Lesson 14-3

Example 1 Independent Events
A bag contains 12 marbles. Three are green, two are blue, 6 are yellow and 1 is red. Jama chooses one marble, records the color and places it back into the bag. She then chooses another marble. Find the probability that Jama chooses a green marble each time.

$P(A \text{ and } B) = P(A) \cdot P(B)$ — Definition of independent events

$P(\text{green and green}) = \underbrace{P(\text{green})} \cdot \underbrace{P(\text{green})}$

$= 0.25 \cdot 0.25$ — $P(\text{green}) = \frac{3}{12}$ or 0.25

$= 0.0625$ — Multiply.

The probability that Jama will choose a green marble each time is 6.25%.

Example 2 Dependent Events
Four cards are drawn randomly from a standard deck of cards and not replaced. Find the probability if the cards are drawn in the order indicated.

a. ***P*(four, king, queen)**

The selection of the first card affects the selection of the next card since there is one less card from which to choose. So, the events are dependent.

First card: $P(\text{four}) = \frac{4}{52}$ or $\frac{1}{13}$

Second card: $P(\text{king}) = \frac{4}{51}$

Third card: $P(\text{queen}) = \frac{4}{50}$ or $\frac{2}{25}$

$P(\text{four, king, queen}) = P(\text{four}) \cdot P(\text{king}) \cdot P(\text{queen})$

$= \frac{1}{13} \cdot \frac{4}{51} \cdot \frac{2}{25}$ — Substitution.

$= \frac{8}{16575}$ — Multiply.

The probability of drawing four, king, and queen is $\frac{8}{16575}$.

b. ***P*(club, club, red)**

Notice that after selecting a club, not only is there one fewer card from which to choose, there is also one fewer club.

$P(\text{club, club, red}) = P(\text{club}) \cdot P(\text{club}) \cdot P(\text{red})$

$= \frac{13}{52} \cdot \frac{12}{51} \cdot \frac{26}{50}$ — Substitution.

$= \frac{4056}{132600}$ or $\frac{13}{425}$ — Multiply.

The probability of drawing 2 clubs and a red card is $\frac{13}{425}$.

c. ***P*(spade, club, not heart)**

Since the card that is not a heart is selected after the first two cards, there are 39 – 2 or 37 cards that are not hearts.

P(spade, club, not heart) = P(spade) · P(club) · P(not heart)

$$= \frac{13}{52} \cdot \frac{13}{51} \cdot \frac{37}{50} \qquad \text{Substitution}$$

$$= \frac{6253}{132600} \text{ or } \frac{481}{10200} \qquad \text{Multiply.}$$

Example 3 Mutually Exclusive Events

Brad has 25 CD's. Eight are rock, eight are jazz, two are rap and seven are classical. He chooses one CD at random. What is the probability that the CD chosen is a jazz CD or a rap CD?

Since the CD cannot be both a jazz and a rap CD, the events are mutually exclusive.

$P(\text{jazz}) = \frac{8}{25}$ ← number of jazz CDs / ← total number of CDs

$P(\text{rap}) = \frac{2}{25}$ ← number of rap CDs / ← total number of CDs

P(jazz or rap) = P(jazz) + P(rap) Definition of mutually exclusive events

$$= \frac{8}{25} + \frac{2}{25} \qquad \text{Substitution.}$$

$$= \frac{10}{25} \text{ or } \frac{2}{5} \qquad \text{Add.}$$

The probability of choosing a jazz CD or a rap CD is $\frac{2}{5}$.

Example 4 Inclusive Events

There are 26 students in Mr. Collins' English class. Twelve are seniors and fourteen are juniors. Eight of the seniors are boys and six of the juniors are boys. What is the probability that a randomly selected student is a boy or a senior?

Since eight students are boys and seniors, these events are inclusive.

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

P(boy or senior)

= P(boy) + P(senior) – P(boy and a senior)

$$= \frac{14}{26} + \frac{12}{26} - \frac{8}{26} \qquad \text{Substitution.}$$

$$= \frac{14+12-8}{26} \qquad \text{The LCD is 26.}$$

$$= \frac{18}{26} \text{ or } \frac{9}{13} \qquad \text{Simplify.}$$

The probability of a students being a boy or a senior is $\frac{9}{13}$ or about 69%.