

Use Venn diagrams to answer each of the following.

1. Ana Pott, a psychology professor at a Southern California college, was planning a study of viewer responses to certain aspects of the movies *Casablanca*, *High Noon*, and *Vertigo*. Upon surveying her class of 55 students, she determined the following data:

17 had seen <i>Casablanca</i>	8 had seen <i>Casablanca</i> and <i>Vertigo</i>
17 had seen <i>High Noon</i>	10 had seen <i>High Noon</i> and <i>Vertigo</i>
23 had seen <i>Vertigo</i>	2 had seen all three of these movies.
6 had seen <i>Casablanca</i> and <i>High Noon</i>	

How many students had seen

- (a) exactly two of these movies? (b) exactly one of these movies?
(c) none of these movies? (d) *Casablanca* but neither of the others?
2. At a Florida community college, half of the 48 mathematics majors were receiving federal financial aid. Of these:

5 had Pell Grants
14 participated in the College Work Study Program
4 had Stafford Loans
2 had Stafford Loans and participated in Work Study.

Those with Pell Grants had no other federal aid.

How many of the 48 math majors had:

- (a) no federal aid?
(b) more than one of these three forms of aid?
(c) federal aid other than these three forms?
(d) a Stafford Loan or Work Study?
3. The following list shows the preferences of 102 people at a wine-tasting party:

99 like Spañada	94 like Ripple and Boone's
96 like Ripple	96 like Spañada and Boone's
99 like Boone's Farm Apple Wine	93 like all three.
95 like Spañada and Ripple	

How many people like:

- (a) none of the three?
(b) Spañada, but not Ripple?
(c) anything but Boone's Farm?
(d) only Ripple?
(e) exactly two kinds of wine?
4. Bob Carlton (Example 3 in the text) was again reassigned, this time to the home economics department of the electric utility. He interviewed 140 people in a suburban shopping center to find out some of their cooking habits. He obtained the following results. Should he be reassigned yet one more time?

58 use microwave ovens	17 use microwave ovens and gas ranges
63 use electric ranges	4 use both gas and electric ranges
58 use gas ranges	1 uses all three
19 use microwave ovens and electric ranges	2 cook only with solar energy

5. A chicken farmer surveyed his flock with the following results. The farmer has:

9 fat red roosters	7 thin brown hens
2 fat red hens	18 thin brown roosters
26 fat roosters	6 thin red roosters
37 fat chickens	5 thin red hens.

Answer the following questions about the flock. [*Hint:* You need a Venn diagram with circles for fat, for male (a rooster is a male, a hen is a female), and for red (assume that brown and red are opposites in the chicken world).] How many chickens are:

- fat?
- red?
- male?
- fat, but not male?
- brown, but not fat?
- red and fat?

6. It was once said that Country-Western songs emphasize three basic themes: love, prison, and trucks. A survey of the local Country-Western radio station produced the following data:

12 songs about a truck driver who is in love while in prison	2 about people in prison who are not in love and do not drive trucks
13 about a prisoner in love	8 about people who are out of prison, are not in love, and do not drive a truck
28 about a person in love	
18 about a truck driver in love	16 about truck drivers who are not in prison.
3 about a truck driver in prison who is not in love	

(a) How many songs were surveyed?

Find the number of songs about:

- truck drivers
- prisoners
- truck drivers in prison
- people not in prison
- people not in love.

7. Nadine Tracy conducted a survey among 75 patients admitted to the cardiac unit of a Massachusetts hospital during a two-week period.

Let B = the set of patients with high blood pressure
 C = the set of patients with high cholesterol levels
 S = the set of patients who smoke cigarettes.

Nadine's data are as follows:

$$n(B) = 47$$

$$n(C) = 46$$

$$n(S) = 52$$

$$n[(B \cap C) \cup (B \cap S) \cup (C \cap S)] = 51$$

$$n(B \cap S) = 33$$

$$n(B \cap C) = 31$$

$$n(B \cap C \cap S) = 21.$$

Find the number of these patients who:

- had either high blood pressure or high cholesterol levels, but not both
- had fewer than two of the indications listed
- were smokers but had neither high blood pressure nor high cholesterol levels
- did not have exactly two of the indications listed.

8. Stacy Thrash, who sells college textbooks, interviewed freshmen on a west coast campus to find out the main goals of today's students.

Let W = the set of those who want to become wealthy
 F = the set of those who want to raise a family
 E = the set of those who want to become experts in their field.

Stacy's findings are summarized here:

$$\begin{aligned} n(W) &= 160 & n(E \cap F) &= 90 \\ n(F) &= 140 & n(W \cap F \cap E) &= 80 \\ n(E) &= 130 & n(E') &= 95 \\ n(W \cap F) &= 95 & n[(W \cup F \cup E)'] &= 10. \end{aligned}$$

Find the total number of students interviewed.

9. Dwaine Tomlinson runs a basketball program in California. On the first day of the season, 60 young men showed up and were categorized by age level and by preferred basketball position, as shown in the following table.

		Position			Totals
		Guard (G)	Forward (F)	Center (N)	
Age	Junior High (J)	9	6	4	19
	Senior High (S)	12	5	9	26
	College (C)	5	8	2	15
Totals		26	19	15	60

Using the set labels (letters) in the table, find the number of players in each of the following sets.

- (a) $J \cap G$ (b) $S \cap N$ (c) $N \cup (S \cap F)$
 (d) $S' \cap (G \cup N)$ (e) $(S \cap N') \cup (C \cap G')$ (f) $N' \cap (S' \cap C')$

10. A study of U.S. Army housing trends categorized personnel as commissioned officers (C), warrant officers (W), or enlisted (E), and categorized their living facilities as on-base (B), rented off-base (R), or owned off-base (O). One survey yielded the following data.

		Facilities			Totals
		B	R	O	
Personnel	C	12	29	54	95
	W	4	5	6	15
	E	374	71	285	730
Totals		390	105	345	840

Find the number of personnel in each of the following sets.

- (a) $W \cap O$ (b) $C \cup B$ (c) $R' \cup W'$
 (d) $(C \cup W) \cap (B \cup R)$ (e) $(C \cap B) \cup (E \cap O)$ (f) $B \cap (W \cup R)'$

In the following exercises, make use of an appropriate formula.

11. Evaluate $n(A \cup B)$ if $n(A) = 8$, $n(B) = 14$, and $n(A \cap B) = 5$.
 12. Evaluate $n(A \cap B)$ if $n(A) = 15$, $n(B) = 12$, and $n(A \cup B) = 25$.