Sets II

2.2.6: Give an example of nonempty sets A, B, and C such that:

(a) $C \subseteq A \cup B$ and $A \cap B \nsubseteq C$

(b) $A \subseteq B$ and $C \subseteq A \cap B$

(c) $A \cup B \subseteq C$ and $C \nsubseteq B$

(d) $A \nsubseteq B \cup C$, $B \nsubseteq A \cup C$, and $C \subseteq A \cup B$

2.2.11: Provide counterexamples for each of the following:

(a) If $A \cup C \subseteq B \cup C$, then $A \subseteq B$

(b) If $A \cap C \subseteq B \cap C$, then $A \subseteq B$

(c) If $(A - B) \cap (A - C) = \emptyset$, then $B \cap C = \emptyset$.

2.3.7: Let $\mathscr{A} = \{A_\alpha : \alpha \in \Delta\}$ be a family of sets, and let B be a set. Prove that

$$B \cap \bigcup_{\alpha \in \Delta} A_\alpha = \bigcup_{\alpha \in \Delta} (B \cap A_\alpha).$$