SIMATS SCHOOL OF ENGINEERING

SAVEETHA INSTITUTE OF MEDICAL AND TECHNICAL SCIENCES

CHENNAI-602105

LAB PROGRAMS (11-20)

ON

CSA1445-COMPILER DESIGN FOR POLYMORPHIC FUNCTIONS

SLOT C

Submitted by

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To

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11)Implement a C program to perform symbol table operations.

Aim:

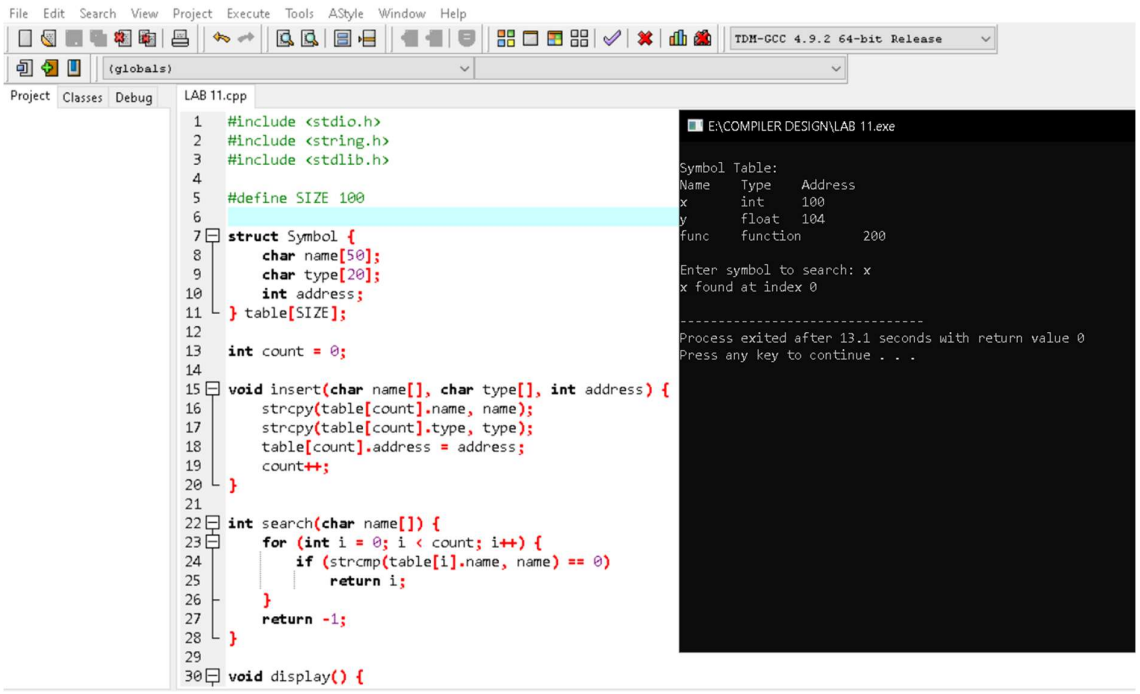
To implement a symbol table in C that supports insertion, search, and display operations.

Code:

```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#define SIZE 100
struct Symbol {
    char name[50];
    char type[20];
    int address;
} table[SIZE];
int count = 0;
void insert(char name[], char type[], int address) {
    strcpy(table[count].name, name);
    strcpy(table[count].type, type);
    table[count].address = address;
    count++;
}
int search(char name[]) {
    for (int i = 0; i < count; i++) {
        if (strcmp(table[i].name, name) == 0)
            return i;
    }
    return -1;
}
```

```
void display() {
    printf("\nSymbol Table:\n");
    printf("Name\tType\tAddress\n");
    for (int i = 0; i < count; i++) {
        printf("%s\t%s\t%d\n", table[i].name, table[i].type, table[i].address);
    }
}
int main() {
    insert("x", "int", 100);
    insert("y", "float", 104);
    insert("func", "function", 200);
    display();
    char searchName[50];
    printf("\nEnter symbol to search: ");
    scanf("%s", searchName);

    int pos = search(searchName);
    if (pos != -1)
        printf("%s found at index %d\n", searchName, pos);
    else
        printf("%s not found in symbol table.\n", searchName);

    return 0;
}
```

Output:



12)Write a C program to construct recursive descent parsing for the given grammar

Aim:

To implement a recursive descent parser for the given grammar.

