COMPILER PROJECT II 2020

The goal of the second term-project is to implement a bottom-up syntax analyzer (a.k.a., parser) as we've learned. More specifically, you will implement the syntax analyzer for a simplified C programming language with the following context free grammar G;

CFG G:

01: CODE → VDECL CODE | FDECL CODE | ϵ
02: VDECL → vtype id semi | vtype ASSIGN semi
03: ASSIGN → id assign RHS
04: FDECL → vtype id lparen ARG rparen lbrace BLOCK RETURN rbrace
05: ARG → vtype id MOREARGS | ϵ
06: MOREARGS → comma vtype id MOREARGS | ϵ
07: BLOCK → STMT BLOCK | ϵ
08: STMT → VDECL | ASSIGN semi
09: STMT → if lparen COND rparen lbrace BLOCK rbrace ELSE
10: STMT → while lparen COND rparen lbrace BLOCK rbrace
11: STMT → for lparen ASSIGN semi COND semi ASSIGN rparen lbrace BLOCK rbrace
12: ELSE → else lbrace BLOCK rbrace | ϵ
13: RHS → EXPR | literal
14: EXPR → TERM addsub EXPR | TERM
15: TERM → FACTOR multdiv TERM | FACTOR
16: FACTOR → lparen EXPR rparen | id | num | float
17: COND → FACTOR comp FACTOR
18: RETURN → return FACTOR semi

✓ **Terminals (20)**

1. **vtype** for the types of variables and functions
2. **num** for signed integers
3. **float** for floating-point numbers
4. **literal** for literal strings
5. **id** for the identifiers of variables and functions

6. **if, else, while, for** and **return** for if, else, while, for and return statements respectively
7. **addsub** for + and - arithmetic operators
8. **multdiv** for * and / arithmetic operators
9. **assign** for assignment operators
10. **comp** for comparison operators
11. **semi** and **comma** for semicolons and commas respectively
12. **lparen, rparen, lbrace,** and **rbrace** for (,), {, and } respectively

✓ **Non-terminals (14)**

CODE, VDECL, FDECL, ARG, MOREARGS, BLOCK, STMT, ASSIGN, RHS, EXPR, TERM, FACTOR, COND, RETURN

✓ **Start symbol:** CODE

Descriptions

✓ The given CFG G is not ambiguous and non-left recursive.

✓ Source codes include zero or more declarations of functions and variables (CFG line 1)

✓ Variables are declared with or without initialization (CFG line 2 ~ 3)

✓ Functions can have zero or more input arguments (CFG line 4 ~ 6)

✓ Function blocks include zero or more statements (CFG line 7)

✓ There are five types of statements: 1) variable declarations, 2) assignment operations, 3) if-else statements, 4) while statements, and 5) for statements (CFG line 8 ~ 11)

✓ if statements can be used with or without an else statement (CFG line 8 & 12)

✓ The right hand side of assignment operations can be classified into two types; 1) arithmetic operations (expressions) and 2) literal strings (CFG line 13)

✓ Arithmetic operations are the combinations of +, -, *, / operators (CFG line 14 ~ 16)

Based on this CFG, you should implement a bottom-up parser.

✓ You are required 1) to construct an NFA for recognizing viable prefixes of G, 2) to convert the NFA into a DFA, 3) to compute the follow sets, 4) to construct a SLR parsing table, and 5) to implement a SLR parser.

For the implementation, you can use C, C++, JAVA, or Python as you want. However, your syntax analyzer should work as follows;

✓ **The execution flow of your syntax analyzer:**

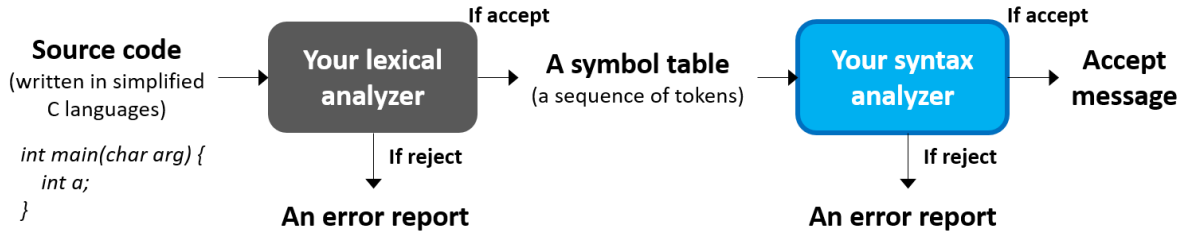
lexical_analyzer <input_file_name>

syntax_analyzer <output_of_your_lexical_analyzer>

✓ **Input:** An output of your lexical analyzer program

✓ **Output:** just an acceptance message

- (If an output is "reject") please make an error report which explains why and where the error occurred (e.g., line number)



Term-project schedule and submission

- ✓ **Deadline: 6/27, 23:59 (through an e-class system)**
  - For a delayed submission, you will lose 0.1 * your original project score per each delayed day
- ✓ Submission file: team_<your_team_number>.zip or .tar.gz
  - The compressed file should contain
    - The source code of **your syntax and lexical analyzer** with detailed comments
    - The executable binary file of **your syntax analyzer + lexical analyzer**
    - Documentation (the most important thing!)
      - It must include 1) your DFA transition graph or table for recognizing viable prefixes of the CFG G and 2) your SLR parsing table
      - It must include any changes in the CFG G and all about how your syntax analyzer works for validating token sequences (for example, overall procedures, implementation details like algorithms and data structures, working examples, and so on)
    - Test input files and outputs which you used in this project
      - The test input files are not given. You should make the test files, by yourself, which can examine all the syntax grammars.
- ✓ If there exist any error in the given CFG, please send an e-mail to hskimhello@cau.ac.kr