Final_Exam

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1.

The numeric type can be an example that a simple assignment statement is legal in C++ but not in java. For example, if A is integer, and B is floating number, then we can see the result in C++ since the converting between integer and floating is valid. However, the simple assignment does not work in Java thus the assignment is illegal in Java.

2.

Implicit type conversion: Implicit type conversion is that data is converted without losing the values inside the variable. Example) int a;   long b = 3; a = b;

Benefit:

Writability: The implicit conversion is easy to implement.

Drawbacks:

Readability: The implicit conversion reduces the readability.

Reliability: The implicit conversion occurs some errors that unexpected.

Cost: The implicit conversion must work all the time thus it takes processing time to convert data type into the compiler required form

Explicit type conversion: Explicit type conversion is called a ‘cast’. The user intends to make a conversion and that the user is aware that data losing might occur. It is possible to fail runtime because of the cast. Example) float b = 3.3; int a = (int)b – 2;

Benefit:

Readability : Explicit conversion is more readable because, we can easily see the type conversion.

Cost: explicit conversion is cheaper than implicit conversion. Explicit conversion is easier to debug.

Drawbacks:

Writability: Explicit conversion is not convenient. The writer needs to consider data losing.

Reliability: explicit conversion might occur data losing or raise exceptions

3.

1) a * b -1 + c

$(a * b)^1 -1 + c$

$((a * b)^1 -1)^2 + c$

$(((a*b)^1-1)^2 + c)^3$

2) a * (b-1) / c % d

$a * (b-1)^1 / c \% d$

$(a * (b-1)^1)^2/ c \% d$

$(a * (b-1)^1)^2/ (c \% d)^3$

$((a * (b-1)^{1})^{2}/ (c \% d)^{3})^{4}$

3) (a – b) / c & (d * e / a – 3)

$(a - b)^{1} / c \& (d * e / a - 3)$

$(a - b)^{1} / c \& ((d * e)^{2} / a - 3)$

$(a - b)^{1} / c \& ((d * e)^{2} / (a - 3)^{3})$

$(a - b)^{1} / c \& ((d * e)^{2} / (a - 3)^{3})^{4}$

$((a - b)^{1} / (c \& ((d * e)^{2} / (a - 3)^{3})^{4})^{5}$

$(((a - b)^{1} / (c \& ((d * e)^{2} / (a - 3)^{3})^{4})^{5})^{6}$

4) (a + b <= c) * (d > b - e)

$((a + b)^{1} <= c) * (d > b - e)$

$((a + b)^{1} <= c)^{2} * (d > b - e)$

$((a + b)^{1} <= c)^{2} * (d > (b - e)^{3})$

$((a + b)^{1} <= c)^{2} * (d > (b - e)^{3})^{4}$

$(((a + b)^{1} <= c)^{2} * (d > (b - e)^{3})^{4})^{5}$

5) -a || c = d && e

$(-a)^{1} || c = d \&\& e$

$(-a)^{1} || c = (d \&\& e)^{2}$

$((-a)^{1} || c)^{3} = (d \&\& e)^{2}$

$(((-a)^{1} || c)^{3} = (d \&\& e)^{2})^{4}$

6) a > b ~| c || d <= 17

$a > b \sim| c || (d <= 17)^{1}$

$(a > b)^{2} \sim| c || (d <= 17)^{1}$

$((a > b)^{2} \sim| c)^{3} || (d <= 17)^{1}$

(((a > b)^{2} ~| c)^{3} || (d <= 17)^{1})^{4}

7) -a + b

-(a + b)^{1}

(-(a + b)^{1})^{2}

8) a + b * c + d

a + (b * c)^{1} + d

(a + (b * c)^{1})^{2} + d

((a + (b * c)^{1})^{2}+ d)^{3}

9) E = ++(a++)

E = ++(a++)^{1}

E = (++(a++)^{1})^{2}

(E = (++(a++)^{1})^{2})^{3}

4.

1) a * b -1 + c

(5 * 7)^{1} -1 + c

(35 -1)^{2} + c

(34 + 11)^{3}

45 (can’t represent to use 5bit)

(01) 01101

2) a * (b-1) / c % d

a * (7-1)^{1} / c % d

(5 * 6)^{2}/ 11 % -13

30 / -2

-15

10001

3) (a – b) / c & (d * e / a – 3)

(5 – 7)^{1} / c & (d * e / a – 3)

-2 / c & ((-13 * -2)^{2} / a – 3)

-2 / c & (26 / (5 – 3)^{3})

-2 / c & (26 / 2)^{4}

(-2 / (11 & 13)^{5}

-2/(01011 & 01101)

-2/(01001)

-2/9

11110/01001

Remainder ➔ 011

4) (a + b <= c) * (d > b - e)

((5 + 7)^{1} <= c) * (d > b - e)

(12 <= 11)^{2} * (d > b - e)

(12<=11) * (d > 9)

(12<=11) * (-13 > 9)

0(false) * 0(false)

00000

5) -a || c = d && e

-5 || c = d && e

-5 || c = (-13 && -2)^{2}

-5 || 11 = -13 && -2

1(true) = 1(true)

00001

6) a > b ~| c || d <= 17

a > b ~| c || (-13 <= 17)^{1}

(5 > 7)^{2} ~| c || 1(true)

(0(false) ~| 11)^{3} || 1

00000 ~| 01011 || 1

01011 || 1

11 || 1

1(true)

00001

7) -a + b

-(5 + 7)^{1}

(-12)^{2}

10100

8) a + b * c + d

a + (7 * 11)^{1} + d

(5 + 77)^{2} + d

(82-13)^{3}

69(can’t represent to use 5bit)

(010) 00101

9) E = ++(a++)

E = ++(5++)^1

E = (++5)^2

-2 = ++5

0(false)

00000

5.

V = { Stmt, Postfix, Prefix, unary_op, binary_op, bitwise_op, incre_op, decre_op}

E = { variables, =, /= }

R = [

Stmt => Postfix incre_op | Postfix decre_op

Stmt => incre_op Prefix | decre_op Prefix

Stmt => unary_op variables

Stmt => Stmt | Stmt Stmt | Stmt = Stmt

Stmt => variables binary_op variables | variables bitwise_op variables

Postfix => variables

Prefix => variables

unary_op => + | - | ! | *

binary_op => “||” | && | / | % | >= | <= | + | - | ! | * | > | <

bitwise_op => & | “~|”

incre_op => ++

decre_op => --

]

S = Stmt

6.

1) a * b -1 + c

$(((a*b)^1-1)^2 + c)^3$

((a.multiplication(b)).minus(1)).plus(c)

2) a * (b-1) / c % d

$((a * (b-1)^1)^2/ (c \% d)^3)^4$

a.multiplication(b.minus(1)).division(c.modulus(d))

3) (a – b) / c & (d * e / a – 3)

$(((a - b)^1 / (c \& ((d * e)^2 / (a - 3)^3)^4)^5)^6$

(a.minus(b)).division(c.bitwiseAND(d.multiplication.(e)).division(a.minus(3)))

4) (a + b <= c) * (d > b - e)

$(((a + b)^1 <= c)^2 * (d > (b - e)^3)^4)^5$

((a.plus(b)).comparision(c)).multiplication(d.comparision(b.minus(e)))

5) -a || c = d && e

$(((-a)^1 || c)^3 = (d \&\& e)^2)^4$

((-a).logicalOR(c)).equal((d.logicalAND(e)))

6) a > b ˜| c || d <= 17

$(((a > b)^2 \tilde{}| c)^3 || (d <= 17)^1)^4$

((a.comparision(b)).bitwiseOR(c)).logicalOR(d.comparision(17))

7) -a + b

$(-(a + b)^1)^2$

-(a.plus(b))

8) a + b * c + d

$((a + (b * c)^1)^2+ d)^3$

((b.mutiplication(c)).plus(a)).plus(d)

9) E = ++(a++)

$(E = (++(a++)^1)^2)^3$

E.equal(increment.(a.increment))

No. There is not a need express to represent precedence. We can express each expression using function calls. Example) a + b * c + d. we need to multiply b and c then add a and add d. We can express like

((b.mutiplication(c)).plus(a)).plus(d) ➔ We can see the order of processing.

7.

