# Math 79 HW #1
Dr. Fred Park

1. Section 10.1: 11,12,17,19,20,21,23,25,27,28,29,33,35,38
2. Section 10.2: 8,9,12,16,

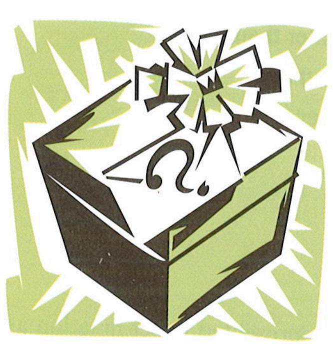
**b.** $A \cup B$ means the event the spinner lands on a number that is even *or* greater than 5 *or* both. Since it is possible for a number to be *both* greater than 5 and also even, $A$ and $B$ are not mutually exclusive events. To find $P(A \cup B)$, therefore, we can first find $P(A \cap B)$. Then we can calculate the probability by using the result $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. $A \cap B$ means the event in which the spinner lands on a number that is even *and* greater than 5. This event can happen in two ways; that is, $A \cap B = \{6, 8\}$. Therefore, $P(A \cap B) = \frac{2}{8}$. Now we have enough information to calculate $P(A \cup B)$:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) = \frac{4}{8} + \frac{3}{8} - \frac{2}{8} = \frac{5}{8}.$$

This result means that about $\frac{5}{8}$ of the time this experiment is performed, the spinner lands on a number that is even or greater than five (or both). The spinner might be expected to land on an even number greater than five $\frac{2}{8}$, or $\frac{1}{4}$, of the time.

**c.** $B \cup C$ means the event the spinner lands on a number that is greater than 5 *or* less than 3. It is impossible for a number to satisfy both conditions, so $B$ and $C$ are mutually exclusive events. Thus, $P(B \cup C) = P(B) + P(C) = \frac{3}{8} + \frac{2}{8} = \frac{5}{8}$. We can verify this result by counting the outcomes in $B \cup C$. Listing the numbers that are greater than 5 or less than 3, we have $B \cup C = \{6, 7, 8, 1, 2\}$. Thus, $P(B \cup C) = \frac{5}{8}$. On the other hand, $B \cap C$ means the event the spinner lands on a number that is greater than 5 *and* also less than 3. Since this cannot happen, $B \cap C = \varnothing$ and $P(B \cap C) = 0$. Thus, $P(B \cup C) = \frac{5}{8}$ means that when the experiment is performed, we expect that the spinner will land on a number greater than 5 or less than 3 about $\frac{5}{8}$ of the time. ■

## SOLUTION OF THE INITIAL PROBLEM



Following a wedding, the attendants for the groom loaded the wedding gifts into a van and took them to the reception hall. After they had taken all the presents into the hall, they noticed that three of the presents did not have gift cards from the senders. They returned to the van and found the three cards, but there was no way to tell which card went with which gift. Slightly flustered, the attendants decided to arbitrarily put a card with each of the untagged gifts. What are the chances that at least one of those gifts was paired with the correct card?

SOLUTION Let $E$ be the event that at least one gift receives the correct card. We will indicate the three gifts by the letters $A$, $B$, and $C$, and their respective cards by $a$, $b$, and $c$. We list all the possible combinations of gifts and cards in Table 10.5. Each line of the table indicates one way in which gifts can be matched with cards. For example, the entry $(B, c)$ means that gift $B$ receives the card that belongs with gift $C$.

**Table 10.5**

| | | |
|---|---|---|
| $(A, a)$ | $(B, b)$ | $(C, c)$ |
| $(A, a)$ | $(B, c)$ | $(C, b)$ |
| $(A, b)$ | $(B, a)$ | $(C, c)$ |
| $(A, b)$ | $(B, c)$ | $(C, a)$ |
| $(A, c)$ | $(B, a)$ | $(C, b)$ |
| $(A, c)$ | $(B, b)$ | $(C, a)$ |

There are six outcomes in the sample space corresponding to the six rows in the table, and only the fourth and fifth lines correspond to all the gifts receiving the wrong cards. In the other four cases, at least one card is matched with the correct gift. We conclude that $P(E) = \frac{4}{6} = \frac{2}{3}$.



# PROBLEM SET 10.1

**Problems 1 through 4**

Calculating probabilities often requires that you perform operations with fractions. The following problems are designed to help you brush up on fractions. Perform the given operations by hand. If the result is a fraction, express it in lowest terms.

