ABESIT

COLLEGE CODE – 290

Lab File

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SESSION	2019-20
NAME OF LAB	Compiler Design Lab (RCS 652)

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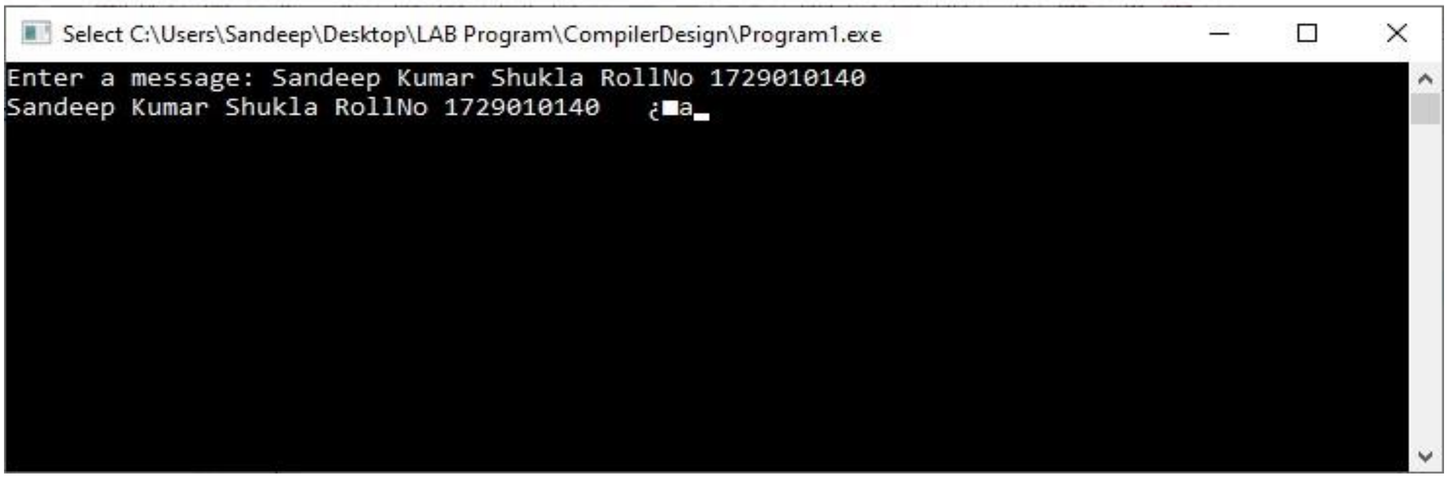
Program - 1

Aim :- *Write a C program to print a message with help of getchar() and putchar() in a line.*

Code :-

```
#include <stdio.h>
int main() {
 int i = 0;
 char msg[100], ch;
 printf("Enter a message: ");
 while (ch = getchar()) {
  if (ch == '\n') {
   break;
  }
  msg[i++] = ch;
 }
 i = 0;
 while (msg[i] != NULL) {
  putchar(msg[i++]);
 }
return 0;
}
```

Output :-


Select C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\Program1.exe

```
Enter a message: Sandeep Kumar Shukla RollNo 1729010140
Sandeep Kumar Shukla RollNo 1729010140   ¿■a_
```

Program - 2

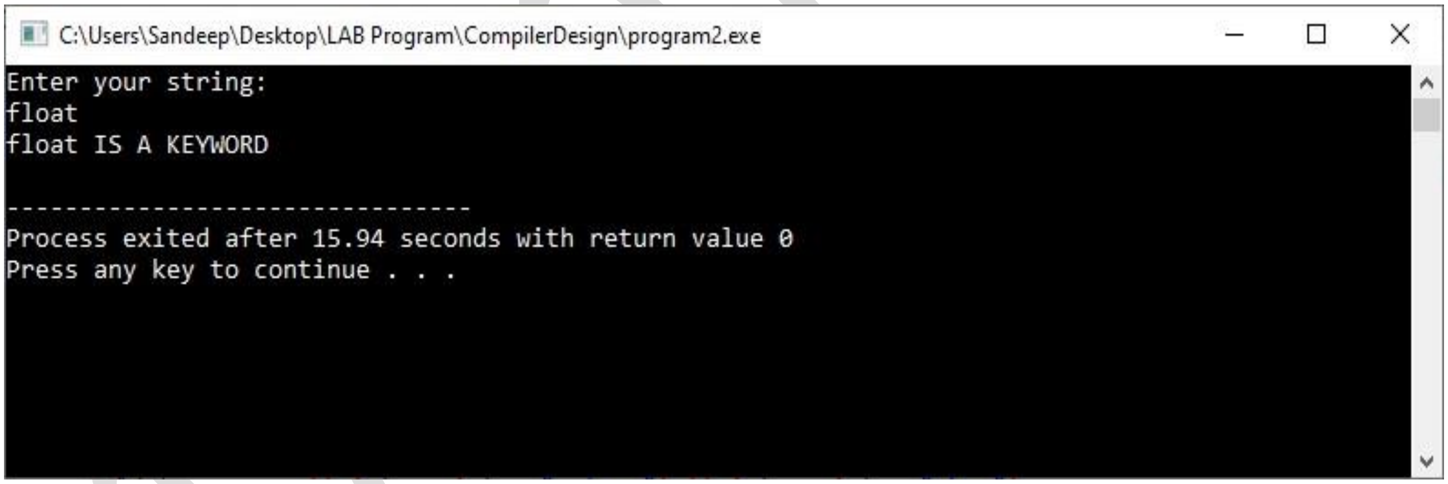
Aim :- *Write a C program for identifying keywords for lexical analyzer.*