Copy repl link

https://repl.it/@todok4636/PLCFinalQ7

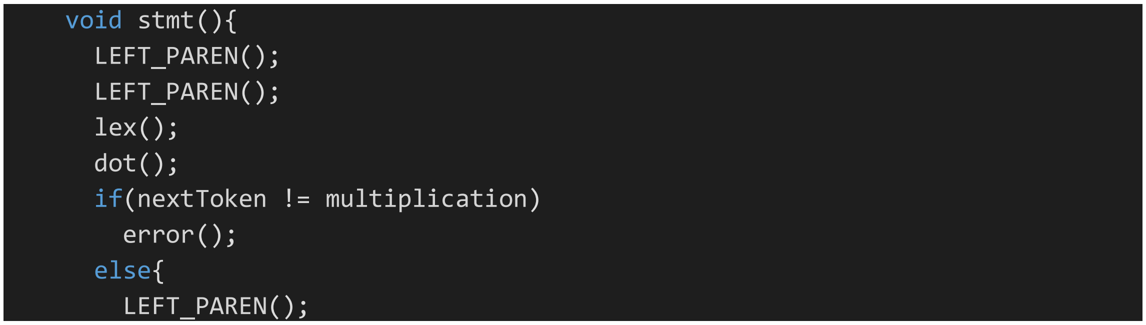
Inviting link

https://repl.it/join/vypzsmxv-todok4636

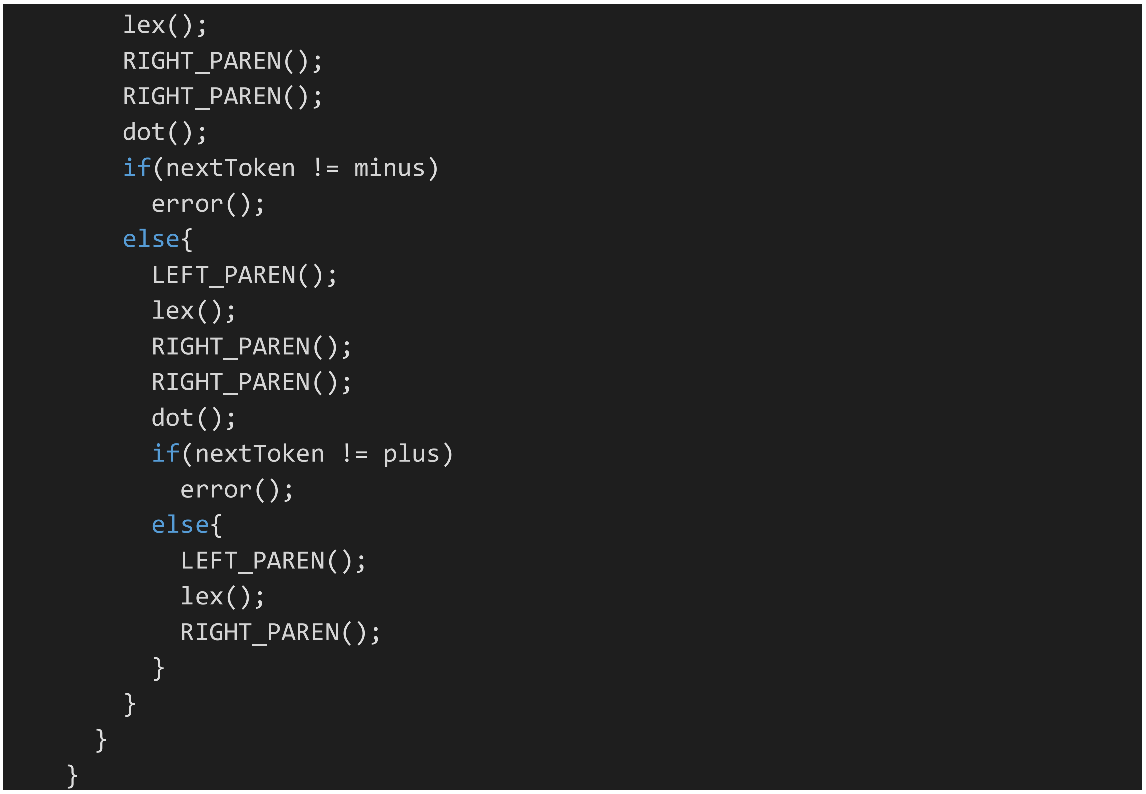
1) a * b -1 + c

$(((a*b)^1-1)^2 + c)^3$

((a.multiplication(b)).minus(1)).plus(c)



```
void stmt(){
  LEFT_PAREN();
  LEFT_PAREN();
  lex();
  dot();
  if(nextToken != multiplication)
    error();
  else{
    LEFT_PAREN();
```

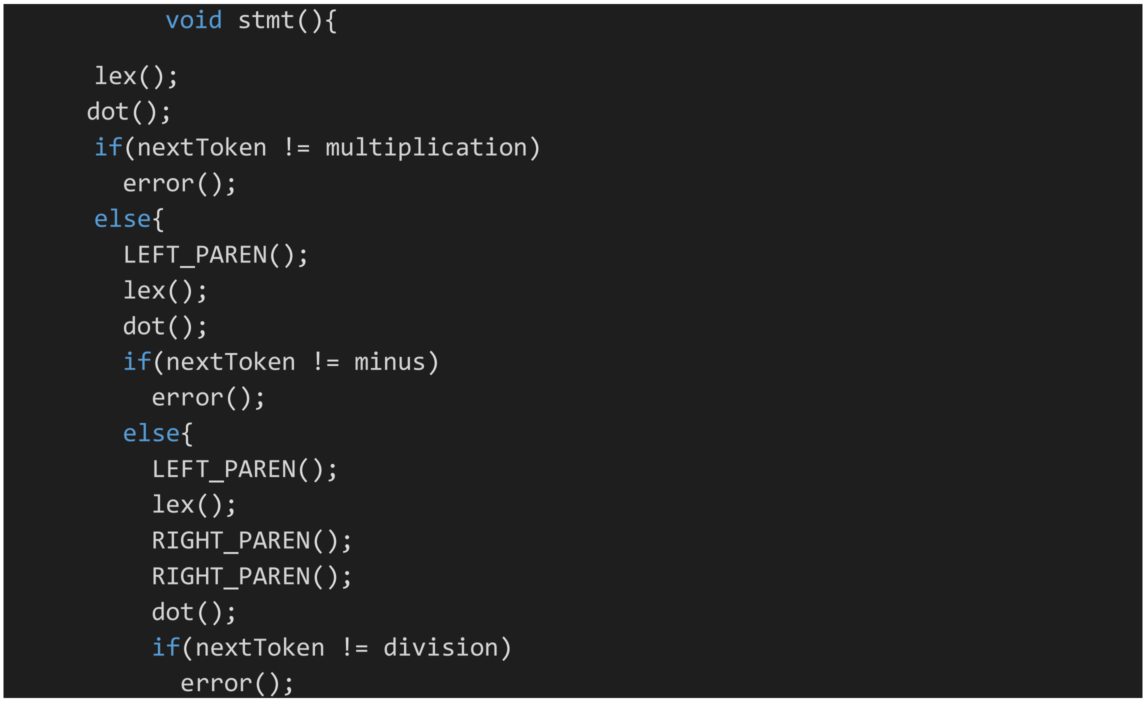


```
    lex();
    RIGHT_PAREN();
    RIGHT_PAREN();
    dot();
    if(nextToken != minus)
      error();
    else{
      LEFT_PAREN();
      lex();
      RIGHT_PAREN();
      RIGHT_PAREN();
      dot();
      if(nextToken != plus)
        error();
      else{
        LEFT_PAREN();
        lex();
        RIGHT_PAREN();
      }
    }
  }
}
```

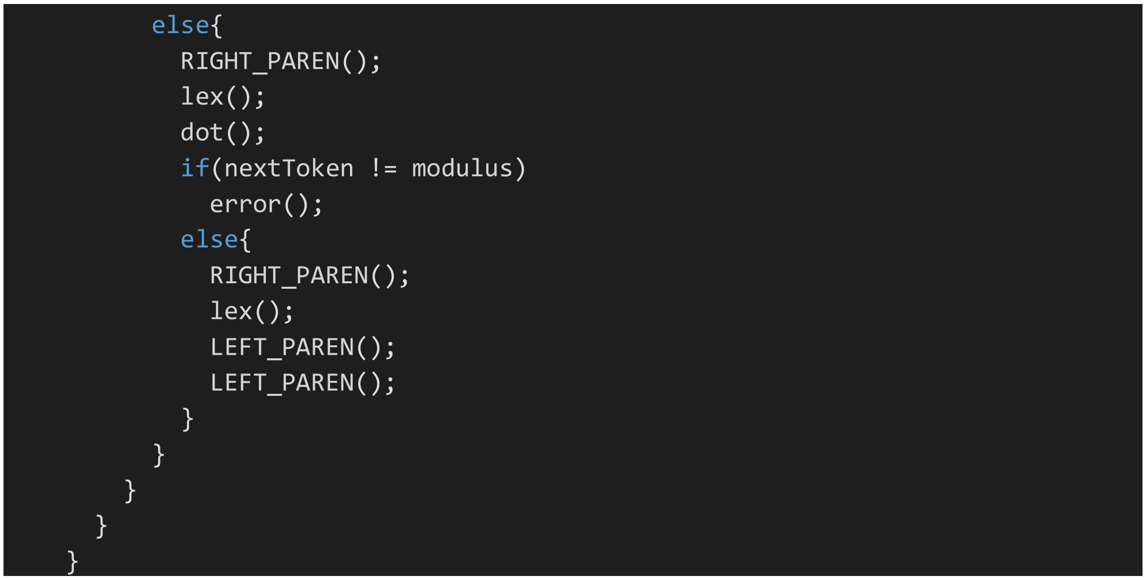
2) a * (b-1) / c % d

$((a * (b-1)^{1})^{2}/ (c \% d)^{3})^{4}$

a.multiplication(b.minus(1)).division(c.modulus(d))



```
       void stmt(){

  lex();
  dot();
  if(nextToken != multiplication)
    error();
  else{
    LEFT_PAREN();
    lex();
    dot();
    if(nextToken != minus)
      error();
    else{
      LEFT_PAREN();
      lex();
      RIGHT_PAREN();
      RIGHT_PAREN();
      dot();
      if(nextToken != division)
        error();
```