**1. a.** $\frac{1}{8} + \frac{3}{4}$ **b.** $\frac{1}{3} + 1 - \frac{11}{15}$

**c.** $\frac{3}{10} \cdot \frac{2}{9}$ **d.** $\dfrac{\frac{4}{7}}{\frac{3}{2}}$

**2. a.** $\frac{2}{3} + \frac{1}{5}$ **b.** $\frac{5}{8} + 1 - \frac{1}{12}$

**c.** $\frac{5}{8} \cdot \frac{4}{15}$ **d.** $\dfrac{\frac{3}{5}}{\frac{2}{3}}$

**3. a.** $\dfrac{\frac{8}{15}}{\frac{11}{45}}$

**b.** $\frac{1}{4} \cdot \frac{2}{5} + \frac{3}{4} \cdot \frac{3}{5}$

**c.** $\frac{1}{3}(240) + \frac{2}{5}(-50)$

**4. a.** $\dfrac{\frac{2}{7}}{1 - \frac{2}{7}}$

**b.** $\frac{2}{3} \cdot \frac{2}{3} + \frac{1}{3} \cdot \frac{2}{3}$

**c.** $\frac{3}{8}(500) + \frac{7}{16}(80) + \frac{3}{16}(-1200)$

**5.** According to the weather report, there is a 20% chance of snow in the county tomorrow. Which of the following statements would be an appropriate interpretation of this statement?

**a.** Out of the next 5 days, it will snow 1 of those days.

**b.** Out of the next 24 hours, snow will fall for 4.8 hours.

**c.** Of past days when conditions were similar, 1 of 5 had some snow in the county.

**d.** It will snow on 20% of the area of the county tomorrow.

**6.** The doctor says, "There is a 40% chance that your problem will get better without surgery." Which of the following statements would be an appropriate interpretation of this statement?

**a.** You can expect to feel 40% better.

**b.** In the future, you will feel better on 2 of every 5 days.

**c.** Among you and the next four other patients with the same problem, two will get better without surgery.

**d.** Among patients with symptoms similar to yours who have participated in research studies of nonsurgical treatments, about 40% got better.

**7.** List the elements of the sample space and one possible event for each of the following experiments.

**a.** A quarter is tossed, and the result is recorded.

**b.** A single die with faces labeled $A, B, C, D, E, F$ is rolled, and the letter on the top face is recorded.

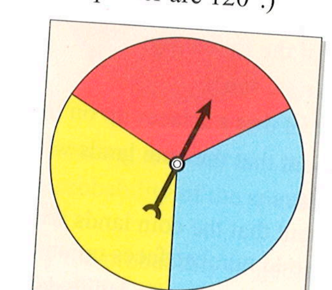
**c.** A telephone number is selected at random from a telephone book, and the fourth digit is recorded.

**8.** List the elements of the sample space and one possible event for each of the following experiments.

**a.** A \$20 bill is obtained from an automatic teller machine, and the right-most digit of the serial number is recorded.

**b.** Some white and black marbles are placed in a jar, mixed, and a marble is chosen without looking. The color of the marble is recorded.

**c.** The following "Red–Blue–Yellow" spinner is spun once, and the color is recorded. (All central angles in the spinner are 120°.)



**9.** An experiment consists of drawing a slip of paper from a bowl in which there are 10 slips of paper labeled $A, B, C, D, E, F, G, H, I$, and $J$ and recording the letter on the paper. List each of the following:

**a.** The sample space

**b.** The event that a vowel is drawn

**c.** The event that a consonant is drawn

**d.** The event that a letter between $B$ and $G$ (excluding $B$ and $G$) is drawn

**e.** The event that a letter in the word ZOOLOGY is drawn

**10.** An experiment consists of drawing a ping-pong ball out of a box in which 12 balls were placed, each marked with a number from 1 to 12, inclusive, and recording the number on the ball. List the following:

**a.** The sample space

**b.** The event that an even number is drawn

**c.** The event that a number less than 8 is drawn

**d.** The event that a number divisible by 2 and 3 is drawn

**e.** The event that a number greater than 12 is drawn

**11.** An experiment consists of tossing four coins and noting whether each coin lands with a head or a tail showing. List each of the following:

**a.** The sample space
**b.** The event that the first coin shows a head
**c.** The event that three of the coins show heads
**d.** The event that the fourth coin shows a tail
**e.** The event that the second coin shows a head and the third coin shows a tail

**12.** An experiment consists of flipping a coin and rolling an eight-sided die and noting whether the coin lands with a head or a tail showing and which number faces up on the die. The eight faces on each die are labeled 1, 2, 3, 4, 5, 6, 7, and 8 as shown.