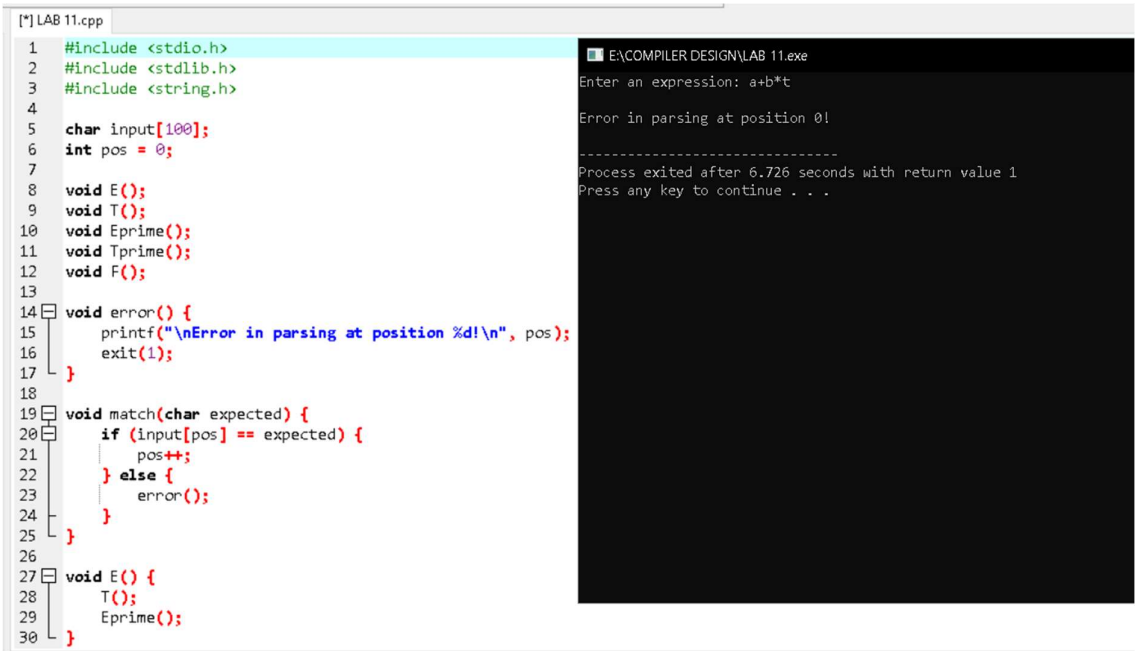
Code:

```
#include <stdio.h>
#include <string.h>
char input[100];
int index = 0;
void E(), T(), F(), E_prime(), T_prime();
void match(char expected) {
    if (input[index] == expected) {
        index++;
```

```
    } else {
        printf("Error in parsing\n");
        exit(0);
    }
}
void E() {
    T();
    E_prime();
}
void E_prime() {
    if (input[index] == '+') {
        match('+');
        T();
        E_prime();
    }
}
void T() {
    F();
    T_prime();
}
void T_prime() {
    if (input[index] == '*') {
        match('*');
        F();
        T_prime();
    }
}
```

```
void F() {
    if (input[index] == '(') {
        match('(');
        E();
        match(')');
    } else if (input[index] == 'i') {
        match('i');  // Assuming 'i' represents an identifier
    } else {
        printf("Error in parsing\n");
        exit(0);
    }
}
int main() {
    printf("Enter input string: ");
    scanf("%s", input);
    E();
    if (input[index] == '\0') {
        printf("Parsing successful\n");
    } else {
        printf("Error: Unexpected input\n");
    }
    return 0;
}
```

Output:



13) Write a C program to implement either Top Down parsing technique or Bottom Up Parsing technique to check whether the given input string is satisfying the grammar or not.

Aim:

To implement a Bottom-Up Parsing technique (Shift-Reduce Parsing) in C to check whether the given input string satisfies the specified grammar.

