Compiler Project Documentation

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Subject: Formal Languages and Compilers

Academic Year: Second Semester 2024/25

# 1. Project Overview

This project is a compiler implemented using FLEX and YACC. It supports a simple language that includes variable declarations, arithmetic expressions, assignments, and basic type checking. The language allows for two types: int and float. The compiler performs lexical, syntactic, and semantic analysis, and includes a dynamic symbol table.

# 2. Grammar of the Language

The grammar supports declarations, assignments, and arithmetic expressions.  
Below is the abstract grammar:  
  
program -> program stmt | ε  
stmt -> decl ';' | assign ';'  
decl -> INT\_TYPE ID | FLOAT\_TYPE ID  
assign -> ID '=' expr  
expr -> expr '+' expr | expr '-' expr | expr '\*' expr | expr '/' expr | NUM | ID

# 3. Input Format

The input consists of lines of code written in the defined language. Each declaration or statement must end with a semicolon. Identifiers must be declared before use, and expressions can include both identifiers and numeric literals.

# 4. How to Run the Compiler

To compile and run the compiler using MSYS2 terminal:  
1. Run `flex lexer.l`  
2. Run `bison -d parser.y`  
3. Compile with `gcc parser.tab.c lex.yy.c symbol\_table.c -o compiler`  
4. Run the executable with `./compiler < input.txt`  
Provide your code as input.txt to test the compiler.

# 5. Files Included in the Project

- lexer.l: The LEX file for tokenization  
- parser.y: The YACC file for grammar and semantics  
- symbol\_table.c / symbol\_table.h: Dynamic symbol table  
- test inputs: Sample input programs to validate the compiler  
- README or this documentation

# 6. Example Inputs and Outputs

Input:  
int x;  
float y;  
x = 5;  
y = x + 3.5;  
z = 4;  
int a;  
float b;  
a = 4.3;  
b = a + 1;  
float result;  
result = 3.0 + 4.5 \* 2;  
int x;  
x = 2 + 3 \* 4 - 1;  
int p;  
float q;  
p = 2;  
q = p / 2.0;  
w = q + 1;

Output:  
Assignment OK: x = 5.000000  
Assignment OK: y = 8.500000  
Error: Undeclared variable z  
Type error: assigning float to int variable a  
Assignment OK: b = 5.000000  
Assignment OK: result = 12.000000  
Assignment OK: x = 13.000000  
Assignment OK: p = 2.000000  
Assignment OK: q = 1.000000  
Error: Undeclared variable w