Compiler Construction (CS 402)
Phase 3
Semantic Analyzer

Assigned: April 11, 2016
Due Date: April 25, 2016

Instructions

All problems relating to the Syntax Phase and Lexical Phase should be resolved first before starting this phase.

The main objective of this phase is Type Checking.

- All the assignment expressions can be of the form

  integer = *integer* *char* = *char* *float*= *integer* *float* = *float* are correct.

  However, integer = *float* *float* = *char* *char* = *integer* *char* = *float* all are errors.

- The arithmetic expressions like that of addition/subtraction/division/multipication etc. will resolve to

  char + *char* → *char*, *integer* + *integer* → *integer*, *integer* + *float* → *float* are all correct while,

  integer+ *char* *char* + *float* *float* + *integer* → *integer* will be an error.

- The expression having a relational operator will always resolve to an integer and this is possible only if both sides of the relational operator resolve to same type. i.e.

  if *integer* < *integer* or *char* < *char*, or *float* < *float* then the type returned will be integer.
  Everything else will be treated as an error.

- The expressions in the **for** loop will be of integer type only that is the loop will be from integer to integer with an increment in integer .For e.g.

```
For ( k = 2 ; j < 2 ; k ++ )
```

Here the type of k , j is integer and all these inner expressions resolve to integers only.

- The conditional expression in the **while** loop, **do while** loop, and **if else** will only be of integer type. This follows from the fact that the relational expressions will only resolve to integer type.
- The increment and decrement operator are valid operators for float and integer type only.
- All the array variables must be accessed with index.
- The index part of the array should resolve to integer type only.
- The function definition must match with the function call e.g. if function definition is

  ```
  void f1 (int a, char c)
  ```

  Then the valid call is `f1 (12, 'e')`
- The return type of the function should match with the function definition's return type.
- Expression in switch statement resolve either to char or integer type, and their corresponding case statement should have the same constant type as that of the switch's expression.
- Some errors that are reported in this phase are

  - Undeclared identifier
  - Multiple declarations of same identifier or function
  - Type mismatch in statement or expression
  - Integer expected in conditional expression
  - Array variables must be addressed with index part

Please follow guideline given with syntax analysis phase to report errors.