This homework covers the reading from Chapter 2, Sections 2, 3, and 4. It is due by the end of Wednesday, March 3, and will be accepted late with a penalty until noon on Sunday, March 7.

Note that there is a test coming up on Friday, March 5, which will be given in class (as long as circumstances permit). A study guide for the test will be available by Monday, March 1. The will cover everything we have done up to Section 2.4. Because of the test, there will not be a new assignment next week.

1. (*2 points*) The associative law for intersection states that $A \cap (B \cap C) = (A \cap B) \cap C)$ for any sets A, B, and C. Verify this law by reducing it to the associative law for propositional logic.

2. (*3 points*) Let a, b, and c be values of type *int* given as hexadecimal numbers in Java as

```
a = 0xABCD1234          b = 0x5678EF09          c = 0xFFFF
```

Find the values of the following Java expressions, writing the answers as hexadecimal numbers. Do not just give the value, which you could get Java to compute for you; show enough work or explain your reasoning, to show how the answer is computed.

a) `(a << 16) | (b >>> 16)` **b)** `a & (c << 16)` **c)** `(a & (c << 16)) | (b & c)`

3. (*4 points*) Consider the two 16-bit integers n and m shown below. First, compute the three 16-bit integers $\tilde{}n$, and n & m, and $n \mid m$. Then, what subset of $\{15, 14, \ldots, 1, 0\}$ does each of the integers n, m, $\tilde{}n$, n & m, and $n \mid m$ correspond to? (Write out each set in full using the usual set notation.)

$$n = 1001\ 1101\ 1000\ 0101$$
$$m = 0101\ 1001\ 1100\ 0111$$

4. (*3 points*) What is computed by the following method? (Hint: Write N in binary!) Explain your answer.

```
int countSomething( int N ) {
    int ct = 0;
    for (int i = 0; i <= 31; i++) {
        if ( (N & 1) == 1 ) {
            ct++;
        }
        N = N >>> 1;
    }
    return ct;
}
```

5. (*2 points*) Describe the set $\{1, 2, 3\} \times \mathbb{N}$. Show that you understand its structure.

6. (*5 points*)

a) Consider the function $f \colon \mathbb{Z} \to \mathbb{Z}$ given by $f(n) = n + 1$. Is f a one-to-one function? Is f an onto function? Justify your answers.

b) Now, consider the function $g \colon \mathbb{N} \to \mathbb{N}$ given by $g(n) = n + 1$. Is g a one-to-one function? Is g an onto function? Justify your answers.