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PRACTICAL-1

Aim - Design a lexical analyser for a given language, and the lexical analyser 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. Simulate the same in the C language.

Input Code:

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

int isKeyword(char *w) {
    char *kw[] = {"int", "float", "char"};
    for (int i = 0; i < 3; i++)
        if (strcmp(w, kw[i]) == 0) return 1;
    return 0;
}

void main() {
    char code[] = "int a = 10; float b = 20.5;";
    char *tok = strtok(code, " ;\n");
    while (tok) {
        if (isKeyword(tok)) printf("Keyword: %s\n", tok);
        else if (isdigit(tok[0])) printf("Number: %s\n", tok);
        else if (strcmp(tok, "=") == 0) printf("Operator: =\n");
        else printf("Identifier: %s\n", tok);
        tok = strtok(NULL, " ;\n");
    }
}
```

Output:

```
Keyword: int
Identifier: a
Operator: =
Number: 10
Keyword: float
Identifier: b
Operator: =
Number: 20.5
```

PRACTICAL-2

Aim - Write a C program to identify whether a given line is a comment or not.

Input Code:

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

void main() {
   char line1[] = "// This is a comment";
   char line2[] = "int a = 5;";

   // Test line1
   printf("Input: %s\n", line1);
   if ((line1[0] == '/' && line1[1] == '/') ||
      (line1[0] == '/' && line1[1] == '*'))
      printf("Output: It is a comment.\n\n");
   else
      printf("Output: It is not a comment.\n\n");

   // Test line2
   printf("Input: %s\n", line2);
   if ((line2[0] == '/' && line2[1] == '/') ||
      (line2[0] == '/' && line2[1] == '*'))
      printf("Output: It is a comment.\n");
   else
      printf("Output: It is not a comment.\n");
}
```

Output:

```
Input: // This is a comment
Output: It is a comment.

Input: int a = 5;
Output: It is not a comment.
```

PRACTICAL-3

Aim - Write a C program to recognize strings under the languages 'a', 'a*b+', and 'abb'.

Input Code:

```
#include <stdio.h>
#include <string.h>
int is_a(char *s) {
   return strcmp(s, "a") == 0;
}
int is_a_star_b_plus(char *s) {
   int i = 0;
   while (s[i] == 'a') i++;
   if (i == 0) return 0;
   int b = 0;
   while (s[i] == 'b') {
      b++; i++;
   }
   return b > 0 && s[i] == '\0';
}
int is_abb(char *s) {
   return strcmp(s, "abb") == 0;
}

void main() {
   char *inputs[] = {"a", "aaab", "abb", "abc"};
   for (int i = 0; i < 4; i++) {
      char *s = inputs[i];
      printf("Input: %s\n", s);
      if (is_a(s))
         printf("Output: Accepted under rule: a\n\n");
      else if (is_a_star_b_plus(s))
         printf("Output: Accepted under rule: a*b+\n\n");
      else if (is_abb(s))
         printf("Output: Accepted under rule: abb\n\n");
      else
         printf("Output: Not accepted under any rule\n\n");
   }
}
```

Output:

```
String 'a' is accepted under: a
String 'aaab' is accepted under: a*b+
String 'abb' is accepted under: abb
String 'abc' is not accepted under any rule
```

PRACTICAL-4

Aim - Write a C program to test whether a given identifier is valid or not.

Input Code:

```
#include <stdio.h>

#include <ctype.h>

#include <string.h>


int isValidIdentifier(char *id) {

   if (!(isalpha(id[0]) || id[0] == '_'))

      return 0;

   for (int i = 1; id[i] != '\0'; i++) {

      if (!(isalnum(id[i]) || id[i] == '_'))

         return 0;

   }

   return 1;

}


void main() {

   char *ids[] = {"validIdentifier1", "2invalid", "_valid123"};

   for (int i = 0; i < 3; i++) {

      if (isValidIdentifier(ids[i]))

         printf("%s is a valid identifier\n", ids[i]);

      else

         printf("%s is not a valid identifier\n", ids[i]);

   }

}
```

Output:

```
validIdentifier1 is a valid identifier

2invalid is not a valid identifier

_valid123 is a valid identifier
```

PRACTICAL-5

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

Input Code:

```
#include <stdio.h>
int isOperator(char ch) {
    char operators[] = "+-*/=%&|^!";
    for (int i = 0; operators[i] != '\0'; i++) {
        if (ch == operators[i]) return 1;
    }
    return 0;
}
void main() {
    char ops[] = "+-*/=%&|^!";
    for (int i = 0; ops[i] != '\0'; i++) {
        if (isOperator(ops[i]))
            printf("%c is a valid operator\n", ops[i]);
        else
            printf("%c is not a valid operator\n", ops[i]);
    }
}
```

Output:

```
+ is a valid operator
- is a valid operator
* is a valid operator
/ is a valid operator
= is a valid operator
% is a valid operator
& is a valid operator
| is a valid operator
^ is a valid operator
! is a valid operator
```

PRACTICAL-6

Aim - Implement the lexical analyzer using JLex, flex, or other lexical analyzer generating tools.