C Code Implementation:

```
#include <stdio.h>

#include <string.h>

char stack[50];

char input[50];

int top = -1;

int ip = 0;

void push(char c) {

   stack[++top] = c;

}
```

```
void pop() {
   top--;
}
void display() {
   printf("\nStack: %s\t Input: %s", stack, input + ip);
}
int reduce() {
   if (top >= 2) {
      if (stack[top] == 'E' && stack[top - 1] == '+' && stack[top - 2] == 'E') {
         printf("\nReduce by E -> E+E");
         top -= 2;
         return 1;
      }
      if (stack[top] == 'E' && stack[top - 1] == '*' && stack[top - 2] == 'E') {
         printf("\nReduce by E -> E*E");
         top -= 2;
         return 1;
      }
   }
   if (top >= 2) {
      if (stack[top] == ')' && stack[top - 1] == 'E' && stack[top - 2] == '(') {
         printf("\nReduce by E -> (E)");
         top -= 2;
         return 1;
      }
   }
   if (top >= 0) {
```

```
        if (stack[top] == 'a') {
            printf("\nReduce by E -> a");
            stack[top] = 'E';
            return 1;
        }
    }
    return 0;
}
int main() {
    printf("Enter the input string ending with $: ");
    scanf("%s", input);
    push('$');
    printf("\nBottom-Up Parsing (Shift-Reduce) Simulation:\n");
    display();
    while (1) {
        if (input[ip] != '\0') {
            push(input[ip++]);
            printf("\nShift '%c'", stack[top]);
            display();
        }
        while (reduce()) {
            display();
        }
        if (input[ip] == '\0' && top == 1 && stack[top] == 'E' && stack[0] == '$')
{
            printf("\n\nThe input string is successfully parsed!\n");
            break;
        }
```

```
    if (input[ip] == '\0' && top != 1) {
        printf("\n\nError: The input string cannot be parsed by the given grammar.\n");
        break;
    }
  }
  return 0;
}
```

LAB 11.cpp

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

char stack[100];
char input[100];
int top = -1;

void push(char c) {
    stack[++top] = c;
}

void pop() {
    top--;
}

void display() {
    printf("\nStack: %.*s\tInput: %s", top + 1, stack
}

int reduce() {
    if (top >= 2 && stack[top - 2] == 'E' && (stack[t
        pop(); pop(); pop();
        push('E');
        return 1;
    }
    if (top >= 2 && stack[top - 2] == '(' && stack[to
        pop(); pop(); pop();
        push('E');
        return 1;
```

E:\COMPILER DESIGN\LAB 11.exe

```
Enter the input string (without spaces, id as 'i'): E -> E + E

Stack: E        Input: E
Parsing successful!

--------------------------------
Process exited after 3.301 seconds with return value 0
Press any key to continue . . .
```

14)Implement the concept of Shift reduce parsing in C Programming.

Aim:

To implement the Shift-Reduce Parsing technique in C to parse a given input string based on a specified grammar.

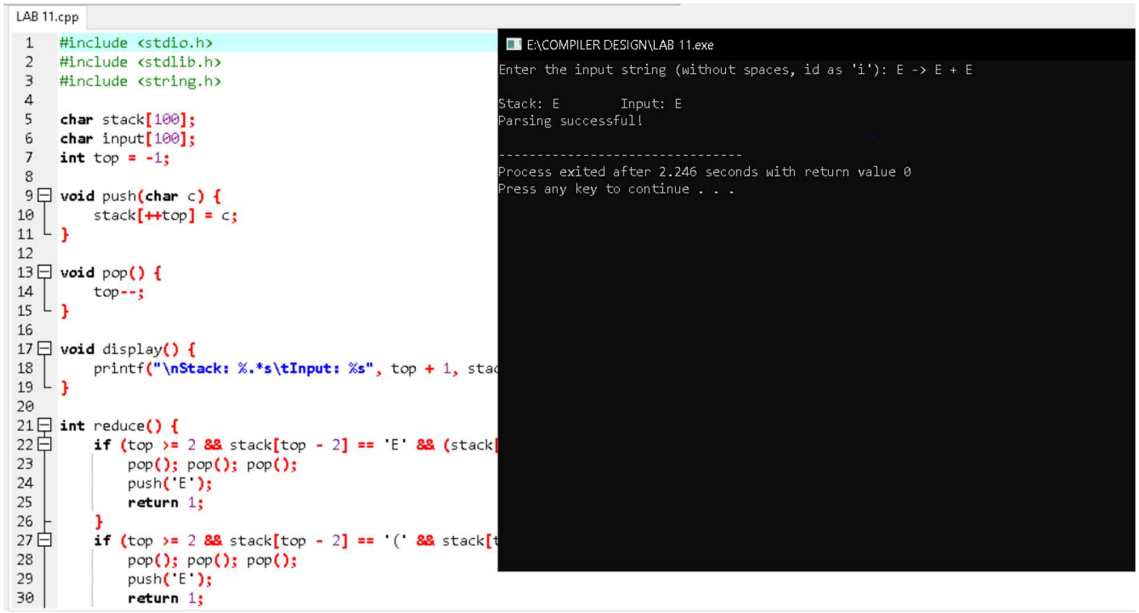
Code:

