

Sets - collection of items

$$\{a, 1, 7, \text{"bob"}\} = \{1, \text{"bob"}, 7, a\}$$

$$\{x \in \mathbb{Z} \mid -2 < x < 5\}$$

$$= \{-1, 0, 1, 2, 3, 4\}$$

← 6 elements

$$\{x \in \mathbb{R} \mid -2 < x < 5\}$$

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Subsets

$A \subseteq B$ iff every element of A is also in B

$$A \subseteq B \iff \forall x \text{ if } x \in A \text{ then } x \in B$$

proper subset $A \subset B$
 $A \subseteq B$ and $\exists x$ st $x \in B$ and $x \notin A$

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$$2 \in \{1, 2, 3\} \checkmark$$

$$\{2\} \in \{1, 2, 3\} \times$$

$$\{2\} \subseteq \{1, 2, 3\} \checkmark$$

$$2 \subseteq \{1, 2, 3\} \times$$

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$A = B$ iff $A \subseteq B$ and $B \subseteq A$

Empty set (null set)
 $\{\}, \emptyset$

Universal set: U

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union $A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

intersection $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$

difference $A - B = \{x \mid x \in A \text{ and } x \notin B\}$

complement $A^c = \{x \mid x \notin A\}$

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two sets A, B are disjoint iff $A \cap B = \{\}$

$A_1, A_2, A_3, \dots, A_n$ are mutually disjoint for all $i, j = 1, \dots, n$
 $A_i \cap A_j = \{\}$ when $i \neq j$

collection of non-empty sets $\{A_1, A_2, \dots, A_n\}$ is a partition of a set A iff

- ⓐ $A = A_1 \cup A_2 \cup \dots \cup A_n$
- ⓑ A_1, A_2, \dots, A_n are mutually disjoint

eg $A = \{1, 2, 3, 4, 5, 6, 7\}$
 $B = \{1, 3, 7\}$ $C = \{2, 4\}$
 $D = \{6\}$ $E = \{5\}$

partition of A

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$$A = \{ \{1,2\}, \{3,4\}, 4, \{5\} \}$$

$4 \in A?$ \checkmark $\{ \{1,2\}, 4 \} \subseteq A?$ \checkmark
 $2 \in A?$ \times $\{ 1,2,3 \} \subseteq A?$ \times
 $\{5\} \in A?$ \checkmark $\{ 1 \} \in A?$ \times
 $\{ \{1\} \} \subseteq A?$ \times

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$$A = \{ x, y, z \}$$

Power set of A $\mathcal{P}(A)$ or 2^A
 set of all subsets

$$\mathcal{P}(A) = \{ \{ \}, \{x\}, \{y\}, \{z\}, \{x,y\}, \{x,z\}, \{y,z\}, \{x,y,z\} \}$$

$\{ \} \subseteq A$
 for every set A

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Ordered n-tuple
 $(x_1, x_2, x_3, \dots, x_n)$
 $(2,3) \neq (3,2)$
 $(a,b) = (c,d)$ iff $a=c$ and $b=d$

Cartesian Product $A \times B$
 $A \times B = \{ (a,b) \mid a \in A \text{ and } b \in B \}$
 $A_1 \times A_2 \times \dots \times A_n = \{ (a_1, a_2, \dots, a_n) \mid a_i \in A_i \}$

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Properties

$$A \cap B \subseteq A$$

$$A \cap B \subseteq B$$


$$A \subseteq A \cup B$$

$$B \subseteq A \cup B$$

Element argument to prove $A \subseteq B$
 $\forall x, \text{ if } x \in A \text{ then } x \in B$
 1. suppose $x \in A$
 2. show $x \in B$

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