Code :-

```
#include <stdio.h>

#include<conio.h>

#include<string.h>

#include <stdbool.h> /*C90 does not support the boolean data type.C99 does include it with
this include*/


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);

}
```

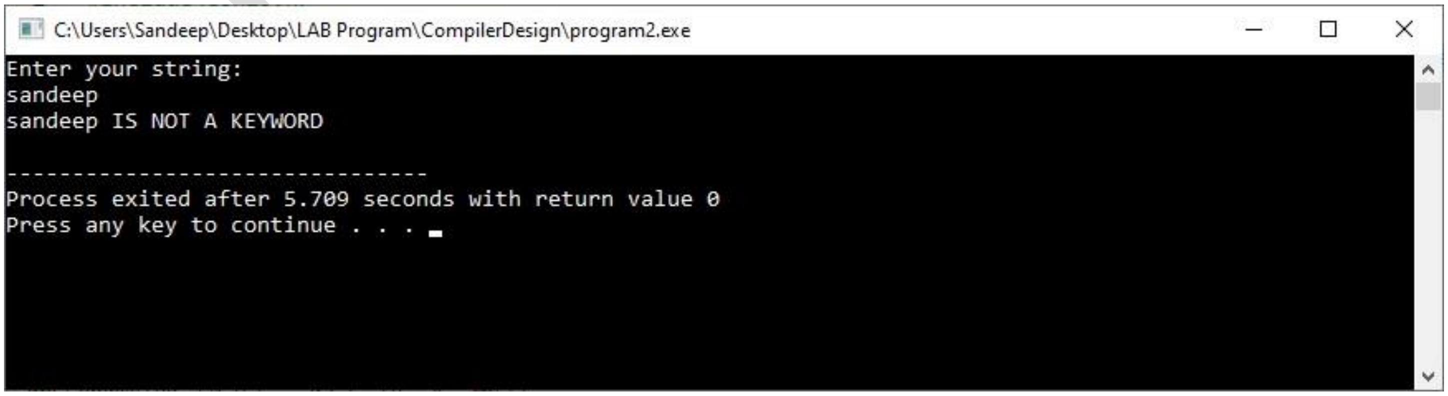
```
int main() {
  char str[20];
  puts("Enter your string:");
  gets(str);
  if (isKeyword(str) == true)
      printf("%s IS A KEYWORD\n",str);
  else
      printf("%s IS NOT A KEYWORD\n",str);
  return 0;
}
```

<u>Output</u> :-



C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program2.exe

```
Enter your string:
float
float IS A KEYWORD

--------------------------------
Process exited after 15.94 seconds with return value 0
Press any key to continue . . .
```



C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program2.exe

```
Enter your string:
sandeep
sandeep IS NOT A KEYWORD

--------------------------------
Process exited after 5.709 seconds with return value 0
Press any key to continue . . .
```

