CS 173 Lecture 5a: Sets

Definition. An unordered collection of objects

$\{1,2\} = \{2,1\}$
$= \{1,1,2\}$

Notation. In addition to explicitly listing out set elements, we can use set builder notation

the set of multiples of 5

$= \{ \ldots, -10, -5, 0, 5, 10, \ldots \}$

$= \{ x \in \mathbb{Z} : \exists y \in \mathbb{Z},\ x = 5y \}.$

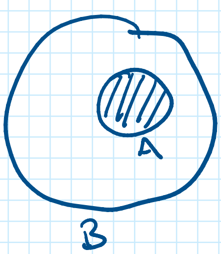
$= \{ 5x : x \in \mathbb{Z} \}$ some people use $|$ (confusing when working w/ divisibility)

$3 \neq \{3\}$ $\quad 3 \in \mathbb{Z}$, $\{3\} \notin \mathbb{Z}.$

type matters. $\{3\} \in \{2, \{3\}\}$

$3 \notin \{2, \{3\}\}.$

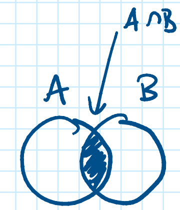
Definition: Given two sets A & B, A is a subset of B $(A \subseteq B)$ if for all x, if $x \in A$, then $x \in B$.



$\{\} = \emptyset \subseteq A$ for all sets A.

Why? For all $x \in \emptyset$, $x \in A$. "vacuous truth"

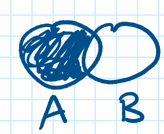
$\emptyset \in A$? Not necessarily.



- intersection: $x \in A \cap B$ iff $x \in A$ and $x \in B$.
- union $x \in A \cup B$ iff $x \in A$ <u>OR</u> $x \in B$

(!!) Pictures are not proofs!

- difference $x \in A - B$ iff $x \in A$ and $x \notin B$.



- complement $x \in \overline{A}$ iff $x \notin A$.

... iff $x \in A$ and $x \notin B$.

– complement $\quad x \in \overline{A}$ iff $x \notin A$.

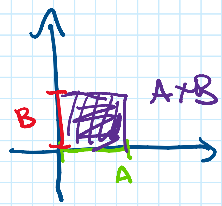
(usually what we mean is $A \subseteq \mathcal{U}$, $\overline{A}$ (with respect to $\mathcal{U}$) is $\mathcal{U} \setminus A$)

– product $\quad A \times B = \{ (x,y) : x \in A,\ y \in B \}$.

eg. $A = [0,1]$

$B = [0,1]$

$A \times B = [0,1] \times [0,1] = \{ (x,y) : 0 \le x \le 1,\ 0 \le y \le 1 \}$



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

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

$A \cap B = \{3\} = B \cap A$

$A - B = \{1,2\}$

$B - A = \{4,5\}$.