

# Chapter 10

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**Chapter  
10****Probability and Statistics**

Dear Family,

When you plan an outdoor event like a picnic, you cannot be certain that the weather will cooperate. Almost immediately, you begin to wonder—will it be warm or cool? sunny or cloudy? dry or rainy? There is no way to be certain, so you turn to the weather forecast to find out what is likely. When weather forecasters say there is a 60% chance of rain, do you ever wonder how they know? The weather report introduces you to the concept of probability.

The National Weather Service keeps track of daily conditions. They record the temperature, humidity, air pressure, and other data, including the weather produced by those conditions. The forecasters compare this historical data with current conditions and may see that out of 100 days with similar conditions, 60 of them were rainy days.

In probability, a *favorable outcome* is the result you are looking for, such as the number of rainy days. The ratio of the favorable outcome to the total number of outcomes is the probability.

$$\frac{\text{number of favorable outcomes}}{\text{total number of outcomes}} = \frac{\text{days with rain}}{\text{total days}} = \frac{60}{100} = 0.6 = 60\%$$

The next time you are relying on good weather, you may want to do your own research. You and your student can think about these topics:

- *The Farmer's Almanac* provides historical weather information, such as the number of times it rained on a given date. Use this information to determine the probability that it will rain on the date of your event.
- For some events, like a pool party or a picnic by the lake, you may want to get a sense of what the temperature will be. What is the probability that the temperature will be above 70 degrees the day of your event?
- What other conditions and probabilities do you want to know?

You might revise your plans if the conditions aren't favorable.

Pick a favorable day and then enjoy your picnic! Remember to watch for ants—they are almost certain to attend!

**Capítulo**  
**10****Probabilidad y estadística**

Estimada Familia:

Cuando planea un evento al aire libre, como por ejemplo un picnic, no se puede saber si el clima va a cooperar. Casi inmediatamente, uno empieza a preguntarse—¿habrá frío o calor?, ¿estará soleado o nublado?, ¿seco o mojado? No hay modo de estar seguro, por lo que uno observa el pronóstico del tiempo para ver cómo estará. Cuando los pronosticadores del tiempo dicen que hay 60% de probabilidades de lluvia, ¿alguna vez se han preguntado como lo saben? El informe del tiempo lo introduce al concepto de la probabilidad.

El Servicio de Pronósticos Nacionales hace un seguimiento de las condiciones diarias. Registran la temperatura, humedad, presión del aire y otros datos, incluyendo el tiempo producido por tales condiciones. Los pronosticadores comparan estos datos históricos con condiciones actuales y observan que por cada 100 días con condiciones similares, 60 de ellos fueron días lluviosos.

$$\frac{\text{número de resultados favorables}}{\text{número total de resultados}} = \frac{\text{días lluviosos}}{\text{días totales}} = \frac{60}{100} = 0.6 = 60\%$$

La próxima vez que tengan que contar con un buen clima, querrán hacer su propia investigación. Usted y su estudiante pueden pensar acerca de estos temas:

- *El Almanaque del Granjero* proporciona información histórica del clima, como por ejemplo el número de veces que llovió en una fecha dada. Usen esta información para determinar la probabilidad de lluvia en la fecha de su evento.
- Para algunos eventos, como por ejemplo una fiesta al lado de la piscina o un picnic por el lago, querrán saber cómo será la temperatura. ¿Cuál es la probabilidad de que la temperatura esté por encima de los 70 grados el día de su evento?
- ¿Qué otras condiciones y probabilidades desea saber?

Querrán revisar sus planes si las condiciones no son favorables.

¡Elijan un día favorable y luego disfruten su picnic! Recuerden revisar que no haya hormigas—¡por lo general suelen asistir también!

**Activity  
10.1****Start Thinking!**

For use before Activity 10.1

If you flip a penny, how many possible results are there?

If you flip a penny and a nickel, how many possible results are there?

If you flip two pennies, how many possible results are there?

**Activity  
10.1****Warm Up**

For use before Activity 10.1

**Simplify the fraction.**

1.  $\frac{12}{50}$

2.  $\frac{14}{28}$

3.  $\frac{16}{20}$

4.  $\frac{5}{25}$

5.  $\frac{18}{30}$

6.  $\frac{24}{42}$

**Lesson**  
**10.1**

**Start Thinking!**

For use before Lesson 10.1

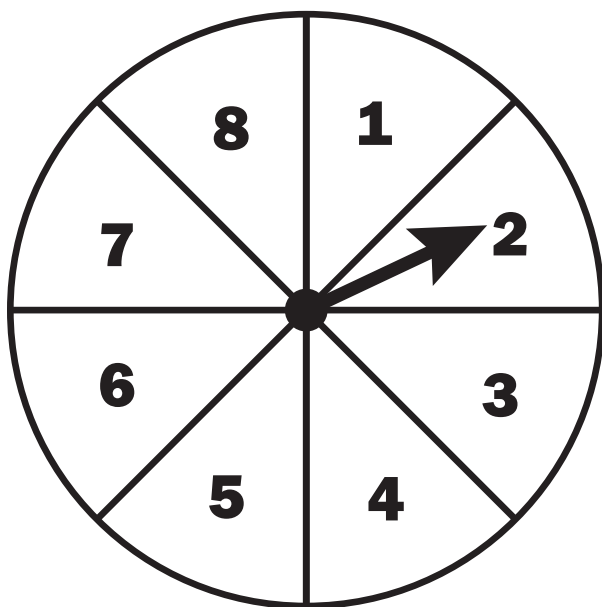
Design a spinner for a board game with different colored regions in which all of the results for spinning are equally likely. Discuss the possible results.

**Lesson**  
**10.1**

**Warm Up**

For use before Lesson 10.1

**You spin the spinner shown.**



1. How many possible results are there?
2. Of the possible results, in how many ways can you spin an even number? an odd number?

**10.1 Practice A**

You randomly choose one of the tiles shown below. Find the favorable outcomes of the event.



1. Choosing a 4
2. Choosing an even number
3. Choosing a number less than 2
4. Choosing an odd number greater than 6
5. Choosing a number divisible by 2
6. Choosing a number greater than 10

You randomly choose one shape from the bag.

