Intro to set theory outline

- Def $^n$ of a set. ($a \in A, a \notin A$)

- Def $^n$ of $A \subseteq B$ (example of $A \neq B$)

- Def $^n$ of $A = B$

- Def $^n$ of $\emptyset = \{\}$

- Def $^n$ of $A \supsetneq B$

- Def $^n$ of $A \cap B$, $\bigcap_{i=1}^{n} A_i = A_1 \cap \cdots \cap A_n$ (Give example for 2 and 3 sets)

- Def $^n$ of $A \cap B = \emptyset$ (disjoint)

- Def $^n$ of $A \cup B$

  Show $\bigcap = \bigcup \bigcup$

  For disjoint sets union acts like a + sign.

- Def $^n$ of $\bigcup_{i=1}^{n} A_i = A_1 \cup \cdots \cup A_n$

- Def $^n$ of $A^c = \mathbb{U} - A$ (Define universal set $\mathbb{U}$ first)
  
  We need a universal set to eliminate extraneous elements in $\{x \mid x \notin A\}$.

- Properties of the complement
  1. $(A^c)^c = A$

  $A^c = \overline{A} \xrightarrow{(A^c)^c} \overline{\overline{A}} = A$

  2. $A \cup A^c = \mathbb{U}$

  (De proof by pictures)

  3. $A \cap A^c = \emptyset$

- De Morgan's laws
  1. $(A \cup B)^c = A^c \cap B^c$

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

- Subtracting sets: $A - B = A \cap B^c$

- Distributive Laws:
  1. $C \cap (A \cup B) = (C \cap A) \cup (C \cap B)$

  2. $C \cup (A \cap B) = (C \cup A) \cap (C \cup B)$

- Differences between how we combine sets and how we combine numbers
  - tools for manipulating numbers: $+,-, \times, \div$
  - tools for manipulating sets: $\cap, \cup, -, \in$