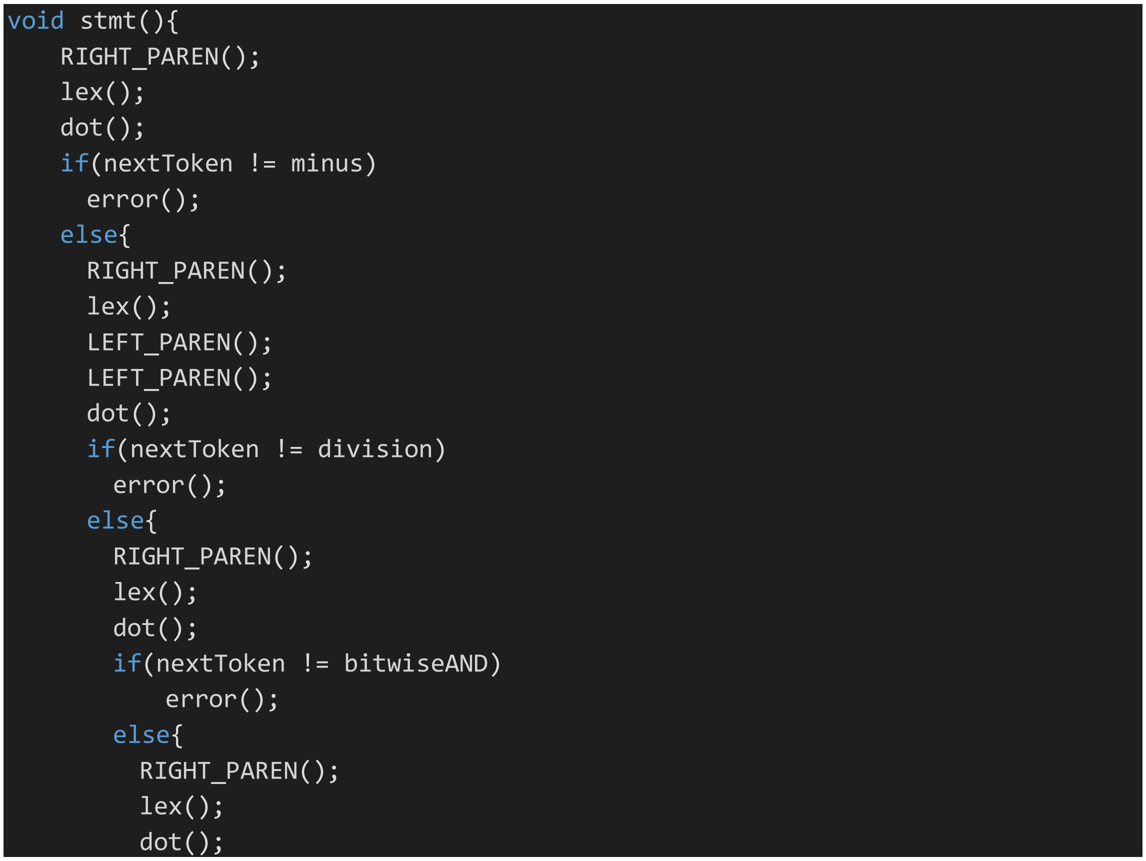


```
          else{
            RIGHT_PAREN();
            lex();
            dot();
            if(nextToken != modulus)
              error();
            else{
              RIGHT_PAREN();
              lex();
              LEFT_PAREN();
              LEFT_PAREN();
            }
          }
        }
      }
    }
```

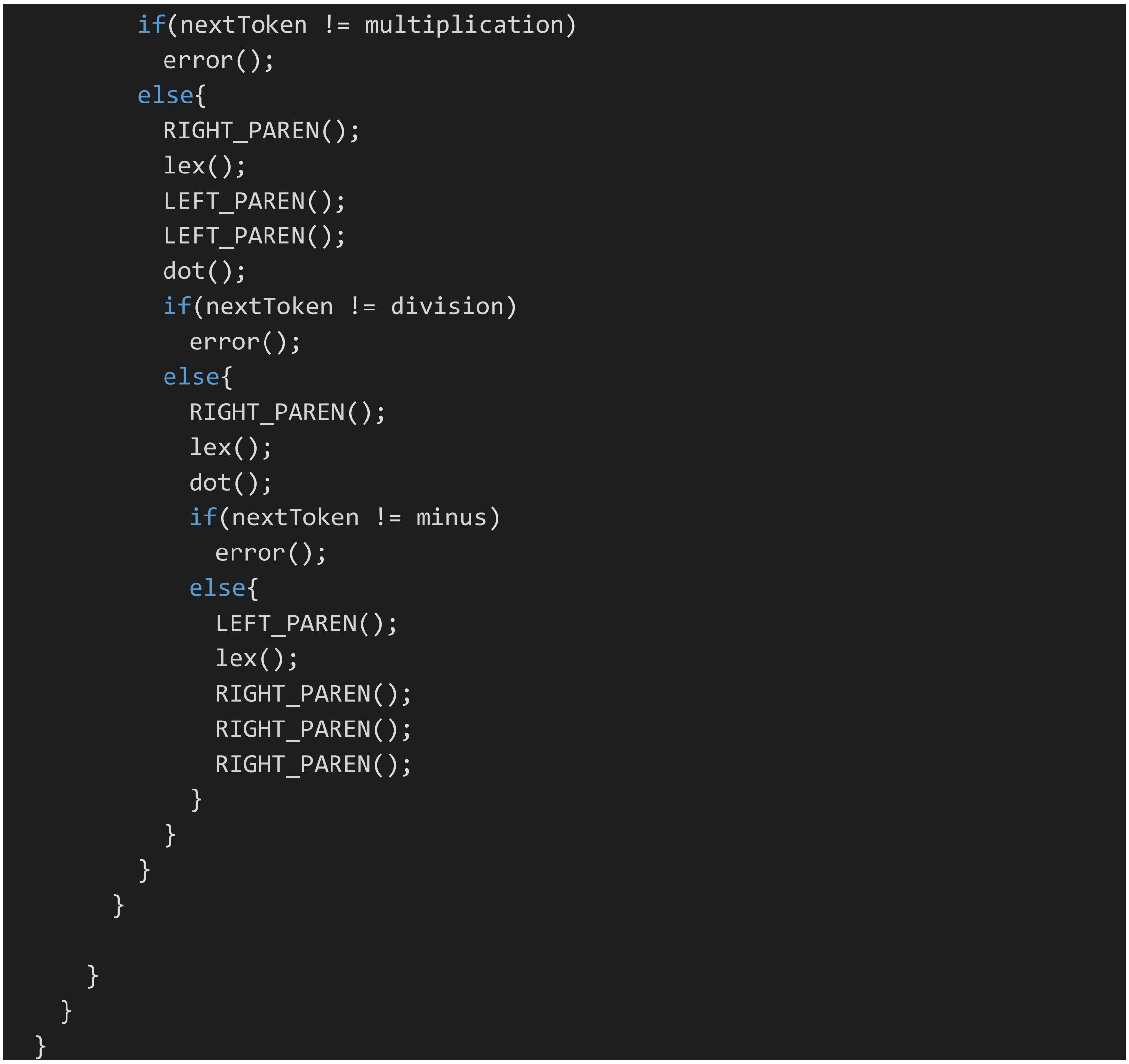
3) (a – b) / c & (d * e / a – 3)

$(((a - b)^{1} / (c \& ((d * e)^{2} / (a - 3)^{3})^{4})^{5})^{6}$

(a.minus(b)).division(c.bitwiseAND(d.multiplication.(e)).division(a.minus(3)))



```
void stmt(){
    RIGHT_PAREN();
    lex();
    dot();
    if(nextToken != minus)
      error();
    else{
      RIGHT_PAREN();
      lex();
      LEFT_PAREN();
      LEFT_PAREN();
      dot();
      if(nextToken != division)
        error();
      else{
        RIGHT_PAREN();
        lex();
        dot();
        if(nextToken != bitwiseAND)
            error();
        else{
          RIGHT_PAREN();
          lex();
          dot();
```

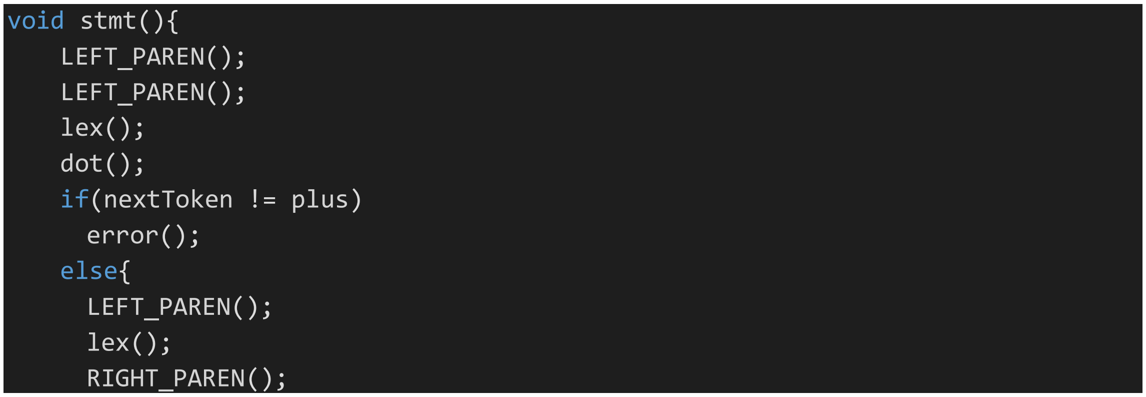


```
          if(nextToken != multiplication)
            error();
          else{
            RIGHT_PAREN();
            lex();
            LEFT_PAREN();
            LEFT_PAREN();
            dot();
            if(nextToken != division)
              error();
            else{
              RIGHT_PAREN();
              lex();
              dot();
              if(nextToken != minus)
                error();
              else{
                LEFT_PAREN();
                lex();
                RIGHT_PAREN();
                RIGHT_PAREN();
                RIGHT_PAREN();
              }
            }
          }
        }

      }
    }
  }
```

4) (a + b <= c) * (d > b - e)

$(((a + b)^1 <= c)^2 * (d > (b – e)^3)^4)^5$

((a.plus(b)).comparision(c)).multiplication(d.comparision(b.minus(e)))



```
void stmt(){
    LEFT_PAREN();
    LEFT_PAREN();
    lex();
    dot();
    if(nextToken != plus)
      error();
    else{
      LEFT_PAREN();
      lex();
      RIGHT_PAREN();
    RIGHT_PAREN();
    dot();
    if(nextToken != comparision)
      error();
    else{
      LEFT_PAREN();
      lex();
      RIGHT_PAREN();
      RIGHT_PAREN();
      dot();
      if(nextToken != multiplication)
        error();
      else{
        LEFT_PAREN();
        lex();
        dot();
        if(nextToken != comparision)
          error();
        else{
          LEFT_PAREN();
          lex();
          dot();
          LEFT_PAREN();
          lex();
          dot();
          if(nextToken != minus)
            error();
          else{
            LEFT_PAREN();
            lex();
            RIGHT_PAREN();
            RIGHT_PAREN();
            RIGHT_PAREN();
          }
        }
      }

    }
  }

}
```

