

# CPSC 323

## Parser Documentation

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### 1. Problem Statement

*Given the output of the Lexical Analyzer, our goal is to create a Syntax Analyzer, or parser, that defines and evaluates the grammar of Rat25s. We need to:*

- Rewrite the Rat25S grammar to remove left recursion and apply left factoring*
- Use the Lexer to tokenize a given input*
- Implement a top-down parsing approach*
- Output tokens, lexemes, and parse tree evaluated by the program.*
- Include error handling to report meaningful syntax errors in the input*

### 2. How to use your program (MAKE SURE TO READ)

**Compile:** `g++ -std=c++20 -o compilersAssignment2 main.cpp classes/Lexer.cpp classes/parser.cpp -Iclasses`

**Run with:** `./compilersAssignment2 input_file.txt`

*with input.txt being the Rat25S code*

### 3. Design of your program

*The major components of our program are:*

*Lexer – tokenizes input and feeds it to the parser*

*Parser – Analyzes the stream top-down*

*Main – Handles the input / output to each file*

*Key data structures:*

*CurrentToken – A pointer to the current token being evaluated on the stack*

*Std::stack<std::variant<std::string, TokenType>> parserStack – Stack to track total / remaining Tokens and expressions to be evaluated*

*Bool Match() - Checks that the current / next token type is the same as what is expected and throws an error otherwise.*

*The algorithm used is Predictive Parsing, utilizing a stack-based FSM to predict the possible next values of tokens and then evaluate whether or not the next token is a legal / expected value.*

*Left recursion will need to have been removed from the rules before coding, which it is.*

*Error detection occurs whenever there is an unexpected token value or a certain token is expected but not present.*

#### **4. Any Limitation**

- 1. Recursive Descent Implementation:** *The parser is implemented as a recursive descent parser, which can face limitations with deeply nested structures due to potential stack overflow.*
- 2. Limited Error Recovery:** *When a syntax error is found the parser appears to throw an exception and terminate rather than attempting to recover and continue parsing.*

#### **5. Any shortcomings**

*None*