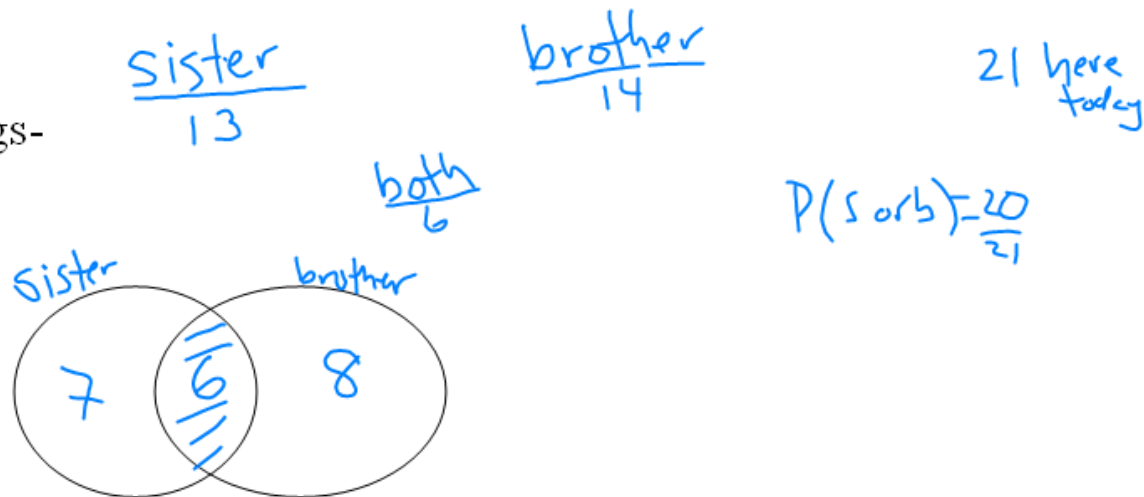


## 10.4 Find Probabilities of Disjoint and Overlapping Events

Example: Siblings-

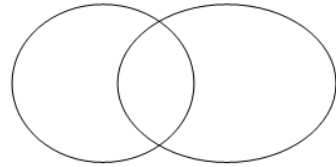


Example:

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

$$\begin{array}{r}
 \text{face card} \quad \text{or} \quad \text{spade} \\
 \frac{12}{52} \quad + \quad \frac{13}{52} \quad - \quad \frac{3}{52} \\
 \phantom{\frac{12}{52}} \phantom{+} \phantom{\frac{13}{52}} \phantom{-} \uparrow \\
 \phantom{\frac{12}{52}} \phantom{+} \phantom{\frac{13}{52}} \phantom{-} \text{overlap}
 \end{array}$$

COMPOUND EVENT: the union (or) or intersection (and) of 2 events.



Two events are OVERLAPPING if they have one or more outcomes in common.

Ex: The probability of rolling a six or an even number on a standard 6 sided die.

Two events are DISJOINT or MUTUALLY EXCLUSIVE if they have no events in common:

Ex: The probability of rolling a six or an odd number on a standard 6 sided die.

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

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

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

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

Example: Find the indicated probability. Are A and B mutually exclusive?

a)  $P(A) = 0.4$

$$P(B) = 0.35$$

$$P(A \text{ OR } B) = 0.5$$

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

$$.5 = .4 + .35 - ?$$

$$.5 = .75 - x$$

$$P(A \text{ and } B) = .25$$

$P(A \text{ and } B)$

b)  $P(A) = 1/3$

$$P(B) = 1/4$$

$$P(A \text{ OR } B) = 7/12$$

Since

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

$$P(A \text{ and } B) = 0$$

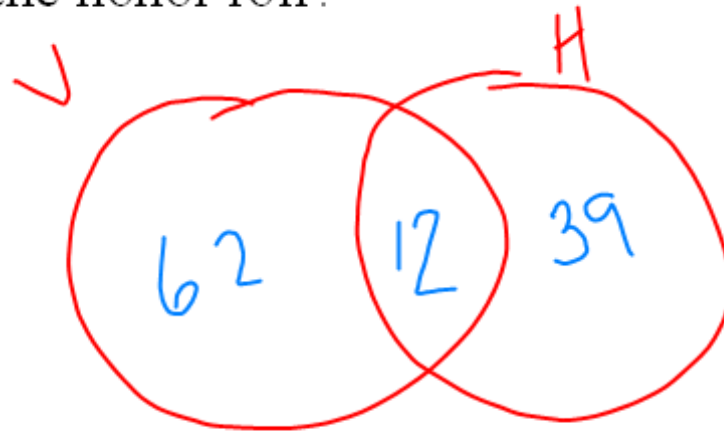
Mutually exclusive

Example: A card is randomly selected from a standard deck of 52 cards. Find the probability of drawing a face card or a diamond.

