Operations on Sets

* Union
- $A \cup B$
- just combine the elements & eliminate multiples
- $A + B$ (or)
- $A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

* Intersection
- $A \cap B = A \text{ and } B = AB$
- what elements overlap
- $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$
- A  B
- all operations yield a set

* Subset
- $A \cap B \subseteq A \cup B$
- $C \subseteq D$, how do we show this?
- pick $x \in C$, show $x \in D$

* Proofs
- $A \cap B \subseteq A \cup B$

1. - pick $x \in A \cap B$, show $x \in A \cup B$

since $x \in A \cap B$, then $x \in A$ and $x \in B$

so $x \in A$

thus $x \in A$ or $x \in B$

hence $x \in A \cup B$

2 prove $(A \cap B \cap C) \cup F \subseteq D \cap E$

pick $(A \cap B \cap C) \cup F$

- solve

* Proving
- pick an arbitrary element from C & show it is in D
- cannot show by example

* Complement
- $A - B = \{x \mid x \in A$ and $x \notin B$
- A  B
- $A - (A \cap B) = A - B$
- complement of B with respect to A
- complement of $A = \bar{A}$
- $U - A = \bar{A}$

* Symmetric difference
- $A \oplus E = (A - E) \cup (E - A)$
- can be written $(A \cup E) - (A \cap E)$
- $x \notin B = x \in \bar{B}$

* Distributive Property
- $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

* De Morgan's Law
- $\overline{A \cup B} = \bar{A} \cap \bar{B}$
- $\overline{A \cap B} = \bar{A} \cup \bar{B}$

*
- $|A \cup B| = |A| + |B| - A \cap B$