(a) Find the number of ways the event can occur.

(b) Find the favorable outcomes of the event.

7. Choosing a triangle
8. Choosing a star
9. Choosing *not* a square
10. Choosing *not* a circle
11. A beverage cooler contains bottles of orange juice and apple juice. There are 44 bottles in the cooler.
  - a. You are equally likely to randomly choose a bottle of orange juice or a bottle of apple juice from the cooler. How many of the bottles are apple juice?
  - b. Two of the bottles of orange juice are replaced with apple juice. How many ways can you randomly choose a bottle of apple juice from the cooler?
12. Three girls and four boys made the final round of the spelling bee.
  - a. How many ways can you randomly choose a girl to be the first contestant?
  - b. Given that part (a) occurred, how many ways can you randomly choose a girl to be the second contestant?



**10.1 Practice B**

You randomly choose one of the tiles shown below. Find the favorable outcomes of the event.



1. Choosing an 8
2. Choosing an even number less than 7
3. Choosing a 5 or a 7
4. Choosing a number divisible by 11
5. Choosing a number that begins with the letter T
6. Choosing a number that doesn't contain line segments

You randomly choose one shape from the bag.  
(a) Find the number of ways the event can occur.  
(b) Find the favorable outcomes of the event.



7. Choosing a triangle
8. Choosing a star
9. Choosing *not* a square
10. Choosing *not* a circle
11. There are 12 cats and 7 dogs at the Humane Society.
  - a. In how many ways can the first customer randomly choose a cat?
  - b. In how many ways can the second customer randomly choose a dog?
  - c. In how many ways can the third customer randomly choose a dog?
  - d. In how many ways can the fourth customer randomly choose a dog?
  - e. When the fifth customer arrives, what are the favorable outcomes of randomly choosing a dog?

## 10.1 Enrichment and Extension

### Counting Jasmine's Rectangular Designs

Jasmine has just been hired to work for a company that designs patios and walkways. Her first assignment is to make pictures of walkway and patio designs that can be made with their new decorative square stones. She needs to make one picture for each of the possible rectangles that can be made with 30 to 40 stones. Jasmine decides to put each rectangular design on a separate card. (*Note:* A rectangle that is 5 stones wide and 6 stones long is the same as one that is 6 stones wide and 5 stones long.)

1. How many cards will Jasmine have to make? List the dimensions of all the different rectangles that can be made with 30 to 40 stones.
2. Jasmine dropped her cards and one of them was ruined.
  - a. Is it more likely that the ruined card has an odd or even number of square stones in the design? Explain your reasoning.
  - b. Is it more likely that the ruined card has more or less than 35 square stones in the design? Explain your reasoning.
3. A customer wants to buy the number of blocks between 30 and 40 that will give her the most options for a rectangular patio or walkway. How many should she buy? Explain your reasoning.
4. Another customer wants to make a rectangular walkway that is between 2 and 5 blocks wide. He's not sure how long he wants to make it, but he wants to buy some blocks to set out in the space in order to visualize his options before making his decision. He wants to have at least 30 stones and at least six options to consider. What is the least number of blocks that he should buy? Explain your reasoning.
5. The side length of the square stones is 9 inches. A customer wants to make a patio that is 3 feet 3 inches by 5 feet 9 inches. The stones can be cut in halves, quarters, or thirds.
  - a. Draw a picture showing how many full and partial squares he will need to make the patio.
  - b. How many stones will he need to buy in order to have the least waste?
  - c. How many stones will he need to have cut and to what sizes? How many stone pieces will he have left over, and what sizes will they be?



# 10.1 Puzzle Time

## What Is Brown, Has A Hump, And Lives At The North Pole?

Circle the letter of each correct answer in the boxes below. The circled letters will spell out the answer to the riddle.

**You randomly pick a card out of a deck of 52 cards. Find the number of ways the event can occur.**

- 1. Choosing a spade
- 2. Choosing an ace
- 3. Choosing *not* a king
- 4. Choosing a red card
- 5. Choosing a heart that is a face card
- 6. Choosing *not* a diamond

**Your teacher randomly selects among the following names to be your partner in a project: Girls—Amanda, Meredith, Erin, Gail, and Mackenzie; Boys—Scott and Peter. Find the number of ways the event can occur.**

- 7. Choosing a girl
- 8. Choosing *not* a girl
- 9. Choosing Meredith
- 10. Choosing *not* Peter

**You randomly choose one month to celebrate a family reunion. Find the number of ways the event can occur.**

- 11. Choosing a month after March
- 12. Choosing a month before September
- 13. Choosing *not* December
- 14. Choosing *not* June or July

T	B	A	R	C	H	V	I	E	M	L	R	S	Y	D	F	O
7	32	4	41	16	36	10	22	13	21	42	2	17	8	15	33	12
G	L	Y	O	J	S	T	W	A	C	D	A	R	M	E	S	L
20	9	14	3	44	5	48	19	35	11	24	39	40	1	26	18	6

**Activity  
10.2****Start Thinking!**

For use before Activity 10.2

You have one number cube to roll and a friend has two number cubes to roll. Explain who has a better chance of rolling a 4.

**Activity  
10.2****Warm Up**

For use before Activity 10.2

**Determine whether the fraction is in lowest terms. If not, simplify the fraction.**

1.  $\frac{6}{14}$

2.  $\frac{12}{27}$

3.  $\frac{7}{10}$

4.  $\frac{24}{35}$

5.  $\frac{16}{25}$

6.  $\frac{22}{44}$

**Lesson**  
**10.2**

**Start Thinking!**

For use before Lesson 10.2

Explain how a weather forecaster might use probability.

