Finite Math

Jake Landgraf

B20 Hayes-Healy Hall

Office Hours: TBD, by appointment

Website: jacoblandgraf.com → teaching → Finite Math

Course Structure:

Midterms (2)	300pts	600pts
Final	150pts	
HW (WebAssign)	100pts	
Quizzes	50pts	

Set: collection of things

Examples: A = The set of 26 English letters

B = The set of people in this class

C = The set of even numbers

~~D~~ = The set of top-three ice cream flavors

(not well-defined)

Notation: $\boxed{k \in A}$

$\in$ is an element of

$7 \notin C$

$\notin$ is not an element of

Ways to write sets:

- Describe them (just like above)
- List the elements

  set of primary colors = {red, yellow, blue}

  curly braces

  the possible rolls of a six-sided die = {1, 2, 3, 4, 5, 6}

- Give a pattern

  set of even numbers = {0, 2, 4, 6, ...}

  "et cetera"

  set of 26 English letters = {a, b, c, d, ..., x, y, z}

- Set-builder notation

$$\{x \mid x \text{ is a vowel of the English alphabet}\} = \{a, e, i, o, u\}$$

"such that"

$$\{x \mid x - 3 = 2\} = \{5\}$$

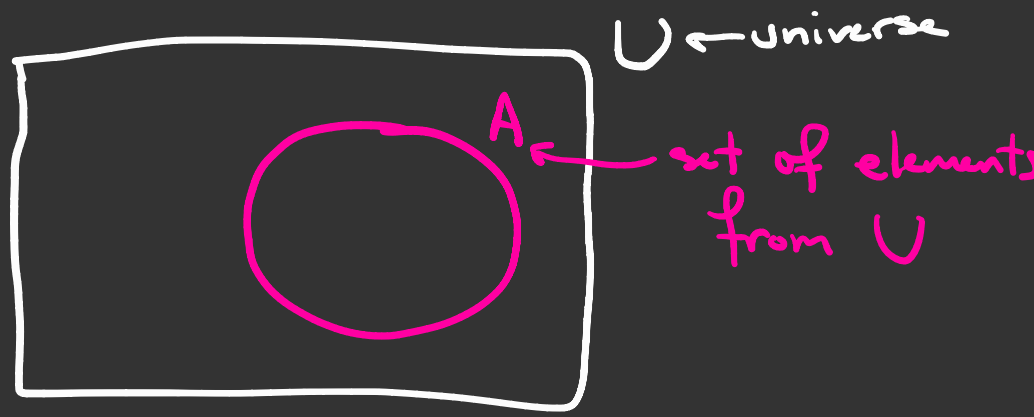
Empty Set: contains no elements

Notation: $\varnothing$

Examples: $\{x \mid x < 3 \text{ and } x > 5\} = \varnothing$

Nonempty: contain at least one element

Venn Diagram:



Set Equality: contain exacltly the same elements

- $\{1, 2, 3\} = \{1, 1, 2, 3\}$ (repetition doesn't matter)

- $\{1, 2, 3\} = \{3, 2, 1\}$ (order doesn't matter)

Subset: $A \subseteq B$ if every element of A is also in B

$\subseteq$ is a subset of

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

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

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

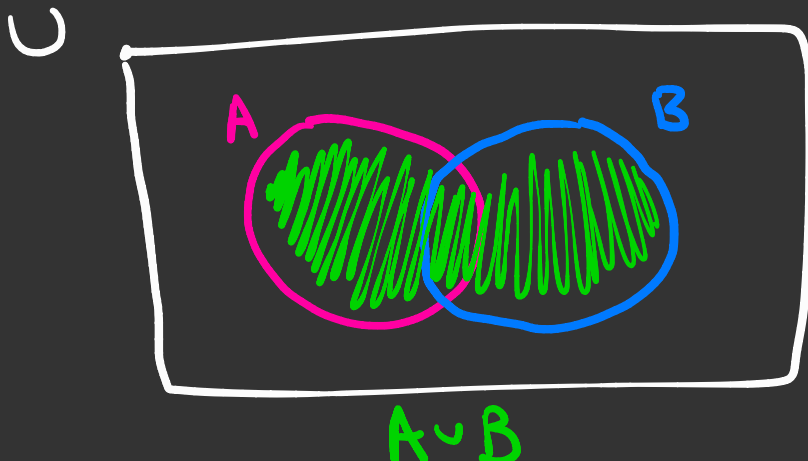
A is a <u>proper</u> subset of B if $A \subseteq B$, and $A \neq B$ and $A \neq \emptyset$

Union of sets: $A \cup B$ is set of element in A, B, or both

union

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

inclusive or

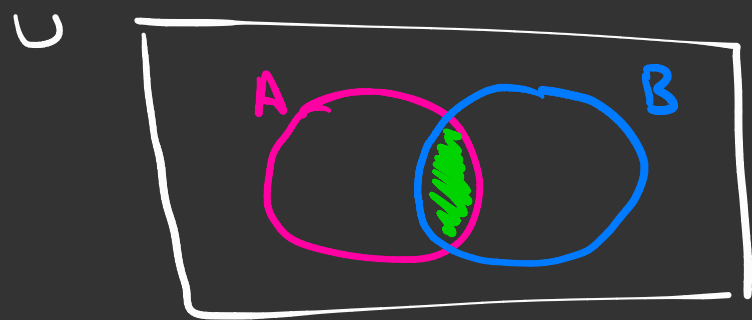


- $\{1,2,3\} \cup \{4,5,6\} = \{1,2,3,4,5,6\}$

Intersection of sets: $A \cap B$ is set of element in A and in B

$\cap$ intersection

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



$A \cap B$

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

$$\{1,2,3\} \cap \{4,5,6\} = \emptyset$$

Note:

$$A \subseteq A \cup B$$

$$B \subseteq A \cup B$$

$$A \supseteq A \cap B$$

$$B \supseteq A \cap B$$

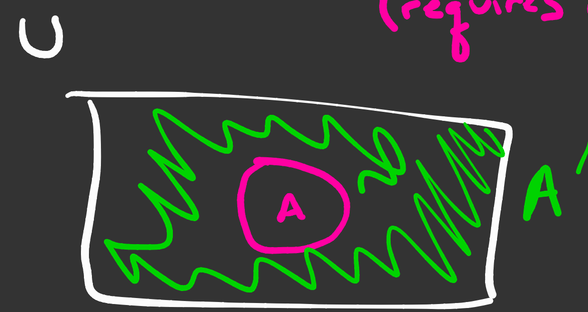
Complement of sets: $A' = A^c$ is set of elements in U not in A (← complement)

(requires a universal set)

$U = \{1, 2, 3, 4, 5, 6\}$

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

$A' = \{4, 5, 6\}$



Note:

$A \cap A' = \emptyset$

$A \cup A' = U$

Disjoint sets : If $A \cap B = \emptyset$, we say A and B are disjoint