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| Team 10 |
| **Compiler Term-Project #2** |
| The implementation of a bottom-up syntax analyzer |

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# SPECIFICATIONS

|  |
| --- |
| **CFG G:**   1. CODE → VDECL CODE | FDECL CODE | ε 2. VDECL → vtype id semi | vtype ASSIGN semi 3. ASSIGN → id assign RHS 4. FDECL → vtype id lparen ARG rparen lbrace BLOCK RETURN rbrace 5. ARG → vtype id MOREARGS | ε 6. MOREARGS → comma vtype id MOREARGS | ε 7. BLOCK → STMT BLOCK | ε 8. STMT → VDECL | ASSIGN semi 9. 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**   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**  CODE, VDECL, FDECL, ARG, MOREARGS, BLOCK, STMT, ASSIGN, RHS, EXPR, TERM, FACTOR, COND, RETURN  **Start symbol**  CODE |

## Modified part in specifications

In the CFG, we add one more line.

00: GOAL -> CODE

# FIRST SET

This is the result of First Set. You can check our handwriting version at the [appendix 1](#_1._First_Set).

|  |
| --- |
| First(RETURN) = {return}  First(FACTOR) = {lparen, id, num, float}  First(COND) = {lparen, id, num, float}  Fist(TERM) = {lparen, id, num, float}  First(EXPR) = {lparen, id, num, float}  First(RHS) = {lparen, id, num, float, literal}  First(ELSE) = {else, ε}  First (VDECL) = {vtype}  Fist (ASSIGN) = {id}  First (STMT) = {for, while, if, vtype, id}  First (BLOCK) = {for, while, if, vtype, id, ε}  First (MOREARGS) = {comma, ε}  First (ARG) = {vtype, ε}  First (FDECL) = {vtype}  First (CODE) = {vtype, ε}  First (GOAL) = {vtype, ε} |

# FOLLOW SET

This is the result of Follow Set. You can check our handwriting version at the [appendix 2](#_2._Follow_Set).

|  |
| --- |
| Follow (GOAL) = {$}  Follow (CODE) = {$}  Follow (VDECL) = {vtype, rbrace, return, for, while, if, vtype, id, $}  Follow (ASSIGN) = {semi, rparen}  Follow (FDECL) = {$, vtype}  Follow (ARG) = {rparen}  Follow (MOREARGS) = {rparen}  Follow (BLOCK) = {rbrace, return}  Follow (STMT) = {rbrace, return, if, while, for, vtype, id}  Follow (ELSE) = {rbrace, return, if, while, for, vtype, id}  Follow (RHS) = {semi, rparen}  Follow (EXPR) = {semi, rparen}  Follow (TERM) = {addsub, rparen, semi}  Follow (FACTOR) = {semi, comp, multdiv, rparen, addsub}  Follow (COND) = {semi, rparen}  Follow (RETURN) = {rbrace} |

# NFA (Non-deterministic Finite Automata)

Our team drew the NAF (Non-deterministic Finite Automata) using flow chart drawing tool[[1]](#footnote-1). The graph is too big, so it is hard to see the detail, so we included the drawing file in the “Handwriting” folder, if you want please check the directory.

## 1. Overall Graph

텍스트, 지도이(가) 표시된 사진

자동 생성된 설명

# DFA (Deterministic Finite Automata)

DFA is generated using the NFA which we built. At first, we attached the number on each node and derived the DFA using subset (powerset) construction algorithm. You can check the handwriting version at the [appendix 3](#_3._NFA_to).

## 1. NFA with numbering

This image also can be found at the “Handwriting” directory.

텍스트, 지도, 그리기이(가) 표시된 사진

자동 생성된 설명

## 2. Subset Construction

|  |  |
| --- | --- |
| = T0  = T1  = T2  = T3  = T4  = T5  = T2  = T3  = T4  = T6  = T7  = T8  = T4  = T3  = T2  = T9  = T10  = T11  = T12  = T13  = T14  = T15  = T16  = T17  = T18  = T19  = T20  = T21  = T22  = T23  = T24  = T25  = T26  = T27  = T28  = T18  = T19  = T20  = T21  = T22  = T23  = T29  = T30  = T31  = T32  = T18  = T19  = T20  = T21  = T23  = T58  = T57  = T20  = T21  = T22  = T23  = T59  = T43  = T11  = T10  = T60  = T31  = T61  = T62  = T63  = T64  = T65  = T66  = T67  = T20  = T21  = T22  = T23  = T68  = T69  = T57  = T20  = T21  = T22  = T23  = T70  = T36  = T37  = T38  = T39  = T40  = T41  = T42  = T43  = T71  = T36  = T37  = T38  = T39  = T40  = T41  = T42  = T43  = T72 | = T22  = T23  = T33  = T19  = T20  = T21  = T22  = T23  = T34  = T35  = T36  = T37  = T38  = T39  = T40  = T41  = T42  = T43  = T44  = T45  = T46  = T47  = T36  = T37  = T38  = T39  = T40  = T41  = T42  = T43  = T48  = T49  = T50  = T51  = T52  = T7  = T10  = T53  = T54  = T55  = T20  = T21  = T22  = T23  = T56  = T57  = T20  = T21  = T22  = T73  = T74  = T75  = T43  = T76  = T77  = T78  = T79  = T80  = T81  = T36  = T37  = T38  = T39  = T40  = T41  = T42  = T43  = T82  = T36  = T37  = T38  = T39  = T40  = T41  = T42  = T43  = T83  = T84 |