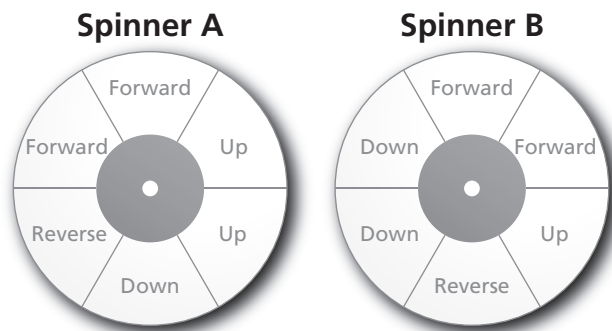
**Lesson**  
**10.2**

**Warm Up**

For use before Lesson 10.2

**You are playing a game using the spinners shown.**

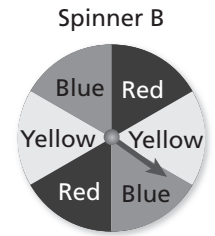
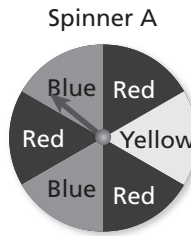
1. You want to move up.  
On which spinner are you more likely to spin “Up”? Explain.
2. You want to reverse.  
Which spinner would you spin? Explain.



**10.2 Practice A**

You are playing a game using the spinners shown.

1. You want to spin red. Which spinner should you spin? Explain.
2. You want to spin yellow. Which spinner should you spin? Explain.
3. You want to spin blue. Does it matter which spinner you spin? Explain.



Describe the likelihood of the event given its probability.

4. The probability that it will snow today is zero.
5. You make a free throw 70% of the time.
6. Your band marches in  $\frac{1}{6}$  of the parades.

You randomly choose one song from a collection of 4 country songs, 2 jazz songs, 3 rock songs, and 1 pop song. Find the probability of the event.

7. Choosing a jazz song
8. Choosing a pop song
9. *Not* choosing a country song
10. Choosing a blues song
11. Your football team has a 75% chance of winning a game. Your team is scheduled to play 16 games. Estimate how many games your team will win.
12. In a classroom, the probability that the teacher chooses a boy from 20 students is 0.45.
  - a. How many students are *not* boys?
  - b. Describe the likelihood of *not* choosing a boy.
13. A box contains ten slips of paper numbered 1 through 10. Find the probability and describe the likelihood of each event.
  - a. Choosing a number greater than 2
  - b. Choosing a number that is a multiple of 2
  - c. Choosing a number that is less than 10

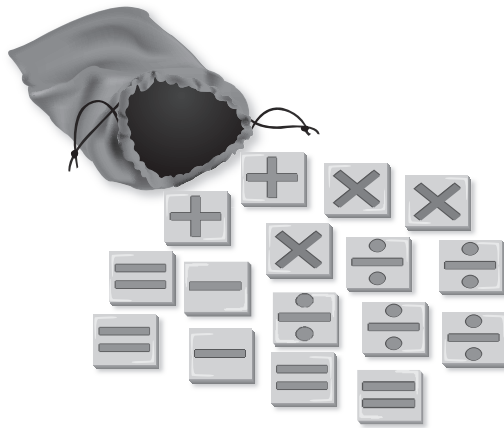
**10.2 Practice B**

Describe the likelihood of the event given its probability.

1. The school bus arrives late  $\frac{2}{7}$  of the time.
2. The probability that it rains during a hurricane is 1.
3. There is an 85% chance that you will go to the concert.

You randomly choose one mathematical operator from the collection.  
Find the probability of the event.

4. Choosing a multiplication sign
5. Choosing a plus sign
6. *Not* choosing an equal sign
7. *Not* choosing a greater than sign



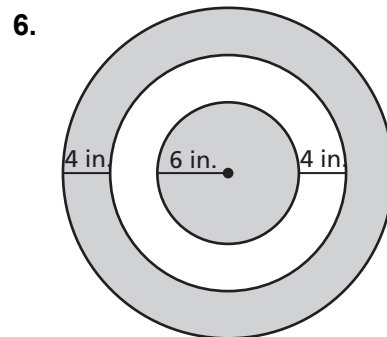
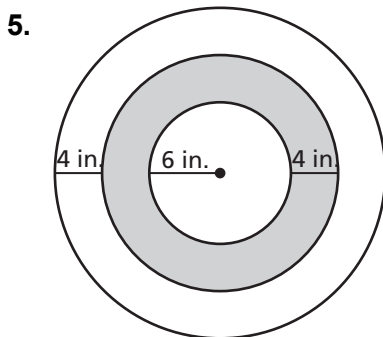
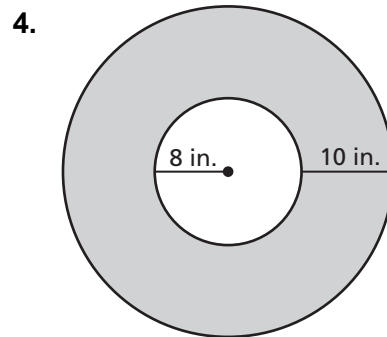
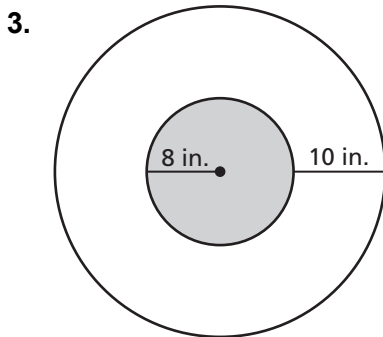
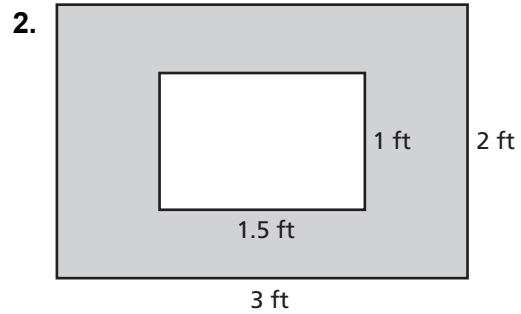
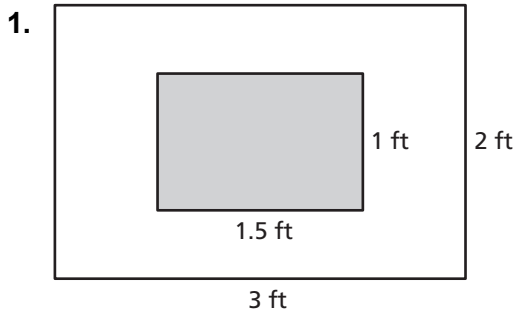
8. One-half of the boxes of cereal contain a prize.
  - a. Find the probability of winning a prize.
  - b. Find the probability of *not* winning a prize.
  - c. If you purchased two boxes of cereal, estimate the number of prizes you would receive.
9. A store has 30 blue pens, 18 black pens, and 12 red pens in stock. You buy 3 blue pens, 9 black pens, and 3 red pens. Find the probability of each event before and after your purchase. Then describe how your purchase affects the probability of each event.
  - a. Randomly choosing a blue pen
  - b. Randomly choosing a black pen
  - c. Randomly choosing a red pen

# 10.2

## Enrichment and Extension

### Geometric Probability

Assume that a dart thrown at the target is equally likely to hit anywhere on the target. The probability  $P$  that the dart lands in the shaded region is  $P = \frac{\text{area of shaded region}}{\text{total area of target}}$ . Find the probability that the dart lands in the shaded region.