5) -a || c = d && e

$(((-a)^1 \, || \, c)^3 = (d \,\&\&\, e)^2)^4$

((-a).logicalOR(c)).equal((d.logicalAND(e)))

```
void stmt(){
    LEFT_PAREN();
    LEFT_PAREN();
    unary_op().minus();
    lex();
    RIGHT_PAREN();
    dot();
    if(nextToken != logicalOR)
      error();
    else{
      LEFT_PAREN();
      lex();
      RIGHT_PAREN();
      RIGHT_PAREN();
      dot();
      if(nextToken != equal)
        error();
      else{
        LEFT_PAREN();
        LEFT_PAREN();
        lex();
        dot();
        if(nextToken != logicalAND)
          error();
        else{
          LEFT_PAREN();
          lex();
          RIGHT_PAREN();
          RIGHT_PAREN();
          RIGHT_PAREN();
        }
      }
    }
  }
```

6) a > b ~| c || d <= 17

$(((a > b)^2 \sim| c)^3 \, || \, (d <= 17)^1)^4$

((a.comparision(b)).bitwiseOR(c)).logicalOR(d.comparision(17))

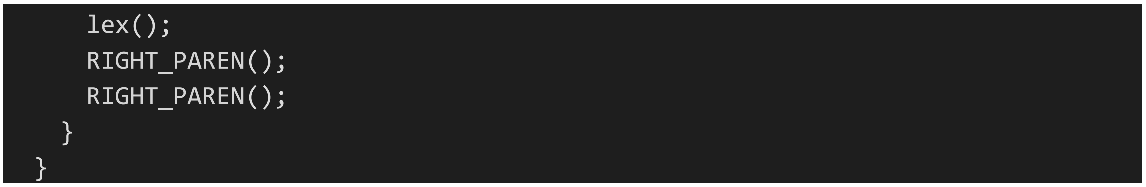
```
void stmt(){
    LEFT_PAREN();
    LEFT_PAREN();
    lex();
    dot();
    if(nextToken != comparision)
      error();
    else{
      LEFT_PAREN();
      lex();
      RIGHT_PAREN();
      RIGHT_PAREN();
      dot();
      if(nextToken != bitwiseOR)
        error();
      else{
        LEFT_PAREN();
        lex();
        RIGHT_PAREN();
        RIGHT_PAREN();
        dot();
        if(nextToken != logicalOR)
          error();
        else{
          LEFT_PAREN();
          lex();
          dot();
          if(nextToken != comparision)
            error();
          else{
            LEFT_PAREN();
            lex();
            RIGHT_PAREN();
            RIGHT_PAREN();
          }
        }
      }
    }
  }
```

7) -a + b

$(-(a + b)^1)^2$

-(a.plus(b))

```
void stmt(){
    unary_op().minus();
    LEFT_PAREN();
    lex();
    dot();
    if(nextToken != plus)
      error();
    else{
      LEFT_PAREN();
```

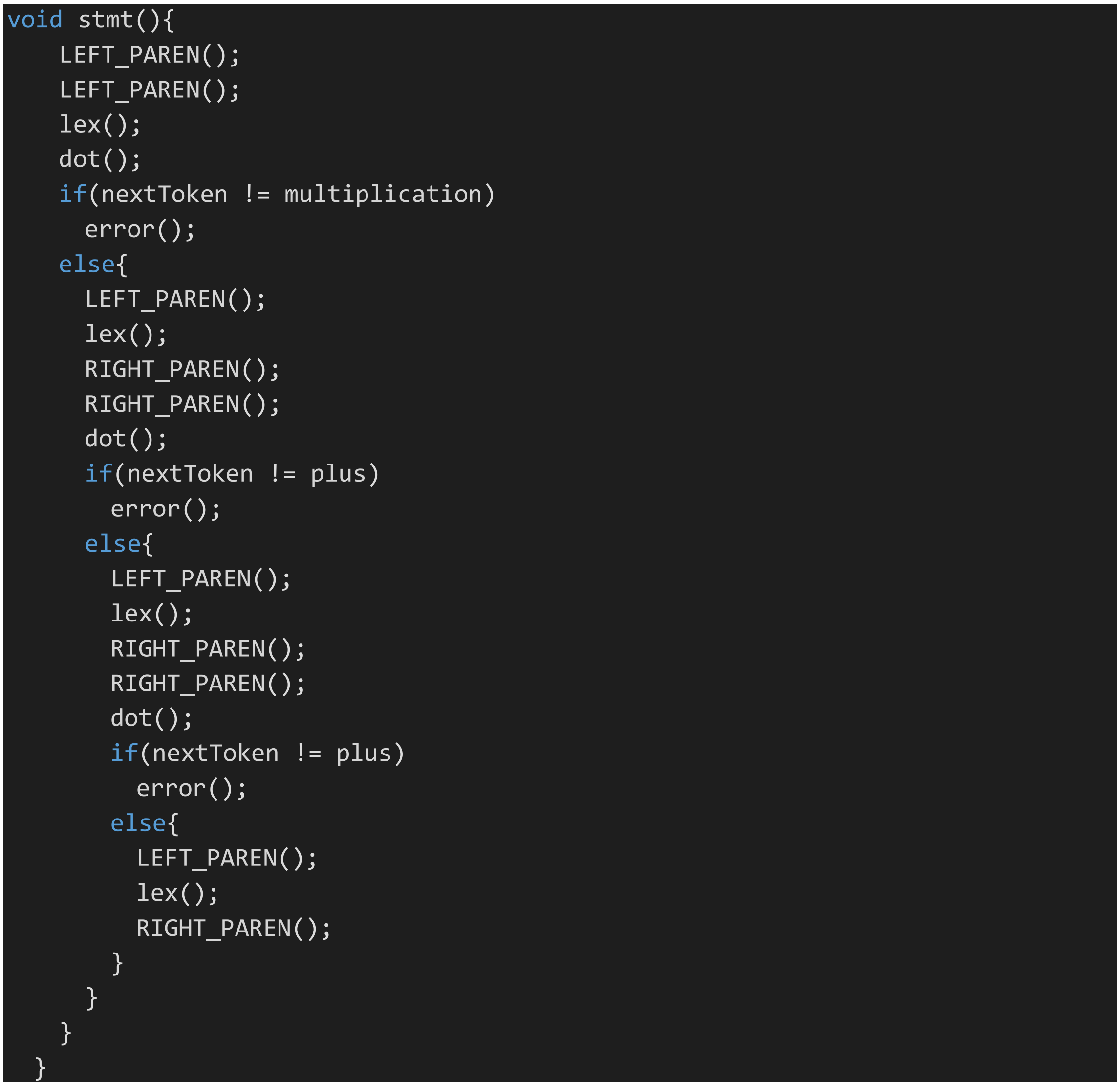


```
      lex();
      RIGHT_PAREN();
      RIGHT_PAREN();
    }
  }
```

8) a + b * c + d

$((a + (b * c)^{1})^{2}+ d)^{3}$

((b.mutiplication(c)).plus(a)).plus(d)



```
void stmt(){
    LEFT_PAREN();
    LEFT_PAREN();
    lex();
    dot();
    if(nextToken != multiplication)
      error();
    else{
      LEFT_PAREN();
      lex();
      RIGHT_PAREN();
      RIGHT_PAREN();
      dot();
      if(nextToken != plus)
        error();
      else{
        LEFT_PAREN();
        lex();
        RIGHT_PAREN();
        RIGHT_PAREN();
        dot();
        if(nextToken != plus)
          error();
        else{
          LEFT_PAREN();
          lex();
          RIGHT_PAREN();
        }
      }
    }
  }
```

9) E = ++(a++)

$(E = (++(a++)^{1})^{2})^{3}$

E.equal(increment.(a.increment))

```
void stmt(){
  lex();
  dot();
  if(nextToken != equal)
   error();
  else{
   LEFT_PAREN();
   if(nextToken != increment)
    error();
   else{
    dot();
    LEFT_PAREN();
    lex();
    dot();
    if(nextToken != increment)
     error();
    else{
     RIGHT_PAREN();
     RIGHT_PAREN();
    }
   }
  }
 }
```

8.

