = c;
        }
        for(j = 0; j < count; j++)
        {
            if(production[j][0] == c)
            {
                if(production[j][2] == '#')
                {
                    if(production[q1][q2] == '\0')
            first[n++] = '#';
                    else if(production[q1][q2] != '\0'
                            && (q1 != 0 || q2 != 0))
                    {
                        // Recursion to calculate First of New
                    // Non-Terminal we encounter after epsilon
                        findfirst(production[q1][q2], q1, (q2+1));
```

```
                        }
                else
                        first[n++] = '#';
                }
                else if(!isupper(production[j][2]))
                        {       first[n++] =
                production[j][2];
                }  else
                {
                        // Recursion to calculate First of
                        // New Non-Terminal we encounter
                        // at the beginning
                        findfirst(production[j][2], j, 3);  }
        }
    }
}

void followfirst(char c, int c1, int c2)
{
    int k;

    // The case where we encounter
    // a Terminal
if(!(isupper(c)))
        f[m++] = c;
    else
    {
        int i = 0, j = 1;
        for(i = 0; i < count; i++)
        {
            if(calc_first[i][0] == c)
                break;
        }

        //Including the First set of the
        // Non-Terminal in the Follow of
    // the original query
        while(calc_first[i][j] != '!')
        {
            if(calc_first[i][j] != '#')
            {
                f[m++] = calc_first[i][j];
```

```
                    }
                    else
                    {
                        if(production[c1][c2] == '\0')
                        {
                            // Case where we reach the
                            // end of a production
                            follow(production[c1][0]);
                        }
                        else
                        {
                            // Recursion to the next symbol        //
                        in case we encounter a "#"
                            followfirst(production[c1][c2], c1, c2+1);
                        }
                    }
                    j++;
                }
            }
        }
```

Result: The FIRST and FOLLOW sets of the non-terminals of a grammar were found successfully using python language.

Experiment -6 **Predictive Parsing Table**

Aim: To write a a program for Predictive Parsing table.

Algorithm:

For the production A → α of Grammar G.

- For each terminal, a in FIRST (α) add A → α to M [A, a].
- If ε is in FIRST (α), and b is in FOLLOW (A), then add A → α to M[A, b].
- If ε is in FIRST (α), and $ is in FOLLOW (A), then add A → α to M[A, $].
- All remaining entries in Table M are errors.

Program:

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

char prol[7][10] = { "S", "A", "A", "B", "B", "C", "C" }; char
pror[7][10] = { "A", "Bb", "Cd", "aB", "@", "Cc", "@" };
char prod[7][10] = { "S->A", "A->Bb", "A->Cd", "B->aB", "B->@", "C->Cc", "C-
>@" };
char first[7][10] = { "abcd", "ab", "cd", "a@", "@", "c@", "@" };
char follow[7][10] = { "$", "$", "$", "a$", "b$", "c$", "d$" }; char
table[5][6][10];

int numr(char c)
{
  switch (c)
  {      case
'S':
return 0;

    case 'A':
return 1;
      case 'B':
return 2;
      case 'C':
return 3;
```

```
        case
'a':
return 0;
        case 'b':
return 1;
        case 'c':
return 2;
        case 'd':
return 3;
        case '$':
return 4;
   }

   return (2);
}

int main() {
   int i, j, k;

     printf("The following grammar is used for Parsing Table:\n");

   for (i = 0; i < 7; i++)
      printf("%s\n", prod[i]);

   printf("\nPredictive parsing table:\n");

   fflush(stdin);

   for (i = 0; i < 7; i++)
   {      k = strlen(first[i]);
for (j = 0; j < 10; j++)
if (first[i][j] != '@')
            strcpy(table[numr(prol[i][0]) + 1][numr(first[i][j]) + 1], prod[i]);
}

   for (i = 0; i < 7; i++)
   {
      if (strlen(pror[i]) == 1)
      {
         if (pror[i][0] == '@')
         {
```

```
            k = strlen(follow[i]);
for (j = 0; j < k; j++)
               strcpy(table[numr(prol[i][0]) + 1][numr(follow[i][j]) + 1], prod[i]);
         }
      }
   }

   strcpy(table[0][0], " ");

   strcpy(table[0][1], "a");

   strcpy(table[0][2], "b");

   strcpy(table[0][3], "c");

   strcpy(table[0][4], "d");

   strcpy(table[0][5], "$");

   strcpy(table[1][0], "S");

   strcpy(table[2][0], "A");

   strcpy(table[3][0], "B");

   strcpy(table[4][0], "C");

   printf("\n--------------------------------------------------------\n");

   for (i = 0; i < 5; i++)
for (j = 0; j < 6; j++)
      {
         printf("%-10s", table[i][j]);
         if (j == 5)
            printf("\n--------------------------------------------------------\n");
}
}
```