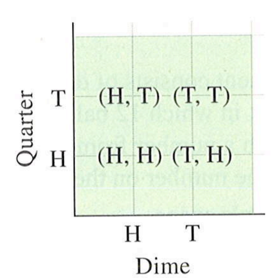
Eight-Sided Die

List each of the following:

**a.** The sample space
**b.** The event that a 2 faces up on the die
**c.** The event that the coin lands with a head showing
**d.** The event that the coin lands with a tail showing and an odd number faces up on the die
**e.** The event that the coin lands with a head showing or a 7 faces up on the die

**Problems 13 and 14**

One way to find the sample space of an experiment involving two parts is to plot the possible outcomes of one part of the experiment horizontally and the outcomes of the other part vertically, then fill in the pairs of outcomes in a rectangular array. For example, suppose that an experiment consists of tossing a dime and a quarter. The sample space could be plotted as:




The sample space of the experiment is {(H, H), (H, T), (T, H), (T, T)}.

**13.** Use the method just described to construct the sample space for the experiment of tossing a coin and rolling a four-sided die with faces labeled 1, 2, 3, and 4.

**14.** Use the method just described to construct the sample space for the experiment of tossing a coin and drawing a marble from a jar containing purple, green, and yellow marbles.

**15.** A standard six-sided die is rolled 60 times with the following results.

| Outcome | Frequency |
|---|---|
| 1 | 10 |
| 2 | 9 |
| 3 | 10 |
| 4 | 12 |
| 5 | 8 |
| 6 | 11 |

**a.** Find the experimental probability of the following events.
**1.** Getting a 4
**2.** Getting an odd number
**3.** Getting a number greater than 3
**b.** Based on the experimental probability in (a), if the die is rolled 250 times, how many times would you expect to get an even number?

**16.** A dropped thumbtack will land with the point up or the point down. The results for tossing a thumbtack 60 times are as follows.

| Outcome | Frequency |
|---|---|
| Point up | 42 |
| Point down | 18 |

**a.** What is the experimental probability that the thumbtack lands
**1.** point up?
**2.** point down?
**b.** Based on the experimental probability in (a), if the thumbtack is tossed 100 times, about how many times would you expect it to land
**1.** point up?
**2.** point down?



**17.** An experiment consists of tossing three fair coins.
**a.** List the outcomes in the sample space and the theoretical probability for each outcome in a table.
**b.** Find the theoretical probability for the event of getting at least one head.
**c.** Find the theoretical probability for the event of getting exactly two heads.

**18.** A jar contains three marbles: one red, one green, and one yellow. An experiment consists of drawing a marble from the jar, noting its color, placing it back in the jar, mixing, and drawing a second marble.
**a.** List the outcomes in the sample space and the theoretical probabilities for each outcome in a table.
**b.** Find the theoretical probability for the event of getting at least one red marble.
**c.** Find the theoretical probability for the event of getting no red marbles.

**Problems 19 and 20**

Refer to Example 10.2(d), which gives the sample space for the experiment of rolling two standard dice. Assume the dice are fair, and give the theoretical probabilities of the listed events.

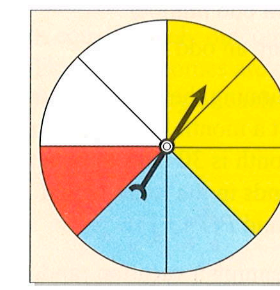
**19. a.** Getting a 4 on the second die
**b.** Getting an even number on each die
**c.** Getting a total of at least 7 dots
**d.** Getting a total of 15 dots

**20. a.** Getting a 5 on the first die
**b.** Getting an even number on one die and an odd number on the other die
**c.** Getting a total of no more than 7 dots
**d.** Getting a total greater than 1

**21.** An experiment consists of rolling two standard dice and noting the numbers that show on the top faces. Assume the dice are fair.
**a.** List the elements in the sample space.
**b.** Find the theoretical probability of the event that the product of the two numbers is even.
**c.** Find the theoretical probability of the event that the product of the two numbers is odd.
**d.** Find the theoretical probability of the event that the product of the two numbers is a multiple of 5.

**22.** An experiment consists of rolling an eight-sided die and a standard six-sided die and noting the numbers that show on the top faces. Assume the dice are fair.
**a.** List the elements in the sample space.
**b.** Find the theoretical probability of the event that the sum of the two numbers is greater than 6.
**c.** Find the theoretical probability of the event that the sum of the two numbers is less than 7.
**d.** Find the theoretical probability of the event that the product of the two numbers is a multiple of 5.

**23.** Refer to the following spinner.
**a.** What is the probability of the spinner landing on yellow?
**b.** Explain why the probability of getting white is the same as the probability of getting blue.



**24.** Refer to the preceding spinner.
**a.** What is the probability of the spinner landing on white?
**b.** Explain why the probability of getting red is less than the probability of getting any other color.