Copy repl link

https://repl.it/@todok4636/PLCFinalQ8HyunkiLee

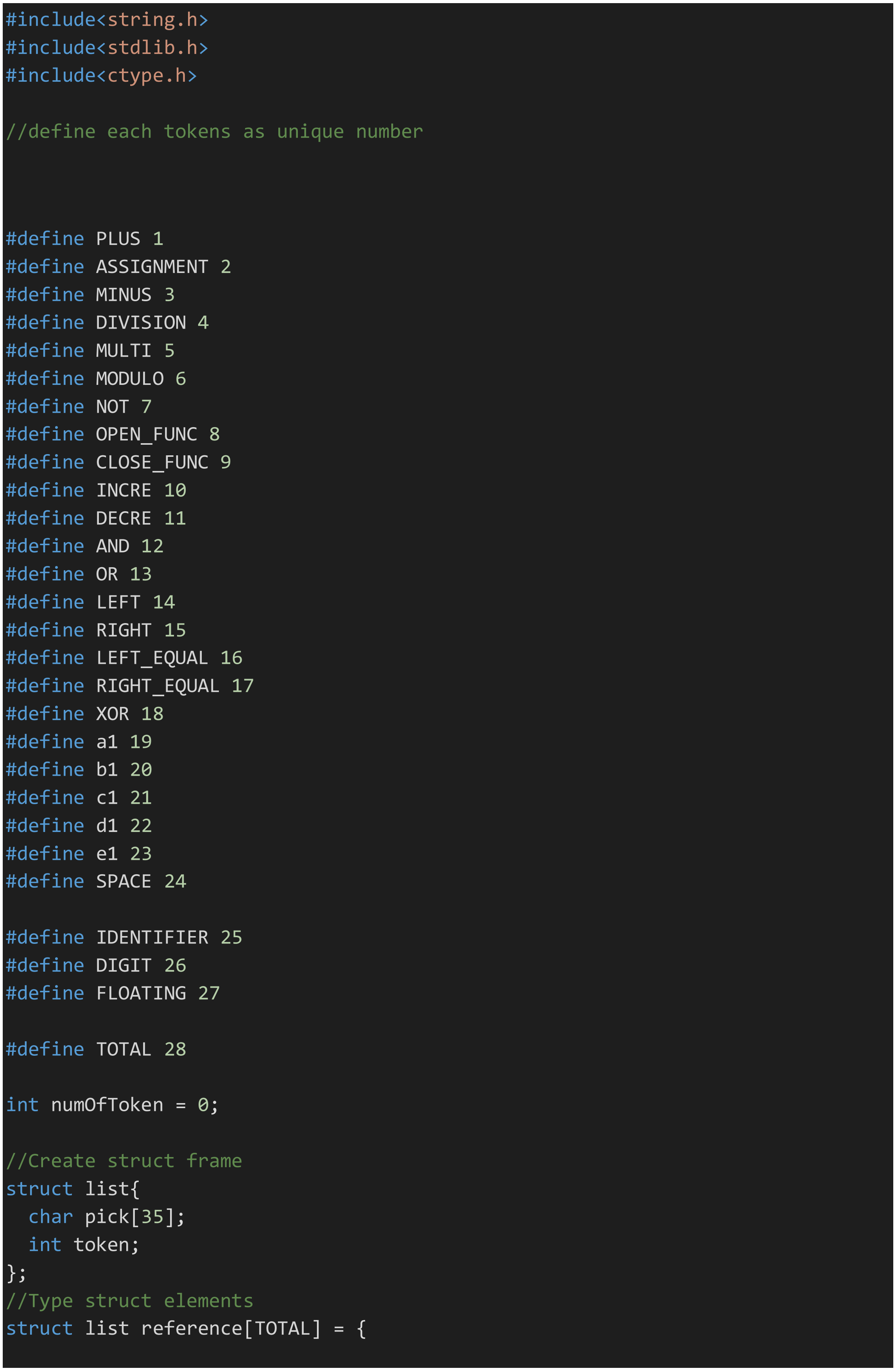
Inviting link

https://repl.it/join/ulaptgxb-todok4636

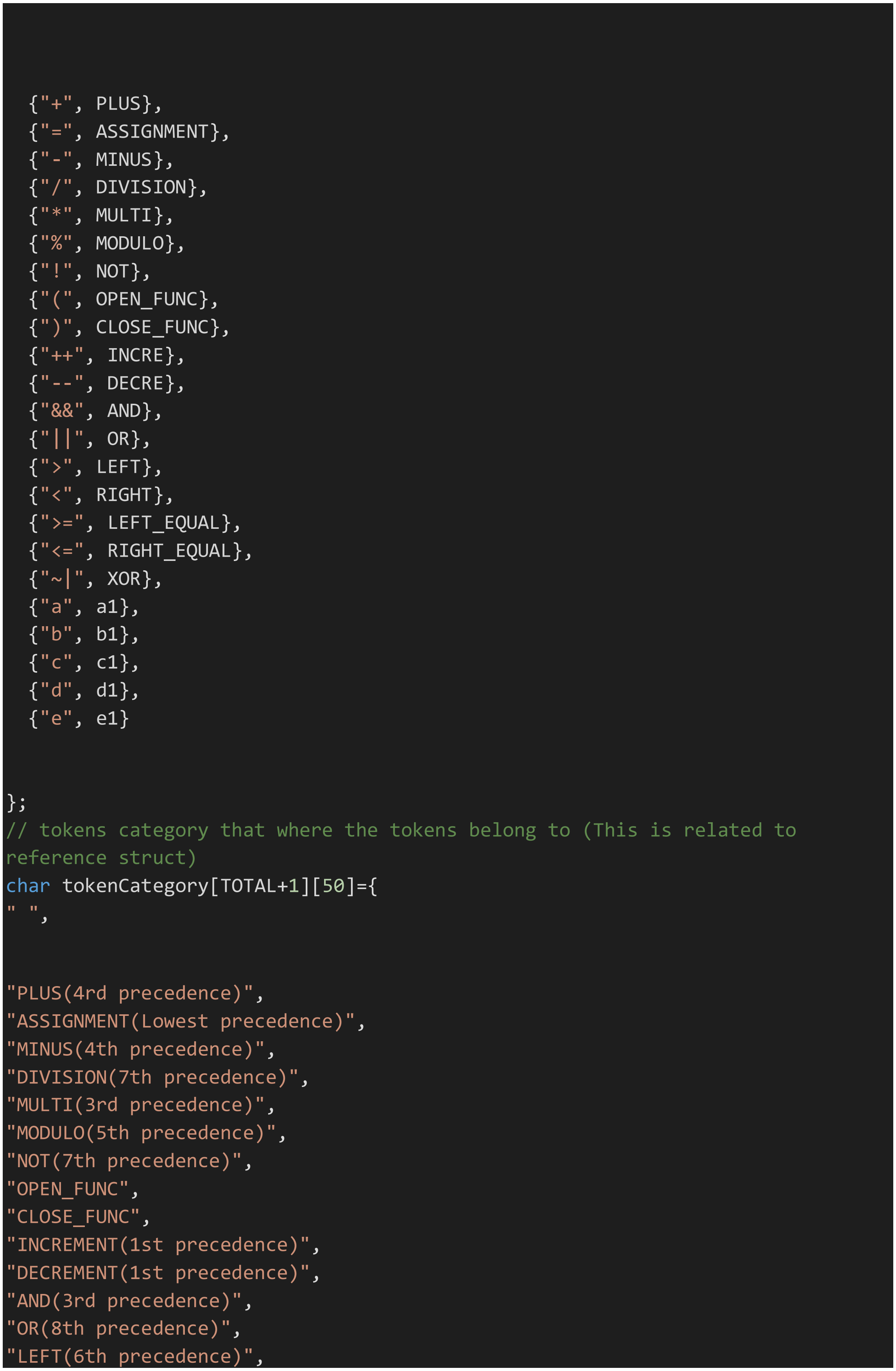
I will track variables and operators as tokens. When we tokenize the variables, we do not care about variables' type or value.

