CS61C Fall 2018 GS Worksheet 1a(Num Rep)

1. Number Representation (Spring 2017 MT1 #1)

Consider a base-5 number format where the digits can take values 0, 1, 2, 3, 4:

a. What is the largest number that can be represented as an unsigned base-5 number of N digits? Express your answer in terms of N.

_____

b. Convert 623_{10} to a number in base 5:

_____

2. Another Number Representation

a. Convert the following 8-bit two's complement numbers from hexadecimal to decimal:

0x80 = _____
0xF4 = _____
0x0E = _____

b. Assume that the most significant bit (MSB) of x is a 0. We store the result of flipping x's bits into y. Interpreted in the following number representations, how large is the magnitude of y relative to the magnitude of x? Circle ONE choice per row.

Unsigned	|y| < |x|	|y| = |x|	|y| > |x|	Can't Tell
One's Complement	|y| < |x|	|y| = |x|	|y| > |x|	Can't Tell
Two's Complement	|y| < |x|	|y| = |x|	|y| > |x|	Can't Tell
Sign and Magnitude	|y| < |x|	|y| = |x|	|y| > |x|	Can't Tell

3. **Back to the Base-ics** (Fall 2017 MT1 #1)

a) **Show how the binary string 0b1011 0110 can be interpreted and displayed as the following types:**

Hexadecimal: 0x_____

Unsigned Decimal: _____

Two's Complement Decimal: _____

b) **What is the minimum number of bits needed to represent all the unsigned integer values that a three-digit base-7 number could encode? Your answer should be a simplified decimal value.**

Powers of 7 are shown below for reference:
7^1 = 7 7^2 = 49 7^3 = 343 7^4 = 2401

_____

c) **What bias should be added for a biased three-digit base-7 number to yield an equal number of positive and negative numbers? Your answer should be a simplified decimal value.**

_____

d) **Convert the unsigned number 0xDF to its base-7 equivalent (i.e. the base-7 number with the same decimal value). What is the resulting number? The prefix 0s is for base-7.**

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4. Num Rep!
Answer the following questions about number representation:

(a) Unsigned Base 4

(i) What is the range that a 4 digit unsigned base 4 number can represent? Write the bounds in decimal.

(ii) Convert 107(base 10) to unsigned base 4.

(b) Signed Base 4

(i) Suppose we wanted to use a bias in order to represent negative numbers in base 4. If we are working with a 4 digit base 4 number, what should we choose as our bias?
(Our bias should create equal amounts of negative and positive numbers for our range. If this is not possible, select a bias that will result in 1 more negative number than positive numbers).

Express your answer in decimal.

(ii) Suppose rather than using a bias notation, we decide to do the following. For each base 4 number, we will reserve the most significant digit to strictly be used as a sign bit. A digit value of 1 will indicate a negative number, and a digit value of 0 will indicate a positive number. Any other values will result in an invalid number.

For instance: 00034 = +3 10034 = −3 20034 = Invalid

How many valid representation can we represent with a 4 digit base 4 number using this scheme?