CMSC 430 Project 2

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Project 2 - Approach

After reading most of the assigned readings and watching the video lectures I proceeded with project 2. I followed “Project 2 Approach” step by step, beginning with adding the tokens from Project 1 to scanner.l of Project 2. I used Git in VS Code and committed after completing each step. To see if my changes worked, I remade the file and compiled using the corresponding test file. After confirming that my terminal’s output matched the desired output, I moved on to the next step. After modifying the grammar to parse booleans, reals and real literals, multiple variable declarations, case selection, conditional statements, optional parameters in the function header, remainder and exponent operators, or/not operators, and nested ifs, I implemented error handling as specified by the requirements.

```
alexhong@Alexs-iMac Project 2 Hong % make
bison -d -v parser.y
mv parser.tab.c parser.c
cp parser.tab.h tokens.h
g++ -c scanner.c
clang: warning: treating 'c' input as 'c++' when in C++ mode, this behavior is deprecated [-Wdeprecated]
g++ -c parser.c
clang: warning: treating 'c' input as 'c++' when in C++ mode, this behavior is deprecated [-Wdeprecated]
g++ -o compile scanner.o parser.o listing.o
```

```
alexhong@Alexs-iMac Project 2 Hong % ./compile < tests/mytest1.txt

    1  -- Function with a Real Variable and Boolean and Real Literals
    2  -- Function with 2 parameters
    3  -- Function with multiple variables initialized
    4  -- Function with If/Else statement
    5
    6  function main a: integer, b: integer returns boolean;
    7      c: integer is 11;
    8      d: real is 5.E3;
    9      e: real is 3.1;
   10  begin
   11      if a < b and a < c then
   12          b >= c;
   13      else
   14          a > c;
   15      endif;
   16  end;
   17
   18
  Compiled Successfully. Total Errors: 0
```

```
alexhong@Alexs-iMac Project 2 Hong % ./compile < tests/mytest2.txt

    1  -- Function with case selection
    2  -- Function with single parameter
    3  -- Function with remainder and exponent operators
    4
    5  function main z: boolean returns integer;
    6      a: integer is 4 ** 2;
    7  begin
    8      case a is
    9          when 1 => 3 rem 5;
   10          when 2 => (2 + 5 -4) / 3;
   11          others => 4;
   12      endcase;
   13  end;
  Compiled Successfully. Total Errors: 0
```

```
alexhong@Alexs-iMac Project 2 Hong % ./compile < tests/mytest3.txt

    1  -- Function with or/not operators
    2  -- No parameters
    3  -- Nested ifs
    4
    5  function hello returns integer;
    6      a: integer is 10;
    7      b: integer is 2;
    8  begin
    9      if a * b = 20 or a / b = 5 then
   10          if a - b = 8 then
   11              a + b ** 2;
   12          else
   13              a + b rem 23;
   14          endif;
   15      else
   16          not true and not not false;
   17      endif;
   18  end;
  Compiled Successfully. Total Errors: 0
```

```
alexhong@Alexs-iMac Project 2 Hong % ./compile < tests/mytest5.txt

   1  -- Function with 1 error
   2
   3  function bad a: itger returns integer;
syntax error, unexpected IDENTIFIER, expecting BOOLEAN or INTEGER or REAL
   4      c: real is 3.1;
   5      b: boolean is true;
   6  begin
   7      c > 0;
Lexical Errors: 0
Syntax Errors: 1
Semantic Errors: 0
```

```
alexhong@Alexs-iMac Project 2 Hong % ./compile < tests/mytest6.txt

    1  -- Function with 1 error
    2
    3  function main returns boolean;
    4      a: integer is 9
    5  begin
syntax error, unexpected BEGIN_, expecting ';'
    6      if a > 10 then
    7          a ** 2;
    8      else
    9          not false;
Lexical Errors: 0
Syntax Errors: 1
Semantic Errors: 0
```

```
alexhong@Alexs-iMac Project 2 Hong % ./compile < tests/mytest4.txt

    1  // Multiple errors
    2
    3  function main a integer returns real;
syntax error, unexpected INTEGER, expecting ':'
    4      b: integer is * 2;
syntax error, unexpected MULOP
    5      c: real is 6.0;
    6  begin
    7      if a > c then
    8          b + / 4.;
syntax error, unexpected MULOP
    9      else
   10          case b is
   11              when => 2;
syntax error, unexpected ARROW, expecting INT_LITERAL
   12              when 2 => c;
   13          endcase;
syntax error, unexpected ENDCASE, expecting OTHERS or WHEN
   14      endif;
Lexical Errors: 0
Syntax Errors: 5
Semantic Errors: 0
```

Project 2 - Lessons Learned

There were several times where I broke the program and had to roll back changes. I am glad that I used source control.

The most frustrating mistake was when I had unintentionally written two consecutive vertical bars (“|”) in one of my rules. This led the compiler to complain and resulted in shift/reduce conflicts detected. It took me a while to find the bug and I was reminded about the importance of details.

I also had to find a different way to specify verbose error messages since the skeleton code’s declaration did not work on my system.

Overall, this project taught and reinforced many concepts about recursion and operator precedence.

```
variable:
    IDENTIFIER ':' type IS statement_ |
    | error ';'
    ;
```

```
alexhong@Alexs-iMac Project 2 Hong % make
flex scanner.l
mv lex.yy.c scanner.c
bison -d -v parser.y
parser.y: conflicts: 3 shift/reduce
```

parser.y

```
12
13    #include <string>
14
15    using namespace std;
16
17    #include "listing.h"
18
19    int yylex();
20    void yyerror(const char* message);
21
22    %}
23
24    %error-verbose
```