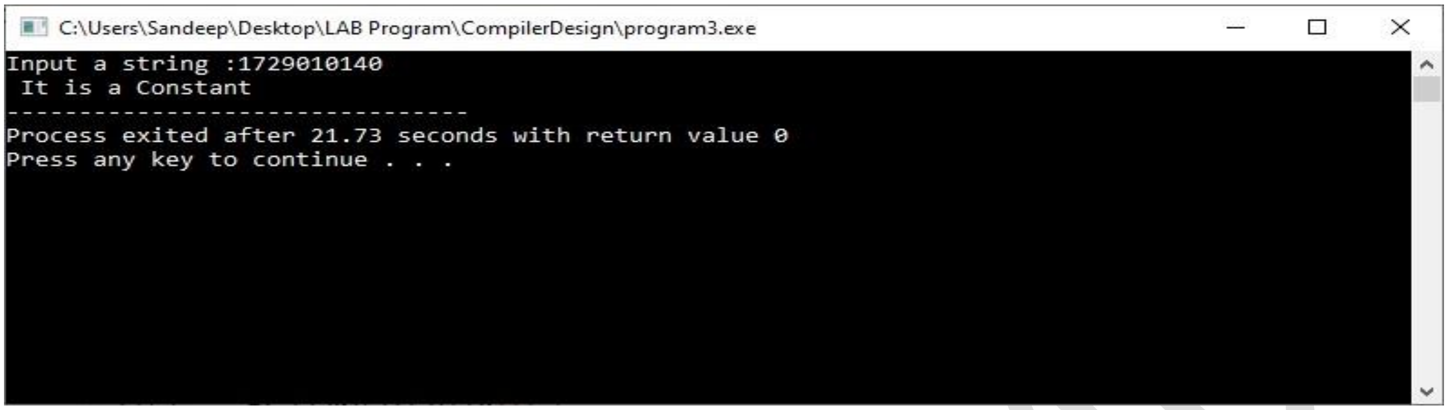
Program - 3

Aim :- *Write a C program to check whether a string is constant or not .*

Code :-

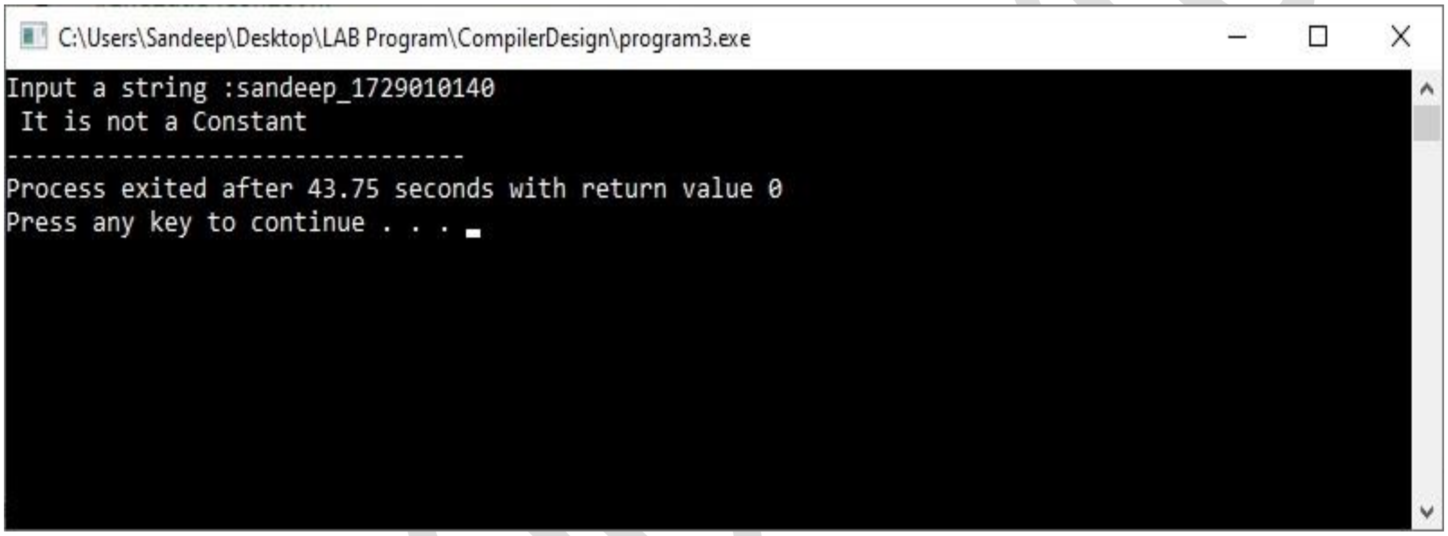
```
#include<stdio.h>
#include<conio.h>
#include<ctype.h>
#include<string.h>
int main() {
  char str[10];
  int len, a;
  printf("Input a string :");
  gets(str);
  len = strlen(str);
  a = 0;
  while (a < len) {
    if (isdigit(str[a])) {
           a++;
           }
           else {
        printf(" It is not a Constant");
        break;
    }
  }
  if (a == len) {
    printf(" It is a Constant");
  }
  return 0;
}
```

Output :-



C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program3.exe

```
Input a string :1729010140
 It is a Constant
--------------------------------
Process exited after 21.73 seconds with return value 0
Press any key to continue . . .
```



C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program3.exe

```
Input a string :sandeep_1729010140
 It is not a Constant
--------------------------------
Process exited after 43.75 seconds with return value 0
Press any key to continue . . .
```

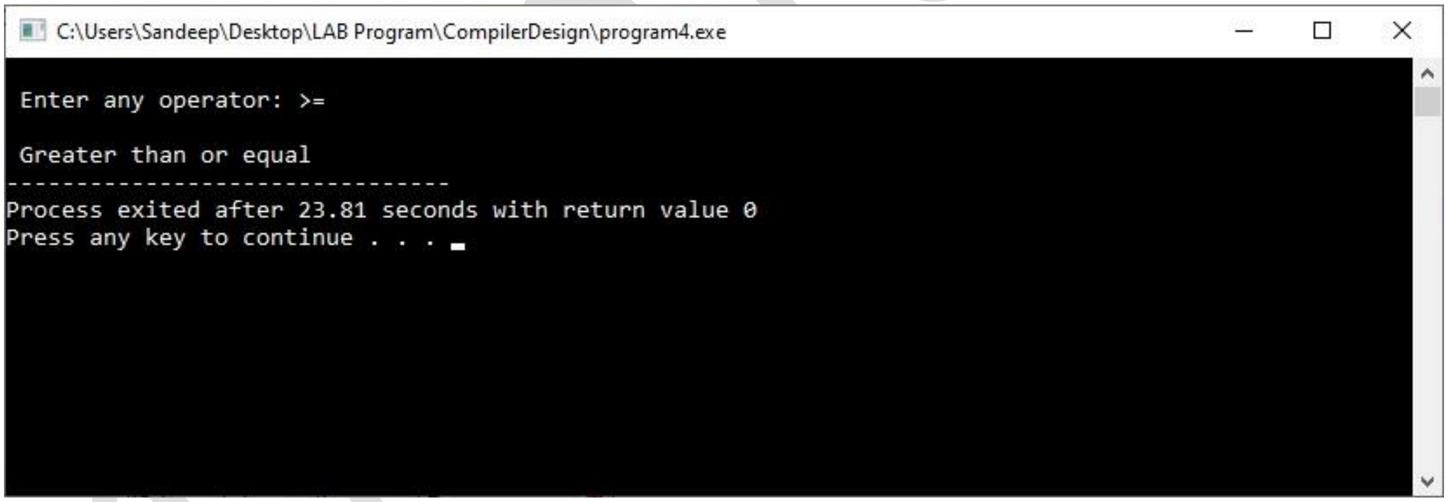
Program - 4

Aim :- *Write a C program to simulate lexical analyzer for validating operators.*