Result: The implementation and creation of predictive parse table using c was executed successfully.

Experiment -7 **Shift Reduce Parsing**

Aim: To write a program to implement Lexical Analysis using C.

Algorithm:

- Shift reduce parsing is a process of reducing a string to the start symbol of a grammar.
- Shift reduce parsing uses a stack to hold the grammar and an input tape to hold the string.
-
- Sift reduce parsing performs the two actions: shift and reduce. That's why it is known as shift reduces parsing.
- At the shift action, the current symbol in the input string is pushed to a stack.
- At each reduction, the symbols will replaced by the non-terminals. The symbol is the right side of the production and non-terminal is the left side of the production.

Program:

```
#include<stdio.h>
#include<string.h> int
k=0,z=0,i=0,j=0,c=0; char
a[16],ac[20],stk[15],act[10];
void check();
int main()
   {

      puts("GRAMMAR is E->E+E \n E->E*E \n E->(E) \n E->id");
puts("enter input string ");
      gets(a);       c=strlen(a);
strcpy(act,"SHIFT->");
puts("stack \t input \t action");
      for(k=0,i=0; j<c; k++,i++,j++)
       {
        if(a[j]=='i' && a[j+1]=='d')
          {
stk[i]=a[j];
stk[i+1]=a[j+1];
stk[i+2]='\0';
```

```
a[j]=' ';               a[j+1]='
';
printf("\n$%s\t%s$\t%si
d",stk,a,act);
              check();
}          else            {
stk[i]=a[j];
stk[i+1]='\0';
              a[j]=' ';
              printf("\n$%s\t%s$\t%ssymbols",stk,a,act);
check();
           }
}

   }
void check()
   {
     strcpy(ac,"REDUCE TO E");
for(z=0; z<c; z++)
       if(stk[z]=='i' && stk[z+1]=='d')
         {
stk[z]='E';
stk[z+1]='\0';
           printf("\n$%s\t%s$\t%s",stk,a,ac);
j++;
         }
     for(z=0; z<c; z++)
       if(stk[z]=='E' && stk[z+1]=='+' && stk[z+2]=='E')
         {
stk[z]='E';
stk[z+1]='\0';
stk[z+2]='\0';
           printf("\n$%s\t%s$\t%s",stk,a,ac);
i=i-2;
         }
     for(z=0; z<c; z++)
       if(stk[z]=='E' && stk[z+1]=='*' && stk[z+2]=='E')
         {
stk[z]='E';
stk[z+1]='\0';
stk[z+1]='\0';
```

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

Result: The implementation of shift reduce parsing was executed and verified successfully.

Experiment -8 **Computation of Lead and Trail**

Aim: To write a program to compute of Lead and Trail.

Algorithm:

1. For Leading, check for the first non-terminal.
2. If found, print it.
3. Look for next production for the same non-terminal.
4. If not found, recursively call the procedure for the single non-terminal present before the comma or End Of Production String.
5. Include it's results in the result of this non-terminal.
6. For trailing, we compute same as leading but we start from the end of the production to the beginning.
7. Stop

