CSE 321: Discrete Structures
Assignment #3
Due: Friday, October 21

Reading Assignment: Read Sections 1.6 - 1.8, pp. 233 – 236, 2.4-2.5

Problems: (8 points each)

1. Section 1.5, problem 22, part (a).
2. Section 1.5, problem 28
3. Section 1.5, problem 64
4. Which of the following statements are true?
   - $\{x\} \subseteq \{x\}$
   - $\{x\} \in \{x, \{x\}\}$
   - $\{x\} \in \{x\}$
   - $\{x, \{x\}\} \subseteq \mathcal{P}(\{x\})$
5. Carefully prove the following implications.
   - $(A \cup B = B) \rightarrow (A \subseteq B)$
   - $(A \cap B = A) \rightarrow (A \subseteq B)$
6. Give an example of a function from $\mathcal{N}$ to $\mathcal{N}$ which is
   - one-to-one but not onto
   - onto but not one-to-one
   - both onto and one-to-one (but different from the identity function)
   - neither one-to-one nor onto.

The next two problems use the following definition: Let g be a function from the set A to the set B and let f be a function from the set B to the set C. The *composition* of the functions f and g, denoted by $f \circ g$, is defined by

$$(f \circ g)(a) = f(g(a)).$$

7. Let $f : \mathcal{R} \to \mathcal{R}$, where $f(x) = x^3$ and $g : \mathcal{R} \to \mathcal{R}$, where $g(x) = x - 3$. Give expressions for $f \circ f$, $f \circ g$, $g \circ f$ and $g \circ g$.

8. If f and $f \circ g$ are one-to-one, does it follow that g is one-to-one? Justify your answer.