# 10.2 Puzzle Time

## Did You Hear About The...

A	B	C	D	E	F
G	H	I	J	K	L
M	N				

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

$\frac{3}{4}$ SHE
Likely WENT
$\frac{1}{4}$ BYTE
$\frac{3}{20}$ COMPUTER
$\frac{11}{20}$ GET
0 BECAUSE
Unlikely ROCK
$\frac{13}{20}$ HE
$\frac{1}{20}$ HOW
$\frac{7}{20}$ THE

**Describe the likelihood of the event given its probability.**

- A. You take the bus home from school  $\frac{1}{4}$  of the time.
- B. The probability your favorite show is on tonight is 0.
- C. 50% of the time you flip a coin you flip tails.
- D. Your team wins the swim meets  $\frac{4}{5}$  of the time.
- E. The probability that the cafeteria will have milk is 1.

**An MP3 player has 60 songs stored on it. Of the songs, 21 are rock, 9 are rap, 18 are dance, and 12 are country. If songs are played randomly, find the probability of each event.**

- F. A rock song is played.
- G. A rap song is played.
- H. A dance song is played.
- I. A country song is played.
- J. A rock song is *not* played.
- K. Either a dance song or rap song is played.
- L. Either a rock song or country song is played.
- M. A country song is *not* played.
- N. A song is played.

$\frac{1}{100}$ WHERE
$\frac{1}{5}$ SO
Impossible STAR
1 GIG
Certain TO
$\frac{3}{10}$ STORE
$\frac{9}{20}$ COULD
$\frac{9}{10}$ MUSIC
Equally Likely to Happen or Not Happen WHO
$\frac{4}{5}$ A

**Activity  
10.3****Start Thinking!**

For use before Activity 10.3

You have a bag filled with 6 red marbles, 4 blue marbles, and 8 yellow marbles. Explain to a partner how to find the probability of pulling out a red marble.

**Activity  
10.3****Warm Up**

For use before Activity 10.3

**A number cube is rolled. Determine the probability of each event.**

1. Rolling a 5
2. Rolling an even number
3. Rolling a 3 or 4
4. Rolling a 6
5. Rolling a 1, 5, or 6
6. Rolling an odd number



**Lesson  
10.3****Start Thinking!**

For use before Lesson 10.3

Review with a partner how to find relative frequency. Use an example to explain.

**Lesson  
10.3****Warm Up**

For use before Lesson 10.3

**You have three sticks. Each stick has one red side and one blue side. You throw the sticks 10 times and record the results. Use the table to find the relative frequency of the event.**

1. Tossing 3 red
2. Tossing 1 red, 2 blue
3. Tossing 1 blue, 2 red
4. *Not* tossing all red

<b>Outcome</b>	<b>Frequency</b>
3 red	2
3 blue	4
1 red, 2 blue	0
1 blue, 2 red	4

## 10.3 Practice A

You have two sticks. Each stick has one blue side and one pink side. You throw the sticks 10 times and record the results. Use the table to find the experimental probability of the event.

Outcome	Frequency
2 blue	1
2 pink	3
1 blue, 1 pink	6

- Tossing 2 pink
- Tossing 1 blue and 1 pink
- Not tossing all pink
- You check 15 bananas. Six of the bananas are bruised.
  - What is the experimental probability that a banana is bruised?
  - What is the experimental probability that a banana is *not* bruised?
- Sixteen students have cell phones. Five of the cell phones have touch screens.
  - What is the experimental probability that a student's cell phone has a touch screen?
  - Out of 144 students' cell phones, how many would you expect to have touch screens?

You flip a coin twice. You repeat this process 12 times. The table gives the results.

Outcome	Frequency
2 Heads	2
1 Head, 1 Tail	7
2 Tails	3

- Use the first table to find the experimental probability of each outcome.
- Based upon experimental probability, which outcome is most likely?
- The second table gives the possible outcomes of flipping a coin twice. Each of these outcomes is equally likely. What is the theoretical probability of flipping 1 tail?
- Compare your answers to Exercises 7 and 8.

1st Flip	2nd Flip
Head	Head
Head	Tail
Tail	Head
Tail	Tail

**10.3 Practice B**

You have four sticks. Two sticks have one blue side and one pink side. One stick has 2 blue sides. One stick has 2 pink sides. You throw the sticks 20 times and record the results. Use the table to find the experimental probability of the event.

Outcome	Frequency
3 blue, 1 pink	7
2 blue, 2 pink	9
1 blue, 3 pink	4

1. Tossing 1 pink and 3 blue
2. Tossing the same number of blue and pink
3. *Not* tossing 3 pink
4. Tossing at most 2 blue
5. You check 30 containers of yogurt. Seven of them have an expiration date within the next 3 days.
  - a. What is the experimental probability that a container of yogurt will have an expiration date within the next 3 days?
  - b. Out of 120 containers of yogurt, how many would you expect to have an expiration date within the next 3 days?
6. The plant produces 1200 packages of grapes. An inspector randomly chooses 24 packages and discovers that 8 of the packages have broken seals. How many of the 1200 packages of grapes would you expect to have broken seals?
7. You flip 3 coins 50 times, and flipping 3 tails occurs 6 times.
  - a. What words above refer to the *total number of trials*?
  - b. What words above refer to the *number of times the event occurs*?
  - c. What words above refer to the *event*?
  - d. What is the experimental probability that you flip 3 tails?
  - e. How many times would you expect to flip 3 tails out of 200 trials of flipping 3 coins?