Program:

```
#include<iostream>
#include<conio.h>
#include<stdio.h>
#include<string.h>
#include<stdlib.h> using
namespace std;

int vars,terms,i,j,k,m,rep,count,temp=-1; char
var[10],term[10],lead[10][10],trail[10][10];
struct grammar
{
	int prodno;   char
lhs,rhs[20][20];
}gram[50]; void
get()
{
	cout<<"\nLEADING AND TRAILING\n";
	cout<<"\nEnter the no. of variables : ";
cin>>vars;
	cout<<"\nEnter the variables : \n";
	for(i=0;i<vars;i++)
	{
		cin>>gram[i].lhs;
		var[i]=gram[i].lhs;
```

```
	}
	cout<<"\nEnter the no. of terminals : ";
	cin>>terms;
	cout<<"\nEnter the terminals : "; for(j=0;j<terms;j++)
		cin>>term[j];
	cout<<"\nPRODUCTION DETAILS\n";
	for(i=0;i<vars;i++)
	{
		cout<<"\nEnter the no. of production of "<<gram[i].lhs<<":";
cin>>gram[i].prodno;
		for(j=0;j<gram[i].prodno;j++)
		{
			cout<<gram[i].lhs<<"->";
			cin>>gram[i].rhs[j];
		}
	}
}
void leading()
{
	for(i=0;i<vars;i++)
	{
		for(j=0;j<gram[i].prodno;j++)
		{
			for(k=0;k<terms;k++)
			{
				if(gram[i].rhs[j][0]==term[k])
					lead[i][k]=1;
				else
				{
					if(gram[i].rhs[j][1]==term[k])
						lead[i][k]=1;
				}
			}
		}
	}
	for(rep=0;rep<vars;rep++)
	{
		for(i=0;i<vars;i++)
		{
			for(j=0;j<gram[i].prodno;j++)
			{
```

```
				for(m=1;m<vars;m++)
				{
					if(gram[i].rhs[j][0]==var[m])
					{
						temp=m;
						goto out;
					}
				}
				out:
				for(k=0;k<terms;k++)
				{
					if(lead[temp][k]==1)
						lead[i][k]=1;
				}
			}
		}
	}
}
void trailing()
{
	for(i=0;i<vars;i++)
	{
		for(j=0;j<gram[i].prodno;j++)
		{
			count=0;
			while(gram[i].rhs[j][count]!='\x0')
				count++;
			for(k=0;k<terms;k++)
			{
				if(gram[i].rhs[j][count-1]==term[k])
					trail[i][k]=1;
				else
				{
					if(gram[i].rhs[j][count-2]==term[k])
						trail[i][k]=1;
				}
			}
		}
	}
	for(rep=0;rep<vars;rep++)
	{
```

```
		for(i=0;i<vars;i++)
		{
			for(j=0;j<gram[i].prodno;j++)
			{
				count=0;
				while(gram[i].rhs[j][count]!='\x0')
					count++;
				for(m=1;m<vars;m++)
				{
					if(gram[i].rhs[j][count-1]==var[m])
						temp=m;
				}
				for(k=0;k<terms;k++)
				{
					if(trail[temp][k]==1)
						trail[i][k]=1;
				}
			}
		}
	}
}
void display()
{
	for(i=0;i<vars;i++)
	{
		cout<<"\nLEADING("<<gram[i].lhs<<") = ";
		for(j=0;j<terms;j++)
		{
			if(lead[i][j]==1)
				cout<<term[j]<<",";
		}
	}
	cout<<endl;
	for(i=0;i<vars;i++)
	{
		cout<<"\nTRAILING("<<gram[i].lhs<<") = ";
		for(j=0;j<terms;j++)
		{
			if(trail[i][j]==1)
				cout<<term[j]<<",";
		}
```

```
        }
} int
main()
{

        get();
leading();
trailing();
display();

}
```

Input: Enter the no. of variables : 3

Enter the variables :
E T
F

Enter the no. of terminals : 5

Enter the terminals : (
)
+ *
id

PRODUCTION DETAILS

Enter the no. of production of E:2
E->E+T
E->T

Enter the no. of production of T:2
T->T*F
T->F

Enter the no. of production of F:2
F->(E) F->id

Result: The program to find lead and trail was successfully compiled and run.

Experiment -9 **Computation of LR[0]**

Aim: To write a program to implement LR(0) items.