Code :-

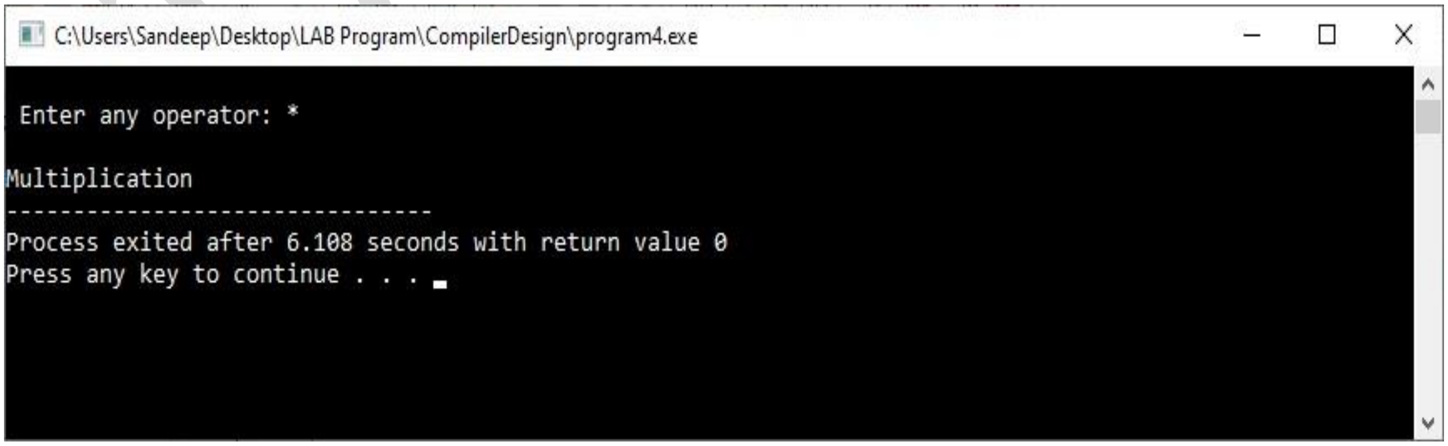
```
#include<stdio.h>
#include<conio.h>
int main() {
        char s[5];
        printf("\n Enter any operator: ");
        gets(s);
        switch (s[0]) {
                case '>':
                  if (s[1] == '=') printf("\n Greater than or equal");
                  else printf("\n Greater than");
                  break;
                case '<':
                  if (s[1] == '=') printf("\n Less than or equal");
                  else printf("\nLess than");
                  break;
                case '=':
                  if (s[1] == '=') printf("\nEqual to");
                  else printf("\nAssignment");
                  break;
                case '!':
                  if (s[1] == '=') printf("\nNot Equal");
                  else printf("\n Bit Not");
                  break;
                case '&':
                  if (s[1] == '&') printf("\nLogical AND");
                  else printf("\n Bitwise AND");
                  break;
                case '|':
                  if (s[1] == '|') printf("\nLogical OR");
                  else printf("\nBitwise OR");
                  break;
                case '+':
                  printf("\n Addition");
                  break;
                case '-':
                  printf("\nSubstraction");
                  break;
                case '*':
                  printf("\nMultiplication");
                  break;
                case '/':
                  printf("\nDivision");
                  break;
                case '%':
                  printf("Modulus");
                  break;
                default:
                  printf("\n Not a operator");
        }
        return 0;
}
```

Output :-



C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program4.exe

```
 Enter any operator: >=

 Greater than or equal
--------------------------------
Process exited after 23.81 seconds with return value 0
Press any key to continue . . .
```



C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program4.exe

```
 Enter any operator: *

Multiplication
--------------------------------
Process exited after 6.108 seconds with return value 0
Press any key to continue . . .
```

Program - 5

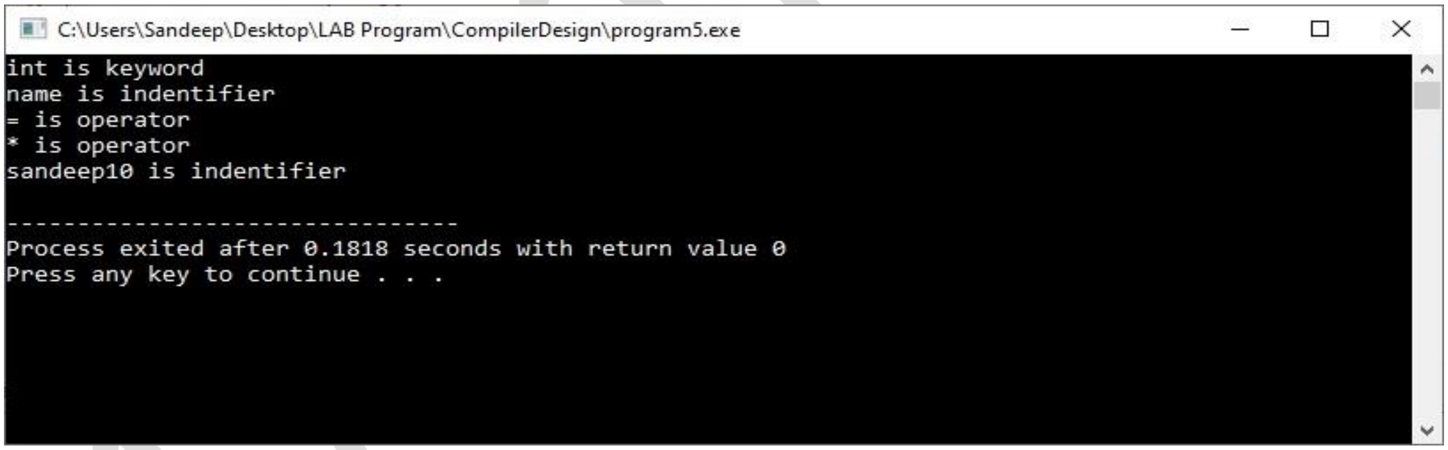
Aim :- *Write a C program to implement lexical analyzer.*