## 10.3 Enrichment and Extension

### What's the Difference?

Many card games involve making choices based on how likely it is to choose a certain card. By performing an experiment with a regular deck of cards, you will be finding the probability of certain outcomes when cards are chosen at random. A deck of cards has 4 suits. Each suit has 13 cards: a Jack, Queen, King, Ace, and the numbers 2 through 10. For this experiment, the Ace is worth 1, the Jack is worth 11, the Queen is worth 12, and the King is worth 13.

**Experiment Directions:** Put all of the cards face down and spread them out. Choose two cards at random. Find the absolute value of the difference between the values of the cards. Replace the two cards. Mix the cards and repeat.

**Answer Exercises 1 and 2 before performing the experiment.**

1. Make a list of all the possible outcomes and design a frequency table to record your results.
2. Make some predictions. Will all the outcomes be equally likely? If not, what outcomes will be most likely? least likely? Explain your reasoning.
3. Perform the experiment at least 60 times. Record the results in your frequency table from Exercise 1.
4. Make a bar graph of your results. Compare your results with your classmates. Were they similar? Explain.
5. Describe any patterns you notice. Did they fit your predictions? What outcomes are most likely? least likely? Explain.
6. Explain why it would be difficult to find theoretical probability for this situation.
7. What is the advantage to doing a large number of trials? Explain why doing more trials is especially important for this experiment.
8. You want to change the experiment. Instead of taking the absolute value of the difference, this time you will take the value of the first card minus the value of the second card. How would this change your results? Explain.
9. A friend asks you to play the following game. Two cards are chosen at random. If the absolute value of the difference is between 1 and 6, Player 1 gets a point. If the absolute value of the difference is between 7 and 12, Player 2 gets a point. If the difference is zero, both players get a point. Replace the cards, shuffle, and repeat. The first person to get 10 points wins. Explain why this game is not fair. Rewrite the rules to make the game more fair.

# 10.3 Puzzle Time

## Who Kept Tom Sawyer Cool In The Summertime?

Write the letter of each answer in the box containing the exercise number.

You randomly pick a nut from a can of mixed nuts 20 times and record the results: 5 almonds, 6 peanuts, 2 hazelnuts, 3 pecans, and 4 cashews. Find the experimental probability of the event.

- |                                 |                                  |
|---------------------------------|----------------------------------|
| 1. Choosing an almond           | 2. Choosing a peanut             |
| 3. Choosing a peanut or cashew  | 4. Choosing <i>not</i> an almond |
| 5. Choosing <i>not</i> a peanut | 6. Choosing a walnut             |

You pour 50 nuts into a bowl. Use the results from the example above to make the following predictions.

- How many peanuts would you expect to be in the bowl?
- How many almonds and pecans would you expect to be in the bowl?
- How many nuts that are *not* a peanut would you expect to be in the bowl?

You and your friends decide to play hide-and-seek. In a plastic container, there are 2 blue flashlights, 4 green flashlights, 1 red flashlight, 3 white flashlights, and 2 black flashlights. Find the theoretical probability of the event.

- |                                 |   |
|---------------------------------|---|
| 10. Choosing a green flashlight | 11. Choosing a black flashlight                   |
| 12. Choosing a red flashlight   | 13. Choosing a flashlight that is <i>not</i> blue |
14. The theoretical probability of choosing a green marble is  $\frac{1}{3}$ . If there are 6 marbles in the bag, how many marbles would you expect to be green?

Answers	
C. $\frac{3}{4}$	E. 0
B. $\frac{1}{3}$	A. 2
U. 15	Y. 20
E. $\frac{1}{4}$	R. $\frac{1}{6}$
K. $\frac{1}{12}$	H. 35
L. $\frac{3}{10}$	F. $\frac{5}{6}$
R. $\frac{1}{2}$	N. $\frac{7}{10}$

9	7	4	12	2	6	10	1	11	3	8		13	14	5
---	---	---	----	---	---	----	---	----	---	---	--	----	----	---

**Activity  
10.4****Start Thinking!**

For use before Activity 10.4

Make a list of your two favorite ice cream flavors and your four favorite ice cream toppings.

You are allowed one ice cream flavor and one topping.

Make a list of your choices. How many choices are there?

**Activity  
10.4****Warm Up**

For use before Activity 10.4

**Multiply.**

**1.**  $3 \times 4 \times 5$

**2.**  $7 \times 3 \times 6$

**3.**  $5 \times 5 \times 4$

**4.**  $9 \times 10 \times 12$

**5.**  $15 \times 10 \times 9$

**6.**  $7 \times 6 \times 12$

**Lesson**  
**10.4****Start Thinking!**

For use before Lesson 10.4

You have 5 pairs of jeans, 4 T-shirts, and 3 pairs of shoes. Find how many outfit combinations are possible. Explain how you got your answer.

**Lesson**  
**10.4****Warm Up**

For use before Lesson 10.4

1. A lock is numbered from 0 to 9. Each combination uses three numbers in a right, left, right pattern. Find the total number of possible combinations for the lock.

**10.4 Practice A**

Use a tree diagram to find the sample space and the total number of possible outcomes.

1.

Pet	
<b>Animal</b>	Hamster, Guinea Pig, Snake
<b>Name</b>	Lucky, Shadow, Smokey, Max

2.

Ice Cream	
<b>Cone</b>	Waffle, Sugar
<b>Flavor</b>	Chocolate, Vanilla, Strawberry

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

3.

Pizza	
<b>Size</b>	Small, Medium, Large
<b>Crust</b>	Thin, Thick, Regular

4.

Car	
<b>Transmission</b>	Automatic, Manual
<b>Doors</b>	2-door, 4-door
<b>Color</b>	Red, Blue, Black, White

5. You are taking a true-false test that has 10 questions. Assuming you answer every question, in how many different ways can the test be completed?
6. A game system allows players to design a personal picture. Each picture is designed by choosing from male or female, 8 face shapes, 48 eyes, 12 noses, 24 mouths, and 82 hair styles. How many different pictures are possible?



# 10.4 Practice B

Use a tree diagram to find the sample space and the total number of possible outcomes.