Algorithm:

1. Start.
2. Create structure for production with LHS and RHS.
3. Open file and read input from file.
4. Build state 0 from extra grammar Law S' -> S $ that is all start symbol of grammar and one Dot (.) before S symbol.
5. If Dot symbol is before a non-terminal, add grammar laws that this nonterminal is in Left Hand Side of that Law and set Dot in before of first part of Right Hand Side.
6. If state exists (a state with this Laws and same Dot position), use that instead.
7. Now find set of terminals and non-terminals in which Dot exist in before.
8. If step 7 Set is non-empty go to 9, else go to 10.
9. For each terminal/non-terminal in set step 7 create new state by using all grammar law that Dot position is before of that terminal/non-terminal in reference state by increasing Dot point to next part in Right Hand Side of that laws.
10. Go to step 5.
11. End of state building.
12. Display the output.
13. End.

Program:

```
#include<iostream>
#include<conio.h>
#include<string.h> using
namespace std;

char prod[20][20],listofvar[26]="ABCDEFGHIJKLMNOPQR";
int novar=1,i=0,j=0,k=0,n=0,m=0,arr[30]; int
noitem=0;

struct Grammar
{
```

```
	char lhs;
	char rhs[8];
}g[20],item[20],clos[20][10];
int isvariable(char variable)
{
	for(int i=0;i<novar;i++)
if(g[i].lhs==variable)
			return i+1;
	return 0;
}
void findclosure(int z, char a)
{
	int n=0,i=0,j=0,k=0,l=0;
	for(i=0;i<arr[z];i++)
	{
		for(j=0;j<strlen(clos[z][i].rhs);j++)
		{
			if(clos[z][i].rhs[j]=='.' && clos[z][i].rhs[j+1]==a)
			{
				clos[noitem][n].lhs=clos[z][i].lhs;
	strcpy(clos[noitem][n].rhs,clos[z][i].rhs);
char temp=clos[noitem][n].rhs[j];
clos[noitem][n].rhs[j]=clos[noitem][n].rhs[j+1];
				clos[noitem][n].rhs[j+1]=temp;
				n=n+1;
			}
		}
	}
	for(i=0;i<n;i++)
	{
		for(j=0;j<strlen(clos[noitem][i].rhs);j++)
		{
			if(clos[noitem][i].rhs[j]=='.' && isvariable(clos[noitem]
[i].rhs[j+1])>0)
			{
				for(k=0;k<novar;k++)
				{
					if(clos[noitem][i].rhs[j+1]==clos[0][k].lhs)
					{
						for(l=0;l<n;l++)
							if(clos[noitem][l].lhs==clos[0][k].lhs
```

```
&& strcmp(clos[noitem][l].rhs,clos[0][k].rhs)==0)
                                        break;
                              if(l==n)
                              {
                                   clos[noitem][n].lhs=clos[0][k].lhs;
                              strcpy(clos[noitem][n].rhs,clos[0][k].rhs);
                                   n=n+1;
                              }
                         }
                    }
               }
          }
     }
     arr[noitem]=n;
int flag=0;
for(i=0;i<noitem;i++)
     {
          if(arr[i]==n)
          {
               for(j=0;j<arr[i];j++)
               {
                    int c=0;
                    for(k=0;k<arr[i];k++)
                         if(clos[noitem][k].lhs==clos[i][k].lhs &&
strcmp(clos[noitem][k].rhs,clos[i][k].rhs)==0)
                              c=c+1;
                    if(c==arr[i])
                    {
