Chapter 10.4: Find Probabilities of Disjoint and Overlapping Events

A   B $\cup$ → union → or

$\cap$ → intersection → and

B

A

Union of A and B

Overlapping events share at least one outcome.

Disjoint, mutually exclusive, events have no common outcomes.

$$P(A\,or\,B) = P(A) + P(B) - P(A\,and\,B)$$

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

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

$$= \frac{4}{52} + \frac{12}{52} - 0$$

$$= \frac{16}{52} = \boxed{\frac{4}{13}}$$

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

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

$$= \frac{12}{52} + \frac{13}{52} - \frac{3}{52}$$

$$= \frac{22}{52} \quad \boxed{\frac{11}{16}}$$

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 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?

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$\frac{113}{200} = \frac{74}{200} + \frac{51}{200} - X$$

$$\frac{113}{200} = \frac{125}{200} - X \qquad -125$$

$$-\frac{12}{200} = -X \qquad -\frac{125}{200}$$

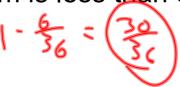$$X = \frac{12}{200} = \frac{6}{100} = \boxed{\frac{3}{50}}$$

The event $\overline{A}$, is called the complement of event A, it consists of all outcomes that are not in A.

ex. When two six-sided dice are rolled, there are 36 possible outcomes. find the probability of the given event.
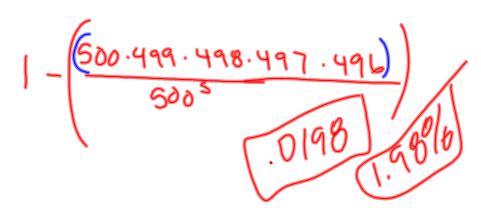
a. The sum is not 6

$$1 - \frac{5}{36} = \frac{31}{36}$$

b. the sum is less than or equal to 9

$$1 - \frac{6}{36} = \frac{30}{36}$$

A restaurant gives a free fortune cookie to every guest. The restaurant claims there are 500 different messages hidden inside the fortune cookies. What is the probability that a group of 5 people receive at least 2 fortune cookies with the same message inside?

$$1 - \left(\frac{500 \cdot 499 \cdot 498 \cdot 497 \cdot 496}{500^5} \right)$$

.0198   1.98%

Homework: Chapter 10.4 pg.710
#'s 4-24e,28,30,38,42