2.4

Venn Diagrams with Three Sets
General Procedure for Constructing Venn Diagrams with Three Sets

- When you have elements to place in three sets, work from the inside out.
- Step 1: Find the elements that are common to all three sets and place in region V.
General Procedure for Constructing Venn Diagrams with Three Sets continued

Step 2:

- Find the elements for region II. Find the elements in \( A \cap B \). The elements in this set belong in regions II and V. Place the elements in the set \( A \cap B \) that are not listed in region V in region II. The elements in regions IV and VI are found in a similar manner.
General Procedure for Constructing Venn Diagrams with Three Sets continued

- **Step 3:** Determine the elements to be placed in region I by determining the elements in set A that are not in regions II, IV, and V. The elements in regions III and VII are found in a similar manner.
Step 4: Determine the elements to be placed in region VIII by finding the elements in the universal set that are not in regions I through VII.

TIP: As you work the examples and problems, print out Steps 1-4 from the slides.
Example: Constructing a Venn diagram for Three Sets

Construct a Venn diagram illustrating the following sets.

\[ U = \{1, 2, 3, 4, 5, 6, 7, 8\} \]
\[ A = \{1, 2, 5, 8\} \]
\[ B = \{2, 4, 5\} \]
\[ C = \{1, 3, 5, 8\} \]

Solution:

- Find the intersection of all three sets and place in region V, \( A \cap B \cap C = \{5\} \).
Example: Constructing a Venn diagram for Three Sets continued

- Determine the intersection of sets $A$ and $B$ and place in region II.
  \[ A \cap B = \{2, 5\} \]
  Element 5 has already been placed in region V, so 2 must be placed in region II.

- Now determine the numbers that go into region V.
  \[ A \cap C = \{1, 2, 5, 8\} \]
  Since 5 has been placed in region V, place 1 and 8 in region IV.
Example: Constructing a Venn diagram for Three Sets continued

- Now determine the numbers that go in region VI. $B \cap C = \{5\}$

- There are now new numbers to be placed in this region. Since all numbers in set $A$ have been placed, there are no numbers in region I. The same procedures using set $B$ completes region III. Using set $C$ completes region VII.
Example: Constructing a Venn diagram for Three Sets continued

- The Venn diagram is then completed.
De Morgan’s Laws

- Skip this section
Next Steps

- Read Examples 1-2
- Work Problems in text on p. 71:
  9--12, all; 23-34, all
- Do Online homework corresponding to this section