                         flag=1;
                    goto exit;
                    }
               }
          }
     }
     exit:;
     if(flag==0)
          arr[noitem++]=n;
}

int main()
{
```

```
        cout<<"ENTER THE PRODUCTIONS OF THE GRAMMAR(0 TO END) :
\n";
        do
        {
                cin>>prod[i++];
        }while(strcmp(prod[i-1],"0")!=0); for(n=0;n<i-
        1;n++)
        {
                m=0; j=novar;
                g[novar++].lhs=prod[n][0];
                for(k=3;k<strlen(prod[n]);k++)
                {
                        if(prod[n][k] != '|')
                        g[j].rhs[m++]=prod[n][k];
                        if(prod[n][k]=='|')
                        {
                                g[j].rhs[m]='\0';
                                m=0;
                                j=novar;
                                g[novar++].lhs=prod[n][0];
                        }
                }
        }
        for(i=0;i<26;i++)
if(!isvariable(listofvar[i]))
                        break;
        g[0].lhs=listofvar[i];        char
temp[2]={g[1].lhs,'\0'};    strcat(g[0].rhs,temp);
cout<<"\n\n augumented grammar \n";
for(i=0;i<novar;i++)
cout<<endl<<g[i].lhs<<"->"<<g[i].rhs<<" ";

        for(i=0;i<novar;i++)
        {
                clos[noitem][i].lhs=g[i].lhs;
strcpy(clos[noitem][i].rhs,g[i].rhs);
if(strcmp(clos[noitem][i].rhs,"ε")==0)
                        strcpy(clos[noitem][i].rhs,".");
                else
                {
```

```
                              for(int j=strlen(clos[noitem][i].rhs)+1;j>=0;j--)
clos[noitem][i].rhs[j]=clos[noitem][i].rhs[j-1];
clos[noitem][i].rhs[0]='.';
                    }
          }
          arr[noitem++]=novar;
          for(int z=0;z<noitem;z++)
          {
                    char list[10];
                    int l=0;
                    for(j=0;j<arr[z];j++
          )
                    {
                              for(k=0;k<strlen(clos[z][j].rhs)-1;k++)
                              {
                                        if(clos[z][j].rhs[k]=='.')
                                        {
                                                  for(m=0;m<l;m++)
                                                            if(list[m]==clos[z][j].rhs[k+1])
                                                                      break;
                                                  if(m==l)
                                                            list[l++]=clos[z][j].rhs[k+1];
                                        }
                              }
                    }
                    for(int x=0;x<l;x++)
                              findclosure(z,list[x]);
          }
          cout<<"\n THE SET OF ITEMS ARE \n\n";
          for(int z=0; z<noitem; z++)
          {
                    cout<<"\n I"<<z<<"\n\n";
for(j=0;j<arr[z];j++)                              cout<<clos[z][j].lhs<<"-
>"<<clos[z][j].rhs<<"\n";

          }

}
```

