Name: _____ ALGONQUIN COLLEGE **Lab Section:** _____

Objectives: To practice binary/octal/hexadecimal conversions and two's complement mathematics.

References: ECOA2e Section 2.3, 2.4

Show all your work clearly, either on the back of this page or on attached separate sheets.

1. Write down all the negative powers of two from zero ("1") to -4 ("0.0625").
2. Convert 0.34375_{10} to 0.0101_2 binary, stopping at four fractional bits (ECOA2e Example 2.7 p.45).
3. Convert 6235_8 octal to $C9D_{16}$ hexadecimal (ECOA2e Example 2.9 p.46).
4. What are the largest and smallest integers an 8-bit word can hold using a sign-magnitude representation? (p.47)
5. What are the largest and smallest integers an 8-bit word can hold using a one's complement representation?
6. What are the largest and smallest integers an 8-bit word can hold using a two's complement representation?
7. What are the largest and smallest integers a 16-bit word can hold using a two's complement representation?
8. Convert 23_{10} to 8-bit 00010111_2 binary one's complement (ECOA2e Example 2.16 p.53).
9. Write 23_{10} in octal and hexadecimal.
10. Convert -9_{10} to 8-bit 11110110_2 binary one's complement (ECOA2e Example 2.16 p.53).
11. Write 11110110_2 in octal and hexadecimal.
12. Convert -23_{10} to 8-bit 11101000_2 binary one's complement.
13. How do you know that a two's-complement addition has overflowed?
14. Convert 23_{10} to 8-bit 00010111_2 binary two's complement (ECOA2e Example 2.19 p.54).
15. Write 00010111_2 in octal and hexadecimal.
16. Convert -9_{10} to 8-bit 11110111_2 binary two's complement (ECOA2e Example 2.19 p.54).
17. Write 11110111_2 in octal and hexadecimal.
18. Convert -23_{10} to 8-bit 11101001_2 binary two's complement (ECOA2e Example 2.19 p.54).
19. Write 11101001_2 as octal and hexadecimal.
20. Write 10010011_2 as octal and hexadecimal.
21. Convert 8-bit 10010011_2 binary *unsigned* to 147_{10} decimal.
22. Convert 8-bit 10010011_2 binary *sign-magnitude* to -19_{10} decimal (note the negative).
23. Convert 8-bit 10010011_2 binary *one's complement* to -108_{10} decimal (note the negative).
24. Convert 8-bit 10010011_2 binary *two's complement* to -109_{10} decimal (note the negative).
25. Copy the left column of ECOA2e Table 2.2 p.63 and perform the given two's complement additions. Without looking, fill in the remaining four columns based on the results. (Note: this table has one printing error in it.)
26. Convert 16-bit two's complement $1A8C_{16}$ to $6{,}796_{10}$ decimal.
27. Convert 16-bit two's complement $7FFF_{16}$ to $32{,}767_{10}$ decimal.
28. Convert 16-bit two's complement 8000_{16} to decimal $-32{,}768_{10}$ (note the negative).
29. Convert 16-bit two's complement $A123_{16}$ to decimal $-24{,}285_{10}$ (note the negative).
30. Convert 16-bit two's complement $FFFF_{16}$ to decimal -1_{10} (note the negative).
31. Circle the negative numbers (16-bit two's complement): $6FFF_{16}$ $7FFF_{16}$ 8000_{16} 8001_{16} $9FC5_{16}$ $A123_{16}$ $BFFF_{16}$
32. Add 16-bit two's complement $ABCD_{16}$ to $7FFF_{16}$ and give the Result, Carry, and Overflow. Is the result correct?
33. Add 16-bit two's complement $8A9C_{16}$ to $ABCD_{16}$ and give the Result, Carry, and Overflow. Is the result correct?
34. Add 16-bit two's complement 9999_{16} to 4321_{16} and give the Result, Carry, and Overflow. Is the result correct?