

IC220: HW 5a

Due: 8 Mar 2019

Full Name: _____ **Alpha:** _____

Circle Your Section: Aviv/1001 Aviv/2001 Aviv/4001 Choi/5001 Missler/5002

Total Points: 80

Preliminary: Carefully do the assigned reading for Chapter 2 (2.1-2.3,2.5-2.10,2.12)

1. Convert the given decimal numbers to their binary representation

(a) [5 points]

	5 (4-bits)	-7 (4-bits)
Unsigned		
Sign Magnitude		
One's Compliment		
Two's Compliment		

(b) [5 points]

	-3 (4-bits)	-3 (6-bits)
Sign Magnitude		
One's Compliment		
Two's Compliment		

2. Assume the following is in binary two's complement form, convert to decimal, base 10.

(a) [**1 point**] 001011

(b) [**2 points**] 111011

3. Apply the negation operator to the binary values, and show the resulting binary value, in two's complement.

(a) [**1 point**] -(001011)

(b) [**1 point**] -(111011)

4. Suppose we use 8-bits to represent a two's complement binary number.

(a) [**5 points**] What is the largest number that can be presented? (Give answer in binary **and** decimal)

(b) [**5 points**] What is the smallest number that can be presented? (Give answer in binary **and** decimal)

5. [10 points] Complete the following 6-bit, two's complement additions. Indicate if there is an overflow or not.

(a)

$$\begin{array}{r} 010101 \\ + 001101 \\ \hline \end{array}$$

(b)

$$\begin{array}{r} 111111 \\ + 111101 \\ \hline \end{array}$$

(c)

$$\begin{array}{r} 010011 \\ + 001110 \\ \hline \end{array}$$

(d)

$$\begin{array}{r} 010011 \\ + 111110 \\ \hline \end{array}$$

6. [10 points] Complete the following 6-bit, two's complement **subtraction**. Indicate if there is an overflow or not.

(a)

$$\begin{array}{r} 011101 \\ - 100101 \\ \hline \end{array}$$

(b)

$$\begin{array}{r} 111111 \\ - 111101 \\ \hline \end{array}$$

(c)

$$\begin{array}{r} 010011 \\ - 001110 \\ \hline \end{array}$$

(d)

$$\begin{array}{r} 010011 \\ - 111110 \\ \hline \end{array}$$

7. **[5 points]** Convert the (decimal) 269 into a 32-bit two's complement binary number. *(Note, you can use a calculator for this, but you'd be expected to do this by hand, without a calculator, on a exam.)*

8. **[5 points]** Convert the (decimal) -45 into a 32-bit two's complement binary number. *(Note, you can use a calculator for this, but you'd be expected to do this by hand, without a calculator, on a exam.)*

9. Convert the following 32-bit binary, two's complement number into decimal. *(Note, you can use a calculator for this, but you'd be expected to do this by hand, without a calculator, on a exam.)*

(a) **[5 points]**

1111 1111 1111 1111 1111 1111 1000 0110

(b) **[5 points]**

0000 0000 0000 0000 0000 0101 0110

10. [5 points] Multiply the following binary numbers together. (Assume unsigned).

(a)

$$\begin{array}{r} 10011 \\ x 110 \\ \hline \end{array}$$

(b)

$$\begin{array}{r} 0101 \\ x 101 \\ \hline \end{array}$$

11. [5 points] Convert the following C code to MIPS. Note: use **integers** not floats here! Also, use **mult** instruction that we learned in class that takes just 2 arguments.

```
int cube(int x){  
    return x*x*x;  
}
```

12. [5 points] Convert the following C code to MIPS. Note: use **integers** not floats here! Also, use **mult** instruction that we learned in class that takes just 2 arguments.

```
int log(int x, int b){  
    int r = 0;  
    while (x < b){  
        x = x*x;  
        r+=1;  
    }  
    return r;  
}
```