13/02/2025 -LAB PROGRAMS

CSA1447 -COMPILER DESIGN FOR SYNTAX SMITH

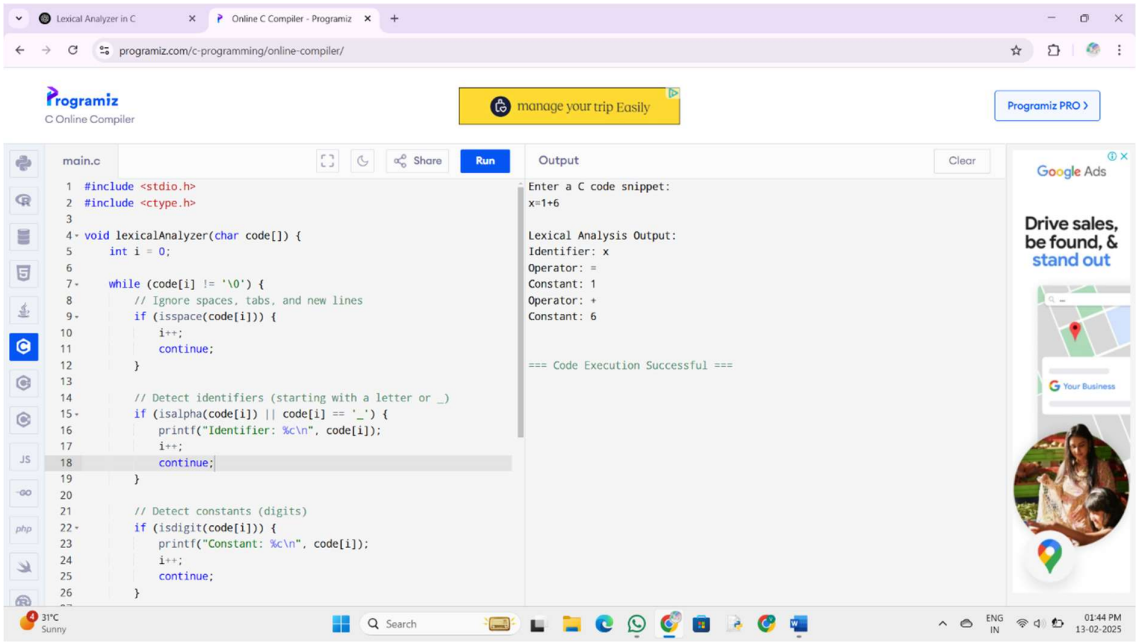
1. The lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Develop a lexical Analyzer to identify identifiers, constants, operators using C program.

Answer:

```
#include <stdio.h>

#include <ctype.h>


void lexicalAnalyzer(char code[]) {

   int i = 0;


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

      // Ignore spaces, tabs, and new lines

      if (isspace(code[i])) {

         i++;

         continue;

      }


      // Detect identifiers (starting with a letter or _)

      if (isalpha(code[i]) || code[i] == '_') {

         printf("Identifier: %c\n", code[i]);

         i++;

         continue;

      }


      // Detect constants (digits)

      if (isdigit(code[i])) {
```

```
            printf("Constant: %c\n", code[i]);
            i++;
            continue;
        }

        // Detect operators (+, -, *, /, =)
        if (code[i] == '+' || code[i] == '-' || code[i] == '*' || code[i] == '/' || code[i] == '=') {
            printf("Operator: %c\n", code[i]);
            i++;
            continue;
        }

        i++; // Move to next character
    }
}

int main() {
    char code[100];

    printf("Enter a C code snippet:\n");
    fgets(code, sizeof(code), stdin);

    printf("\nLexical Analysis Output:\n");
    lexicalAnalyzer(code);

    return 0;
}
```

Op:



2. Extend the lexical Analyzer to Check comments, dened as follows in C:

a) A comment begins with // and includes all characters until the end of that line.

