Basic Set Theory

- **Containment.** $A \subseteq B \Leftrightarrow x \in A \Rightarrow x \in B$.
- **Equality.** $A = B \Leftrightarrow A \subseteq B$ and $B \subseteq A$.
- **Union.** The *union* of A and B, written $A \cup B$, is the set of elements that belong to either A or B or both:
$$A \cup B = \{x | x \in A \text{ or } x \in B\}.$$
- **Intersection.** The *intersection* of A and B, written $A \cap B$, is the set of elements that belong to both A and B.
$$A \cap B = \{x | x \in A \text{ and } x \in B\}.$$
- **Complement.** The *complement* of A, written A^c, is the set of all elements that are not in A:
$$A^c = \{x | x \notin A\}.$$
- **Properties:**
  1. Commutativity
     - **a.** $A \cup B = B \cup A$
     - **b.** $A \cap B = B \cap A$
  2. Associativity
     - **a.** $A \cup (B \cup C) = (A \cup B) \cup C$
     - **b.** $A \cap (B \cap C) = (A \cap B) \cap C$
  3. Distributive Laws
     - **a.** $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
     - **b.** $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
  4. De Morgan's Laws
     - **a.** $(A \cup B)^c = A^c \cap B^c$
     - **b.** $(A \cap B)^c = A^c \cup B^c$