```
#include <stdio.h>

#include <string.h>
```

```
char stack[50];
char input[50];
int top = -1, ip = 0;
void push(char c) { stack[++top] = c; }
void pop() { top--; }
int reduce() {
    if (top >= 2) {
        if (stack[top] == 'E' && stack[top - 1] == '+' && stack[top - 2] == 'E') {
            top -= 2;
            stack[top] = 'E';
            return 1;
        }
        if (stack[top] == 'E' && stack[top - 1] == '*' && stack[top - 2] == 'E') {
            top -= 2;
            stack[top] = 'E';
            return 1;
        }
    }
    if (top >= 2 && stack[top] == ')' && stack[top - 1] == 'E' && stack[top - 2]
== '(') {
        top -= 2;
        stack[top] = 'E';
        return 1;
    }
    if (top >= 0 && stack[top] == 'a') {
        stack[top] = 'E';
        return 1;
    }
```

```
    return 0;
}
int main() {
    printf("Enter input string (end with $): ");
    scanf("%s", input);
    push('$');
    while (1) {
        if (input[ip] != '\0') {
            push(input[ip++]);
        }
        while (reduce());
        if (input[ip] == '\0' && top == 1 && stack[0] == '$' && stack[1] == 'E') {
            printf("String is successfully parsed!\n");
            break;
        }
        if (input[ip] == '\0' && top != 1) {
            printf("Error: Parsing failed.\n");
            break;
        }
    }
    return 0;
}
```

Output:



15. Write a C Program to implement Operator Precedence Parsing.

Aim:

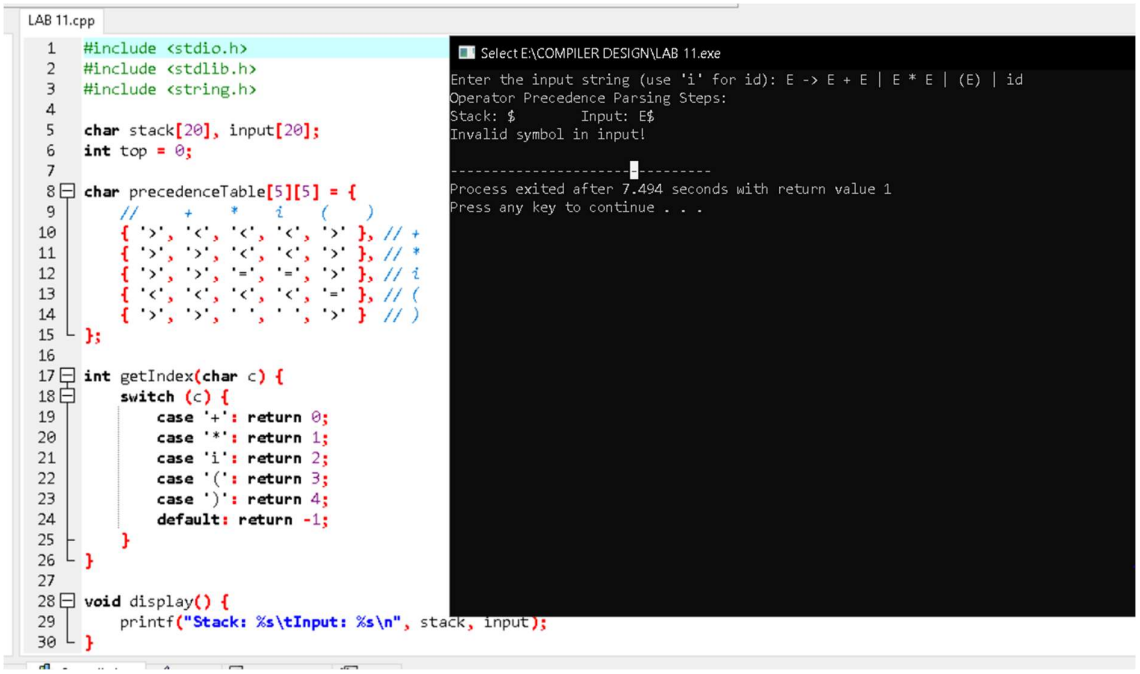
To implement Operator Precedence Parsing in C to parse and evaluate a given input expression using operator precedence relations.

Code:

