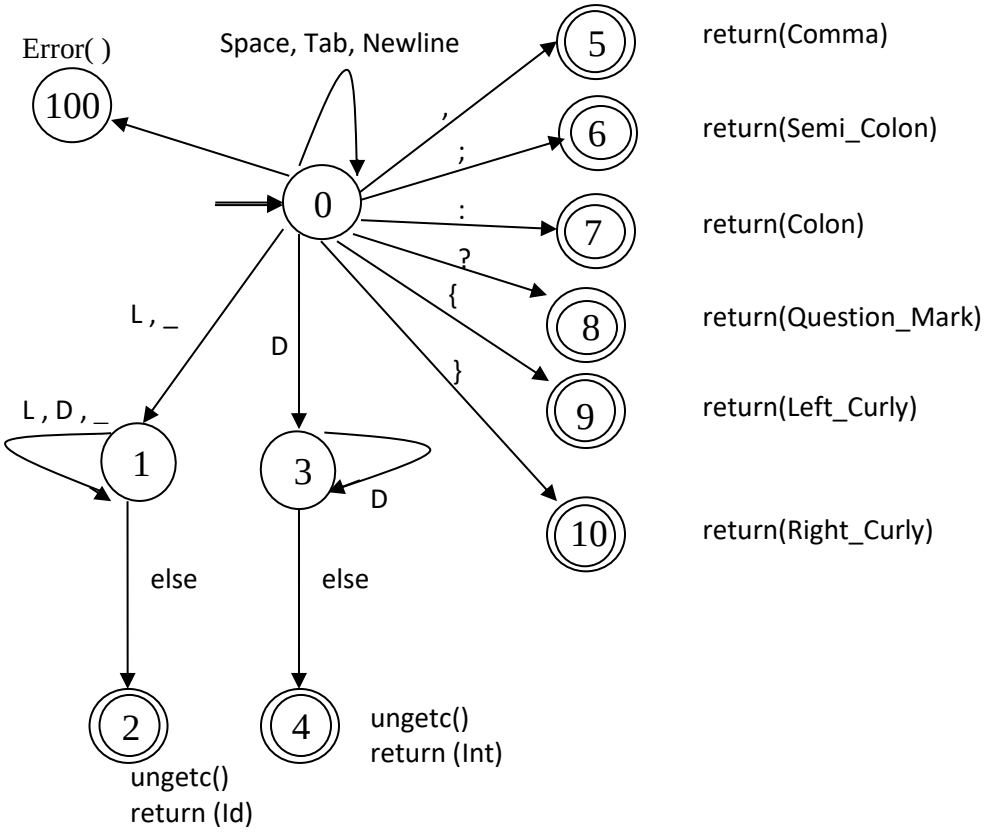
Group Project Part 1: Converting Finite Automata into a Program

Group Project (Part 1 – Lexical Analyzer)

- Identify lexemes and tokens from the source code.
- Truncate white spaces and comments from the source code.
- Differentiate between identifiers and reserved words.
- Generate an error after encountering some illegal character.

Integrated FA for Identifiers, White Spaces, Integers, Relational Operators and Assignment Operator:



Program for the above FA:

```
//Add commands here to import all related packages

void tokenizer();
void error();
char lookahead;

    //Write commands here to open "input.txt" file for reading and "output.txt"
    //file for writing
    // main function to start execution
void main()
{
    // call to takenizer to generate tokens
    tokenizer();
    printf("Tokens have been identified successfully....!!!");
    getch();

}

void tokenizer()
{
    // Write statement(s) here to store all reserved words of C/Java into an array


    // Create an array named "lexeme" to store lexemes
    char lexeme[30];
    int state=0;            // integer variable representing states
    char specifiers[]={'n','a','t','r', 'b',39,92};
       // specifiers  39 represents ' and 92 represents \
    int i=0,j=0,k=0, flag = 0;
```

```
if file "input.txt" does not exist, display some error message and quit

else
{
        //Read one character from the input file and store it in lookahead
        //variable
        while (pointer does not reach End of File)
        {
                switch(state)
                {
                case 0:
```

