Lab # 4

1. Problem Statement:-

- You are tasked with building a top-down parser for simple algebraic expressions.
- The expressions can involve addition (+), subtraction (-), and multiplication (*) operations.
- Operands can be numerical values or variable names.
- For tokenization, utilize the task from previous lab.

2. Grammar:-

- **expr -> term expr'**
- **expr' -> + term expr' | - term expr' | ε**
- **term -> factor term'**
- **term' -> * factor term' | ε**
- **factor -> NUMBER | VARIABLE | (expr)**
- **NUMBER -> [0-9]+**
- **VARIABLE -> [a-zA-Z]+**

3. Explanation:-

- expr:
  - Represents an algebraic expression and is defined as a term (term) followed by an optional extension expr'. This extension allows for the presence of additional terms connected by addition or subtraction operators.
- expr':
  - Captures the possibility of having multiple terms connected by addition or subtraction operators. It's defined as either + term expr', - term expr', or epsilon (ε) indicating the end of the expression.
- term:
  - Represents a term in the expression and is defined as a factor (factor) followed by an optional extension term'. This extension allows for the presence of additional factors connected by multiplication operators.
- term':
  - Captures the possibility of having multiple factors connected by multiplication operators. It's defined as either * factor term' or epsilon (ε).

- factor:
    - Represents a factor, which can be a numerical value (NUMBER), a variable name (VARIABLE), or an expression enclosed in parentheses.
- NUMBER:
    - Represents a numerical value.
- VARIABLE:
    - Represents a variable name.

4. ***Detailed Outline of the task:-***

- Use the lexical analyzer built in previous lab to extract tokens from source code
- Build a top-down parser based on the provided grammar to recognize and parse algebraic expressions.
- Implement error handling to detect syntax errors in the input expressions.
- Test your parser with various input expressions to ensure it correctly recognizes and parses algebraic expressions.
- Examples of Correct Expressions:-
    - `a + 5`
    - `3 * b - 2`
    - `x * (y + 7)`
- Examples of Incorrect Expressions:-
    - `a / 5`
    - `3 * [ b - 2]`
    - `x / {y + 7}`