```
#include <stdio.h>
#include <string.h>
int prec(char c) {
    if (c == '+' || c == '-') return 1;
    if (c == '*' || c == '/') return 2;
    return 0;
}
void parse(char *exp) {
    char stack[50];
    int top = -1, i = 0;
```

```
    stack[++top] = '$'
    while (exp[i] != '\0') {
        while (top >= 0 && prec(stack[top]) >= prec(exp[i])) {
            printf("Reduce by popping %c\n", stack[top--]);
        }
        printf("Shift '%c'\n", exp[i]);
        stack[++top] = exp[i++];
    }
    while (top > 0) {
        printf("Reduce by popping %c\n", stack[top--]);
    }
    printf("Parsing Successful!\n");
}
int main() {
    char exp[50];
    printf("Enter expression: ");
    scanf("%s", exp);
    parse(exp);
    return 0;
}
```

Output:



16. Write a C Program to Generate the Three-Address Code representation for the given input statement.

Aim:

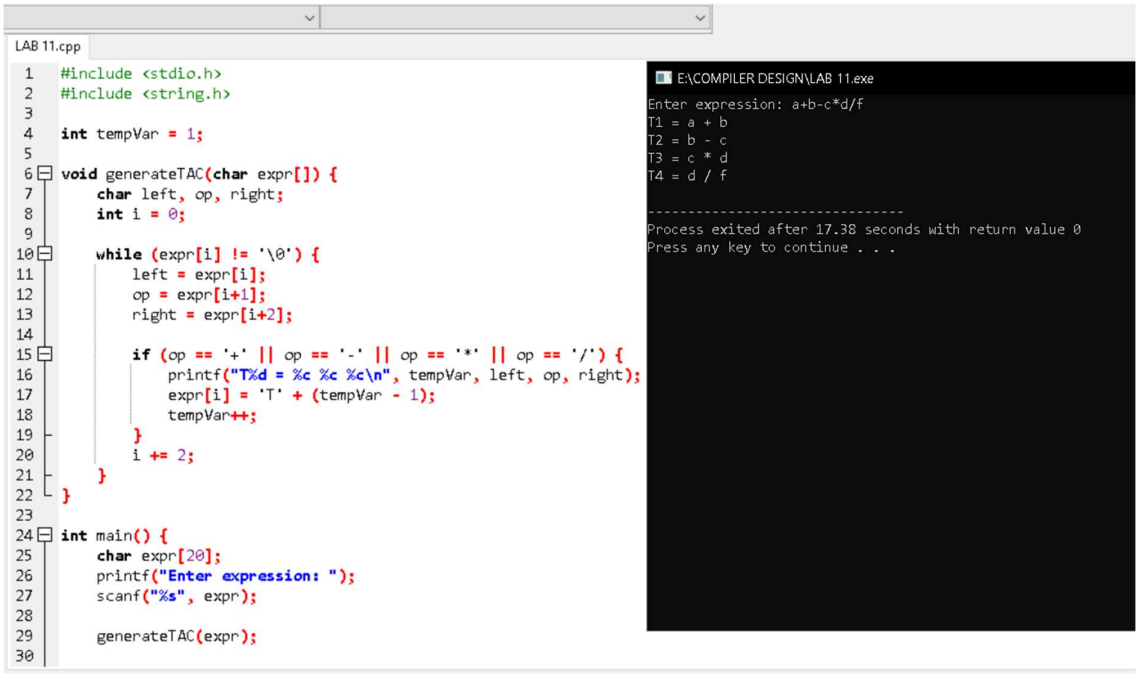
To implement a C program that generates three-address code for arithmetic expressions.

Code:

