Homework 1: Due Monday, January 30

Problem 1: Determine which of the following are true or false. Briefly explain.
a. $-5 \in \mathbb{Q}$.
b. $7 \in \{1, 4, \{7\}\}$.
c. $\{1, 5\} \in \{1, 2, 6, 5\}$.
d. $\{2, 8\} \subseteq \{1, 2, 3, 4, 5, 6, 7, 8\}$.
e. $\mathbb{Z} \in \mathbb{Q}$.
f. $\mathbb{R}^+ \cap \mathbb{N} \subseteq \mathbb{Z}$.
g. $\{n \in \mathbb{Z} : n > \frac{1}{2}\} \cup \{n \in \mathbb{Z} : n < \frac{1}{8}\} = \mathbb{Z}$.

Problem 2: Let $A = \{1, 2, 3, 4, 5\}$, let $B = \{1, 4, 5, 7, 8, 9\}$, and let $C = \{2, 4, 6, 7, 9\}$. Determine each of the following.
a. $A \cup B$.
b. $A \cup C$.
c. $A \cap B \cap C$.
d. $(A \cup B) \cap (A \cup C)$.
e. $A - (B \cup C)$.

Problem 3: Let A, B, and C be sets, which are each subsets of some universal set $\mathcal{U}$. Illustrate each of the following using Venn Diagrams:
a. $(A \cup C) - A$.
b. $\overline{A \cap B} \cap C$.
c. $B - (A \cap C)$

Problem 4: Use a Venn diagram, together with some explanation, to explain why the following statements are true for any choice of sets.
a. $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.
b. $A \cap (B - A) = \emptyset$.
c. $\overline{A \cap B} = \overline{A} \cup \overline{B}$.

Problem 5: Given two sets A and B, we define

$$A \triangle B = \{x : x \text{ is an element of exactly one of } A \text{ or } B\},$$

and we call this set the *symmetric difference* of A and B.
a. Determine $\{1, 3, 8, 9\} \triangle \{2, 3, 4, 7, 8\}$.
b. Write $A \triangle B$ in terms of the sets A and B using only the operations of union, intersection, and difference. Explain.

Problem 6: (Exercise 1.6.2) What is the difference between trunc() and floor()? Give an example of actual parameter for which they would produce different results.