Set: $S = \{ a, b, c, f, g \}$

$x \in S \iff x \text{ in this list?}$

$S = \{ x \mid p(x) \}$

$S = \{ x \mid x \in \mathbb{Z} \land x > 7 \}$

or $\{ x \in \mathbb{Z} \mid x > 7 \}$

$x \in S$ means "x makes $T$"

$\emptyset = \{ \}$ empty set

$\mathbb{N} = \{ 0, 1, 2, 3, \ldots \}$

$\mathbb{Z} = \{ 0, 1, -1, 2, -2, \ldots \}$

$\mathbb{R} = \text{real numbers}$
\[ \cup \text{ union } \quad A \cup B = \{ x | x \in A \lor x \in B \} \]
\[ \cap \text{ intersection } \quad A \cap B = \{ x | x \in A \land x \in B \} \]
\[ \{1, 3, 7\} \cup \{3, 5, 8\} = \{1, 3, 5, 7, 8\} \]
\[ \{1, 3, 7\} \cap \{3, 5, 8\} = \{3\} \]

- **set difference**
  \[ A - B = \{ x | x \in A \land x \notin B \} \]
  \[ = A \cap B^c \]

\[ A \times B = \{ (a, b) | a \in A \land b \in B \} \]
\[ \{a, b\} \times \{1, 2, 3\} = \{ (a, 1), (a, 2), (a, 3), (b, 1), (b, 2), (b, 3) \} \]

**A ⊆ B** means \( \forall x \in A, x \in B \)
\[ \{1, 3, 7\} \not\subset \{3, 5, 8\} \]
\[ \{3\} \subset \{3, 5, 8\} \]
\[ A \cup A = A \quad A \cup B = B \cup A \]

\[ A \cap A = A \quad A \cap B = B \cap A \]

\[ (A \cup B) \cup C = A \cup (B \cup C) \]

\[ A \cup (B \cap C) = (A \cup B) \cap (A \cup C) \]

\[ (A \cap B) \cap C = A \cap (B \cap C) \]

\[ A \cap (B \cup C) = (A \cap B) \cup (A \cap C) \]

\[ (A \cup B) \cap A = A \]

\[ (A \cap B)^c = A^c \cup B^c \]

\[ (A \cap B)^c = A^c \cap B^c \]

\[ A - (B \cup C) = (A - B) \cap (A - C) \]
A and B are disjoint iff \( A \cap B = \emptyset \)

\[ \mathcal{P}(A) = 2^A = \{ X \mid X \subseteq A \} \]

Ex: \( \mathcal{P}(\{ c, d \}) = \{ \{ \}, \{ c \}, \{ d \}, \{ c, d \}, \emptyset \} \]

\( c \notin \{ c, d \} \)

A partition of \( A \) is a set of subsets of \( A \), \( \mathcal{T} \)

s.t.

1) \( \forall x \in A, \exists S \in \mathcal{T} s.t. x \in S \)

2) all \( S_1, S_2 \) in \( \mathcal{T} \) are disjoint

3) \( \emptyset \notin \mathcal{T} \)

Ex: \( A = \{1, 2, 3, 4, 5\} \)

\( \mathcal{T} = \{\{1\}, \{2\}, \{3\}, \{4\}, \{5\}\} \)

not a partition
\{113, 333, 3, 49, 5, 53\} is a partition

Relation on \( A, B \) is a subset of \( A \times B \).

Ex: \( A = \{1, 2, 3\}, \ B = \{a, b\} \)

Let \( R = \{(1, a) \}, \{(1, b)\} \), \( \{(3, b)\} \)

\( R \) is a relation on \( A, B \)

\( aRb \iff (a, b) \in R \)

1. \( R_a \)

2. \( R_a \)

Equivalence relation: 1) transitive \( \forall x, y, \ z \in A, \ xRy \land yRz \implies xRz \)

2) reflexive \( \forall x \in A, \ xRx \)

3) symmetric \( \forall x, y \in A, \ xRy \iff yRx \)

Ex: Let \( A = \{Colm, Mike, Andrew, \ldots\} \)

Let \( R = \{(x, y) \in A \times A \mid x, y \text{ had a class together aside from CS 478}\} \)
\[ \{ (a, b), (a, c), (a, a), (c, c), \\
( c, a), (m, h), (m, c), (m, m), \\
( m, l), (m, j), (h, c), (h, m), (h, a) \\
( h, h), (h, l), (h, j), (j, c), (j, h), \\
( j, m), (j, l), (j, j), (l, l), (l, j), \\
( l, h), (l, m), (l, c), (c, c), \\
( c, h), (c, m), (c, l), (c, j) \} \]

not egov rel

since not trans

aRb all b

but not aRh