Source Code

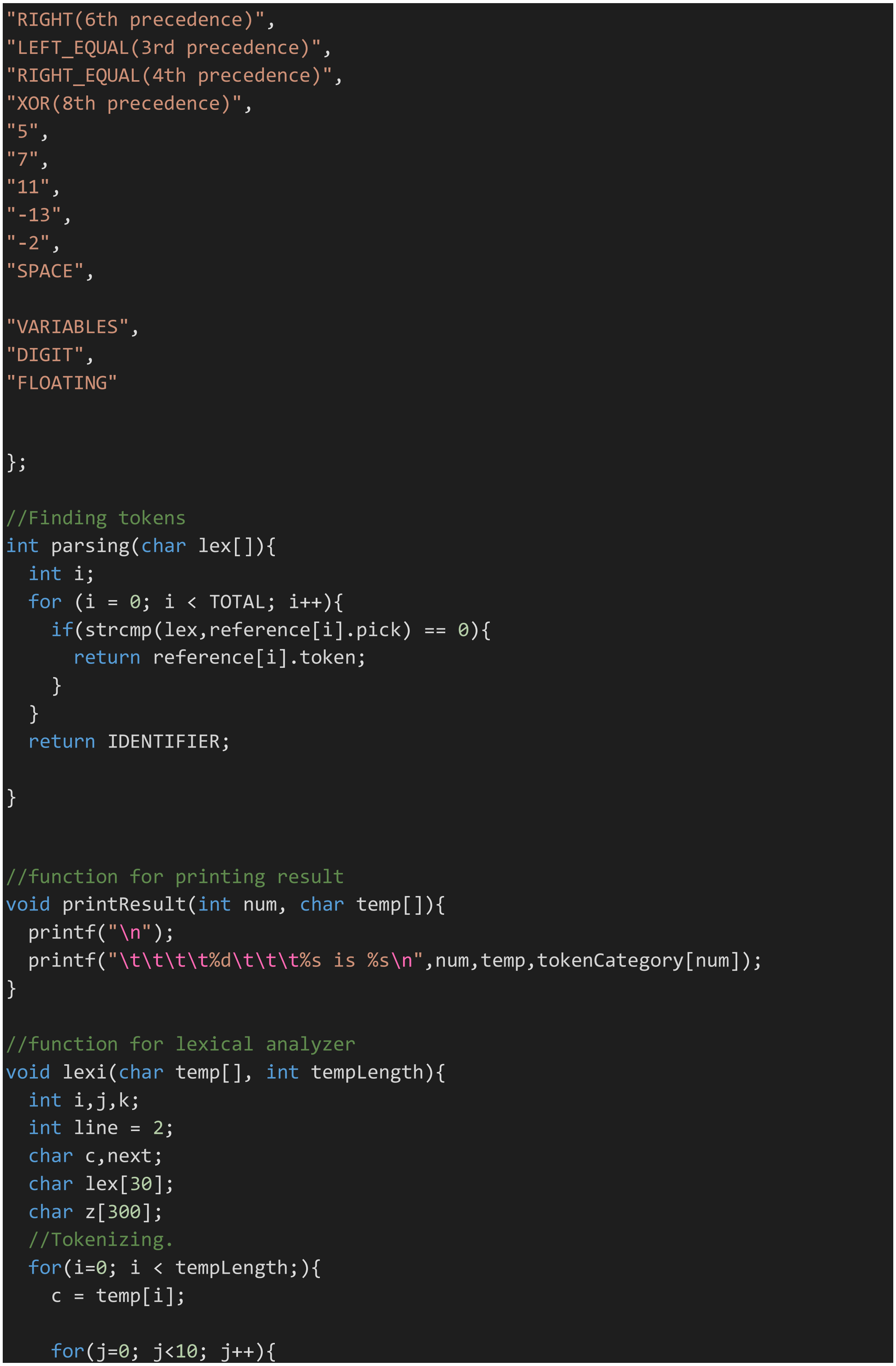
```
#include<stdio.h>
```



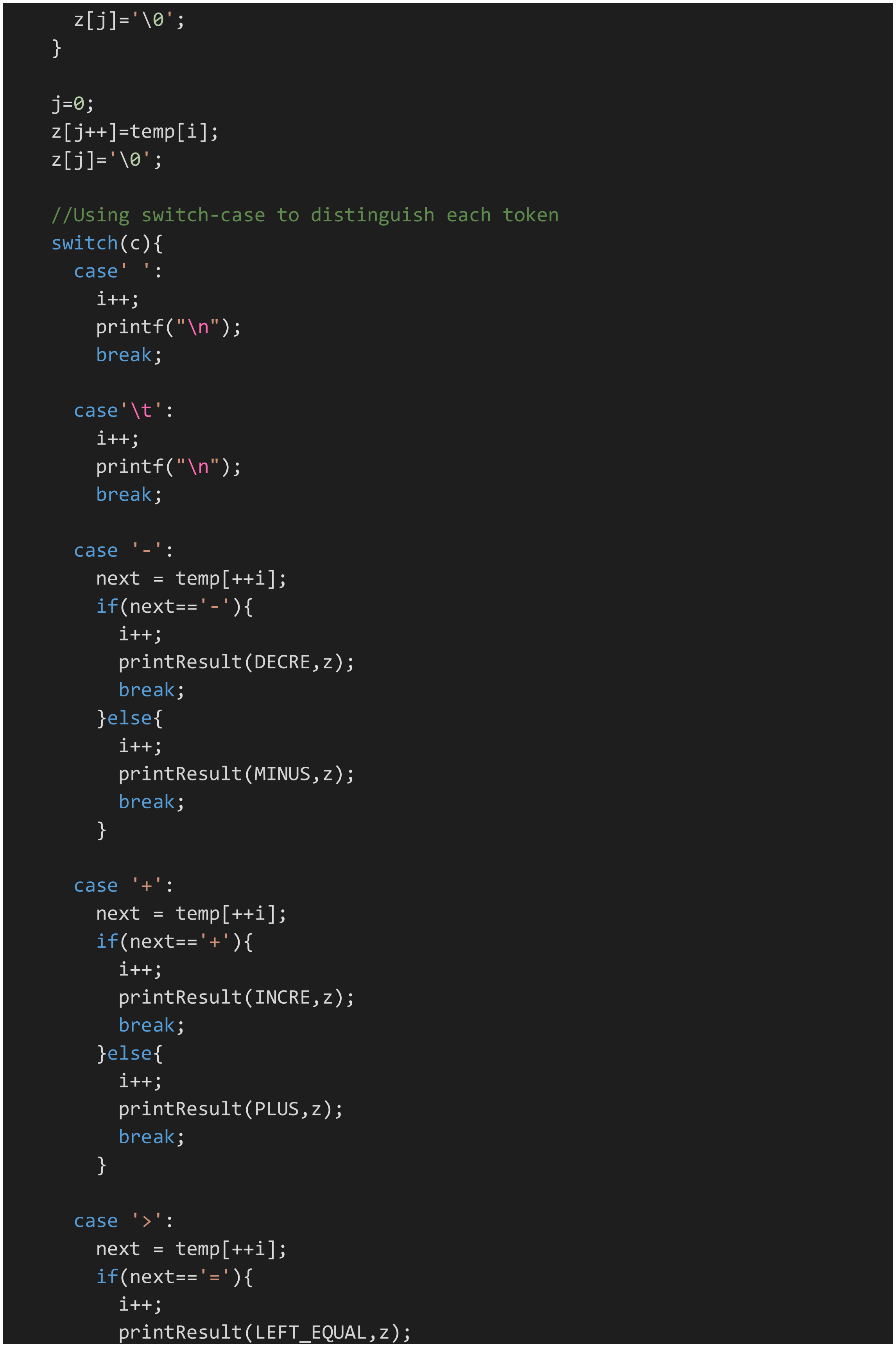
```
#include<string.h>
#include<stdlib.h>
#include<ctype.h>

//define each tokens as unique number



#define PLUS 1
#define ASSIGNMENT 2
#define MINUS 3
#define DIVISION 4
#define MULTI 5
#define MODULO 6
#define NOT 7
#define OPEN_FUNC 8
#define CLOSE_FUNC 9
#define INCRE 10
#define DECRE 11
#define AND 12
#define OR 13
#define LEFT 14
#define RIGHT 15
#define LEFT_EQUAL 16
#define RIGHT_EQUAL 17
#define XOR 18
#define a1 19
#define b1 20
#define c1 21
#define d1 22
#define e1 23
#define SPACE 24

#define IDENTIFIER 25
#define DIGIT 26
#define FLOATING 27

#define TOTAL 28

int numOfToken = 0;

//Create struct frame
struct list{
  char pick[35];
  int token;
};
//Type struct elements
struct list reference[TOTAL] = {
```



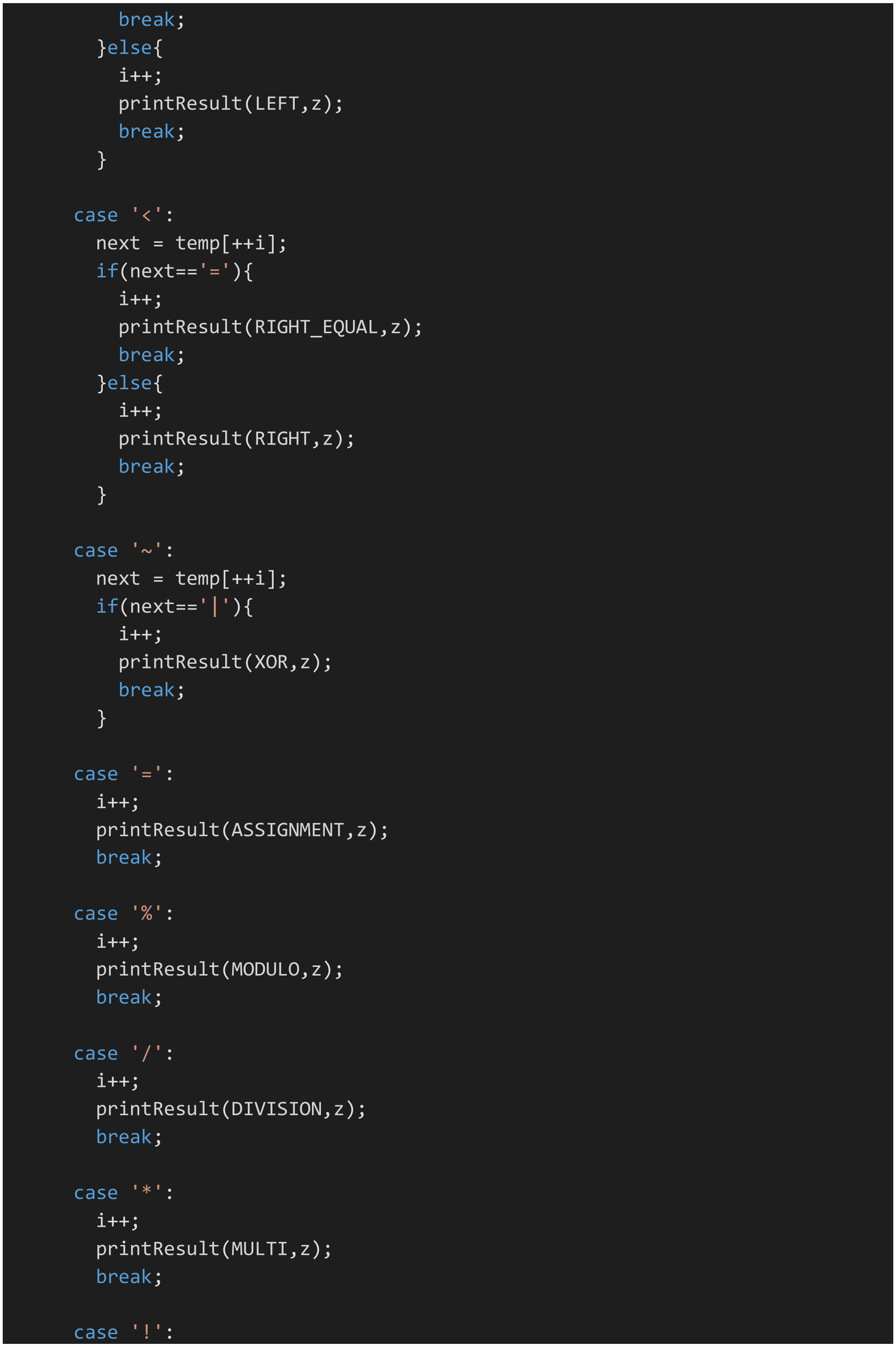
```
  {"+", PLUS},
  {"=", ASSIGNMENT},
  {"-", MINUS},
  {"/", DIVISION},
  {"*", MULTI},
  {"%", MODULO},
  {"!", NOT},
  {"(", OPEN_FUNC},
  {")", CLOSE_FUNC},
  {"++", INCRE},
  {"--", DECRE},
  {"&&", AND},
  {"||", OR},
  {">", LEFT},
  {"<", RIGHT},
  {">=", LEFT_EQUAL},
  {"<=", RIGHT_EQUAL},
  {"~|", XOR},
  {"a", a1},
  {"b", b1},
  {"c", c1},
  {"d", d1},
  {"e", e1}


};
// tokens category that where the tokens belong to (This is related to
reference struct)
char tokenCategory[TOTAL+1][50]={
" ",


"PLUS(4rd precedence)",
"ASSIGNMENT(Lowest precedence)",
"MINUS(4th precedence)",
"DIVISION(7th precedence)",
"MULTI(3rd precedence)",
"MODULO(5th precedence)",
"NOT(7th precedence)",
"OPEN_FUNC",
"CLOSE_FUNC",
"INCREMENT(1st precedence)",
"DECREMENT(1st precedence)",
"AND(3rd precedence)",
"OR(8th precedence)",
"LEFT(6th precedence)",
```



