#1. Write the following numbers as binary fractions with 4 fractional bits (0.0001 precision)

a. 29.3 __11101.0100 __ 29 (rt. to left): (1), /2 =14 (0), /2 = 7 (1), /2 = 3 (1), /2 =1 (1) (odd->"1")
0.3 (left to rt.) x2 = 0.6 (0), x2 = 1.2 (1), 0.2 x2 = 0.4 (0), x2 = 0.8 (0)

b. 0.1223 _ 0.0001 _ (left to rt.) x2 = 0.2446 (0), x2 = 0.4892 (0), x2 = 0.9784 (0), x2 = 1.9568 (1)

#2. Write the missing unsigned integer numbers in binary, hex, and decimal representations.

Decimal	Hex	Binary
299	1 2B 299/256 =1, 43/16=2, 11	1 0010 1011 1 2 B(11) from hex
107 6x16 +11	**6B**	0110 1011 4+2 8+2+1
173 10x16 + 13	AD 10,11,12,13 -> A,B,C,D	**1010 1101** 8+2=10 8+4+1=13 -> AD
131	0x 83 131/16 = 8, r = 3	0100 0011 8 2+1=3
165 10x16 + 5	**A5**	1010 0101 (from hex)
99 6x16 + 3	0x 63 0101 0011 = 6 3 hex	**01010011**

#3. a. Express or decode the following binary floating point numbers. The fraction part (mantissa) should be normalized to five-bit accuracy (to 0.1xxxx where only the four bits xxxx are stored in memory, but show all here). The exponent should be a 5-bit number in 2's-compliment representation.

Decimal Number	Sign Bit	Mantissa (fraction)	Exponent
2.125 = 4 x0.503125	**0** +	**0.10001** = 0.503125	**00010** = 2, 2^2 = 4
56 =11100	0 "+"	0.11100 11100. shift +5 = 0.11100	00101 (5)
-0.0003203 0.656 x 2^-11 (or /2048)	**1** "-"	**0.10101** 0.5 + 0.125 +0.031=0.656	**10101** "-" (01010+1)=01011=-11
-0.0398 0.000010100011	1 "-"	0.10100 shift "." right 4 -(00100)	11100 -4 = "-" :(~00100+1) = 11100

0.0398x2=0.0796 (0), x2=0.1592(0), x2=.3184(0),x2=.6368(0),x2=1.2736(1), x2=.5472(0),x2=1.0944(1), x2= 0.1888 (0), x2= 0.3776 (0), x2= 0.7552 (0), x2 = 1.5104 (1) ,,, (1)

b. How many bits of memory are required to store floating point numbers in this form? 1+(5-1) +5 = 10

c. What is the precision to which a number can be stored (accuracy in %) ? 5 bits - 1/2^5 = __ **3** __ %

Extra info: The range of absolute values is 0.5 x 2^-16 to -0.98 x 2^15 (how is zero stored?).

#4. Show how you would do the following calculations using 2's complement 10-bit binary numbers when A = 98 and B=205. Show the operations in binary, and the results in binary and decimal

	Binary	Decimal
A	hex 98/16=6, 2 0x62 (leading zero is sign bit) _________ 0 0110 0010 _____	_____**98**____________________
B	hex 205/16 = 12(C), 13 (D) 0xCD __________0 1100 1101 __________	_____**205**____________________
-A	1 1001 1101 (flip bits) + 0 0000 0001 (add 1) _________ 1 1001 1110 __________	_____**-98**____________________
-B	1 0011 0010 (flip bits) + 0 0000 0001 (add 1) _________ 1 0011 0011 _________	_____**-205**____________________
A – B	0 0110 0010 +A 1 0011 0011 -B __________ 1 1001 0101 ______	1 -> "-", find magnitude by flip, +1 0 0110 1010 + 1 0 0110 1011 = 0x6B =6x16+11 ________-107 _______
B - A	0 1100 1101 +B 1 1001 1110 -A __________ 0 0110 1011 _________	"0" -> "+", 0x6B = 107 __________ 107 ______________
(-A) + (-B)	sign extend to increase precision (sign bit repeated to new bits on left) 1111 1001 1110 -A 1111 0011 0011 -B ___________1110 1101 0001 _______	1 -> "-", find magnitude by flip, +1 0001 0010 1110 + 1 0001 0010 1111 = 0x12F =256 + 2*16 + 15 __________ -303 ___________