CS 229, Fall 2003 **Homework #4**

This homework is due in class on Friday, October 10. It covers Chapter 2, Sections 1, 2, and 3. You can work with other people in the class, but you should write up your solutions in your own words to turn in. Remember that unsupported answers will not receive any credit.

1. Let $A = \{1, 3, 5\}$, let $B = \{2, 4, 5, 6\}$, let $C = \{\{1\}, \{2, 3\}\}$, and let $D = \{\{1, 3\}, \{2, 3\}\}$. Compute each of the following sets:

a) $A \cup B$ **b)** $A \cup C$ **c)** $A \cap C$ **d)** $C \cap D$
e) $B \setminus A$ **f)** $A \setminus C$ **g)** $C \setminus D$ **h)** $\mathcal{P}(D)$

(For this problem only, you do not have to justify your work.)

2. Identify the set $\mathbb{R} \setminus \mathbb{Q}$. Explain your answer.

3. Let A, B, and C be sets. Suppose that $A \subseteq C$ and $B \subseteq C$. Prove that $A \cup B \subseteq C$.

4. Use the laws of logic to verify that $\overline{A \cap B} = \overline{A} \cup \overline{B}$ for all sets A and B.

5. Simplify the following expressions, where X, Y, and Z are sets. Justify each step in the simplification. (In your answer, the complement operator should only be applied to individual sets.)

a) $\overline{\overline{X} \cap \overline{Y}}$ **b)** $X \cup \overline{(Y \cap \overline{X})}$ **c)** $\overline{X \cap Y} \cup \overline{X \cap Z}$

6. Let `A` and `B` be 32-bit integers, and let `M` be the 32-bit hexadecimal number `0xFFFF0000`. Consider the computation

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C = (A & M) | (B & ~M)
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Explain carefully how the value of `C` is derived from the values of `A` and `B`. Give at least one example, for a particular choice of `A` and `B`.

7. Do exercise 6 on page 86 of the textbook. (Be sure to justify your answer.)

8. Do exercise 9 on page 87 of the textbook. (Be careful; this is a subtle problem that needs some thought.)