Input:

E->E+T

E->T

T->T*F
T->F
F->(E)
F->i 0

Result: The program for computation of LR[0] was successfully compiled and run.

EX.NO.10

Intermediate Code Generation

AIM:To write a C program to implementation of code generation

Program

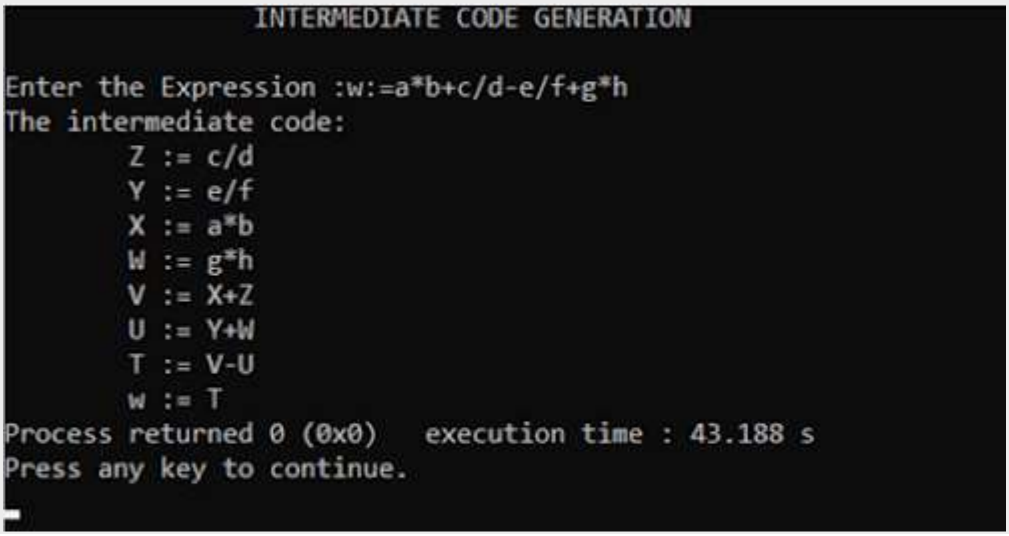
```
#include<stdio.h>
#include<conio.h>
#include<string.h>
int i=1,j=0,no=0,tmpch=90;
char str[100],left[15],right[15];
void findopr();
void explore();
void fleft(int);
void fright(int);
struct exp
{
int pos;
char op;
}k[15];
void main()
{
printf("\t\tINTERMEDIATE CODE GENERATION\n\n");
printf("Enter the Expression :");
scanf("%s",str);
printf("The intermediate code:\n");
```

```
findopr();
explore();
}
void findopr()
{
for(i=0;str[i]!='\0';i++)
if(str[i]==':')
{
k[j].pos=i;
k[j++].op=':';
}
for(i=0;str[i]!='\0';i++)
if(str[i]=='/')
{
k[j].pos=i;
k[j++].op='/';
}
for(i=0;str[i]!='\0';i++)
if(str[i]=='*')
{
k[j].pos=i;
k[j++].op='*';
}
for(i=0;str[i]!='\0';i++)
if(str[i]=='+')
{
```

```
k[j].pos=i;
k[j++].op='+';
}
for(i=0;str[i]!='\0';i++)
if(str[i]=='-')
{
k[j].pos=i;
k[j++].op='-';
}
}
void explore()
{
i=1;
while(k[i].op!='\0')
{
fleft(k[i].pos);
fright(k[i].pos);
str[k[i].pos]=tmpch--;
printf("\t%c := %s%c%s\t\t",str[k[i].pos],left,k[i].op,right);
printf("\n");
i++;
}
fright(-1);
if(no==0)
{
fleft(strlen(str));
```

```
printf("\t%s := %s",right,left);

getch();

exit(0);

}

printf("\t%s := %c",right,str[k[--i].pos]);

getch();

}

void fleft(int x)

{

int w=0,flag=0;

x--;

while(x!= -1 &&str[x]!= '+' &&str[x]!='*'&&str[x]!='='&&str[x]!='\0'&&str[x]!='-
'&&str[x]!='/'&&str[x]!=':')

{

if(str[x]!='$'&& flag==0)

{

left[w++]=str[x];

left[w]='\0';

str[x]='$';

flag=1;

}

x--;

}

}

void fright(int x)

{

int w=0,flag=0;
```

```
x++;

while(x!= -1 && str[x]!= '+'&&str[x]!='*'&&str[x]!='\0'&&str[x]!='='&&str[x]!=':'&&str[x]!='-'&&str[x]!='/')

{

if(str[x]!='$'&& flag==0)

{

right[w++]=str[x];

right[w]='\0';

str[x]='$';

flag=1;

}

x++;

}

}
```



EX.NO : 11

Quadruple Triplet, Indirect Triple

AIM: To write a C program to implementation of Quadruple, Triplet, Indirect triple.

ALGORITHM:

step 1: Start.
Step 2: Enter the three address codes.
Step 3: If the code constitutes only memory operands they are moved to the register and according to the operation the corresponding assembly code is generated.
Step 4: If the code constitutes immediate operands then the code will have a # symbol proceeding the number in code.
Step 5: If the operand or three address code involve pointers then the code generated will constitute pointer register. This content may be stored to other location or vice versa.
Step 6: Appropriate functions and other relevant display statements are executed.
Step 7: Stop.

