HW #1

CSEE W3827 - Fundamentals of Computer Systems Spring 2022

Prof. Rubenstein
Due 2/4/22, 5pm

Topics: binary number representations (2-complement, 1-complement, floating point)
Note that this homework has 5 problems and is 1 pages long.
It's a bit long and tedious. Not all HW will be like this.

1. Assume an architecture where all numbers are to be represented using 8 bits. What are the (base 10) values of the 8-bit binary numbers when interpreted using (i) unsigned, (ii) signed magnitude, (iii) 1's complement, (iv) 2's complement form:

   (a) 00110011
   (b) 10000000
   (c) 11111111
   (d) 10011011
   (e) 10001010

2. Convert the following (base 10) numbers to their binary representation using 8-bit (i) signed magnitude, (ii) 1's complement, (iii) 2's complement forms:

   (a) -1
   (b) -15
   (c) -67
   (d) -127

3. For each pair of x and y below, convert x and y to their 8-bit 2's-complement forms, **subtract** y from x (so you need to negate y and then add). Indicate whether an overflow occured (and show clearly how you know), and convert the solution back to base 10 (even when an overflow occured and the solution is wrong, i.e., your answer should fit in the 8-bit representation of that form.).

   (a) $x = 10, y = -13$
   (b) $x = 117, y = 35$
   (c) $x = 117, y = -35$
   (d) $x = -117, y = 35$
   (e) $x = -117, y = 11$

4. Given the bit pattern 1010 1101 0001 0000 0000 0000 0000 0010 , what does it represent, assuming that it is

   (a) a two's complement integer?
   (b) an unsigned integer?
   (c) a single precision (32-bit) floating-point number?

5. Represent the following numbers, given here in binary form, as floating point numbers using IEEE 754 floating-point standard representation:

   (a) 11010.1110
   (b) -11011.10
   (c) 0.000101
   (d) -1.010101
   (e) 10000000010