

ECE 130 HW#4 – Due Monday, March 22.

Do not use a calculator! Show all work!

1. Complete the following table with the indicated 4-bit signed system representations:

Decimal Value	Unsigned Binary	Sign and Magnitude	1's Complement	2's Complement
8	1000	X	X	X
7	0111	0111	0111	0111
6	0110	0110	0110	0110
5	0101	0101	0101	0101
4	0100	0100	0100	0100
3	0011	0011	0011	0011
2	0010	0010	0010	0010
1	0001	0001	0001	0001
0	0000	0000/1000	0000/1111	0000
-1	X	1001	1110	1111
-2	X	1010	1101	1110
-3	X	1011	1100	1101
-4	X	1100	1011	1100
-5	X	1101	1010	1011
-6	X	1110	1001	1010
-7	X	1111	1000	1001
-8	X	X	X	1000

2. Perform the following arithmetic problems in a 4-bit 2's complement binary system. Convert the decimal values to their 2's complement representation, calculate the result of binary addition, and then convert your answer back to decimal. Indicate when overflow/underflow has occurred.

a) $5 - 3$

Base 10	Base 2		
(carry)	1010		
+5	0101		
-3	1101		Final Answer
= +2	1	0010	+2

No error occurred

b) $3 - 5$

Base 10	Base 2		
(carry)	0110		
+3	0011		
-5	1011		Final Answer
= -2	0	1110	-2

No error occurred

c) $7 + -7$

Base 10	Base 2		
(carry)	1110		
+7	0111		
-7	1001		Final Answer
= 0	1	0000	0

No error occurred

d) $3 + 5$

Base 10	Base 2		
(carry)	1110		
+3	0011		
+5	0101		Final Answer
= +8	0	1000	-8

Overflow occurred

e) $-3 - 5$

Base 10	Base 2		
(carry)	1110		
-3	1101		
-5	1011		Final Answer
= -8	1	1000	-8

No error occurred

f) $-6 + -3$

Base 10	Base 2		
(carry)	0000		
-6	1010		
-3	1101		Final Answer
= -9	1	0111	+7

Underflow occurred