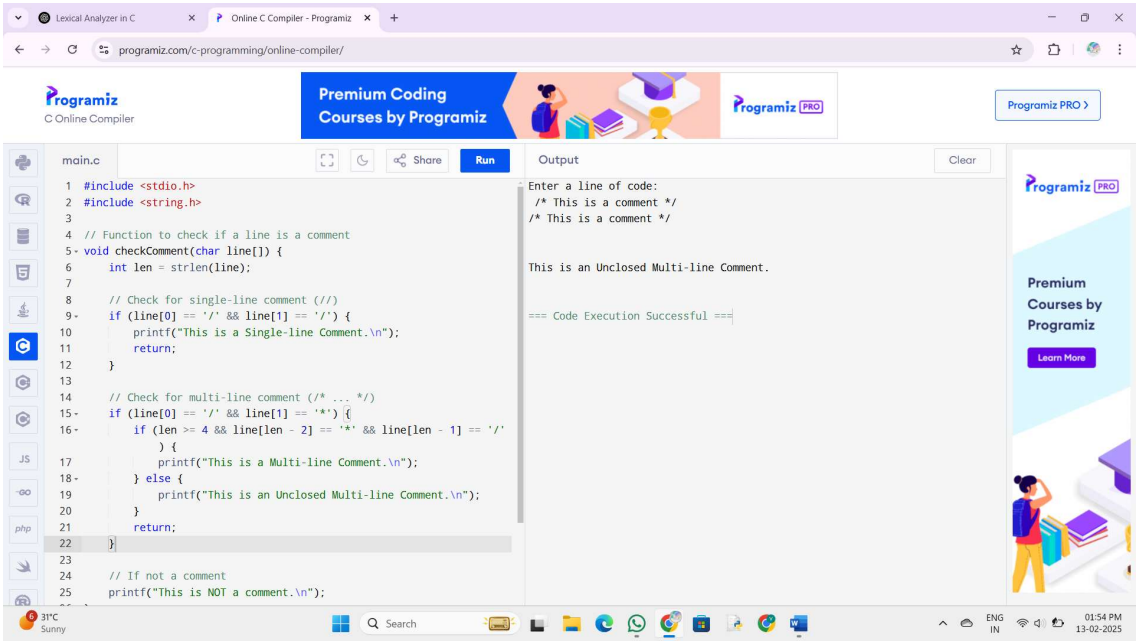
b) A comment begins with /* and includes all characters through the next occurrence of the character sequence */Develop a lexical Analyzer to identify whether a given line is a comment or not.

Answer:

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

// Function to check if a line is a comment
void checkComment(char line[]) {
    int len = strlen(line);

    // Check for single-line comment (//)
    if (line[0] == '/' && line[1] == '/') {
        printf("This is a Single-line Comment.\n");
        return;
```

```
    }

    // Check for multi-line comment (/* ... */)
    if (line[0] == '/' && line[1] == '*') {
        if (len >= 4 && line[len - 2] == '*' && line[len - 1] == '/') {
            printf("This is a Multi-line Comment.\n");
        } else {
            printf("This is an Unclosed Multi-line Comment.\n");
        }
        return;
    }

    // If not a comment
    printf("This is NOT a comment.\n");
}

int main() {
    char line[200];

    printf("Enter a line of code:\n");
    fgets(line, sizeof(line), stdin);