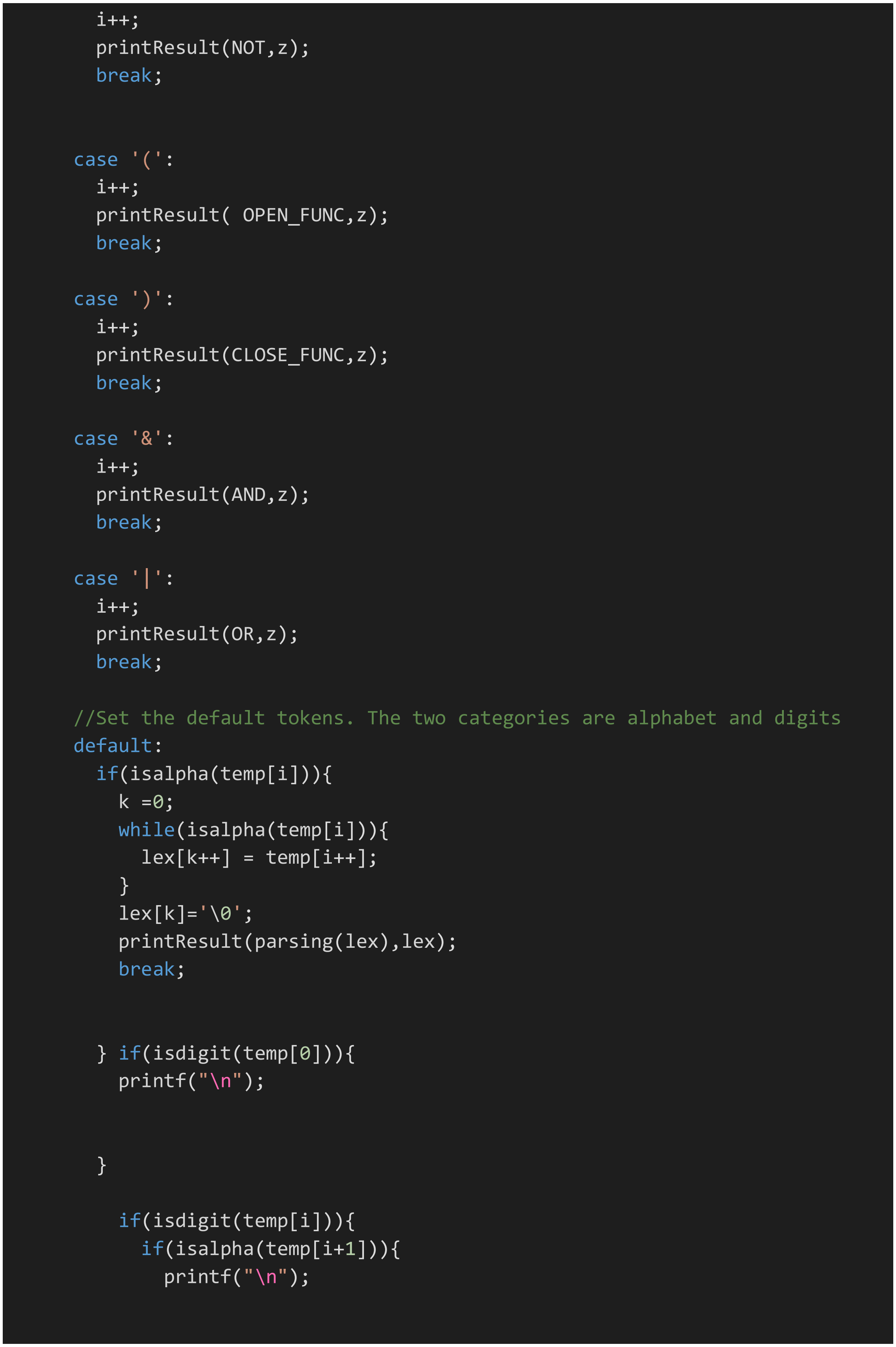
```c
"RIGHT(6th precedence)",
"LEFT_EQUAL(3rd precedence)",
"RIGHT_EQUAL(4th precedence)",
"XOR(8th precedence)",
"5",
"7",
"11",
"-13",
"-2",
"SPACE",

"VARIABLES",
"DIGIT",
"FLOATING"


};

//Finding tokens
int parsing(char lex[]){
  int i;
  for (i = 0; i < TOTAL; i++){
    if(strcmp(lex,reference[i].pick) == 0){
      return reference[i].token;
    }
  }
  return IDENTIFIER;

}


//function for printing result
void printResult(int num, char temp[]){
  printf("\n");
  printf("\t\t\t\t%d\t\t\t%s is %s\n",num,temp,tokenCategory[num]);
}

//function for lexical analyzer
void lexi(char temp[], int tempLength){
  int i,j,k;
  int line = 2;
  char c,next;
  char lex[30];
  char z[300];
  //Tokenizing.
  for(i=0; i < tempLength;){
    c = temp[i];

    for(j=0; j<10; j++){
```



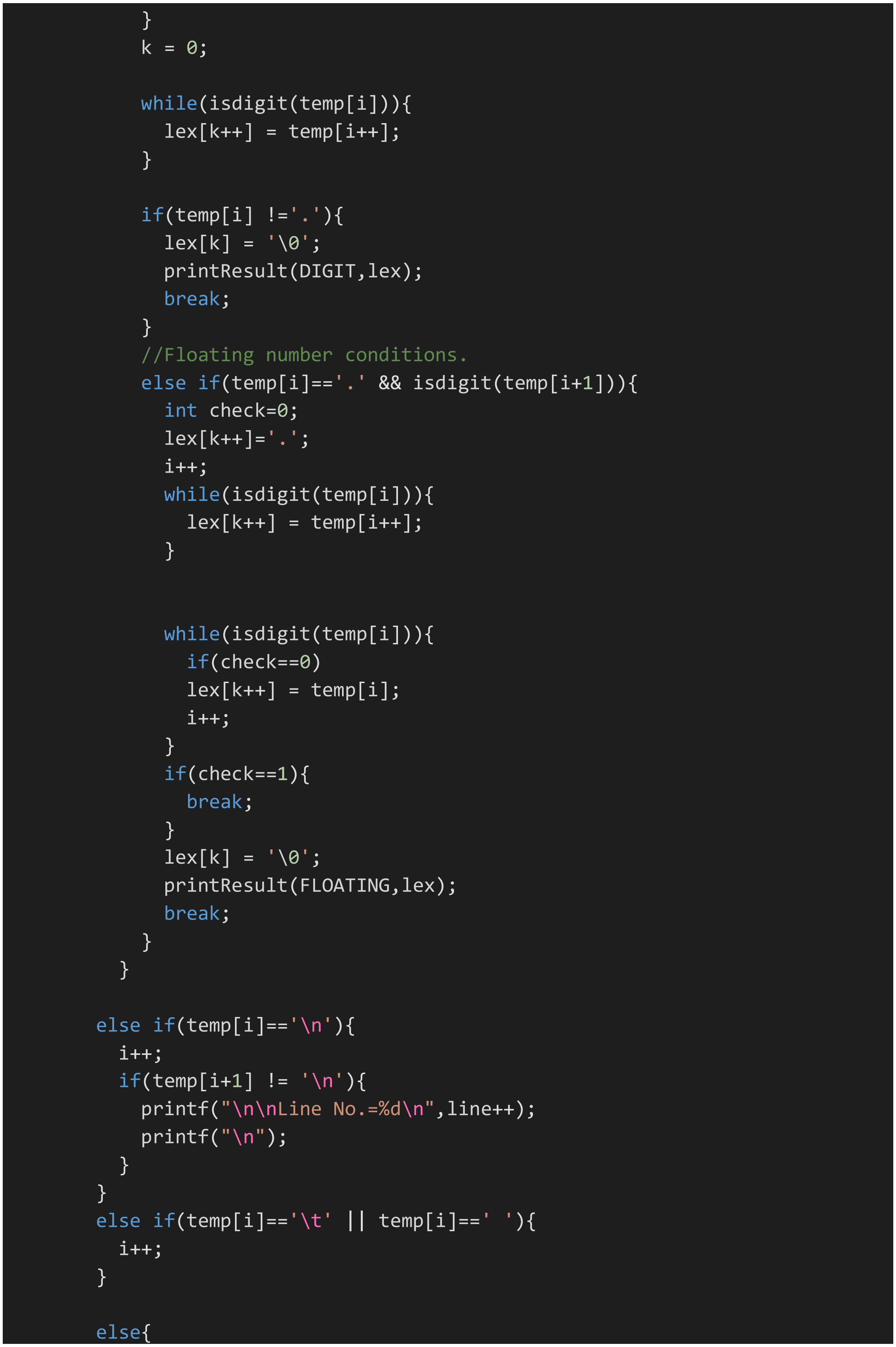
```
    z[j]='\0';
  }

  j=0;
  z[j++]=temp[i];
  z[j]='\0';

  //Using switch-case to distinguish each token
  switch(c){
    case' ':
      i++;
      printf("\n");
      break;

    case'\t':
      i++;
      printf("\n");
      break;

    case '-':
      next = temp[++i];
      if(next=='-'){
        i++;
        printResult(DECRE,z);
        break;
      }else{
        i++;
        printResult(MINUS,z);
        break;
      }

    case '+':
      next = temp[++i];
      if(next=='+'){
        i++;
        printResult(INCRE,z);
        break;
      }else{
        i++;
        printResult(PLUS,z);
        break;
      }

    case '>':
      next = temp[++i];
      if(next=='='){
        i++;
        printResult(LEFT_EQUAL,z);
```