1.

Vacation	
Destination	Amusement Park, Zoo, Beach
Transportation	Car, Plane

2.

Game	
Coin	Quarter, Dime, Nickel, Penny
Card	King, Queen, Jack

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

3.

Computer	
Hard Drive	200 GB, 400 GB
Monitor	17-inch, 20-inch, 22-inch, 24-inch

4.

Sandwich	
Bread	Italian, Wheat
Meat	Ham, Roast Beef, Salami
Cheese	American, Provolone, Swiss


5. You need to hang seven pictures in a straight line.
- In how many ways can this be accomplished?
  - If the picture of your great-grandfather must be in the middle, how many ways can the seven pictures be hung?
6. A license plate must contain two letters followed by four digits. How many license plates are possible? If the rule changed to five digits instead of four digits, how many more license plates would be possible?



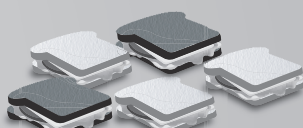
## 10.4 Enrichment and Extension

### Sandwich Shop

A local sandwich shop is running a sandwich special for lunch. A customer can build his or her own sandwich using the choices in the table. The customer selects one item from each category.



## Mel's Sandwich Shop



Bread	Filling	Cheese	Condiments
White	Ham	American	Ketchup
Wheat	Roast Beef	Provolone	Mayonnaise
Sandwich Bun	Tuna Fish	Pepper Jack	Mustard
Pita	Turkey	No Cheese	No Condiment

**Lunch special: \$3.75**

Vegetables may be added free of charge at the self-serve veggie station.  
Make your lunch sandwich into a combo platter for an additional \$1.00!

Use the menu board to answer the questions.

1. How many different sandwiches can you make from the choices on the menu board?
2. The sandwich shop has several customers that are vegetarians. In place of the fillings listed on the menu, the sandwich shop uses a vegetable spread on these orders. How many different vegetarian sandwiches can you make from the choices on the menu board?
3. Customers at the sandwich shop have the option of making their sandwiches into combo platters by adding their choice of chips, pretzels, or an apple.
  - a. How will the addition of the side choices change the total number of combinations calculated in Exercise 1?
  - b. How many combo platters are possible using the choices on the menu board?
4. A customer orders a ham sandwich on wheat bread. Draw a tree diagram that illustrates the possible sandwiches that could result from the order.
5. What is the probability of a customer ordering a ham sandwich on wheat bread with ketchup and no cheese?

# 10.4 Puzzle Time

## What Is An Ant Dictator?

Write the letter of each answer in the box containing the exercise number.

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

1. A restaurant offers five flavors of milkshakes. There are three sizes for each flavor.
2. Students were asked to schedule one from each category: chorus or band; French, Spanish, or German; art, wood shop, or physical education.
3. When ordering a birthday cake, you will need to choose one from each category: white, chocolate, or marble cake; raspberry or strawberry filling; white or buttercream frosting;  $\frac{1}{4}$  or  $\frac{1}{2}$  sheet cake.
4. Your seventh grade class is selling apparel with the school mascot to raise money for a class trip. The sizes are small, medium, large, or extra large. You can choose a T-shirt, a long-sleeved shirt, or a sweatshirt.
5. Each school lunch includes a choice of a main entrée, vegetable, fruit, and beverage. Today, the main entrées are spaghetti, fish sandwich, or cheeseburger. The vegetables are corn, green beans, or carrots. The fruit is an apple or a banana. The beverages are milk or juice.
6. You roll a number cube and flip a coin. What is the probability of rolling an even number and flipping tails?
7. You roll a number cube and flip a coin. What is the probability of rolling a number less than 5 and flipping tails?

Answers	
A.	18
R.	12
C.	$\frac{1}{2}$
Y.	$\frac{1}{4}$
A.	15
T.	36
K.	20
T.	$\frac{1}{3}$
N.	24

2		7	6	4	1	3	5
---	--	---	---	---	---	---	---

**Activity  
10.5****Start Thinking!**  
For use before Activity 10.5

Think about the words independent and dependent. What do they mean?

Give an example of a time in which you were independent. Give an example of a time in which you were dependent.

**Activity  
10.5****Warm Up**  
For use before Activity 10.5

**You randomly choose one marble from a bag containing 5 blue marbles, 2 red marbles, 2 green marbles, and 1 purple marble. Find the favorable outcomes of the event.**

1. Choosing a blue marble
2. Choosing a red marble
3. Choosing a green marble
4. Choosing a purple marble
5. *Not* choosing a blue marble
6. *Not* choosing a red marble

**Lesson  
10.5****Start Thinking!**

For use before Lesson 10.5

You have a bag of marbles. You draw a marble, set it aside, and draw a second marble. Your friend says the events are independent. Is your friend correct? Explain.

**Lesson  
10.5****Warm Up**

For use before Lesson 10.5

**Tell whether the events are *independent* or *dependent*. Explain.**

1. You roll a number cube twice. The first roll is a 3 and the second roll is an odd number.
2. You flip a coin twice. The first flip is heads and the second flip is tails.
3. You randomly draw a marble from a bag containing 3 red marbles and 5 blue marbles. You keep the marble and then draw a second marble.
4. You randomly draw a marble from a bag containing 6 red marbles and 2 blue marbles. You put the marble back and then draw a second marble.



# 10.5

## Practice B

Tell whether the events are *independent* or *dependent*. Explain.

1. You throw the bowling ball at the pins. You have two throws to knock down ten pins.

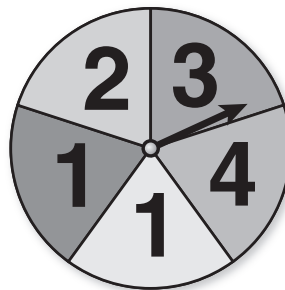
First Throw: You knock down 6 pins.      Second Throw: You knock down 1 pin.

2. You roll a number cube twice.

First Roll: You roll an odd number.      Second Roll: You roll a number less than 2.

You spin the spinner and flip a coin. Find the probability of the compound event.