    checkComment(line);
    return 0;
}
```

Op:



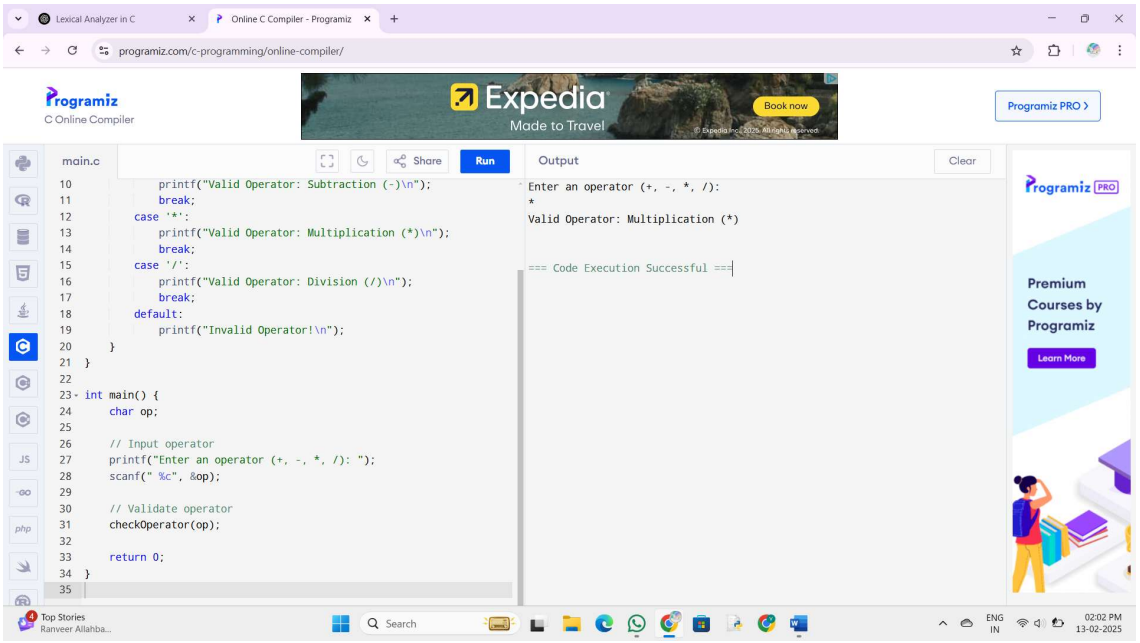
3. Design a lexical Analyzer to validate operators to recognize the operators +,-,*,/ using regular Arithmetic operators .

Answer

```
#include <stdio.h>


// Function to check if the input is a valid operator
void checkOperator(char op) {
   switch(op) {
      case '+':
         printf("Valid Operator: Addition (+)\n");
         break;
      case '-':
         printf("Valid Operator: Subtraction (-)\n");
         break;
```

```
        case '*':
            printf("Valid Operator: Multiplication (*)\n");
            break;
        case '/':
            printf("Valid Operator: Division (/)\n");
            break;
        default:
            printf("Invalid Operator!\n");
    }
}

int main() {
    char op;

    // Input operator
    printf("Enter an operator (+, -, *, /): ");
    scanf(" %c", &op);

    // Validate operator
    checkOperator(op);

    return 0;
}
```

Op:



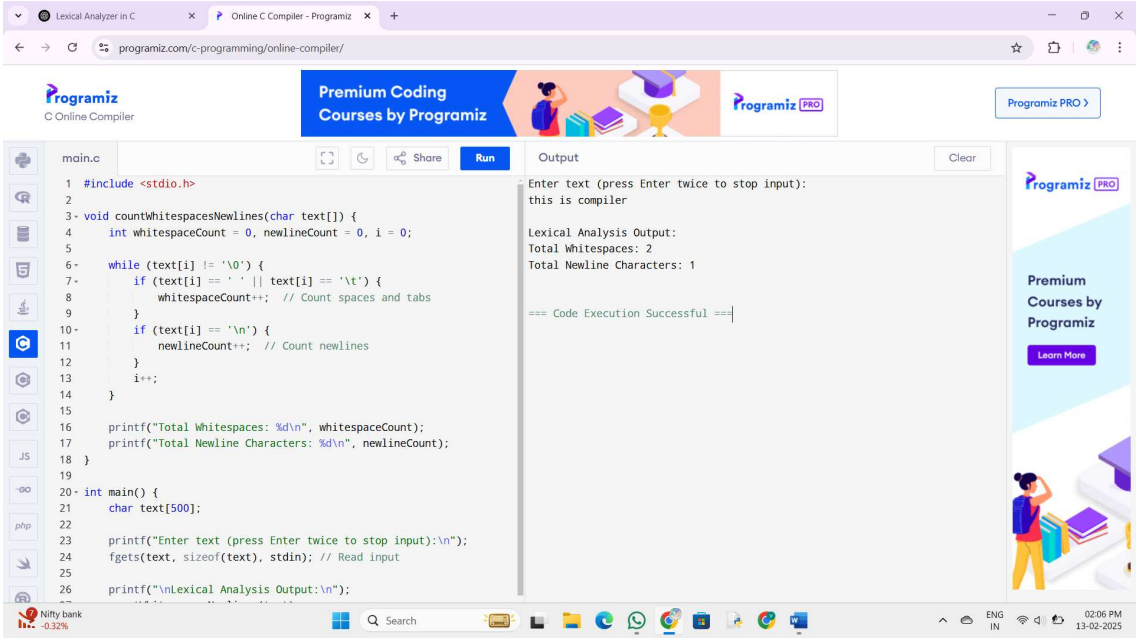
4. Design a lexical Analyzer to find the number of whitespaces and newline characters.

Answer:

