

Week 5 Analysis Exercises

Answer the problems in this file. Place your answers in a plain text file called `analysis_solutions5.txt` and include it in the zip file you submit to the Canvas dropbox.

Problem 3

In most languages, binary arithmetic or logical operators can be chained up in an expression, e.g.:

```
x + y + z      // which, under left-associativity, is equivalent to (x + y) + z
x and y and z  // which, under left-associativity, is equivalent to (x and y) and z
```

Can we also chain up relational comparison operators, e.g. `x < y < z`? And if so, what is the meaning of such an expression?

Well, the answer depends on language, and such an expression's meaning may surprise you. Here are two examples:

```
1 < 2 < 2  // evaluates to 1 in C, False in Python, and is illegal in Java
1 < 3 > 2  // evaluates to 0 in C, True in Python, and is illegal in Java
```

Exercise: Look up the information about chaining-up relational comparison operators for both Python and C. Use your findings to describe the semantics for the following generic expression for each language:

```
a rop1 b rop2 c  // rop1 and rop2 don't have to be the same
```

Express the semantics in any way you want; it could be as simple as, “equivalent to `(a rop1 b) rop2 c`.”

Problem 4

The C language standard at <https://www.open-std.org/jtc1/sc22/wg14/www/docs/n1256.pdf> Section 6.4.4.2 (page 57) gives an EBNF grammar for *decimal-floating-constant* literals, including optional exponent and suffix. (Note: the non-terminal *digit* is defined on p. 51.)

Here is a regular expression that should match exactly these literals (this is essentially what we developed in class on 27Jan).

```
((([0-9]+)?\.[0-9]+|([0-9]+\.)?([eE](\+|-)?[0-9]+)?|([0-9]+[eE](\+|-)?[0-9]+)[f1FL])?)
```

Identify the parts of this regular expression that correspond to non-terminals mentioned in the grammar for *decimal-floating-constant*. For example, `[0-9]` corresponds to *digit* and `[0-9]+` corresponds to *digit-sequence*.

What are the pros and cons of each format (EBNF or regular expression) for describing these literals?