SOURCE CODE:

```
#include<stdio.h>
#include<string.h>
voidpm();
voidplus();
voiddiv();
inti,ch,j,l,addr=100;
char ex[10],exp[10],exp1[10],exp2[10],id1[5],op[5],id2[5];
void main()
{
clrscr();
while(1)
{
printf("\n1.assignment\n2.arithmetic\n3.relational\n4.Exit\nEnter the choice:");
scanf("%d",&ch);
switch(ch)
{
case 1:
printf("\nEnter the expression with assignment operator:");
scanf("%s",exp);
l=strlen(exp);
exp2[0]='\0';
i=0;
```

```
while(exp[i]!='=')
{
i++;
}
strncat(exp2,exp,i);
strrev(exp);
exp1[0]='\0';
strncat(exp1,exp,l-(i+1));
strrev(exp1);
printf("Three address code:\ntemp=%s\n%s=temp\n",exp1,exp2);
break;

case 2:
printf("\nEnter the expression with arithmetic operator:");
scanf("%s",ex);
strcpy(exp,ex);
l=strlen(exp);
exp1[0]='\0';

for(i=0;i<l;i++)
{
if(exp[i]=='+'||exp[i]=='-')
{
if(exp[i+2]=='/'||exp[i+2]=='*')
{
pm();
break;
}
else
{
plus();
break;
}
}
else if(exp[i]=='/'||exp[i]=='*')
{
div();
break;
}
}
break;

case 3:
printf("Enter the expression with relational operator");
scanf("%s%s%s",&id1,&op,&id2);
if(((strcmp(op,"<")==0)||(strcmp(op,">")==0)||(strcmp(op,"<=")==0)||(strcmp(op,">=")==0)||(strcm
p(op,"==")==0)||(strcmp(op,"!=")==0))==0)
printf("Expression is error");
else
{
printf("\n%d\tif %s%s%sgoto %d",addr,id1,op,id2,addr+3);
addr++;
```

```
printf("\n%d\t T:=0",addr);
addr++;
printf("\n%d\t goto %d",addr,addr+2);
addr++;
printf("\n%d\t T:=1",addr);
}
break;
case 4:
exit(0);
}
}
}
void pm()
{
strrev(exp);
j=l-i-1;
strncat(exp1,exp,j);
strrev(exp1);
printf("Three address code:\ntemp=%s\ntemp1=%c%ctemp\n",exp1,exp[j+1],exp[j]);
}
void div()
{
strncat(exp1,exp,i+2);
printf("Three address code:\ntemp=%s\ntemp1=temp%c%c\n",exp1,exp[i+2],exp[i+3]);
}
void plus()
{
strncat(exp1,exp,i+2);
printf("Three address code:\ntemp=%s\ntemp1=temp%c%c\n",exp1,exp[i+2],exp[i+3]);
}
```

OUTPUT :

Example Generation of Three Address Project Output Result

```
1. assignment
2. arithmetic
3. relational
4. Exit
Enter the choice:1
Enter the expression with assignment operator:
a=b
Three address code:
temp=b
a=temp

1.assignment
2.arithmetic
3.relational
```

4.Exit
Enter the choice:2
Enter the expression with arithmetic operator:
a+b-c
Three address code:
temp=a+b
temp1=temp-c

1.assignment
2.arithmetic
3.relational
4.Exit
Enter the choice:2
Enter the expression with arithmetic operator:
a-b/c
Three address code:
temp=b/c
temp1=a-temp

1.assignment
2.arithmetic
3.relational
4.Exit
Enter the choice:2
Enter the expression with arithmetic operator:
a*b-c
Three address code:
temp=a*b
temp1=temp-c

1.assignment
2.arithmetic
3.relational
4.Exit
Enter the choice:2
Enter the expression with arithmetic operator:a/b*c
Three address code:
temp=a/b
temp1=temp*c
1.assignment
2.arithmetic
3.relational
4.Exit
Enter the choice:3
Enter the expression with relational operator
a
<=
b

100 if a<=b goto 103
101 T:=0
102 goto 104

103 T:=1

1.assignment
2.arithmetic
3.relational
4.Exit
Enter the choice:4

RESULT: Thus the Generation of Three Address was executed and verified Successfully.

EX.NO : 12

Simple Code Generation

AIM:To write a C program to perform the Simple Code Generation

PROGRAM:

```
#include<stdio.h>
#include<conio.h>
#include<string.h>
char op[2],arg1[5],arg2[5],result[5];
void main()
{
  FILE *fp1,*fp2;
  fp1=fopen("input.txt","r");
  fp2=fopen("output.txt","w");
  while(!feof(fp1))
  {

    fscanf(fp1,"%s%s%s%s",op,arg1,arg2,result);
    if(strcmp(op,"+")==0)
    {
      fprintf(fp2,"\nMOV R0,%s",arg1);
      fprintf(fp2,"\nADD R0,%s",arg2);
      fprintf(fp2,"\nMOV %s,R0",result);
    }
     if(strcmp(op,"*")==0)
    {
      fprintf(fp2,"\nMOV R0,%s",arg1);
      fprintf(fp2,"\nMUL R0,%s",arg2);
      fprintf(fp2,"\nMOV %s,R0",result);
    }
    if(strcmp(op,"-")==0)
    {
      fprintf(fp2,"\nMOV R0,%s",arg1);
      fprintf(fp2,"\nSUB R0,%s",arg2);
      fprintf(fp2,"\nMOV %s,R0",result);
    }
```

```
      if(strcmp(op,"/")==0)
    {
      fprintf(fp2,"\nMOV R0,%s",arg1);
      fprintf(fp2,"\nDIV R0,%s",arg2);
      fprintf(fp2,"\nMOV %s,R0",result);
    }
if(strcmp(op,"=")==0)
    {
      fprintf(fp2,"\nMOV R0,%s",arg1);
      fprintf(fp2,"\nMOV %s,R0",result);
    }
    }
    fclose(fp1);
    fclose(fp2);
    getch();
  }
}
```