**Problems 25 and 26**

Two twelve-sided dice having the numbers 1–12 on their faces are rolled and the numbers facing up are added. Assume the dice are fair and find the probabilities for the listed events.

Twelve-Sided Die

**25. a.** The total is 5.
**b.** The total is a perfect square.
**c.** The total is a prime number.

**26. a.** The total is 11.
**b.** The total is a multiple of 7.
**c.** The total is even or 19.

**27.** A six-sided die is constructed that has two faces marked with 2s, three faces marked with 3s, and one face marked with a 5. If this die is rolled once, find the following probabilities:

**a.** Getting a 2

**b.** Not getting a 2

**c.** Getting an odd number

**d.** Not getting an odd number

**28.** A 12-sided die is constructed that has three faces marked with 1s, two faces marked with 2s, three faces marked with 3s, and four faces marked with 4s. If this die is rolled once, find the following probabilities:

**a.** Getting a 4

**b.** Not getting a 4

**c.** Getting an odd number

**d.** Not getting an odd number

**29.** A couple planning their wedding decides to randomly select a month in which to marry. If $T$ is the event the month is 30 days long, and $Y$ is the event the month ends in the letter $y$, find and interpret $P(T)$, $P(Y)$, and $P(T \cup Y)$.

**30.** A family planning a vacation randomly selects one of the states in the United States as their destination. If $O$ is the that event the state borders the Pacific Ocean and $N$ is the event that the state's name contains the word "New," find and interpret $P(O)$, $P(N)$, and $P(O \cup N)$.

**31.** In a class consisting of girls and boys, 6 of the 14 girls and 7 of the 11 boys have done their homework. A student is selected at random. Consider the following events.

*G:* The student is a girl.

*D:* The student has done his or her homework.

**a.** Find $P(G)$ and $P(D)$.

**b.** Find and interpret $P(G \cup D)$ and $P(G \cap D)$.

**c.** Are events $G$ and $D$ mutually exclusive? Explain.

**32.** For an experiment in which a fair coin is tossed and a fair standard die is rolled, consider the following events.

*H:* The coin lands heads up.

*F:* The die shows a number greater than 4.

**a.** Find $P(H)$ and $P(F)$.

**b.** Find and interpret $P(H \cup F)$ and $P(H \cap F)$.

**c.** Are events $H$ and $F$ mutually exclusive?

**33.** Consider the sample space for the experiment in Example 10.2(c) and the following events.

*A:* getting a green on the first spin

*B:* getting a yellow on the second spin

**a.** Find $P(A)$, $P(B)$, $P(A \cap B)$, and $P(A \cup B)$.

**b.** Verify that the equation $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ holds for the probabilities in part (a).

**34.** Suppose a jar contains 20 marbles, numbered 1 through 20, with each odd-numbered marble colored red, and each even-numbered marble colored black. A marble is drawn from the jar and its color and number are noted.

**a.** List the sample space.

**b.** Consider the following events.

*A:* getting a black marble

*B:* getting a number divisible by 3

Find $P(A)$, $P(B)$, $P(A \cap B)$, and $P(A \cup B)$.

**c.** Verify that the equation $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ holds for the probabilities in part (b).

**35. a.** Suppose 45% of people have blood type O. Let $E$ be the event that a person has type O blood. Describe $\overline{E}$ and find $P(\overline{E})$.

**b.** Approximately 8% of babies are born left-handed. Let $F$ be the event that a baby is left-handed. Describe $\overline{F}$ and find $P(\overline{F})$.

**36.** Based on research conducted after the 1989 Loma Prieta earthquake, U.S. Geological Survey (USGS) results indicate that there is a 62% probability of at least one quake of magnitude 6.7 or greater striking the San Francisco Bay region before 2032. Describe the complement of this event and give its probability.

**37.** In Example 10.6, a jar contains four marbles: one red, one green, one yellow, and one white. Two marbles are drawn from the jar, one after another, without replacing the first one drawn. Let $A$ be the event the first marble is green, let $B$ be the event the first marble is green and the second marble is white, and let $C$ be the event the second marble is red.

**a.** Are events $B$ and $C$ mutually exclusive? Explain.

**b.** Are events $A$ and $C$ mutually exclusive? Explain.

**c.** Describe in words the complement of event $A$.

**d.** Find the probability of the event $A$ and the event $\overline{A}$.

**e.** Verify that the equation $P(\overline{A}) = 1 - P(A)$ holds for the probabilities you found in (d).



**38.** A card is drawn from a standard deck. Consider the sample space in Figure 10.4. Let $A$ be the event the card is a diamond, let $B$ be the event the card is a club, and let $C$ be the event the card is a jack, queen, or king.