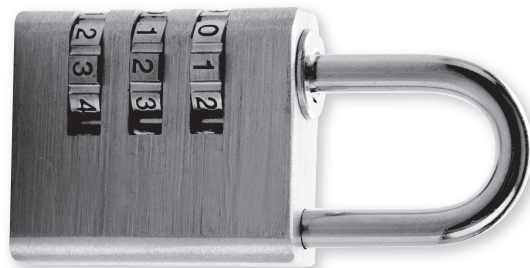
3. Spinning a 1 and flipping tails
4. *Not* spinning an even number and flipping heads



You randomly choose one of the tiles. Without replacing the first tile, you choose a second tile. Find the probability of the compound event.



5. Choosing tiles whose sum is 12
6. Choosing a 6 and then a number greater than 4
7. You randomly draw two cards from a standard deck of 52 cards. What is the probability you draw two hearts?
8. You forgot the combination for your lock. Each wheel has the numbers 0 through 9. What is the probability that you guess the combination correctly?



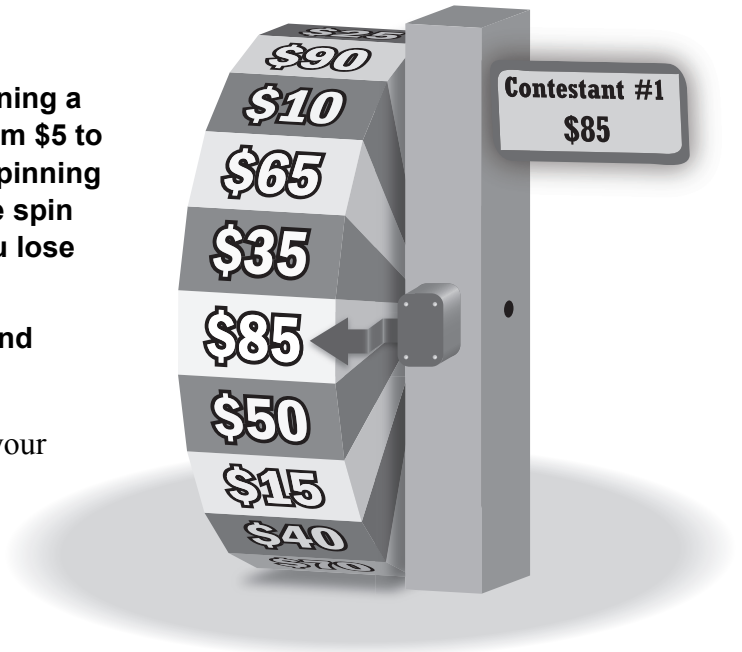
9. A license plate has two letters followed by three digits. What is the probability that the numbers on the license plate are all odd numbers?

## 10.5 Enrichment and Extension

### Winning on a Game Show

You are on a game show. You are spinning a wheel that has 20 sections, ranging from \$5 to \$100 in increments of \$5. You win by spinning more points than your opponent in one spin or a combination of two spins. But, you lose if you exceed \$100.

Your opponent spins \$85 in one spin and decides not to spin again.



1. What is the probability that you tie your opponent on the first spin?
2. How many values on the wheel are greater than \$85? What is the probability that you win on your first spin?
3. How many values on the wheel are less than \$85? What is the probability that you spin less than your opponent on your first spin?
4. You spin \$35 on your first spin.
  - a. What values on the wheel would make you win on your second spin?
  - b. What is the probability that the wheel lands on a winning section on your second spin?
5. You spin \$60 on your first spin.
  - a. What values on the wheel would make you win on your second spin?
  - b. What is the probability that the wheel lands on a winning section on your second spin?
6. What do you notice about the probabilities in Exercises 2, 4(b), and 5(b)? Explain any similarity.
7. You spin less than \$85 on your first spin. What is the probability that the wheel lands on a winning section on your second spin?

Your opponent's score is given. (a) Find the probability that you win after one spin. (b) Find the probability that you spin a lesser amount on your first spin, and then win on your second spin.

8. \$75

9. \$45

10. \$90

11. \$25





## Puzzle Time

### What Animal Goes “Baa-Baa-Woof?”

Write the letter of each answer in the box containing the exercise number.

**You roll a number cube once and flip a coin. Find the probability of the compound event.**

- Rolling a factor of 12 and flipping tails
- Rolling a perfect square and flipping heads

**You have a bag that contains 7 red marbles and 5 blue marbles. You randomly choose one of the marbles. Without replacing the first marble, you choose a second marble. Find the probability of the events.**

- Choosing a red marble and then a blue marble
- Choosing a blue marble and then another blue marble
- Without replacing the first and second marble, you choose a blue marble, a red marble, and then another red marble.

**You are playing a treasure hunt card game that includes 8 treasure chests, 7 pirates, and 9 islands. Each player is dealt 5 cards. Before seeing any of the cards, you randomly make a guess as to which treasure chest is hidden, which pirate buried the treasure, and on which island the treasure is buried.**

- What is the probability that you got all three correct before looking at your cards?
- You look at your cards and are able to eliminate 2 of the treasure chests, 1 of the pirates, and 2 of the islands. Now you try to guess the correct treasure chest, pirate, and island. What is the probability that you get all three correct?
- One of your opponents looks at her cards and is able to eliminate 3 treasure chests and 2 pirates, but none of the islands. She tries to guess the correct treasure chest, pirate, and island. What is the probability that she gets all three correct?
- Another of your opponents looks at his cards and is able to eliminate 5 treasure chests, but no pirates and no islands. He tries to guess the correct treasure chest, pirate, and island. What is the probability that he gets all three correct?

1		9	3	6	2	4	8	7	5
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#### Answers

P.  $\frac{5}{33}$

E.  $\frac{1}{504}$

D.  $\frac{1}{225}$

E.  $\frac{1}{6}$

G.  $\frac{7}{44}$

A.  $\frac{5}{12}$

H.  $\frac{35}{132}$

S.  $\frac{1}{189}$

O.  $\frac{1}{252}$

**Extension  
10.5****Start Thinking!**

For use before Extension 10.5

A proofreader finds two mistakes in 50 papers. About how many mistakes would you expect in 1000 papers? Explain how to find the answer.

