Mathematical Foundations for Computer Applications

Set Operations

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Mathematical Foundations for Computer Applications

Set Operations- Union

- Let A and B be sets. The **union** of the sets A and B, denoted by $A \cup B$, is the set that contains those elements that are either in A or in B, or in both.

$$A \cup B = \{x \mid x \in A \vee x \in B\}.$$

Eg- The union of the sets {1, 3, 5} and {1, 2, 3} is the set

$$\{1, 3, 5\} \cup \{1, 2, 3\} = \{1, 2, 3, 5\}.$$

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Set Operations- Intersection

- Let A and B be sets. The **intersection** of the sets A and B, denoted by $A \cap B$, is the set containing those elements in both A and B.

$$A \cap B = \{x \mid x \in A \ \wedge \ x \in B\}.$$

Eg-The intersection of the sets {1, 3, 5} and {1, 2, 3} is the set {1, 3}

that is, $\{1, 3, 5\} \cap \{1, 2, 3\} = \{1, 3\}$.

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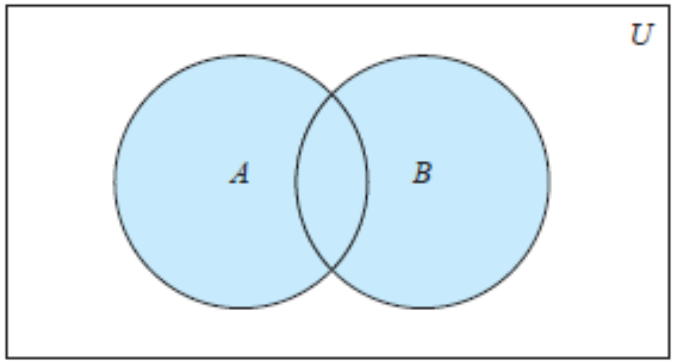
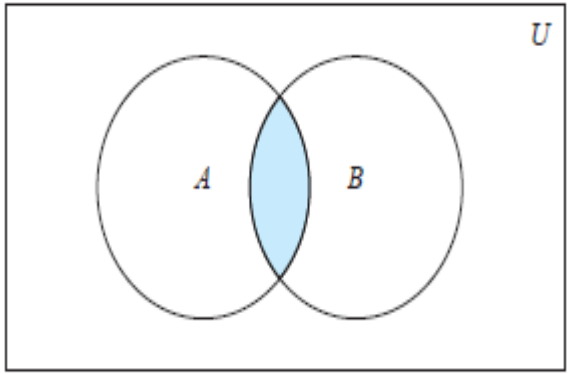
Venn Diagram -- Union , Intersection



$A \cup B$ is shaded.



$A \cap B$ is shaded.

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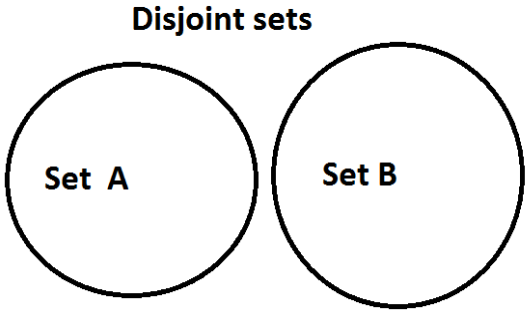
Disjoint Sets

- Two sets are called **disjoint** if their intersection is the empty set.

Example --Let $A = \{1, 3, 5, 7, 9\}$ and $B = \{2, 4, 6, 8, 10\}$.
Because $A \cap B = \emptyset$, A and B are disjoint



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Set Operations--Difference

- Let *A* and *B* be sets. The **difference** of *A* and *B*, denoted by ***A − B***, is the set containing those elements that are **in *A* but not in *B***. The difference of *A* and *B* is also called the ***complement of B with respect to A.***

$$A - B = \{x \mid x \in A \wedge x \notin B\}.$$

- Eg- A= {1, 3, 5} and B= {1, 2, 3} find A-B, B-A.