**a.** Are events $A$ and $B$ mutually exclusive? Explain.

**b.** Are events $A$ and $C$ mutually exclusive? Explain.

**c.** Describe in words the complement of event $A$.

**d.** Find the probability of the event $A$ and the event $\overline{A}$.

**e.** Verify that the equation $P(\overline{A}) = 1 - P(A)$ holds for the probabilities you found in (d).

**39.** Consider the experiment of randomly placing one car (C) and two goats (G) behind three curtains so that one object is behind each curtain. The results are recorded in order.

**a.** List all possible outcomes in the sample space.

**b.** Let $E$ be the event the car is hidden behind curtain number 1. List the outcome(s) of the sample space that correspond to event $E$.

**c.** Describe $\overline{E}$ and list the outcome(s) of the sample space that correspond to $\overline{E}$.

**d.** Find $P(E)$ and $P(\overline{E})$.

**40.** Consider the experiment of randomly placing one silver dollar (D) and three rocks (R) inside four drawers so that one object is in each drawer. The results are recorded in order.

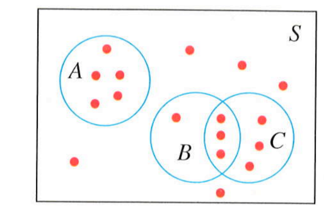
**a.** List all possible outcomes in the sample space.

**b.** Let $E$ be the event the silver dollar is hidden in the first drawer. List the outcome(s) of the sample space that correspond to event $E$.

**c.** Describe $\overline{E}$ and list the outcome(s) of the sample space that correspond to $\overline{E}$.

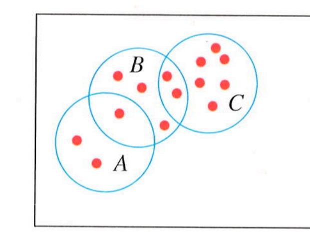
**d.** Find $P(E)$ and $P(\overline{E})$.

**41.** Consider the sample space $S$, as shown, for an experiment with equally likely outcomes. Events $A$, $B$, and $C$ are indicated. Outcomes are represented by points. Find the probability of each of the following events.




**a.** $A$ **b.** $B$ **c.** $C$ **d.** $S$
**e.** $A \cup B$ **f.** $B \cap C$ **g.** $A \cap C$ **h.** $\overline{A}$
**i.** $\overline{B}$ **j.** $\overline{C}$

**42.** Consider the sample space $S$, as shown, for an experiment with equally likely outcomes. Events $A$, $B$, and $C$ are indicated. Outcomes are represented by points. Find the probability of each of the following events.




**a.** A **b.** B **c.** C **d.** S
**e.** $A \cup B$ **f.** $B \cap C$ **g.** $A \cap C$ **h.** $\overline{A}$
**i.** $\overline{B}$ **j.** $\overline{C}$

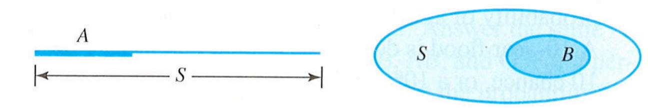
## Extended Problems

**Problems 43 and 44**

When the probability of an event is proportional to a measurement such as length or area, the probability is determined as follows. Let $A$ be an event that can be measured as a length or as an area. Let $m(A)$ and $m(S)$ represent the measure of the event $A$ and of the sample space $S$, respectively. Then

$$P(A) = \frac{m(A)}{m(S)}.$$

For example, in the following figure marked (a), if the length of $S$ is 12 cm and the length of $A$ is 4 cm, then $P(A) = \frac{4}{12} = \frac{1}{3}$. Similarly, in the figure marked (b), if the area of region $B$ is 10 square centimeters and the area of the region $S$ is 60 square centimeters, then $P(B) = \frac{10}{60} = \frac{1}{6}$.




(a) (b)

a “W” at the end of a branch indicates that you win with that outcome. When we add the probabilities at the ends of each branch labeled L, we see that the probability the game ends as a loss is $\frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{8} + \frac{1}{16} + \frac{1}{16} = \frac{11}{16}$, while the probability is only $\frac{5}{16}$ that you will win. Because the chances of losing are more than twice the chance of winning, a payoff of two dollars against our one-dollar bet does not seem like a good deal. If you only want to play when the game is “fair,” you should not take the bet.

## PROBLEM SET 10.2

**Problems 1 and 2**

Draw one-stage tree diagrams to represent the possible outcomes of the given experiments.

**1. a.** Toss one dime and observe whether the coin lands heads or tails.

**b.** Pull a dollar bill from your wallet, and note the last digit in the serial number.

**2. a.** Draw a marble from a bag containing red, green, black, and white marbles, and observe the color.

**b.** Open a yearlong wall calendar and note the month.

**Problems 3 and 4**

Draw two-stage tree diagrams to represent the possible outcomes of the given experiments.

