

# **Discrete Mathematics**

## **Sets and Functions**

Pangyen Weng, Ph.D  
Metropolitan State University



$\pi$

# Intersection and Union

## The Venn Diagram

- › The universal set  $U$  denotes the set of all elements considered.

## The Venn Diagram

- › The universal set  $U$  denotes the set of all elements considered.
- › The Venn diagram: Sets are denoted by regions inside simple closed curves, usually circles or rectangles. Elements in a set are drawn within the region; otherwise outside the region.

## The Venn Diagram

- › The universal set  $U$  denotes the set of all elements considered.
- › The Venn diagram: Sets are denoted by regions inside simple closed curves, usually circles or rectangles. Elements in a set are drawn within the region; otherwise outside the region.

**Example.** Draw the Venn Diagram for

$$A = \{1,2,5\}; U = \{x \in \mathbf{N}: n \leq 10\}$$

## Intersection of Sets

Let  $A$  and  $B$  be sets. The intersection of  $A$  and  $B$  is the set of all elements that are elements of **both**  $A$  and  $B$ .

## Intersection of Sets

Let  $A$  and  $B$  be sets. The intersection of  $A$  and  $B$  is the set of all elements that are elements of both  $A$  and  $B$ .

› Denoted by  $A \cap B$  and read as " $A$  intersect  $B$ ".

## Intersection of Sets

Let  $A$  and  $B$  be sets. The intersection of  $A$  and  $B$  is the set of all elements that are elements of both  $A$  and  $B$ .

- › Denoted by  $A \cap B$  and read as “ $A$  intersect  $B$ ”.
- › How do we denote  $A \cap B$  by Venn diagram?



## Example

Find  $A \cap B$  for

$$A = \{1, 2, 4, 8, 16\}; B = \{2, 4, 6, 8, 10, 12\}$$

## Example

Find  $A \cap B$  for

$$A = \{1, 2, 4, 8, 16\}; B = \{2, 4, 6, 8, 10, 12\}$$

**Exercise.** Find  $C \cap D$  for

$$C = \{1, 2, 3, 4, 5, \dots\}$$

$$D = \{2, 3, 4, 5, 6, \dots\}$$

## Union of Sets

Let  $A$  and  $B$  be sets. The union of  $A$  and  $B$  is the set of all elements that are elements of **either**  $A$  or  $B$ .

› Denoted by  $A \cup B$  and read as “ $A$  union  $B$ ”.

## Union of Sets

Let  $A$  and  $B$  be sets. The union of  $A$  and  $B$  is the set of all elements that are elements of **either**  $A$  or  $B$ .

- › Denoted by  $A \cup B$  and read as “ $A$  union  $B$ ”.
- › Venn diagram?

## Exercises

1. Find  $A \cup B$  for

$$A = \{1, 2, 4, 8, 16\}; B = \{2, 4, 6, 8, 10, 12\}$$

2. Find  $C \cup D$  for

$$C = \{1, 2, 3, 4, 5, \dots\}$$

$$D = \{2, 3, 4, 5, 6, \dots\}$$

## Intersection and Union of Multiple Sets

$$\bigcup_{i=1}^n A_i = A_1 \cup A_2 \cup \cdots \cup A_n,$$

$$\bigcap_{i=1}^n A_i = A_1 \cap A_2 \cap \cdots \cap A_n$$

## Intersection and Union of Multiple Sets

$$\bigcup_{i=1}^n A_i = A_1 \cup A_2 \cup \cdots \cup A_n, \quad \bigcap_{i=1}^n A_i = A_1 \cap A_2 \cap \cdots \cap A_n$$

**Example.**  $A_i = \{i, i + 1, i + 2, \dots\}$ . Find  $\bigcup_{i=1}^5 A_i$  and  $\bigcap_{i=1}^n A_i$ .