```
#include <stdio.h>


void countWhitespacesNewlines(char text[]) {

    int whitespaceCount = 0, newlineCount = 0, i = 0;


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

        if (text[i] == ' ' || text[i] == '\t') {

            whitespaceCount++;  // Count spaces and tabs

        }

        if (text[i] == '\n') {

            newlineCount++;  // Count newlines

        }
```

```
        i++;
    }

    printf("Total Whitespaces: %d\n", whitespaceCount);
    printf("Total Newline Characters: %d\n", newlineCount);
}

int main() {
    char text[500];

    printf("Enter text (press Enter twice to stop input):\n");
    fgets(text, sizeof(text), stdin); // Read input

    printf("\nLexical Analysis Output:\n");
    countWhitespacesNewlines(text);

    return 0;
}
```

Op:



5. Develop a lexical Analyzer to test whether a given identifier is valid or not.

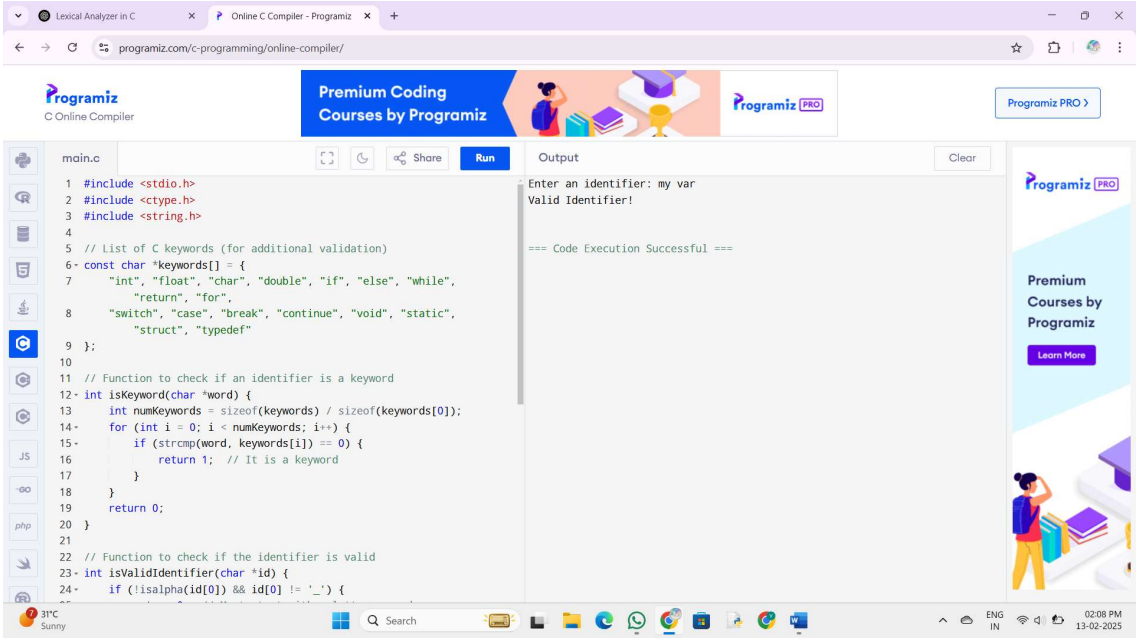
Answer:

