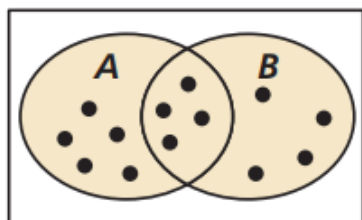
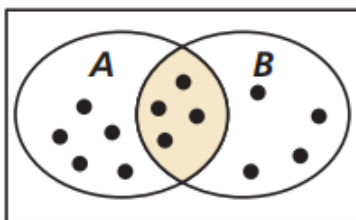
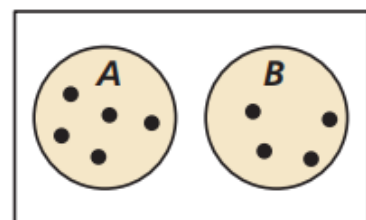


Success Criteria:

- I can identify disjoint (mutually exclusive) events and overlapping events
- I can find the probability of a compound event $P(A \text{ or } B)$
- I can determine if two events are independent
- I can use a probability tree to read conditional probabilities.

Compound Events

When you consider all the outcomes for either of two events A and B , you form the *union* of A and B , as shown in the first diagram. When you consider only the outcomes shared by both A and B , you form the *intersection* of A and B , as shown in the second diagram. The union or intersection of two events is called a **compound event**.

Union of A and B Intersection of A and B Intersection of A and B
is empty.

To find $P(A \text{ or } B)$ you must consider what outcomes, if any, are in the intersection of A and B . Two events are **overlapping** when they have one or more outcomes in common, as shown in the first two diagrams. Two events are **disjoint**, or **mutually exclusive**, when they have no outcomes in common, as shown in the third diagram.

Probability of Compound Events

If A and B are any two events, then the probability of A or B is

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

If A and B are disjoint events, then the probability of A or B is

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

Examples:

Example 1:

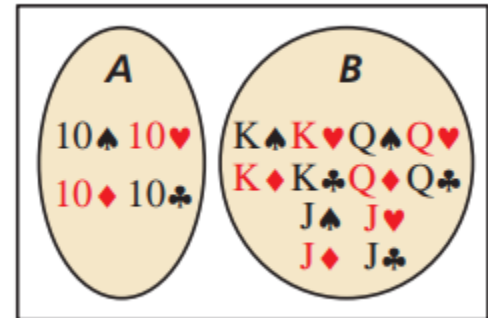
A card is randomly selected from a standard deck of 52 playing cards. What is the probability that it is a 10 or a face card?

Let's Identify the two events:

Event A: selecting a 10

Event B: selecting a face card

Are the above events disjoint? (disjoint is same as mutually exclusive)? Or are the events overlapping? To be overlapping there would have to be a card that is both a 10 as well as a face card. Since that is not possible, we say the events are disjoint.



The Formula for disjoint events: $P(A \text{ or } B) = P(A) + P(B)$

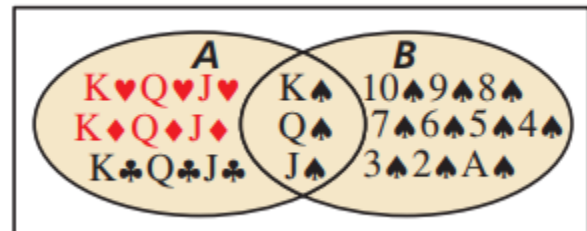
EXAMPLE 2:

A card is randomly selected from a standard deck of 52 playing cards. What is the probability that it is a face card or a spade?

Event A: selecting a face card

Event B: selecting a spade

Because the events have overlap, specifically 3 cards that are both a face card and a spade, we have overlapping events and our formula for the probability:



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

YOU TRY: A card is randomly selected from a standard deck of 52 playing cards. For each scenario given, (a) Draw the venn diagram for event A and event B. (b) State whether the events are disjoining or overlapping. (c) Select the appropriate formula and find the probability.

You Try part one: Find the probability of selecting an Ace or an 8.

Event A: selecting an Ace

Event B: selecting an 8

You Try part Two: Find the probability of selecting a 10 or a diamond.

Event A: selecting a 10

Event B: selecting a diamond

You Try It Part Three:

A bag contains cards numbered 1 through 20. One card is randomly selected. What is the probability that the number on the card is a multiple of 3 or a multiple of 4?

EXAMPLE 3:

Out of 200 students in a senior class, 113 students are either varsity athletes or on the honor roll. There are 74 seniors who are varsity athletes and 51 seniors who are on the honor roll. What is the probability that a randomly selected senior is both a varsity athlete *and* on the honor roll?

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

YOU TRY IT: Out of 45 customers at a breakfast café, 42 customers bought either coffee or orange juice. There were 30 customers who bought orange juice and 40 customers who bought coffee. What is the probability that a randomly selected customer bought both coffee and orange juice?

EXAMPLE 4:

The American Diabetes Association estimates that 8.3% of people in the United States have diabetes. Suppose that a medical lab has developed a simple diagnostic test for diabetes that is 98% accurate for people who have the disease and 95% accurate for people who do not have it. The medical lab gives the test to a randomly selected person. What is the probability that the diagnosis is correct?

Let event A be “person has diabetes” and event B be “correct diagnosis.” Notice that the probability of B depends on the occurrence of A , so the events are dependent. When A occurs, $P(B) = 0.98$. When A does not occur, $P(B) = 0.95$.

We will make a Probability Tree Diagram to help us solve.

YOU TRY IT:

A high school basketball team leads at halftime in 60% of the games in a season. The team wins 80% of the time when they have the halftime lead, but only 10% of the time when they do not. What is the probability that the team wins a particular game during the season?

YOU TRY IT:

A medical association estimates that 10.9% of the people in the United States have a thyroid disorder. Suppose a medical lab has developed a simple diagnostic test that is 96% accurate for people who have the disorder and 99% accurate for people who do not have it. The medical lab gives the test to a randomly selected person. What is the probability that the diagnosis is correct?

