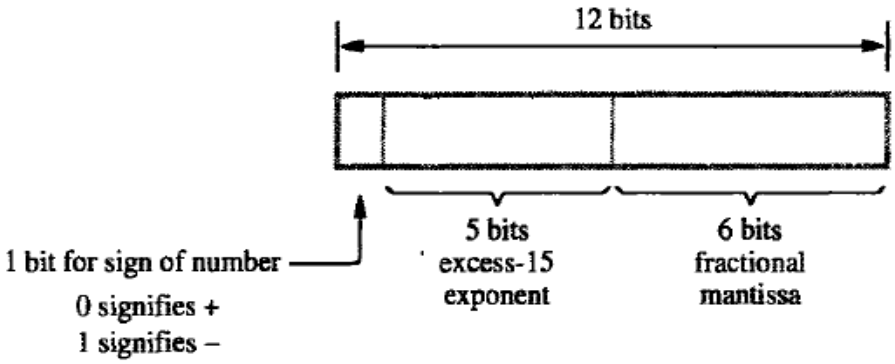
Problem Set 3

Q1. NVDIA (company that designs graphics processing units (GPUs) for the gaming market) uses a "half" format, which is similar to IEEE 754 except that it is 16 bits wide. The left most bit is still the sign bit, the exponent is 5 bits wide and stored in excess-16 format, and the mantissa is 10 bits long. A hidden 1 is assumed.

(a) Represent -0.012, and (1/8) in this "half"format
(b) What are the smallest and largest numbers represented in this format?
(c) How does the range calcultated in part (b) compare to the ranges of 16 bit signed and unsigned integers?

Q2. Consider that floating point numbers are represented in the given 12-bit format as shown.



Represent (i) -0.012 and (1/4) in this format

Q3. Given a floating-point format with one sign bit, four exponent bits (k=4), and three fraction bits (n=3). Answer the following questions:
a. What is the bias?
b. How many different values can be represented with 8 bits?
c. How many of these are infinity? [Hint : Assume exp = all 1's pattern and frac = all 0 pattern]
d. How many of these values are NaN ? [Hint : The exp = all 1's pattern set minus infinty set] ?
e. How many of these are positive, normalized value?
f. How many of these are negative, normalized value?
g. How many of these are positive, denormalized value?
i. What is the smallest positive normalized value?

Q4.Given a floating-point format with a k-bit exponent and an n-bit fraction, write formulas for the exponent E, significand M, the fraction f, and the value V for the quantities that follow. In addition, describe the bit representation.
(a) the number 7.0
(b) the largest odd integer that can be represented exactly
(c) the largest and the smallest number that can be reprsented using k=5(excess-12), n=6
(d) How does the range calcultated in part (c) compare to the ranges of 12 bit signed and unsigned integers?