```
#include <stdio.h>

#include <ctype.h>

#include <string.h>


// List of C keywords (for additional validation)

const char *keywords[] = {

    "int", "float", "char", "double", "if", "else", "while", "return", "for",

    "switch", "case", "break", "continue", "void", "static", "struct", "typedef"

};


// Function to check if an identifier is a keyword

int isKeyword(char *word) {

    int numKeywords = sizeof(keywords) / sizeof(keywords[0]);
```

```
    for (int i = 0; i < numKeywords; i++) {
        if (strcmp(word, keywords[i]) == 0) {
            return 1;  // It is a keyword
        }
    }
    return 0;
}

// Function to check if the identifier is valid
int isValidIdentifier(char *id) {
    if (!isalpha(id[0]) && id[0] != '_') {
        return 0;  // Must start with a letter or underscore
    }

    for (int i = 1; id[i] != '\0'; i++) {
        if (!isalnum(id[i]) && id[i] != '_') {
            return 0;  // Can contain only letters, digits, and underscores
        }
    }

    if (isKeyword(id)) {
        return 0;  // Identifiers cannot be C keywords
    }
```

```
    return 1;
}

int main() {
    char identifier[50];

    printf("Enter an identifier: ");
    scanf("%s", identifier);

    if (isValidIdentifier(identifier)) {
        printf("Valid Identifier!\n");
    } else {
        printf("Invalid Identifier!\n");
    }

    return 0;
}
```

Op:



6.Implement a C program to eliminate left recursion.

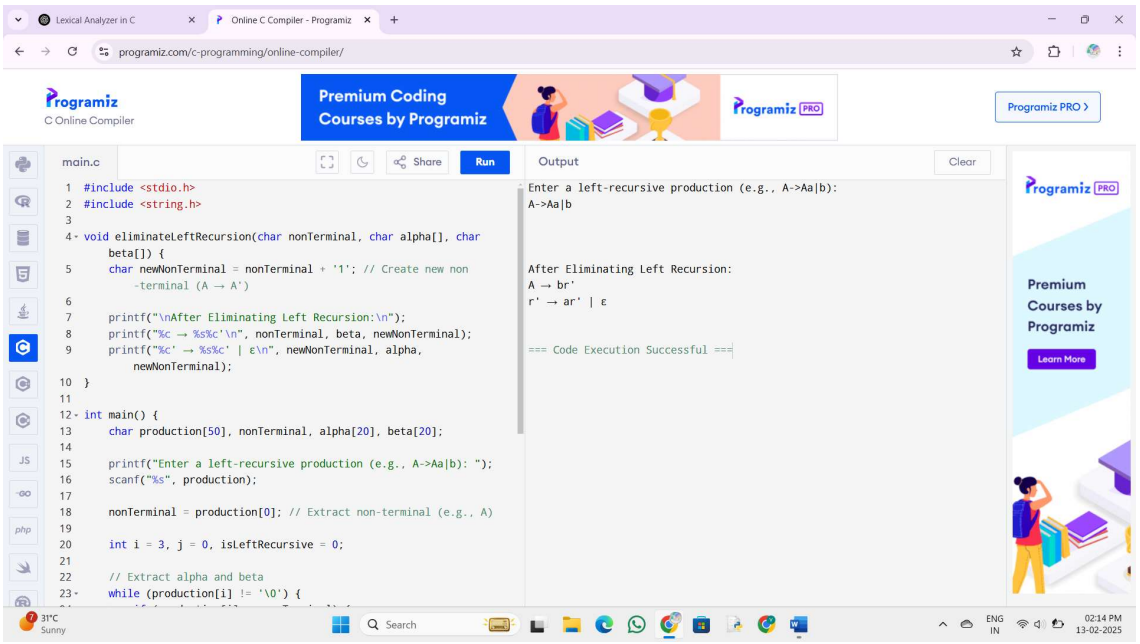
Answer:

