Problem 1. *For each natural number t, let $X_t = (-t, t) = \{x \in \mathbb{R} : -t < x < t\}$ and $Y_t = [-t, t] = \{x \in \mathbb{R} : -t \leq x \leq t\}$. Describe the following sets:*

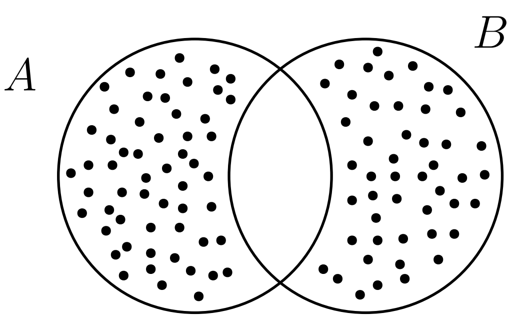
1. $\bigcup_{i=0}^{\infty} X_i$ *and* $\bigcup_{i=0}^{\infty} Y_i$
2. $\bigcap_{i=0}^{\infty} X_i$ *and* $\bigcap_{i=0}^{\infty} Y_i$

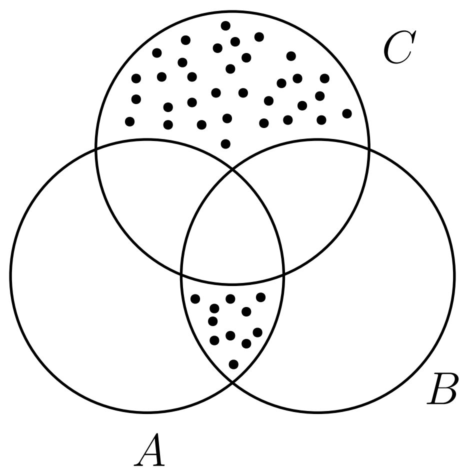
Problem 2. *Let $A = \{2, 7, 15\}$ and B be a set such that $|B| = 5$ answer the following:*

1. *What is the smallest and largest cardinality (size) of $A \cap B$.*
2. *What is the smallest and largest cardinality (size) of $A \cup B$.*
3. *What is the smallest and largest cardinality (size) of $A \times B$.*

Problem 3. *Find an example of a set A of cardinality 5 whose elements are sets and if $B \in A$ then $B \subseteq A$. (These sets are called transitive)*

Problem 4. *Describe the following Venn diagrams in set notation:*





Problem 5. ***(HW)*** *Let A, B, C be sets and prove the following:*

1. $(A, B \subset C) \implies (A \cup B \subset C)$
2. $(A = B) \iff (A \cup B = A \cap B)$
3. $(A \subset B) \implies ((A \cup C) \subset (B \cup C))$

Problem 6. *Let $A, B \subset \mathbb{N}$ be sets of natural numbers and prove the following:*

1. $(A \cup B)^c = A^c \cap B^c$
2. $(A \cap B)^c = A^c \cup B^c$

Problem 7. *Let A be a set and for some $n \in \mathbb{N}$ consider the collection of subsets of A denoted by $X_1, \ldots, X_n$. Then prove the following:*

1. $A \setminus \bigcup_{i=1}^{n} X_i = \bigcap_{i=1}^{n} (A \setminus X_i)$
2. $A \setminus \bigcap_{i=1}^{n} X_i = \bigcup_{i=1}^{n} (A \setminus X_i)$

How does this exercise relate to the previous one?

Problem 8. *(**HW**) Prove or Disprove: Let X, Y, Z be sets, if $X \times Y = Z \times Y$ then $X = Z$.*