The assignment is due at the beginning of class on March 1, 2006.

Problem 1 (10 points) Let $A$, $B$ and $C$ be arbitrary sets. We define $A \triangle B := (A - B) \cup (B - A)$. Prove or disprove:

1. $A \triangle B = B \triangle A$.
2. $(A \triangle B) \triangle C = A \triangle (B \triangle C)$.

Problem 2 (10 points) Let $A$ and $B$ be arbitrary sets. Prove or disprove:

1. $\mathcal{P}(A \cap B) \subseteq \mathcal{P}(A) \cap \mathcal{P}(B)$.
2. $\mathcal{P}(A) \cap \mathcal{P}(B) \subseteq \mathcal{P}(A \cap B)$.

Problem 3 (10 points) For $n \in \mathbb{N}$, let $A_n$ be the open interval $(\frac{1}{2}, \frac{1}{2} + \frac{1}{n})$.
Find $\bigcup_{n \in \mathbb{N}} A_n$ and $\bigcap_{n \in \mathbb{N}} A_n$. Confirm your answers by proofs.

Problem 4 (10 points) For each rational number $q \in \mathbb{Q}$, let $B_q = \{x \in \mathbb{R} | x \neq q\}$.
Find $\bigcup_{q \in \mathbb{Q}} B_q$ and $\bigcap_{q \in \mathbb{Q}} B_q$. Confirm your answers by proofs.