Homework #1
Due Su. 9/10

**Note:** Do not use a calculator or computer to complete the following exercises. You must show all your work and put a box around your final answer to receive credit. Messy or unreadable submissions will receive no credit.

**Total Points**: 89

1. (0 points) How long (in hours) did it take you to complete the homework? This will not affect your grade (unless omitted) but it helps gauge the workload for this and future semesters. If you do not answer this question you will get -5 points.
2. (4 points) Convert the following unsigned binary numbers to decimal.
   (a) (1 point) $0011001_2$
   (b) (1 point) $1001101_2$
   (c) (1 point) $00100011_2$
   (d) (1 point) $0110011010_2$
3. (4 points) Convert the following decimal numbers to unsigned binary.
   (a) (1 point) 10
   (b) (1 point) 17
   (c) (1 point) 31
   (d) (1 point) 78
4. (4 points) Convert the numbers from Problem 2 to hexadecimal.
5. (4 points) Convert the numbers from Problem 3 to hexadecimal.
6. (4 points) Convert the numbers from Problem 2 to octal (base 8).
7. (4 points) Convert the numbers from Problem 3 to octal (base 8).
8. (6 points) Consider building a house. Explain in a short paragraph how to use the principles of modularity, hierarchy, and regularity to save both time and money during construction.
9. (4 points) Give an example of how abstraction helps save time and energy when completing an everyday task of your choice.
10. (5 points) Convert the following decimal numbers to 8-bit sign/magnitude numbers or indicate the decimal number would overflow the range. Write your final answer in **hexadecimal**.
    (a) (1 point) 24
    (b) (1 point) $-59$
    (c) (1 point) $-128$
    (d) (1 point) $-150$
    (e) (1 point) 127
11. (10 points) Convert the decimal numbers from Problem 10 into 8-bit two's complement numbers or indicate that the decimal number would overflow the range. Write your final answer in **hexadecimal**.

12. (4 points) Convert the following 4-bit two's complement numbers to 8-bit two's complement numbers. Write your final answer in **hexadecimal**.
    (a) (2 points) $0101_2$
    (b) (2 points) $1011_2$

13. (4 points) Perform the "one's complement" operation on the following 8-bit binary numbers.
    (a) (1 point) 00100000
    (b) (1 point) 10100111
    (c) (1 point) 01010101
    (d) (1 point) 11110000

14. (4 points) Perform the following additions of unsigned binary numbers. Indicate whether or not the sum overflows a 4-bit result.
    (a) (2 points) $1001_2 + 0100_2$
    (b) (2 points) $1101_2 + 1011_2$

15. (4 points) Repeat Problem 14 above assuming that the binary numbers are in two's complement form.

16. (12 points) Represent the following numbers in 8-bit two's complement representation and perform the addition (using two's complement representation).
    (a) (4 points) $57 + 24$
    (b) (4 points) $33 + (-97)$
    (c) (4 points) $(-41) + (-39)$

17. (12 points) Represent the following numbers in 8-bit two's complement representation and perform the subtraction by taking the the two's complement of the second number and then adding. Do any of the results overflow?
    (a) (4 points) $4 - 5$
    (b) (4 points) $87 - 62$
    (c) (4 points) $(-23) - 107$