Math 310
Set Operations Handout

Definitions:

- Given two sets A and B, the *union* of these sets, denoted $A \cup B$, is the set containing the elements that are either in A or in B (or in both). That is, $A \cup B = \{x : x \in A \vee x \in B\}$.

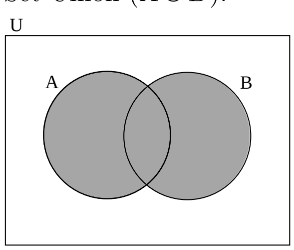
- Given two sets A and B, the *intersection* of these sets, denoted $A \cap B$, is the set containing the elements that are in both A and B. That is, $A \cap B = \{x : x \in A \wedge x \in B\}$.

- Given two sets A and B, the *difference* of these sets, denoted $A - B$, is the set containing the elements that are in A but not in B. That is, $A - B = \{x : x \in A \wedge x \notin B\}$. Note: In general, $A - B \neq B - A$.

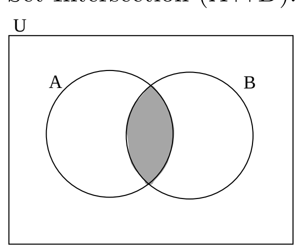
- Given a universal set U and a set A, the *complement* of the set A with respect to the set U, denoted $\overline{A}$, is the set $U - A$. That is, $\overline{A} = \{x \in U : x \notin A\}$.
- Two sets A and B are **disjoint** if their intersection is empty. That is, if $A \cap B = \emptyset$.

Venn Diagrams for Set Operations:

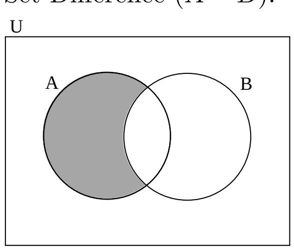
Set Union ($A \cup B$):



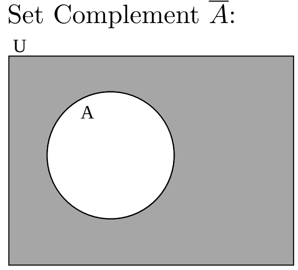
Set Intersection ($A \cap B$):



Set Difference ($A - B$):



Set Complement $\overline{A}$:



Examples: Let $A = \{a, b, c, d, e, f\}$, $B = \{a, c, e, f, g, h, i\}$, $C = \{b, c, d, f, g, h\}$ and $U = \{a, b, c, d, e, f, g, h, i, j\}$

1. $A \cup B = \{a, b, c, d, e, f, g, h, i\}$
2. $A \cap B = \{a, c, e, f\}$
3. $A - C = \{a, e\}$
4. $\overline{C} = \{a, e, i, j\}$
5. $A - (B \cup C) = A - (\{a, b, c, d, e, f, g, h, i\}) = \emptyset$
6. $A \cup (B \cap C) = A \cup (\{c, f, g, h\}) = \{a, b, c, d, e, f, g, h\}$