When finding the probability that event *A* occurs or event *B* occurs, find the total of the number of ways *A* can occur and the number of ways *B* can occur, but *find that total in such a way that no outcome is counted more than once.*

One way to formalize the rule is to add the probability of event *A* and the probability of event *B* and, if there is any overlap, compensate by subtracting the probability of outcomes that are included twice, as in the following rule.

Formal Addition Rule

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

where $P(A \text{ and } B)$ denotes the probability that *A* and *B* both occur at the same time as an outcome in a trial of a procedure.

Although the formal addition rule is presented as a formula, blind use of formulas is not recommended. It is generally better to *understand* the spirit of the rule and use that understanding, as follows.

Intuitive Addition Rule

To find $P(A \text{ or } B)$, find the sum of the number of ways event *A* can occur and the number of ways event *B* can occur, *adding in such a way that every outcome is counted only once.* $P(A \text{ or } B)$ is equal to that sum, divided by the total number of outcomes in the sample space.

The addition rule is simplified when the events are *disjoint.*

DEFINITION Events *A* and *B* are **disjoint** (or **mutually exclusive**) if they cannot occur at the same time. (That is, disjoint events do not overlap.)

Example 2 Disjoint Events

Example of disjoint events:	Randomly selecting someone who is a registered Democrat
	Randomly selecting someone who is a registered Republican
	(The selected person *cannot* be both.)
Example of events that are *not* disjoint:	Randomly selecting someone taking a statistics course
	Randomly selecting someone who is a female
	(The selected person *can* be both.)

Figure 4-4 shows a Venn diagram that provides a visual illustration of the formal addition rule. Figure 4-4 shows that the probability of *A* or *B* equals the probability of *A* (left circle) plus the probability of *B* (right circle) minus the probability of *A* and *B* (football-shaped middle region). This figure shows that the addition of the areas of the two circles will cause double counting of the football-shaped middle region. This is the basic concept that underlies the addition rule. Because of the relationship between the addition rule and the Venn diagram shown in Figure 4-4, the notation $P(A \cup B)$ is sometimes used in place of $P(A \text{ or } B)$. Similarly, the

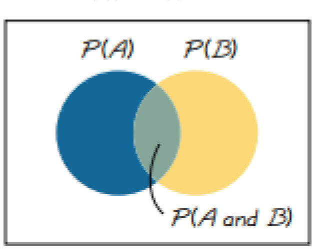

Figure 4-4 Venn Diagram for Events That Are Not Disjoint