Code :-

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

int isKeyword(char buffer[]){
	char keywords[32][10] = {"auto","break","case","char","const","continue","default",
					"do","double","else","enum","extern","float","for","goto",
						"if","int","long","register","return","short","signed",
						"sizeof","static","struct","switch","typedef","union",
							"unsigned","void","volatile","while"};
	int i, flag = 0;
	for(i = 0; i < 32; ++i){
		if(strcmp(keywords[i], buffer) == 0){
			flag = 1;
			break;
		}
	}
	return flag;
}

int main(){
	char ch, buffer[15], operators[] = "+-*/%=";
	FILE *fp;
	int i,j=0;

	fp = fopen("program5.txt","r");

	if(fp == NULL){
		printf("error while opening the file\n");
		exit(0);
	}

	while((ch = fgetc(fp)) != EOF){
		for(i = 0; i < 6; ++i){
```

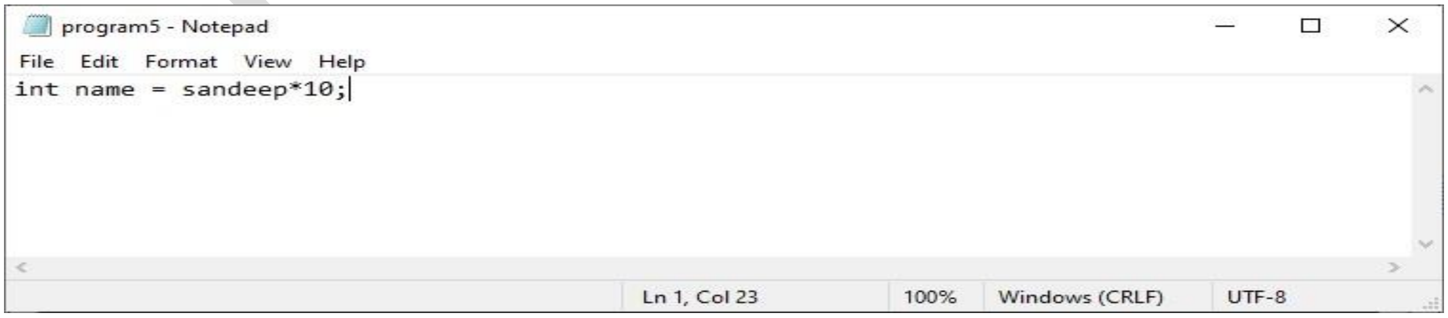
```
                if(ch == operators[i])
                        printf("%c is operator\n", ch);
        }
        if(isalnum(ch)){
                buffer[j++] = ch;
        }
        else if((ch == ' ' || ch == '\n') && (j != 0)){
                        buffer[j] = '\0';
                        j = 0;
                        if(isKeyword(buffer) == 1)
                                printf("%s is keyword\n", buffer);
                        else
                                printf("%s is indentifier\n", buffer);
        }
    }
    fclose(fp);
    return 0;
}
```

<u>Output</u> :-


C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program5.exe

```
int is keyword
name is indentifier
= is operator
* is operator
sandeep10 is indentifier

--------------------------------
Process exited after 0.1818 seconds with return value 0
Press any key to continue . . .
```

This is program5.txt file 👇