```
#include <stdio.h>

#include <string.h>


void eliminateLeftRecursion(char nonTerminal, char alpha[], char beta[]) {

    char newNonTerminal = nonTerminal + '1'; // Create new non-terminal (A → A')


    printf("\nAfter Eliminating Left Recursion:\n");

    printf("%c → %s%c'\n", nonTerminal, beta, newNonTerminal);

    printf("%c' → %s%c' | ε\n", newNonTerminal, alpha, newNonTerminal);

}


int main() {

    char production[50], nonTerminal, alpha[20], beta[20];


    printf("Enter a left-recursive production (e.g., A->Aa|b): ");
```

```
scanf("%s", production);

nonTerminal = production[0]; // Extract non-terminal (e.g., A)

int i = 3, j = 0, isLeftRecursive = 0;

// Extract alpha and beta
while (production[i] != '\0') {
    if (production[i] == nonTerminal) {
        isLeftRecursive = 1;
        i++; // Skip the non-terminal
        while (production[i] != '|' && production[i] != '\0') {
            alpha[j++] = production[i++];
        }
        alpha[j] = '\0';
    } else {
        j = 0;
        while (production[i] != '|' && production[i] != '\0') {
            beta[j++] = production[i++];
        }
        beta[j] = '\0';
    }
    if (production[i] == '|') i++; // Move to the next part
}

if (isLeftRecursive) {
    eliminateLeftRecursion(nonTerminal, alpha, beta);
} else {
```

```
        printf("No Left Recursion Found!\n");
    }


    return 0;
}
```

Op:



7. Implement a C program to eliminate left factoring.

Answer:

```
#include <stdio.h>

#include <string.h>


// Function to remove left factoring

void eliminateLeftFactoring(char nonTerminal, char commonPrefix[], char beta1[], char beta2[]) {

    char newNonTerminal = nonTerminal + '1'; // Create new non-terminal (A → A')
```

```
    printf("\nAfter Eliminating Left Factoring:\n");
    printf("%c → %s%c'\n", nonTerminal, commonPrefix, newNonTerminal);
    printf("%c' → %s | %s\n", newNonTerminal, beta1, beta2);
}

int main() {
    char production[50], nonTerminal, commonPrefix[20], beta1[20], beta2[20];

    printf("Enter a left-factored production (e.g., A->abc|abd): ");
    scanf("%s", production);

    nonTerminal = production[0]; // Extract non-terminal (e.g., A)

    int i = 3, j = 0;

    // Extract the common prefix
    while (production[i] != '\0' && production[i] != '|') {
        commonPrefix[j++] = production[i++];
    }
    commonPrefix[j] = '\0';

    if (production[i] == '|') i++; // Skip '|'

    j = 0;
```

```
    while (production[i] != '\0' && production[i] != '|') {
        beta1[j++] = production[i++];
    }
    beta1[j] = '\0';

    if (production[i] == '|') i++; // Skip '|'

    j = 0;
    while (production[i] != '\0') {
        beta2[j++] = production[i++];
    }
    beta2[j] = '\0';

    eliminateLeftFactoring(nonTerminal, commonPrefix, beta1, beta2);

    return 0;
}
```

Op:

Lexical Analyzer in C | Online C Compiler - Programiz

programiz.com/c-programming/online-compiler/

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main.c

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

// Function to remove left factoring
void eliminateLeftFactoring(char nonTerminal, char commonPrefix[],
    char beta1[], char beta2[]) {
    char newNonTerminal = nonTerminal + '1'; // Create new non
        -terminal (A → A')

    printf("\nAfter Eliminating Left Factoring:\n");
    printf("%c → %s%c'\n", nonTerminal, commonPrefix, newNonTerminal
        );
    printf("%c' → %s | %s\n", newNonTerminal, beta1, beta2);
}

int main() {
    char production[50], nonTerminal, commonPrefix[20], beta1[20],
        beta2[20];

    printf("Enter a left-factored production (e.g., A->abc|abd): ");
    scanf("%s", production);

    nonTerminal = production[0]; // Extract non-terminal (e.g., A)

    int i = 3, j = 0;
```

Output | Clear

```
Enter a left-factored production (e.g., A->abc|abd):
S->aB|cD



After Eliminating Left Factoring:
S → aB$'
$' → cD |


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


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