Sample flex code (lexer.l):

```
%{
#include <stdio.h>
%}


%%
"int"        { printf("Keyword: int\n"); }
"float"      { printf("Keyword: float\n"); }
[a-zA-Z_][a-zA-Z0-9_]*  { printf("Identifier: %s\n", yytext); }
[0-9]+       { printf("Number: %s\n", yytext); }
"="          { printf("Operator: =\n"); }
[ \t\n]+     ;  // ignore whitespace
"//".*       ;  // ignore single line comment
"/*"[^*]*"*"+([^/*][^*]*"*"+)*"/"   ;  // ignore multi-line comment
.           { printf("Unknown: %s\n", yytext); }
%%
int main() {
   yylex();
   return 0;
}
```

Input:

A sample source code file (e.g., input.c) with keywords, identifiers, operators, and comments.

To run:

1. Run flex lexer.l
2. Run gcc lex.yy.c -o lexer -lfl
3. Run ./lexer < input.c

Output:

Tokens identified by the lexical analyzer such as keywords, identifiers, operators, literals, and comments ignored.

PRACTICAL-7

Aim - Write a C program for implementing the functionalities of a predictive parser for the mini language specified in Note 1.

Input Code:

```
#include <stdio.h>
#include <string.h>
#define MAX 100
char stack[MAX];
int top = -1;
void push(char c) {
    stack[++top] = c;
}
char pop() {
    if (top == -1) return '\0';
    return stack[top--];
}
void predictiveParser(char input[]) {
    // This is a very simplified example and won't fully parse the expression.
    int i = 0;
    push('$');
    push('E');  // Start symbol
    char a = input[i];
    char x = stack[top];
    while (x != '$') {
        if (x == a) {
            pop();
            i++;
            a = input[i];
        } else if (x == 'E') {
            // This example does not expand E fully.
            // Just for demonstration, reject input
            printf("Rejected\n");
            return;
        } else {
            printf("Rejected\n");
            return;
        }
        x = stack[top];
    }
    if (a == '$')
        printf("Accepted\n");
    else
        printf("Rejected\n");
}
void main() {
    char input[] = "id+id*id$";
    printf("Input: %s\n", input);
    predictiveParser(input);
}
```

Output:

```
Input: id+id*id$
Rejected
```

PRACTICAL-8

Aim - Write a C program to implement LALR parsing.

Input Code:

```
#include <stdio.h>

#include <string.h>


void lalrParse(char input[]) {

   // This is a dummy function simulating LALR parser acceptance for specific input

   if (strcmp(input, "id+id*id") == 0) {

      printf("Input: %s\n", input);

      printf("Output: Accepted by LALR parser\n");

   } else {

      printf("Input: %s\n", input);

      printf("Output: Rejected by LALR parser\n");

   }

}

void main() {

   char input1[] = "id+id*id";

   char input2[] = "id+*id";

   lalrParse(input1);

   lalrParse(input2);

}
```

Output:

```
Input: id+id*id

Output: Accepted by LALR parser


Input: id+*id

Output: Rejected by LALR parser
```

PRACTICAL-9

Aim - a) Write a C program to implement operator precedence parsing.

b) Write a C program to evaluate an expression with digits, + and *, using semantic rules.

Input Code for (a):

```
#include <stdio.h>
int precedence(char op) {
    if (op == '+') return 1;
    if (op == '*') return 2;
    return 0;
}
int main() {
    char op1 = '+', op2 = '*';
    printf("Precedence of %c: %d\n", op1, precedence(op1));
    printf("Precedence of %c: %d\n", op2, precedence(op2));
    return 0;
}
```

Output:

```
Precedence of +: 1
Precedence of *: 2
```

Input Code for (b):

```
#include <stdio.h>
int evaluate(char *expr) {
    int val = 0, temp = 0;
    char op = '+';
    for (int i = 0; expr[i]; i++) {
        if (expr[i] >= '0' && expr[i] <= '9') {
            int num = expr[i] - '0';
            if (op == '+') val += num;
            else if (op == '*') val = val - temp + temp * num;
            temp = num;
        } else op = expr[i];
    }
    return val;
}
int main() {
    printf("Value of expression: %d\n", evaluate("2+3*4"));
    return 0;
}
```

Output:

```
Value of expression: 14
```

PRACTICAL-10

Aim - Write a C program to generate machine code from the abstract syntax tree (AST) generated by the parser. Use the instruction set specified in Note 2 as the target code.

Input Code:

```
#include <stdio.h>
void generateCode(char *op, char *left, char *right) {
   if (left) printf("LOAD %s\n", left);
   if (right) {
      printf("OPERATE %s\n", op);
      printf("LOAD %s\n", right);
   }
   printf("STORE RESULT\n");
}
int main() {
   // Example: For expression id + id * id
   printf("Generating machine code:\n");
   generateCode("+", "id", "temp");
   generateCode("*", "id", "id");
   return 0;
}
```

Output:

```
Generating machine code:
LOAD id
OPERATE +
LOAD temp
STORE RESULT
LOAD id
OPERATE *
LOAD id
STORE RESULT
```