## 3. Graph

This image also can be found at the “Handwriting” directory.

텍스트이(가) 표시된 사진

자동 생성된 설명

# SLR PARSING TABLE

# CODE ALGORITHM

# TROUBLE & SOLUTION

## 1. Longest matching

# IMPLEMENTATION

Before explaining our works, we introduce the developing environment.

|  |
| --- |
| **Language**   * Python3 (version: 3.7.4)   **Operating System**   * macOS Catalina * Windows 10   **IDE (Integrated Development Environment)**   * Visual Studio Code (version: 1.45.0) * PyCharm (version: 3.9.4)   **Project Management**   * Git (version: 2.24.2) * Git-Hub |

We defined the four tokens: ID, INTEGER, FLOAT, LITERAL as function, and the others are defined as a list type variable. In addition, we defined five symbols; LETTER, SYMBOL, ZERO, NON\_ZERO and DIGIT to improve the productivity and readability.

## 1. Definition of Tokens, Alphabet

We defined the four tokens: ID, INTEGER, FLOAT, LITERAL as function, and the others are defined as a list type variable. In addition, we defined five symbols; LETTER, SYMBOL, ZERO, NON\_ZERO and DIGIT to improve the productivity and readability.

# TEST CASES & RESULT

## 1. Correct Test Code

|  |  |
| --- | --- |
| **Input** | **Result** |
| **텍스트, 화면, 테이블이(가) 표시된 사진  자동 생성된 설명** | 텍스트이(가) 표시된 사진  자동 생성된 설명텍스트이(가) 표시된 사진  자동 생성된 설명 |

## 2. Error Test Code

* In our lexical analyzer, we don’t allow to use the character ‘$’.

|  |  |
| --- | --- |
| **Input** | **Result** |
| 검은색이(가) 표시된 사진  자동 생성된 설명 |  |

* ‘=!’ isn’t correct comparison.

|  |  |
| --- | --- |
| **Input** | **Result** |
|  |  |

* ‘.0’ isn’t correct float.

|  |  |
| --- | --- |
| **Input** | **Result** |
| 검은색, 어두운, 화면, 오렌지이(가) 표시된 사진  자동 생성된 설명 |  |

* ‘1.10’ isn’t correct float. In our lexical analyzer, the right side of a decimal point must be a single digit 0 or a non-empty sequence terminating with a non-zero digit.

|  |  |
| --- | --- |
| **Input** | **Result** |
| 검은색, 어두운, 앉아있는, 측정기이(가) 표시된 사진  자동 생성된 설명 |  |

* ‘a.a’ isn’t correct input.

|  |  |
| --- | --- |
| **Input** | **Result** |
| 검은색, 오렌지, 어두운, 화면이(가) 표시된 사진  자동 생성된 설명 |  |

* ‘12people’ isn’t correct ID. ID should be started with English letter or ‘\_’.

|  |  |
| --- | --- |
| **Input** | **Result** |
| 어두운, 사진, 오렌지, 모니터이(가) 표시된 사진  자동 생성된 설명 |  |

* ‘013’ isn’t corret int.

|  |  |
| --- | --- |
| **Input** | **Result** |
| 검은색, 어두운, 오렌지, 측정기이(가) 표시된 사진  자동 생성된 설명 |  |

* ‘-0’ isn’t correct int.

|  |  |
| --- | --- |
| **Input** | **Result** |
| 검은색, 모니터, 어두운, 화면이(가) 표시된 사진  자동 생성된 설명 |  |

* Literal string should be terminated with a symbol “.

|  |  |
| --- | --- |
| **Input** | **Result** |
| 검은색이(가) 표시된 사진  자동 생성된 설명 |  |

# APPENDIX

## 1. First Set

텍스트이(가) 표시된 사진

자동 생성된 설명

## 2. Follow Set

텍스트이(가) 표시된 사진

자동 생성된 설명

## 3. NFA to DFA

텍스트이(가) 표시된 사진

자동 생성된 설명

텍스트이(가) 표시된 사진

자동 생성된 설명

텍스트이(가) 표시된 사진

자동 생성된 설명

## 4. Transition Table

1. https://app.diagrams.net [↑](#footnote-ref-1)