Write the code for all the outgoing arrows from state 0 after constructing FA for Identifiers, Arithmetic Operators, Arithmetic Assignment Operators, Relational operators, Logical operators, Increment/Decrement Operators, Assignment operators, Integers, floating point numbers, character literals, string literals, Single Line, Multiline Comments, White Spaces and Delimeters/Punctuation Marks

```
…. …….
                        else
                            {
                                error();
                                state=0;
                            }

                                break;
        case 1:
                //Read the next character from the input file
                //Write code for all outgoing arrows from this state
```

```
                    break;
case 2:
                    state=0;
                    //The following code will unget the last character
                    //read from the input file
                    lexeme[i]='\0'; //Storing null character at the end
                    for(j=0;j<32;j++)
                    {
                            if(strcmp(lexeme,reserveWords[j])==0)
                            {
                                    flag = 1;
                                    break;
                            }
                    }
//The following code is used to write the lexeme and its token
//in the output file
                     if( flag)  //If it is reserved word
                     {
                             //Write statements here to print the lexeme
                             //and the reserved word

                             flag=0;
                     }
                     else      //If it is identifier
                     {
                            //Write statements here to print the lexeme
                            //and its corresponding token "ID"
                                            }
                    i=0;
                    break;
```

```
case 3:
        //Write statement to read one character from the
        //input file and store it in lookahead variable
        //Write corresponding code for digit here


        break;
case 4:
        state=0;
        lexeme[i]='\0';
        //Write statements here to print the lexeme
        //and its corresponding token "INTEGER"
        i=0;
        break;
```

Write code here for all the states which are present in your final integrated FA which recognizes

- **(i)** Arithmetic Operators (+ , -, *, /, %)
- **(ii)** Arithmetic Assignment Operators (+=, - =, *=, /=, %=)
- **(iii)** Relational Operators (<, <=, >, >=, ==, !=)
- **(iv)** Logical Operators (&&, ||, !)
- **(v)** Increment/Decrement Operators (++, - -)
- **(vi)** Single Line and Multi Line Comments
- **(vii)** Character and String literals
- **(viii)** Integer and float literals
- **(ix)** Punctuation Marks ([|] | (|) | ; | : | ,) etc

```
        }
}
```

```
    }

}

void error()
{
    //Write statement here to display the error message
    //"UNRECOGNIZED_TOKEN"
    //Write statement to read one character from the input file and store it in
    //lookahead variable
}
```

Assigned on: Wednesday, February 21, 2024
Due Date: Saturday, March 16, 2024 till 11:59 PM (Mid Night)

Important Note: Part 1 of Final Project (Lexical Analyzer):

Group Project Part 1 (Lexical Analyzer) has been uploaded in "Group Project" option of Blackboard. It is a **Group Project**. Its due date is **Saturday March 16, 2024 till 11:59 PM**. You can also upload the solution by **Sunday March 17, 2024 till 11:59 PM with 25% deduction of marks or by Monday March 18, 2023 till 11:59 PM with 50% deduction of marks**. **After this date, no submission will be accepted.**

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Hint:

Construct individual FAs for

- **(i)** Identifiers
- **(ii)** White Spaces
- **(iii)** Arithmetic Operators (+ , -, *, /, %)
- **(iv)** Arithmetic Assignment Operators (+=, - =, *=, /=, %=)
- **(v)** Relational Operators (<, <=, >, >=, ==, !=)
- **(vi)** Logical Operators (&&, ||, !)
- **(vii)** Increment/Decrement Operators (++, - -)
- **(viii)** Assignment Operator
- **(ix)** Single Line and Multi Line Comments
- **(x)** Integers and floating point/real numbers
- **(xi)** Character and String literals
- **(xii)** Punctuation Marks (; | : | , | ‘ | “ | { | } | [|] | (|) etc.)

Then combine these FAs into one integrated FA such that no state should have more than one outgoing edge with the same label. Finally write a program for implementing the integrated FA for lexical analyzer phase of compiler.

Sample input and **output** for this program is as follows:

Input:

```
void main(void)
{
        int a=10; int b=20;
        b = a++;
}
```

Output:

Lexemes	**Tokens**
void	void
main	main
(	Left_Paren
void	void
)	Right_Paren
{	Left_Curly
int	int
a	id
=	Assign_Op
10	Int_Literal
;	Semi_Colon
int	int
b	Id
=	Assign_Op
20	Int_Literal
;	Semi_Colon
b	id
=	Assign_Op
a	id
++	Inc_Op
;	Semi_Colon
}	Right_Curly