```
int name = sandeep*10;
```

<u>**Program - 6**</u>

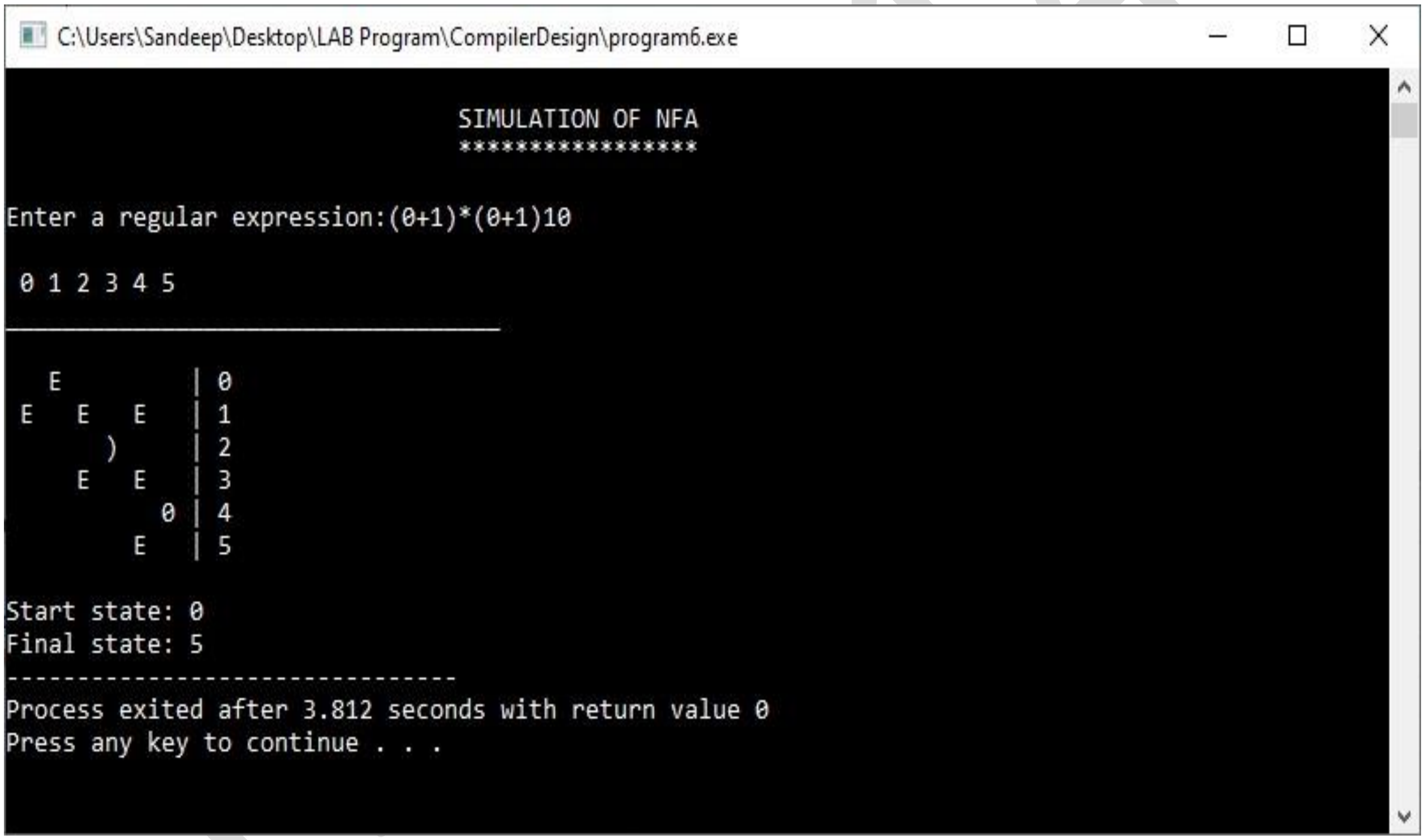
<u>Aim</u> :- *Write a C Program for construction of NFA From regular expression.*

<u>Code</u> :-

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

int main() {
   char m[20], t[10][10];
   int n, i, j, r = 0, c = 0;
   printf("\n\t\t\t\tSIMULATION OF NFA");
   printf("\n\t\t\t\t*****************");
   for (i = 0; i < 10; i++) {
     for (j = 0; j < 10; j++) {
       t[i][j] = ' ';
     }
   }
   printf("\n\nEnter a regular expression:");
   scanf("%s", m);
   n = strlen(m);
   for (i = 0; i < n; i++) {
     switch (m[i]) {
     case '|':
       {
         t[r][r + 1] = 'E';t[r + 1][r + 2] = m[i - 1];t[r + 2][r + 5] = 'E';t[r][r + 3] = 'E';t[r + 4][r + 5] = 'E';t[r
+ 3][r + 4] = m[i + 1];
         r = r + 5;
         break;
       }
     case '*':
       {
         t[r - 1][r] = 'E';t[r][r + 1] = 'E';

         t[r][r + 3] = 'E';t[r + 1][r + 2] = m[i - 1];t[r + 2][r + 1] = 'E';t[r + 2][r + 3] = 'E';r = r + 3;
         break;
       }
     case '+':
       {
         t[r][r + 1] = m[i - 1];
         t[r + 1][r] = 'E';r = r + 1;
         break;
       }
     default:
       {
         if (c == 0) {
           if ((isalpha(m[i])) && (isalpha(m[i + 1]))) {
             t[r][r + 1] = m[i];
             t[r + 1][r + 2] = m[i + 1];
             r = r + 2;
             c = 1;
           }
           c = 1;
         } else if (c == 1) {
           if (isalpha(m[i + 1])) {
             t[r][r + 1] = m[i + 1];
             r = r + 1;
             c = 2;
           }
         } else {
           if (isalpha(m[i + 1])) {

             t[r][r + 1] = m[i + 1];
             r = r + 1;
             c = 3;
           }
         }
       }
       break;
     }
   }
   printf("\n");
   for (j = 0; j <= r; j++) printf(" %d", j);
   printf("\n___________________________________________\n");
        printf("\n");
     for (i = 0; i <= r; i++) {
       for (j = 0; j <= r; j++) {
         printf(" %c", t[i][j]);
       }
       printf(" | %d", i);
```

```
        printf("\n");
      }
      printf("\nStart state: 0\nFinal state: %d", i - 1);
            return 0;

}
```

Output :-



C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program6.exe

```
                                SIMULATION OF NFA
                                *****************

Enter a regular expression:(0+1)*(0+1)10

 0 1 2 3 4 5
___________________________________

   E         | 0
 E   E   E   | 1
       )     | 2
     E   E   | 3
           0 | 4
         E   | 5

Start state: 0
Final state: 5
--------------------------------
Process exited after 3.812 seconds with return value 0
Press any key to continue . . .
```

Program - 7

Aim :- *Write compiler construction tool Yacc (yet another compiler compiler) for unambiguous grammar E->E+T|T*

T->T/F|F

F->(E)|id

of string(id+id/id)

Code :-

```
% {
 #include <stdio.h>
 int regs[26];int base; %
} %
start list
 %
 union {
  int a;
 } %
 type < a > expr number % token DIGIT LETTER
list:
 |
 list stat '\n' |
 list error '\n' {
  yyerrok;
 };
stat: expr {
  printf("%d\n", $1);
 } |
 LETTER '='
expr {
 regs[$1] = $3;
};
factor: '('
expr ')' {
  $$ = $2;
 } |
 |
 term: term '/'
```

```
factor {
  $$ = $1 / $3;
} |
term: factor |
  expr: expr '+'
term {
  $$ = $1 + $3;
} |
expr: term |

  Factor: number |
;
number: DIGIT {
    $$ = $1;
    base = ($1 == 0) ? 8 : 10;
  } |
  number DIGIT {
    $$ = base * $1 + $2;
  }; %
%
main() {
  return (yyparse());
}
yyerror(s) char * s; {
  fprintf(stderr, "%s\n", s);
}
yywrap() {
  return (1);
}
```

Output :-

Input = (2+2/2)