**3. a.** Toss a coin twice, and observe on each toss whether the coin lands heads or tails.

**b.** Select paint colors for an historic home from navy, stone, peach or blue and then select trim colors from light gray, rosedust, or ivory.

**4. a.** Draw a marble from a box containing yellow and green marbles and observe the color. Then draw a marble from a box containing yellow, red, and blue marbles and observe the color.

**b.** Build a computer and printer package, choosing a computer from Dell, Apple, or Hewlett Packard and a printer from Epson, Brother, or Hewlett Packard.

**5.** Different branches on a tree diagram need not have the same number of stages. For example, suppose that from a box containing one red, one white, and one blue ball, we will draw balls (without replacement) until the red ball is chosen. Draw the tree diagram to represent the possible outcomes of this experiment.

**6.** Tree diagrams need not be finite. For example, consider the experiment of tossing a coin until it lands heads. This usually takes only a few tosses (in fact, two on average), but it could take any number of tosses. Draw at least three stages of the tree diagram representing the possible outcomes of this experiment to show the pattern.

**7.** For your vacation, you will travel from your home to New York City, then to London. You may travel to New York City by car, train, bus, or plane, and from New York to London by ship or plane.

**a.** Draw a tree diagram to represent all possible travel arrangements.

**b.** How many different travel arrangements are possible?

**c.** Apply the Fundamental Counting Principle to find the number of possible travel arrangements. Does your answer agree with your result in part (b)?

**8.** Suppose that a frozen yogurt dessert can be ordered in three sizes (small, medium, large), two flavors (vanilla, chocolate), and with any one of four topping options (plain, sprinkles, hot fudge, chocolate chips).

**a.** Draw a tree diagram to represent all possible yogurt desserts.

**b.** How many different desserts are possible?

**c.** Apply the Fundamental Counting Principle to find the number of possible desserts. Does your answer agree with your result in part (b)?

**9.** An experiment consists of tossing a coin and then rolling two dice. How many outcomes are possible for the following? Use the Fundamental Counting Principle.

**a.** tossing the coin

**b.** rolling the first die

**c.** rolling the second die

**d.** conducting the experiment

standard deck, flipping a coin, and spinning a three-color spinner. How many outcomes are possible for the following? Use the Fundamental Counting Principle.

**a.** selecting the card

**b.** tossing the coin

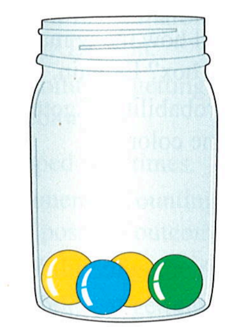
**c.** spinning the spinner

**d.** conducting the experiment

**11.** One marble is selected from each of the following containers.

**a.** Draw a one-stage probability tree diagram and find the probability of drawing the blue marble.

**b.** Draw a one-stage probability tree diagram and find the probability of drawing the blue marble. Find the probability of drawing a yellow marble. Find the probability of drawing the blue marble or a yellow marble.



containers.

**a.** Draw a one-stage probability tree diagram and find the probability of drawing the blue marble.

**b.** Draw a one-stage probability tree diagram and find the probability of drawing a red marble. Find the probability of drawing a yellow marble. Find the probability of drawing a red marble or a yellow marble.

**13.** Refer to the container from problem 11(b). A marble is drawn and replaced, and then a second marble is drawn.

**a.** Draw a two-stage probability tree diagram to represent this experiment.

**b.** What is the probability that both marbles selected are yellow?

**c.** What is the probability that the second marble selected is blue?

**d.** What is the probability that both selected marbles are the same color?

**e.** Repeat the problem if a marble is drawn and *not* replaced, and then a second marble is drawn.

**14.** Refer to the container from problem 12(b). A marble is drawn and replaced, and then a second marble is drawn.

**a.** Draw a two-stage probability tree diagram to represent this experiment.

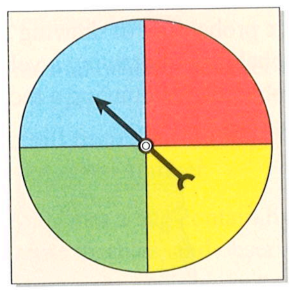
**b.** What is the probability that both marbles selected are red?

**c.** What is the probability that the second marble selected is green?

**d.** What is the probability that both selected marbles are the same color?

**e.** Repeat the problem if a marble is drawn and *not* replaced, and then a second marble is drawn.

**15.** The following spinner is spun twice.



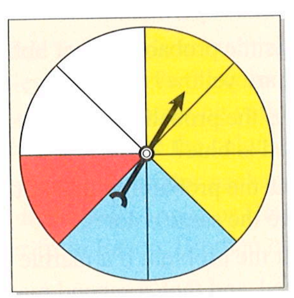
**a.** Draw a two-stage probability tree diagram to represent this experiment.