$$P(\text{face or diam}) = P(\text{face}) + P(\text{diam}) - P(\text{face \& diam})$$
$$\frac{12}{52} + \frac{13}{52} - \frac{3}{52}$$

$$\frac{22}{52} = \left( \frac{11}{26} \right)$$

Example: Out of 200 students in a senior class, there are 74 who are varsity athletes, 51 who are on the honor roll and 12 who are both. Draw a venn diagram. What is the probability that a randomly selected senior is either a varsity athlete or on the honor roll?



$$P(V \text{ or } H) = \frac{113}{200}$$

$$P(V \text{ or } H) = P(V) + P(H) - P(V \& H) = \frac{74}{200} + \frac{51}{200} - \frac{12}{200} = \frac{113}{200}$$

Complements: The event  $\bar{A}$ , called the complement of event  $A$ , consists of all outcomes that are not in  $A$ . (read  $A$  bar)

Probability of the complement:

The probability of the complement of  $A$  is

$$P(\bar{A}) = 1 - P(A)$$

Example: There are 10 people at a dinner party. Find the probability that at least 2 people have the same birthday.

$$1 - \frac{365 P_{10}}{365^{10}}$$

Pg 710 4 - 14 even, 16 - 25, 28 - 30,  
43(draw Venn diagram), 49

**DISJOINT EVENTS** Events  $A$  and  $B$  are disjoint. Find  $P(A \text{ or } B)$ .

3.  $P(A) = 0.3, P(B) = 0.1$

4.  $P(A) = 0.55, P(B) = 0.2$

5.  $P(A) = 0.41, P(B) = 0.24$

6.  $P(A) = \frac{2}{5}, P(B) = \frac{3}{5}$

7.  $P(A) = \frac{1}{3}, P(B) = \frac{1}{4}$

8.  $P(A) = \frac{2}{3}, P(B) = \frac{1}{5}$

**OVERLAPPING EVENTS** Find the indicated probability.

9.  $P(A) = 0.5, P(B) = 0.35$   
 $P(A \text{ and } B) = 0.2$   
 $P(A \text{ or } B) = \underline{\quad ? \quad}$

10.  $P(A) = 0.6, P(B) = 0.2$   
 $P(A \text{ or } B) = 0.7$   
 $P(A \text{ and } B) = \underline{\quad ? \quad}$

11.  $P(A) = 0.28, P(B) = 0.64$   
 $P(A \text{ or } B) = 0.71$   
 $P(A \text{ and } B) = \underline{\quad ? \quad}$

12.  $P(A) = 0.46, P(B) = 0.37$

$P(A \text{ and } B) = 0.31$

$P(A \text{ or } B) = \underline{\quad ? \quad}$

13.  $P(A) = \frac{2}{7}, P(B) = \frac{4}{7}$

$P(A \text{ and } B) = \frac{1}{7}$

$P(A \text{ or } B) = \underline{\quad ? \quad}$

14.  $P(A) = \frac{6}{11}, P(B) = \frac{3}{11}$

$P(A \text{ or } B) = \frac{7}{11}$

$P(A \text{ and } B) = \underline{\quad ? \quad}$

**FINDING PROBABILITIES OF COMPLEMENTS** Find  $P(\overline{A})$ .

16.  $P(A) = 0.5$

17.  $P(A) = 0$

18.  $P(A) = \frac{1}{3}$

19.  $P(A) = \frac{5}{8}$

**CHOOSING CARDS** A card is randomly selected from a standard deck of 52 cards.  
Find the probability of drawing the given card.

20. A king *and* a diamond21. A king *or* a diamond22. A spade *or* a club23. A 4 *or* a 524. A 6 *and* a face card25. *Not* a heart