Output =3

Program - 8

Aim :- *Write compiler construction tool Yacc for string (id+id*id) using shift reduce parsing technique for ambiguous grammar*

*E->E+E|E-E|-E|€|E*E|E/E|id*

Code :-

```
% {
  #include <stdio.h>
  int regs[26];int base; %
} %
start list
  %
  union {
    int a;
  } %
  type < a > expr number %
  token DIGIT LETTER %
  left‘ | ’
  %
  left‘ & ’
  %
  left‘ + ’‘ -‘
  %
  left‘ * ’‘/’ ‘%’ %
  left UMINUS %
  %
  list:
  |
  list stat‘\ n’ |
  list error‘\ n’ {
    yyerrok;
  };
stat: expr {
    printf(“ % d\ n”, $1);
  } |
  LETTER‘ = ’expr {
    regs[$1] = $3;
  };
expr: ‘(‘expr‘)’ {
    $$ = $2;
  } |
  expr‘ * ’expr {
    $$ = $1 * $3;
  } |
  expr‘ / ’expr {
    $$ = $1 / $3;
  } |
  expr‘ % ’expr {
    $$ = $1 % $3;
  } |
  expr‘ + ’expr {
    $$ = $1 + $3;
  } |
  expr‘ - ‘expr {
    $$ = $1 - $3;
  } |
  expr‘ & ’expr {
    $$ = $1 & $3;
  } |
  expr‘ | ’expr {
    $$ = $1 | $3;
  } | ‘-‘expr % prec UMINUS {
    $$ = -$2;
  } |
  LETTER {
    $$ = regs[$1];
  } |
  number;
number: DIGIT {
    $$ = $1;
    base = ($1 == 0) ? 8 : 10;
  } |
  number DIGIT {
    $$ = base * $1 + $2;
  }; %
%
```

```
main() {
  return (yyparse());
}
yyerror(s) char * s; {
  fprintf(stderr, “ % s\ n”, s);
}
yywrap() {
  return (1);
}
```

Output :-

```
Input = 2+2

Output=4
```

Program - 9

Aim :- *Write compiler construction tool lex for string (id+id*id).*

Code :-

```
% {
 #include <stdio.h>
 #include "y.tab.h"
 int c;
 extern int yylval;
 %}
 %%
 " ";
 [a-z] {
    c = yytext[0];
    yylval = c - 'a';
    return(LETTER);

 }
 [0-9] {
    c = yytext[0];
    yylval = c - '0';
    return(DIGIT);

 }
 [^a-z0-9\b] {
    c = yytext[0];
    return(c);

 }
```