**b.** Find the probability the spinner lands on yellow both times.

**c.** Find the probability the spinner lands on red on the second spin.

**d.** Find the probability the spinner lands on blue and then green or lands on green and then blue.

**16.** The following spinner is spun twice.



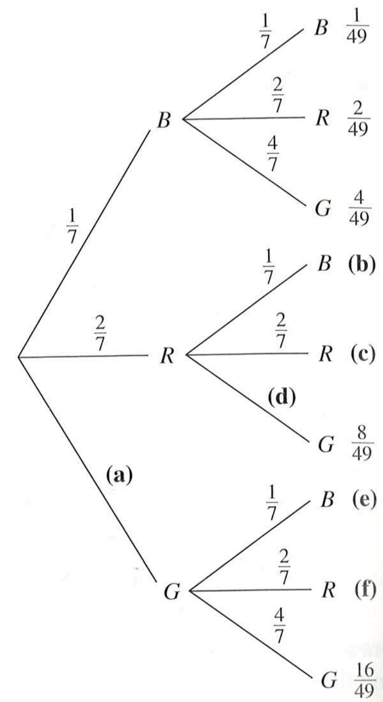
**a.** Draw a two-stage probability tree diagram to represent this experiment.

**b.** Find the probability the spinner lands on yellow both times.

**c.** Find the probability the spinner lands on red on the second spin.

**d.** Find the probability the spinner lands on blue and then yellow or lands on yellow and then red.

**17.** Consider the following two-stage probability tree diagram for the experiment of drawing two marbles from a box. The diagram is unfinished. Fill in the missing probabilities for parts (a) through (f) to complete the diagram.




**g.** How many outcomes are in the sample space?

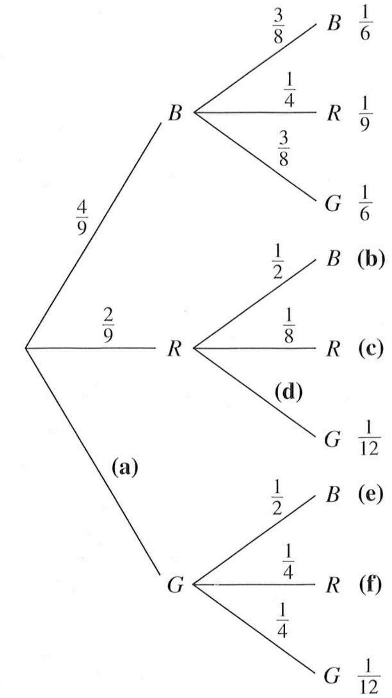
**h.** Were the marbles drawn with replacement or without replacement? Explain.

**i.** Can you tell how many marbles of each type were in the box? Explain.

**j.** Find the probability of getting two marbles that are the same color.



**18.** Consider the following two-stage probability tree diagram for the experiment of drawing two marbles from a box. The diagram is unfinished. Fill in the missing probabilities for parts (a) through (f) to complete the diagram.




**g.** How many outcomes are in the sample space?

**h.** Were the marbles drawn with replacement or without replacement? Explain.

**i.** Can you tell how many marbles of each type were in the box? Explain.

**j.** Find the probability of getting two marbles that are the same color.

**19.** A fair coin is flipped four times.

**a.** Use the Fundamental Counting Principle to find the number of possible outcomes.

**b.** Find the probability of getting four heads.

**c.** Find the probability of getting exactly two heads.

**d.** Find the probability of getting exactly three tails.

**20.** A bowl contains three marbles (red, blue, green). A box contains four numbered tickets (1, 2, 3, 4). One marble is selected at random, and then a ticket is selected at random.

**a.** Use the Fundamental Counting Principle to find the number of possible outcomes.

**b.** Find the probability that the green marble is selected.

**c.** Find the probability that the ticket numbered 2 is selected.

**d.** Find the probability that the red marble and the ticket numbered 3 are selected.

**21.** A box of 20 chocolates contains three different varieties: nut-filled, nougat, and caramel, but all the chocolates appear identical on the outside. Near the nutrition information, the package reads "This box contains 10% nut-filled, 30% caramel, and 60% nougats." Suppose you select two chocolates.