```
#include <stdio.h>

#include <string.h>

int main() {

    char expr[50], temp[5] = "t";

    int i = 0, j = 1, k = 0;

    printf("Enter an arithmetic expression: ");

    scanf("%s", expr);

    printf("\nThree-Address Code:\n");

    while (expr[i] != '\0') {

        if (expr[i] == '+' || expr[i] == '-' || expr[i] == '*' || expr[i] == '/') {

            printf("t%d = %c %c %c\n", k++, expr[i - 1], expr[i], expr[i + 1]);
```

```
            i++;
        }
        i++;
    }
    return 0;
}
```

Output:



17. Write a C program for implementing a Lexical Analyzer to Scan and Count the number of characters, words, and lines in a file.

Aim:

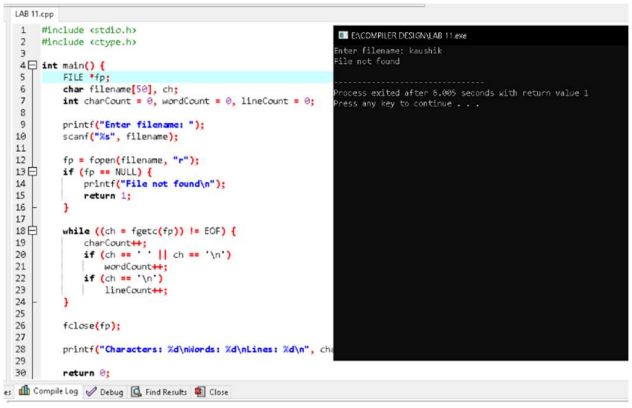
To implement a lexical analyzer in C that scans and counts characters, words, and lines from a given file.

Code:

```
#include <stdio.h>

#include <stdlib.h>

#include <ctype.h>
```

```
int main() {
    FILE *file;
    char filename[50], ch;
    int characters = 0, words = 0, lines = 0;
    printf("Enter filename: ");
    scanf("%s", filename);
    file = fopen(filename, "r");
    if (file == NULL) {
        printf("File not found!\n");
        return 1;
    }
    while ((ch = fgetc(file)) != EOF) {
        characters++;
        if (ch == ' ' || ch == '\t' || ch == '\n') words++;
        if (ch == '\n') lines++;
    }
    fclose(file);
    printf("Characters: %d\nWords: %d\nLines: %d\n", characters, words, lines);
    return 0;
}
```

Output:



18. Write a C program to implement the back end of the compiler.

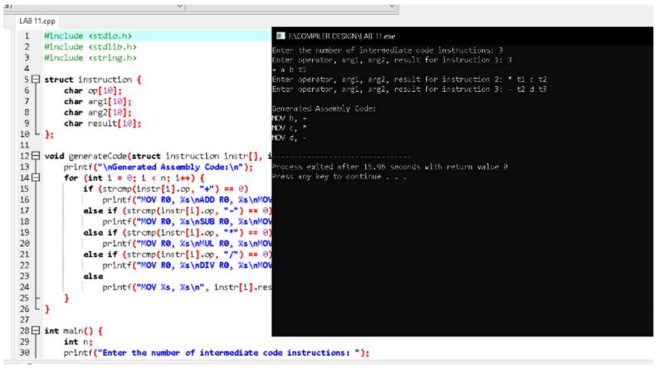
Aim:

To implement the back end of a compiler in C that generates machine code for arithmetic expressions.

Code:

