**Homework 2. Due on October 2**

1. Let $\epsilon > 0$ and $\delta > 0$ and let $a \in \mathbb{R}$. Show that $N_\epsilon(a) \cap N_\delta(a)$ and $N_\epsilon(a) \cup N_\delta(a)$ are $\gamma$ -neighborhood of of $a$ for appropriate values of $\gamma$.

2. Show that if $a, b \in \mathbb{R}$, and $a \neq b$, then there exist $\epsilon$ neighborhood $U$ of $a$ and $V$ neighborhood of $b$ such that $U \cap V = \emptyset$.

3. If $S \subseteqq \mathbb{R}$ is an nonempty bounded set, and $I_S$ is the interval $I_S := [inf\, S, sup\, S]$, show that $S \subseteqq I_S$. Moreover if $J$ is any closed bounded interval of $\mathbb{R}$ such that $S \subseteqq J$, show that $I_S \subseteqq J$.

4. Let $I_n := \left[0, \frac{1}{n}\right]$ for $n \in \mathbb{N}$. Prove that if $x > 0$ then $x \notin \cap_n^\infty I_n$.

5. Express $\frac{2}{17}$ as decimal and binary representations.

6. Problem 6 on page 43 of Rudin.

7. Problem 9 on page 43 of Rudin.