CS-150 Worksheet 2 — Release date: 11/10/2019

This worksheet is about getting familiar with representation methods for different number types, including the use of negative numbers, real numbers, and calculations on them.

☐ Task 2.1

This task is about conversion of numbers to Two's Complement binary representation.

1. Convert the following numbers to an 8-bit Two's Complement binary representation:
   - 34
   - -50
   - -120
   - 109
2. Convert the following numbers from an 8-bit Two's Complement binary representation to decimal:
   - 10111011
   - 00100101
   - 11110111
   - 01111111

☐ Task 2.2

This task is about performing calculations on Two's Complement binary representations.

1. Perform the following additions on numbers which are in 8-bit Two's Complement binary representation:
   - 00010101 + 00101110
   - 10010110 + 00010111
2. Perform the following subtractions on numbers which are in 8-bit Two's Complement binary representation:
   - 00110111 - 00001101
   - 01011010 - 11101111

☐ Task 2.3

This task is about converting floating point numbers from base x to base y.

1. Convert the following from decimal to binary
    - 10.125
    - 223.25
2. Convert the following from binary to hexadecimal:
    - 10010111100.0111
    - 1100.0010101

☐ Task 2.4

This task is about representation of real numbers using the $\texttt{sign} \times \texttt{mantissa} \times \texttt{base}^{\texttt{exp}}$ scheme.

1. Convert each of the following decimal real numbers, identifying the `sign`, `mantissa`, `base` and `exp`. For example: 3.14 would be Sign: +1, Mantissa: 314, Base: 10, Exponent: -2.
    - 4138.12
    - 141402.1112
    - 0.002323
2. Convert each of the following decimal real numbers, identifying the `sign`, `mantissa`, `base` and `exp`, however this time we can only store 5 significant digits. For example: 3.141592 would be Sign: +1, Mantissa: 31415, Base: 10, Exponent: -2. Note that we can't store the "92".
    - 23.451
    - 0.123141
    - 12000.23222
3. Convert each of the following to their true decimal value.
    - Sign: -1, Mantissa: 57231, Base: 10, Exponent: 5
    - Sign: +1, Mantissa: 29320, Base: 10, Exponent: -2
    - Sign: +1, Mantissa: 13123, Base: 10, Exponent: -7

☐ Task 2.5

This task is about representation of real numbers using Scientific Notation.

1. Convert each of the following decimal real numbers into Scientific Notation. For example: 11102019 would be 1.1102019E7.
    - 5240.82
    - 249232.23
    - 0.0014210