```
#include <stdio.h>

int main() {
    char expr[50];
    printf("Enter arithmetic expression: ");
    scanf("%s", expr);
    printf("\nGenerated Assembly Code:\n");
    for (int i = 0; expr[i] != '\0'; i++) {
        if (expr[i] == '+') printf("ADD\n");
        else if (expr[i] == '-') printf("SUB\n");
        else if (expr[i] == '*') printf("MUL\n");
        else if (expr[i] == '/') printf("DIV\n");
        else printf("PUSH %c\n", expr[i]);
    }
    printf("POP RESULT\n");
    return 0;
}
```

Output:



19. Write a C program to compute LEADING() – operator precedence parser for the given grammar.

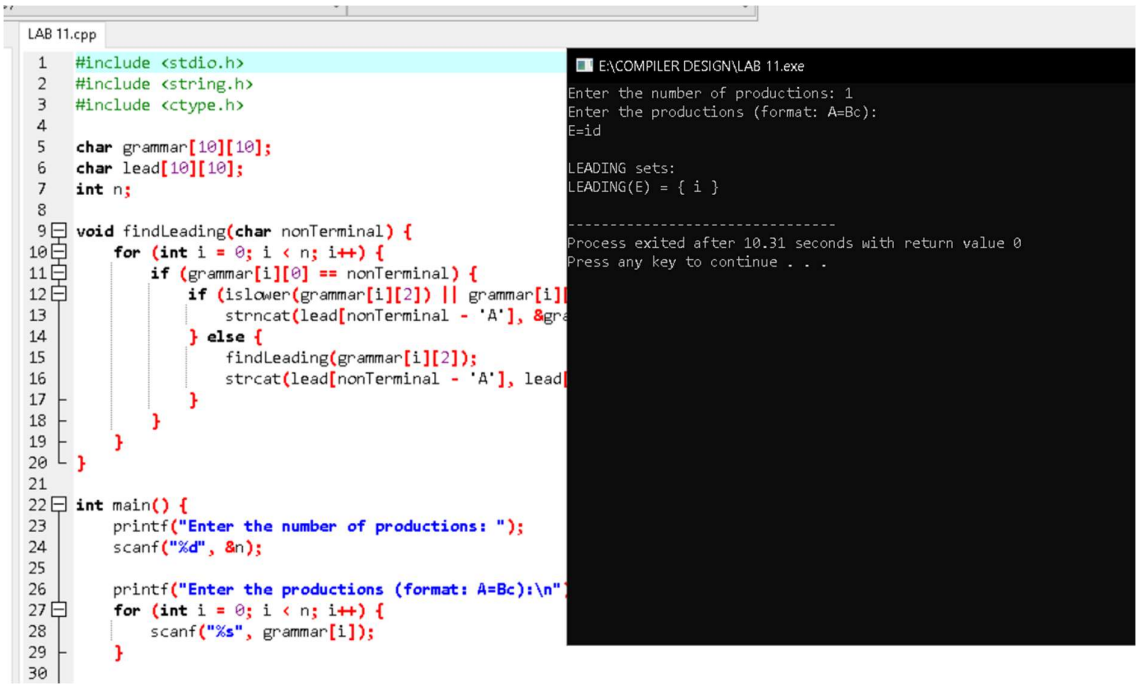
Aim:

To implement a C program that computes the LEADING sets for operators in a given grammar.

Code:

```
#include <stdio.h>
#include <string.h>
void findLeading(char *grammar, char terminal) {
    printf("Leading(%c) = {", terminal);
    for (int i = 0; i < strlen(grammar); i++) {
        if (grammar[i] == terminal && grammar[i + 1] != '\0') {
            printf(" %c ", grammar[i + 1]);
        }
    }
    printf("}\n");
}
int main() {
    char grammar[50], terminal;
    printf("Enter grammar (like E->E+T|T): ");
    scanf("%s", grammar);
    printf("Enter terminal symbol: ");
    scanf(" %c", &terminal);
    findLeading(grammar, terminal);
    return 0;
}
```

Output:



20. Write a C program to compute TRAILING() – operator precedence parser for the given grammar.

Aim:

To implement a C program that computes the TRAILING sets for operators in a given grammar.

Code:

```
#include <stdio.h>

#include <string.h>

void findTrailing(char *grammar, char terminal) {

   printf("Trailing(%c) = {", terminal);

   for (int i = 0; i < strlen(grammar); i++) {

      if (grammar[i] == terminal && i > 0) {

         printf(" %c ", grammar[i - 1]);

      }

   }

   printf("}\n");
```

```
}
int main() {
    char grammar[50], terminal;
    printf("Enter grammar (like E->E+T|T): ");
    scanf("%s", grammar);
    printf("Enter terminal symbol: ");
    scanf(" %c", &terminal);
    findTrailing(grammar, terminal);
    return 0;
}
```

Output: