Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**CS/ECE 252 Introduction to Computer Engineering**

Fall 2018

Instructor: Adil Ibrahim

**Homework 2**

**Deadline: 09/19/2018**

Primary TA contact for this homework: Wen-Fu Lee (wlee256@wisc.edu)

For each question below you need to show the complete working to receive full points. Please utilize the space provided under each question and upload a **PDF** version of your answers on canvas.

**Problem 1 (12 pts)**

Convert these decimal numbers to 8-bit Signed Magnitude, 1’s Complement and 2’s Complement binary number: (1 point for each entry)

|  |  |  |  |
| --- | --- | --- | --- |
| Decimal Number | Signed Magnitude | 1’s Complement | 2’s Complement |
| 21 |  |  |  |
| 126 |  |  |  |
| -3 |  |  |  |
| -117 |  |  |  |

**Problem 2 (2 pts)**

Convert the 2’s complement integer 101010102 to a decimal integer value.

(Correct answer with calculation steps: 2 points; Anything else: 1 point)

**Problem 3 (9 pts)**

1. Add the following 2’s complement numbers together and represent the answers in 8 bits.

i. 100010012 + 1100012

(Correct answer with calculation steps: 2 points; Anything else: 1 point)

ii. 0111002 + 01112

(Correct answer with calculation steps: 2 points; Anything else: 1 point)

1. Which question in (a) creates overflow (if any)? (1 point)

1. Why is sign-extension important when performing arithmetic with 2’s complement number? (2 points)
2. Solve 30 - 9 using 2’s complement subtraction in 8 bits.

(Correct answer with calculation steps: 2 points; Anything else: 1 point)

**Problem 4: (3 pts)**

Compute the following operations:

1. (NOT 100110012) OR (NOT 010101102) (1 point)
2. (01102 AND 11012) OR 10012  (1 point)
3. (NOT 101011112) XOR 011010112  (1 point)

**Problem 5: (4 pts)**

Convert the following IEEE floating point number into decimal.

1 10000101 110110000000000000000002

(Correct answer with calculation steps: 4 points; Anything else: you may get point deduction depending on the correctness and completeness of your calculation steps)

**Problem 6 (4 pts)**

1. In 2’s complement, how many distinct numbers can be represented using 8 bits?

(1 point)

1. What is the largest unsigned integer that may be represented using 16 bits? (1 point)
2. Convert the following to their hex equivalent.
   1. The decimal number 31 (1 point)
   2. The ASCII string **Computer** (1 point)