CHAPTER 2

Set Theory



ALWAYS LEARNING

Copyright © 2015, 2011, 2007 Pearson Education, Inc. \mathbf{P}

2.5

Survey Problems

ALWAYS LEARNING

Copyright © 2015, 2011, 2007 Pearson Education, Inc.

Objectives

- 1. Use Venn diagrams to visualize a survey's results.
- 2. Use survey results to complete Venn diagrams and answer questions about the survey.

Example: Visualizing the Results of a Survey

The results of the survey are summarized in this figure.

a. How many students are willing to donate blood?

Represented by regions I and II.

Thus, n(A) = 370 + 120 = 490.

b. How many are willing to donate blood but not serve breakfast?
Region 1 represents A ∩ B' = 370



- A: Set of students willing to donate blood B: Set of students willing to
 - serve breakfast to donors

Example: Visualizing the Results of a Survey

The results of the survey are summarized in this figure.

- c. How many weren't willing to do either?
 - $A' \cap B'$ is region IV; those areas outside the circles = 290.



- A: Set of students willing to donate blood
- B: Set of students willing to serve breakfast to donors

Copyright © 2015, 2011, 2007 Pearson Education, Inc.

Solving Survey Problems

SOLVING SURVEY PROBLEMS

- 1. Use the survey's description to define sets and draw a Venn diagram.
- 2. Use the survey's results to determine the cardinality for each region in the Venn diagram. Start with the intersection of the sets, the innermost region, and work outward.
- 3. Use the completed Venn diagram to answer the problem's questions.

ALWAYS LEARNING Copyright © 20

Copyright © 2015, 2011, 2007 Pearson Education, Inc.

Example: Surveying People's Attitudes

A survey is taken that asks 2000 randomly selected U.S. and Mexican adults the following question: Do you agree or disagree that the primary cause of poverty is societal injustice?

The results of the survey showed that:

1060 people agreed with the statement

400 Americans agreed with the statement.

If half the adults surveyed were Americans

- a. How many Mexicans agreed with the statement?
- b. How many Mexicans disagreed with the statement?

Solution:

Step 1 Define the sets and draw a Venn diagram.

Set U.S. is the set of Americans surveyed. Set A (labeled "Agree") is the set of people surveyed who agreed with the statement. The area outside the U.S. circle represents the set of Mexicans.



The group of people outside the A circle must be the set of people disagreeing with the statement.

Step 2 Determine the cardinality for each region in the Venn diagram, starting with the innermost region.

We are given the following cardinalities:

- There were 2000 people surveyed: n(U) = 2000.
- Half the people surveyed were Americans: n(U.S.) = 1000.
- The number of people who agreed with the statement was 1060: n(A) = 1060.
- There were 400 Americans who agreed with the statement: $n(U.S. \cap A) = 400$.

Starting with region II and moving outwards to regions I and III, and ending with region IV.



PEARSON Section 2.5, Slide 10

Copyright © 2015, 2011, 2007 Pearson Education, Inc.

ALWAYS LEARNING

- a. The Mexicans who agreed with the statement are shown in region III. This means that 660 Mexicans agreed that societal injustice is the primary cause of poverty.
- b.The Mexicans who disagreed with the statement corresponds to region IV. This means that 340 Mexicans disagreed that societal injustice is the primary cause of poverty.

Example: Constructing a Venn Diagram for a Survey

Sixty people were contacted and responded to a movie survey. The following information was obtained:

- **a.** 6 people liked comedies, dramas, and science fiction.
- **b.** 13 people liked comedies and dramas.
- c. 10 people liked comedies and science fiction.
- **d.** 11 people liked dramas and science fiction.
- e. 26 people liked comedies.
- **f.** 21 people liked dramas.
- g. 25 people liked science fiction.
- Use a Venn diagram to illustrate the survey's results.

The set of people surveyed is a universal set with 60 elements containing three

subsets:

- C = the set of those who like comedies
- D = the set of those who like dramas
- S = the set of those who like science fiction.

Now let's use the numbers in (a) through (g), as well as the fact that 60 people were surveyed, which we call condition (h), to determine the cardinality of each region in the Venn diagram.



ALWAYS LEARNING

Copyright © 2015, 2011, 2007 Pearson Education, Inc.

Example: Using a Survey's Venn Diagram

- The Venn diagram shows the results of the movie survey in the previous Example. How many of those surveyed liked
- **a.** comedies, but neither dramas nor science fiction?



- **b.** dramas and science fiction, but not comedies?
- **c.** dramas or science fiction, but not comedies?
- **d.** exactly one movie style?
- e. at least two movie styles?
- **f.** none of the movie styles?

Example: Using a Survey's Venn Diagram

a. comedies, but neither dramas nor science fiction?

Represented in region I; 9 people



b. dramas and science fiction, but not comedies?Represented in region VI; 5 people

c. dramas or science fiction, but not comedies? $(D \cup S) \cap C'$ 3+5+10=18

ALWAYS LEARNING

Copyright © 2015, 2011, 2007 Pearson Education, Inc.

Example: Using a Survey's Venn Diagram

d. exactly one movie style?

Represented in regions I, III, and VII. There are 9 + 3 + 10 = 22



Section 2.5, Slide 17

e. at least two movie styles? Add the number of elements in regions II, IV, V, & VI: 7 + 4 + 6 + 5 = 22

PEARSON

f. none of the movie styles?Region VIII; 16 people