Output :-

```
(2+2*2)
=6
```

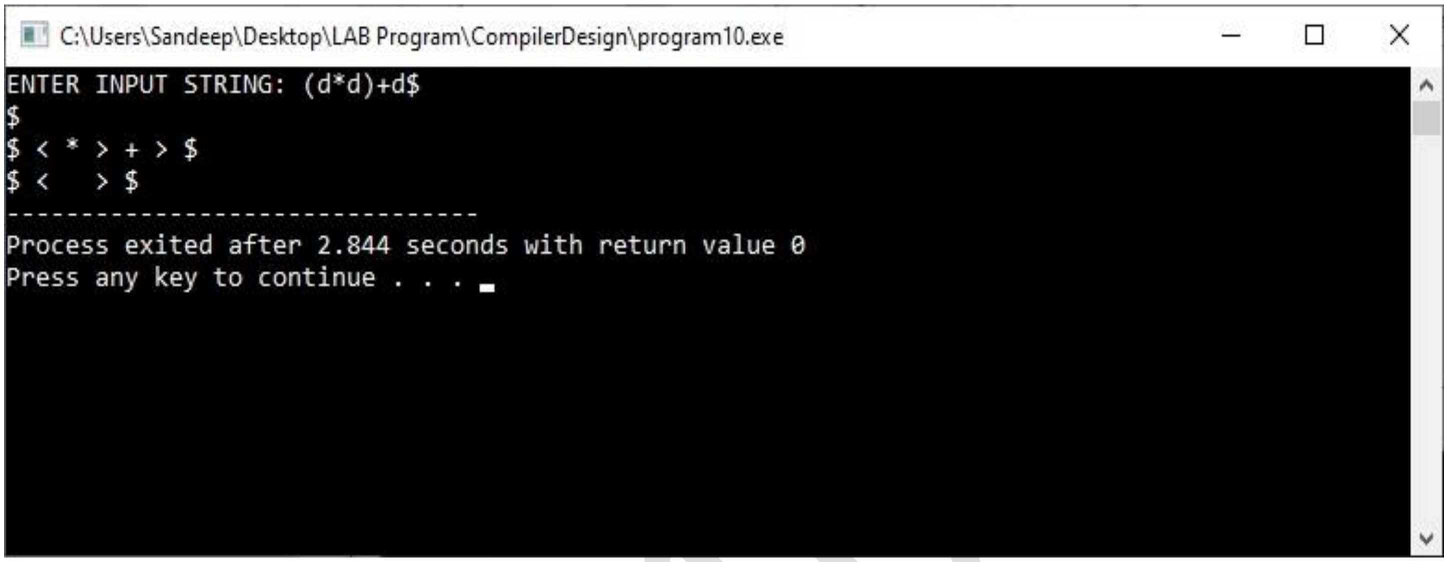
Program - 10

Aim :- *Write a C program for operator precedence parsing.*

Code :-

```
#include<conio.h>
#include<ctype.h>
#include<stdio.h>
int main()
{
  int i, j, x, x1, k, k1, z1, z;
  char a[20], b[20][20], c[20], p[10] = "*+$";
  char fp[10][10] = {
    "id1",
    "id2",
    "id3"
  }, d[10];
  printf("ENTER INPUT STRING: ");
  gets(a);
  i = 0;
  j = 0;
  x = 0;
  x1 = 0;
  printf("$ ");
  while (a[i] != '\0') {
    j = 0;
    while (1) {
      if (a[i] != '+' && a[i] != '*' && a[i] != '$') {
        b[x][j] = a[i];
        i++;
        j++;
      } else {
        c[x] = a[i];
        break;
      }
    }
    b[x][j] = '\0';
    for (k = 0; k < 3; k++)
      if (!strcmp(b[x], fp[k]))
        for (k1 = 0; k1 < 3; k1++)
        if (c[x] == p[k1]) printf("< %s > %c ", b[x], c[x]);
    x++;
    i++;
  }
  c[x] = '\0';
  i = 0;
  printf("\n$ <");
  while (c[i] != '\0') {
    for (k = 0; k < 3; k++)
      if (c[i] == p[k]) z = k;
    i++;
    printf(" %c", c[i - 1]);
    for (k = 0; k < 3; k++)
      if (c[i] == p[k]) z1 = k;
    i++;
    if (z > z1) printf(" <");
    else printf(" >");
    printf(" %c", c[i - 1]);
    i++;
  }
  printf(" > $");
  for (i = 0; i < 3; i++) {
    if (c[i] == p[0]) c[i] = ' ';
  }
  i = 0;
  printf("\n$ <");
  for (k = 0; k < 3; k++)
    if (c[i] == p[k]) z = k;
  printf(" %c", c[i]);
  i++;
  i++;
  for (k = 0; k < 3; k++)
    if (c[i] == p[k]) z1 = k;
  if (z > z1) printf(" <");
  else
    printf(" >");
  printf(" %c", c[i]);
  return 0;
}
```

Output :-



C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program10.exe

```
ENTER INPUT STRING: (d*d)+d$
$
$ < * > + > $
$ <   > $
--------------------------------
Process exited after 2.844 seconds with return value 0
Press any key to continue . . .
```

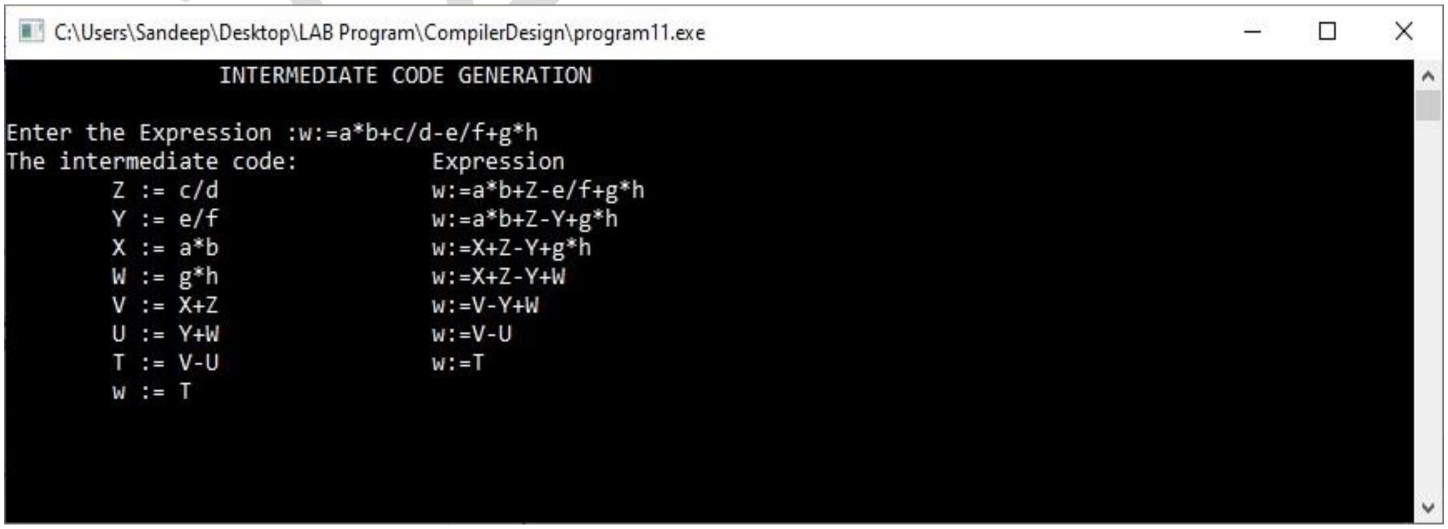
Program - 11

Aim :- *Write a C program for implementation of code generator.*

Code :-

```
#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];

int main() {
  printf("\t\tINTERMEDIATE CODE GENERATION\n\n");
  printf("Enter the Expression :");
  scanf("%s", str);
  printf("The intermediate code:\t\tExpression\n");
  findopr();
  explore();
  return 0;
}

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);
    getch();
    exit(0);
  }
  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++;
    }
}
```

Output :-



```
C:\Users\Sandeep\Desktop\LAB Program\CompilerDesign\program11.exe
                INTERMEDIATE CODE GENERATION

Enter the Expression :w:=a*b+c/d-e/f+g*h
The intermediate code:          Expression
        Z := c/d                w:=a*b+Z-e/f+g*h
        Y := e/f                w:=a*b+Z-Y+g*h
        X := a*b                w:=X+Z-Y+g*h
        W := g*h                w:=X+Z-Y+W
        V := X+Z                w:=V-Y+W
        U := Y+W                w:=V-U
        T := V-U                w:=T
        w := T
```