

Programming Assignment 10

Due at your recitation session on November 3-7

Reading

Read Chapter 8, singleton pattern (page 151 in Section 6.3), and try-finally (page 404 in Section 17.3) in the textbook.

Programming

In this assignment, you will write a spell checker for chemical formulas.

Chemical formulas describe the atomic make-up of molecules. For example, the chemical formula H_2O describes a molecule consisting of two hydrogen atoms and one oxygen atom. Your program will determine whether a string is a syntactically consistent chemical formula.

The simplest chemical formula is the symbol for an element, such as He (helium) or Rn (Radon). You can then take a sequence of chemical formulas and concatenate them. For example, starting with Na (sodium) and Cl (Chlorine), you can build a more complex molecule NaCl (table salt). You can put a number after a chemical formula, as in H_2 , the hydrogen molecule consisting of two hydrogen atoms, and then concatenate the formulas, as in H_2O (water) or BrBa_2 (barium bromide). Finally, you can always put a chemical formula in parentheses, leading to more complicated molecules such as $(\text{AlC}_2)_3\text{Na}_4$, which consists of 3 times the AlC_2 component connected with 4 atoms of sodium, resulting in a molecule that contains 3 aluminum, 6 carbon, and 4 sodium atoms. There is fundamentally no limit on how long a chemical formula can be, and there are very complex molecules in nature.

Your program should check whether a string is a syntactically valid representation for a molecule, but can avoid examining the underlying chemistry. For example, H_3 is a syntactically valid formula, but chemically three hydrogen atoms cannot be combined together. Similarly, Ja is a syntactically valid formula, even though there is no element whose symbol is Ja . However, jA is not syntactically valid because chemical elements always start with an upper case letter and then have zero to two more lower case letters. Also, He1 is not syntactically valid because there is no

point in having a unit multiplier, and H02 is not syntactically valid because the multiplier should not start with 0 (zero).

Your program will read a string and output T if the string is a syntactically valid chemical formula and F otherwise.

Create a repository called `chemistry.git` where you will post your submission. Submit a separate text file to document the error handling architecture that you will follow in your implementation. The architecture document should describe your error handling choices such as a strategy for handling erroneous user input, decisions on local or global error handling, error propagation through the code, presence and location of a barricade, and the other factors in the defensive programming checklist at the end of chapter 8. You will be asked to demonstrate that your code follows the error handling architecture.

Grading Guidelines

A missing or incomplete error handling architecture will be penalized by one full letter grade.

An automatic C (or less) is also triggered by any routine with complexity greater than 4, by any substantially repeated piece of code, and by improperly named routines.

Discussion Guidelines

The project discussion will focus on defensive programming.