  A-B={5}

  B-A={2}

Set Operations- Complement

- Let U be the universal set. The **complement** of the set A, denoted by $\overline{\mathbf{A}}$**,** is the complement of A with respect to U. $\overline{\mathbf{A}} = \mathbf{U - A.}$

$$\overline{\mathbf{A}} = \{x \in U \mid x \notin A\}.$$

Eg-- Let A = {a, e, i, o, u} (where the universal set is the set of letters of the English alphabet). Then

$\overline{A}$ = {b, c, d, f, g, h, j, k, l,m, n, p, q, r, s, t, v, w, x, y, z}.

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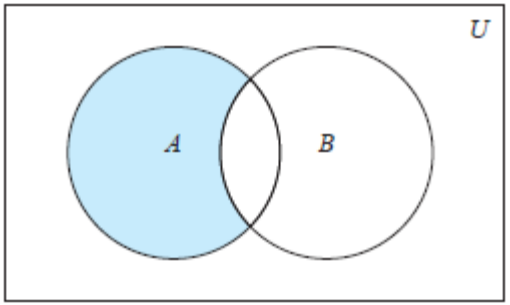
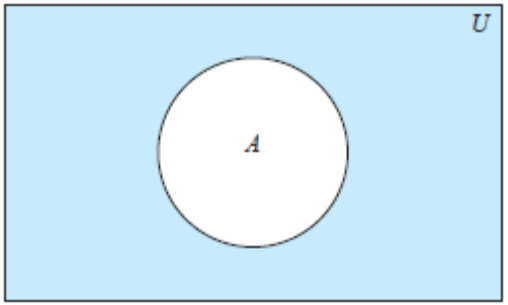
Venn Diagram for difference and Compliment



$A - B$ is shaded.



$\overline{A}$ is shaded.

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Problems

1. If the universal set is given by S={1,2,3,4,5,6}, and A={1,2}, B={2,4,5}, C={1,5,6} are three sets, find the following sets:

- A∪B
- A∩B
- A-B
- B-A
- $\bar{A}$
- $\bar{B}$

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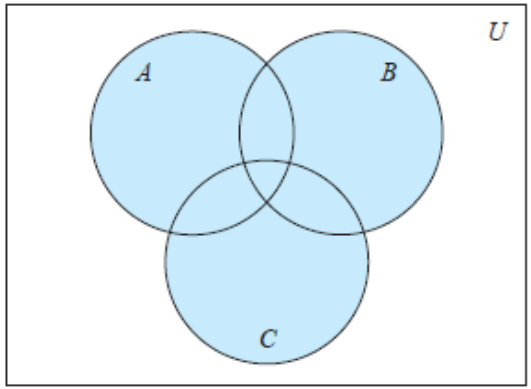
Problems

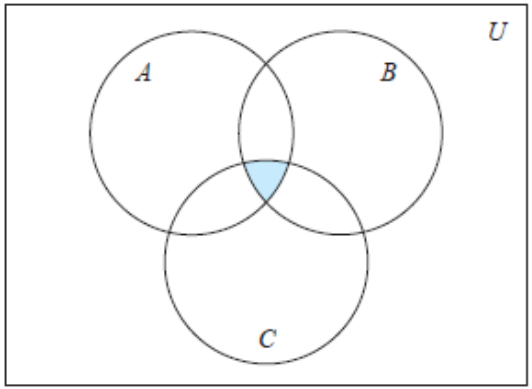
1. Let $A = \{0, 2, 4, 6, 8\}$, $B = \{0, 1, 2, 3, 4\}$, and $C = \{0, 3, 6, 9\}$. What are $A \cup B \cup C$ and $A \cap B \cap C$?

$A \cup B \cup C = \{0, 1, 2, 3, 4, 6, 8, 9\}$.

$A \cap B \cap C = \{0\}$.



(a) $A \cup B \cup C$ is shaded.



(b) $A \cap B \cap C$ is shaded.

THANK YOU

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