Documentation Report
Assignment 4: Semantic Analysis

COMP 442-NN

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1. List of semantic rules implemented

1.1 |X| Global symbol table is created
2.1 |X| Symbol table is created for classes
2.2 |X| Symbol table entry for a class is created in the global symbol table
2.3 |X| Global symbol table entry for a class contains a reference to the local symbol table for the class
3.1 |X| Class symbol table contains an entry for a class data member
3.2 |X| Functions symbol table contains an entry for a function's local variable, including parameters of the function
4.1 |X| Symbol table is created for a free function
4.2 |X| Symbol table entry for a free function is created in the global symbol table
4.3 |X| Global symbol table entry for a free function contains a reference to the local symbol table for the free function
4.4 |X| Symbol table is created for a member function
4.5 |X| Class symbol table entry for a member function is created in the global symbol table
4.6 |X| Class symbol table entry for a member function contains a reference to the local symbol table for the member function
6.1 |X| Undeclared member function definition
6.2 |X| Undefined member function declaration
7. |X| Print of symbol table
8.1 |X| Multiply declared class
8.2 |X| Multiply declared free function
8.3 |X| Multiply declared data member in class
8.4 |X| Multiply declared identifier in function
8.5 || WARNING Shadowed inherited data member
8.6 || WARNING Local variable in a member function shadows a data member of its class
9.1 |X| WARNING Overloaded free function
9.2 |X| WARNING Overloaded member function
9.3 || WARNING Overriden member function
10.1 |X| Type error in expression
10.2 |X| Type error in assignment statement
10.3 |X| Type error in return statement
11.1 |X| Undeclared local variable
11.2 |X| Undeclared data member
11.3 |X| Undeclared member function
11.4 |X| Undeclared/undefined free function
11.5 |X| Undeclared class
12.1 || Function call with wrong number of parameters
12.2 || Function call with wrong type of parameters

13.1 || Use of array with wrong number of dimensions
13.2 || Array index is not an integer
13.3 || Array parameter using wrong number of dimensions
14.1 || Circular class dependency
15.1 || "." operator used on non-class type

2. Design

I first created a SymbolTable and SymbolTableEntry class to make semantic analysis possible. I added both these classes as data members of the Node class. I then created a SymbolClassEntry, SymbolFreeFunctionEntry, and SymbolMemberFunctionDefEntry that all inherit from SymbolTableEntry. These classes would hold data entries. These data entries are SymbolClassDataEntry, SymbolLocalVarParamEntry, and SymbolMemberFunctionDeclEntry which also inherit from SymbolTableEntry.

I then implemented a Visitor interface to make the visitor pattern possible. I also needed to add accept() functions to all node types. I implemented 5 Visitors that all implement the Visitor interface.

Visitor1: SymbolTableCreationVisitor
This visitor was responsible for almost creating the whole symbol table. It made the global symbol table, made class symbol tables, and free function symbol tables (1.1, 2.1, 2.2, 2.3, 3.1, 4.1, 4.2, 4.3)

Visitor2: PopulateFParamsVisitor
This visitor was only tasked with adding the parameter values to the free and member functions (3.2)

Visitor3: MemberFuncVisitor
This visitor was tasked with finishing the creation of symbol tables. It linked member function definitions with member function declarations. It was also tasked with a little bit of semantic error detection, more specifically if member function definitions/declarations were undeclared/undefined (4.4, 4.5, 4.6, 6.1, 6.2)

Visitor4: SemanticErrorVisitor1
This visitor was tasked with the first bulk of semantic errors. It detected multiple declared classes, free functions, data members, and identifiers. It also sent warnings for overloaded free and member functions (8.1, 8.2, 8.3, 8.4, 9.1, 9.2)

Visitor5: SemanticErrorVisitor2
This visitor was tasked with the last of the semantic error detection. It reported type errors in expressions, assignment statements, and return statements. It also detected undeclared variables, data members, member functions, free functions, and classes (10.1, 10.2, 10.3, 11.1, 11.2, 11.3, 11.4, 11.5)

The resulting symbol tables are then printed to the correct file (7.)

3. Use of Tools

Tools used:

1. Lecture slides provided by Joey Paquet for semantic analysis instructions.