input.txt

```
+ a b t1
* c d t2
- t1 t2 t
= t ? x
```

output.txt

```
MOV R0,a

ADD R0,b

MOV t1,R0

MOV R0,c
```

```
MUL R0,d

MOV t2,R0

MOV R0,t1

SUB R0,t2

MOV t,R0

MOV R0,t

MOV x,R0
```

Experiment -13 **Construction of DAG**

Aim: To write a program to construct a direct acyclic graph.

Algorithm:

1. Start the program
2. Include all the header files
3. Check for postfix expression and construct the in order DAG representation
4. Print the output 5. Stop the program

Program:

```
#include<stdio.h>
#include<string.h> int
i=1,j=0,no=0,tmpch=90; char
str[100],left[15],right[15];
void findopr(); void explore();
void fleft(int); void fright(int);
struct exp {  int pos;  char op;
}k[15]; void main()
{

 printf("\t\tINTERMEDIATE CODE GENERATION OF DAG\n\n");

 scanf("%s",str);
 printf("The intermediate code:\t\tExpression\n");
findopr();
 explore();

}
void findopr()
{
 for(i=0;str[i]!='\0';i++)
  if(str[i]==':')
   {
k[j].pos=i;
k[j++].op=':';
}
 for(i=0;str[i]!='\0';i++)
if(str[i]=='/')
```

```
  {
k[j].pos=i;
k[j++].op='/';
  }
 for(i=0;str[i]!='\0';i++)
if(str[i]=='*')
  {
k[j].pos=i;
 k[j++].op='*';
  }
 for(i=0;str[i]!='\0';i++)
if(str[i]=='+')
  {
k[j].pos=i;
 k[j++].op='+';
  }
 for(i=0;str[i]!='\0';i++)   if(str[i]=='-
')
  {
k[j].pos=i;
k[j++].op='-';
  } } void
explore()
{
i=1;
 while(k[i].op!='\0')
 {   fleft(k[i].pos);
fright(k[i].pos);
str[k[i].pos]=tmpch--;
 printf("\t%c := %s%c%s\t\t",str[k[i].pos],left,k[i].op,right);
for(j=0;j <strlen(str);j++)    if(str[j]!='$')
printf("%c",str[j]);   printf("\n");   i++;  }  fright(-1);
 if(no==0)
{
 fleft(strlen(str));
 printf("\t%s := %s",right,left);
 }  printf("\t%s :=  %c",right,str[k[--
i].pos]);

}
void fleft(int x)
{
```

```
 int w=0,flag=0;  x--;  while(x!= -1 &&str[x]!= '+'
&&str[x]!='*'&&str[x]!='='&&str[x]!='\0'&&str[x]! ='-
'&&str[x]!='/'&&str[x]!=':')
 {
  if(str[x]!='$'&& flag==0)
  {
  left[w++]=str[x];
left[w]='\0';
str[x]='$';
flag=1;   }   x--;  }
}
void fright(int x)
{
 int w=0,flag=0;  x++;  while(x!= -1 && str[x]!=
'+'&&str[x]!='*'&&str[x]!='\0'&&str[x]!='='&&str[x]! =':'&&str[x]!='-
'&&str[x]!='/')
 {
  if(str[x]!='$'&& flag==0)
  {
  right[w++]=str[x];
right[w]='\0';
str[x]='$';   flag=1;
  }
x++;
 } }
```

Input: a=b*-c+b*-c

Result: The program for computation of direct acyclic graph was successfully compiled and run.