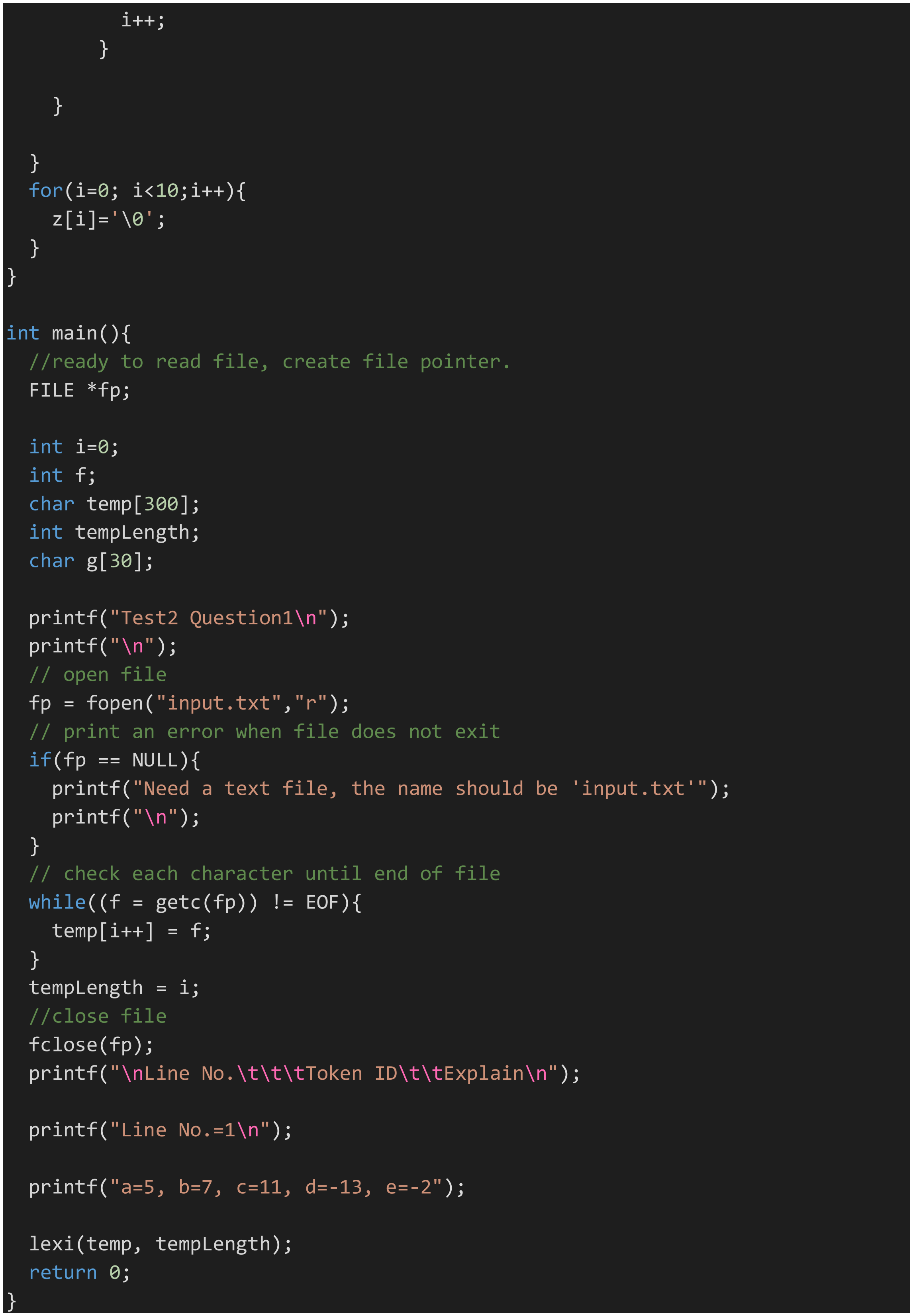
```
        break;
      }else{
        i++;
        printResult(LEFT,z);
        break;
      }

    case '<':
      next = temp[++i];
      if(next=='='){
        i++;
        printResult(RIGHT_EQUAL,z);
        break;
      }else{
        i++;
        printResult(RIGHT,z);
        break;
      }

    case '~':
      next = temp[++i];
      if(next=='|'){
        i++;
        printResult(XOR,z);
        break;
      }

    case '=':
      i++;
      printResult(ASSIGNMENT,z);
      break;

    case '%':
      i++;
      printResult(MODULO,z);
      break;

    case '/':
      i++;
      printResult(DIVISION,z);
      break;

    case '*':
      i++;
      printResult(MULTI,z);
      break;

    case '!':
```



```
      i++;
      printResult(NOT,z);
      break;


    case '(':
      i++;
      printResult( OPEN_FUNC,z);
      break;

    case ')':
      i++;
      printResult(CLOSE_FUNC,z);
      break;

    case '&':
      i++;
      printResult(AND,z);
      break;

    case '|':
      i++;
      printResult(OR,z);
      break;

    //Set the default tokens. The two categories are alphabet and digits
    default:
      if(isalpha(temp[i])){
        k =0;
        while(isalpha(temp[i])){
          lex[k++] = temp[i++];
        }
        lex[k]='\0';
        printResult(parsing(lex),lex);
        break;


      } if(isdigit(temp[0])){
        printf("\n");


      }

        if(isdigit(temp[i])){
          if(isalpha(temp[i+1])){
            printf("\n");
```



```
        }
        k = 0;

        while(isdigit(temp[i])){
          lex[k++] = temp[i++];
        }

        if(temp[i] !='.'){
          lex[k] = '\0';
          printResult(DIGIT,lex);
          break;
        }
        //Floating number conditions.
        else if(temp[i]=='.' && isdigit(temp[i+1])){
          int check=0;
          lex[k++]='.';
          i++;
          while(isdigit(temp[i])){
            lex[k++] = temp[i++];
          }


          while(isdigit(temp[i])){
            if(check==0)
            lex[k++] = temp[i];
            i++;
          }
          if(check==1){
            break;
          }
          lex[k] = '\0';
          printResult(FLOATING,lex);
          break;
        }
      }

    else if(temp[i]=='\n'){
      i++;
      if(temp[i+1] != '\n'){
        printf("\n\nLine No.=%d\n",line++);
        printf("\n");
      }
    }
    else if(temp[i]=='\t' || temp[i]==' '){
      i++;
    }

    else{
```



```
          i++;
        }

    }

  }
  for(i=0; i<10;i++){
    z[i]='\0';
  }
}

int main(){
  //ready to read file, create file pointer.
  FILE *fp;

  int i=0;
  int f;
  char temp[300];
  int tempLength;
  char g[30];

  printf("Test2 Question1\n");
  printf("\n");
  // open file
  fp = fopen("input.txt","r");
  // print an error when file does not exit
  if(fp == NULL){
    printf("Need a text file, the name should be 'input.txt'");
    printf("\n");
  }
  // check each character until end of file
  while((f = getc(fp)) != EOF){
    temp[i++] = f;
  }
  tempLength = i;
  //close file
  fclose(fp);
  printf("\nLine No.\t\t\tToken ID\t\tExplain\n");

  printf("Line No.=1\n");

  printf("a=5, b=7, c=11, d=-13, e=-2");

  lexi(temp, tempLength);
  return 0;
}
```

9.

a>b>c in math logic. We compare a>b and b>a. Otherwise, in c, the logic will be evaluated from left to right. If a>b is true, then return ‘true’ which is 1. After that the we compare 1>c whether it is true or false. Thus, even though some examples are true in math logic, it is possible to be false in c.

10.

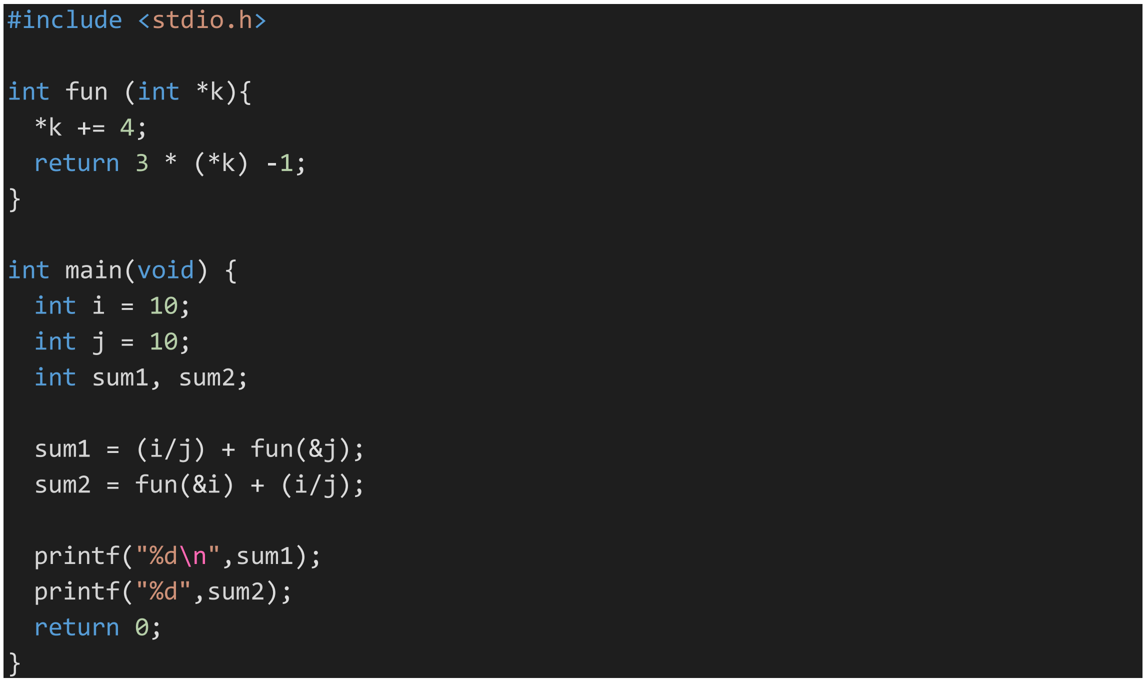
Copy repl link

https://repl.it/@todok4636/PLCFinalQ10HyunkiLee

Inviting link

https://repl.it/join/gflodgmc-todok4636

Source code



```
#include <stdio.h>

int fun (int *k){
  *k += 4;
  return 3 * (*k) -1;
}

int main(void) {
  int i = 10;
  int j = 10;
  int sum1, sum2;

  sum1 = (i/j) + fun(&j);
  sum2 = fun(&i) + (i/j);

  printf("%d\n",sum1);
  printf("%d",sum2);
  return 0;
}
```

Result:

sum1: 42

sum2: 42

In sum1, the (i/j) = 1 and fun(&j) is 41(3*14-1). Thus (i/j) + fun(&j) = 42

In sum2, the fun(&i) = 41(3*14-1) and (i/j) = 1. Thus fun(&i) + (i/j) = 42

This is related to ‘pointer’ in C. Even though we call fun() and use j or i as a variable, the value of original i and j will not be changed.