**a.** How many stages does this experiment have?

**b.** How many chocolates of each type are in the box?

**c.** Create the probability tree diagram for this experiment.

**d.** Find the probability of selecting two nut-filled chocolates.

**e.** Find the probability of selecting a caramel and a nut-filled chocolate.

**f.** Find the probability of selecting a nougat or a caramel.

**22.** While planning the landscaping for your front yard, you select tulip bulbs at a nursery. Your plan is to plant 10 red and 8 white tulips in one flower bed and to plant 2 purple tulips in a small pot near your door. On the way home from the nursery, the bulbs roll out of their bags in the trunk and are mixed up. You cannot predict the color of the tulips just by looking at the bulbs. Suppose you select 2 bulbs to plant in the pot.

**a.** How many stages does this experiment have?

**b.** Create the probability tree diagram for this experiment.

**c.** How many outcomes are there in the sample space?

**d.** Find the probability that both bulbs are purple.

**e.** Find the probability of selecting a red and a white bulb.

**f.** Find the probability of selecting a purple or a red bulb.

**23.** A pinochle deck contains 48 cards. The cards are arranged in the usual four suits. Each suit contains two of each of the following cards: 9, 10, jack, queen, king, and ace. Suppose two cards are drawn without replacement from a standard pinochle deck.

**a.** How many outcomes are possible for this experiment?

**b.** How many outcomes correspond to the event that both cards are face cards?

**c.** What is the probability that both cards are face cards?

**d.** What is the probability of getting a pair?

**e.** What is the probability of getting an identical pair of cards?

**24.** Consider the experiment of drawing two cards without replacement from a standard deck of 52 cards.

**a.** How many outcomes are possible for this experiment?

**b.** How many outcomes correspond to the event that the cards are both face cards?

**c.** What is the probability that both cards are face cards?

**d.** What is the probability of getting a pair?

**e.** Find the probability of drawing two cards that have the same suit.

**25.** A light bulb is selected from box 1 and another from box 2. In box 1, 30% of the bulbs are defective. In box 2, 45% of the bulbs are defective. Each of the selected bulbs is recorded as defective or not defective.

**a.** Draw a probability tree diagram for this experiment.

**b.** Find the probability that both bulbs are defective.

**c.** Find the probability that the first bulb is defective and the second is not defective.

**26.** While still half asleep, you randomly select a black sock from your drawer. After you remove that sock, the drawer contains two white socks and four more black socks. Without replacement you continue to randomly select one sock at a time from your drawer until another black sock is selected. Draw a probability tree diagram to represent this experiment. Find the probability of each of the following events.

**a.** Exactly one draw is needed to get another black sock.

**b.** Exactly two draws are needed to get another black sock.

**c.** Exactly three draws are needed to get another black sock.

**27.** A game at a carnival consists of throwing darts at balloons. Eight balloons are arranged in such a way that the player will always pop one of them. The popped balloon is replaced after each dart is thrown. Two stars are hidden behind the balloons. If the player pops a balloon that reveals a star, he wins a prize. A player pays 50¢ for three darts. Assuming that skill is not involved, find the probability that the player

**a.** wins a prize (gets a star) after just one shot.

**b.** wins in exactly two shots.

**c.** wins in exactly three shots.

**d.** does not win.

**28.** As a Back-to-School promotion, a cereal manufacturer distributes 350,000 boxes of cereal that contain prizes. Fifty boxes contain a certificate for a free desktop computer. Fifty thousand boxes contain a certificate for a dictionary. The rest of the boxes contain a CD spelling program. Suppose you select two boxes.

**a.** Find the probability that you win two computers.

**b.** Find the probability that you win a computer and a CD spelling program.

**c.** Find the probability that you win at least one CD spelling program.

**d.** Find the probability that you win two dictionaries.

**29.** Each individual letter of the word MISSISSIPPI is placed on a piece of paper, and all 11 pieces of paper are placed in a bowl. Two letters are selected at random from the bowl without replacement. Find the probability of

**a.** selecting the two Ps.

**b.** selecting the same letter in both selections.

**c.** selecting two consonants.

**30.** Four families get together for a barbecue. Every member of each family puts his or her name in a hat for a prize drawing. The Martell family has three members, the Werner family four, the Borschowa family four, and the Griffith family six. Two names are drawn from the hat. Find the probability of

**a.** selecting two members of the Borschowa family.

**b.** selecting two members from the same family.

**c.** selecting two members from different families.

**31.** A pair of dice is constructed so that each die is marked with a 1 on one side, a 2 on two sides, and a 3 on three sides. The dice are rolled. Find the probability that

**a.** two 3s are rolled.

**b.** the same number appears on each die.

**c.** two odd numbers are rolled.

**32.** A pair of dice is constructed as in problem 31. The two dice are rolled. What is the probability that

**a.** neither die shows a 2?

**b.** the numbers showing on the two dice are different?

**c.** one die shows an odd number and the other shows an even number?