**Extension  
10.5****Warm Up**

For use before Extension 10.5

**You roll a number cube 10 times and record the results. Use the table to find the experimental probability of the event.**

1. Tossing a 3
2. Tossing a 1
3. Tossing a 6
4. *Not* tossing a 4

<b>Outcome</b>	<b>Frequency</b>
1	4
2	1
3	1
4	2
5	1
6	1

**Extension  
10.5****Practice**

On a spinner, there is a 40% chance of spinning green and a 30% chance of spinning red. Design and use a simulation involving 100 randomly generated numbers to find the experimental probability that you will spin green on the first spin and red on the second spin.

1. Use the random number generator on a graphing calculator. Randomly generate 100 numbers from 0 to 99. The table below shows the results.

94	90	14	51	40	73	4	33	99	20
79	95	22	36	0	93	10	0	54	85
97	27	27	12	5	72	1	42	30	97
2	83	61	20	98	72	30	24	94	92
4	11	69	98	63	31	8	99	19	39
11	24	85	37	59	60	7	1	1	69
70	88	37	11	45	98	69	54	63	92
67	79	55	33	21	62	88	12	45	46
28	81	98	49	40	22	62	61	80	77
46	92	62	33	45	80	86	25	71	46

Let the digits 1 through 4 in the tens place represent green on the first spin and the digits 1 through 3 in the ones place represent red on the second spin. Any number that meets these criteria represents green on the first spin and a red on the second spin.

How many numbers meet the criteria?

2. Find the experimental probability that you spin green on the first spin and red on the second spin.
3. Try to find the theoretical probability of spinning green on the first spin and red on the second spin. What do you think happens to the experimental probability when you increase the number of trials in the simulation?

**Activity**  
**10.6****Start Thinking!**  
For use before Activity 10.6

Review with a partner how to determine if events are *independent* or *dependent*. Use an example.

**Activity**  
**10.6****Warm Up**  
For use before Activity 10.6

**You flip a coin and roll a number cube.  
Find the probability of the event.**

1. Flipping heads and rolling a 6
2. Flipping heads and rolling an odd number
3. Flipping heads and rolling a number greater than 3
4. Flipping tails and rolling a number less than 5

**Lesson  
10.6****Start Thinking!**

For use before Lesson 10.6

You survey 20 students in your school to find their favorite summer activity. Can you make conclusions about the population of your school based on the results? Explain.

**Lesson  
10.6****Warm Up**

For use before Lesson 10.6

**Identify the population and sample.**

1. residents of a city; senior residents of a city
2. members of a gym who play basketball;  
members of a gym
3. books in a classroom; nonfiction books in  
a classroom
4. travel mugs in a souvenir shop; mugs in a  
souvenir shop

## 10.6 Practice A

**Identify the population and the sample.**

1. All students in a school  
30 students in the school
2. 75 strawberries in the field  
All the strawberries in the field
3. You want to know the number of students in your school who read some of the newspaper at least once a week. You survey 30 random students that you meet in the hallway between classes.
  - a. What is the population of your survey?
  - b. What is the sample of your survey?
  - c. Is the sample biased or unbiased? Explain.

**Which sample is better for making a prediction? Explain.**

4. 

<b>Predict the number of residents in St. Lucie County who own a home.</b>	
Sample A	A random sample of 100 residents in the county
Sample B	A random sample of 100 residents in the city of Fort Pierce
5. 

<b>Predict the number of people at a beach who are wearing sunscreen.</b>	
Sample A	A random sample of 50 people at the beach
Sample B	A random sample of 5 people at the beach

**Determine whether you would survey the population or a sample. Explain.**

6. You want to know the average weight of the members of your family.
7. You want to know the number of grocery stores in Florida that carry your favorite cereal.
8. A survey asked 60 randomly chosen students if they eat school lunch. Forty said yes. There were 560 school lunches sold today. Predict the number of students who attend the school.

## 10.6 Practice B

- You want to know the number of fans at the Miami Dolphins and Dallas Cowboys game that think the Dolphins will win. You survey 50 fans with season tickets for the Dolphins.
  - What is the population of your survey?
  - What is the sample of your survey?
  - Is the sample reasonable? Explain.
- Which sample is better for making a prediction? Explain.

Predict the number of families in your town with two or more children.	
Sample A	A random sample of 10 families living near your home
Sample B	A random sample of 10 families living in your town

**Determine whether you would survey the population or a sample. Explain.**

- You want to know the favorite clothing store of the students at your school.
- You want to know the favorite topic of students in your history class.
- An administrator surveys a random sample of 48 out of 900 middle school students. Using the survey results, the administrator predicts that 225 students are in favor of the new dress code. How many of the 48 students surveyed were in favor of the new dress code?

- The table shows the results of a survey of 75 randomly chosen individuals. In the survey, each individual was asked to name his or her favorite type of music.

Music	Frequency
Rock	20
Country	23
Rap	30
Classical	2

- Do you think the individuals surveyed were adults or teenagers? Explain your reasoning.
- What other data displays could be used to show the data?
- If you were to repeat the survey using randomly chosen adults, would you predict that the results of the adult survey will be different if you surveyed adults in their 30s versus adults in their 70s? Explain your reasoning.

## 10.6 Enrichment and Extension

### The Electoral College

The President of the United States is chosen by the Electoral College. The electors usually vote for whichever presidential candidate won the popular vote in their state. The number of electors from each state is equal to the number of senators plus the number of representatives in the House. Every state has two senators, regardless of its population. The number of representatives in the House is proportional to the state's population. The District of Columbia gets three electors even though they do not have representation in Congress.

Distribution of 2004 and 2008 Electoral Votes			
State/District	Senators	House Representatives	Electors
California	2	53	55
District of Columbia	0	0	3
Florida	2	25	27
Louisiana	2	7	9
Montana	2	1	3
<b>Total</b>	<b>100</b>	<b>435</b>	<b>538</b>

1. Do the Electoral College votes represent a sample of each state's population? Explain your reasoning.
2. Your school is holding a mock election, in which all 1308 students will participate in a popular vote. Each student will be assigned to represent one of the fifty states or the District of Columbia. How many of the students in your school should represent California? District of Columbia? Florida? Louisiana? Montana?
3. The presidential election results in 2000 were delayed because the popular vote results were so close in Florida. In the end, George W. Bush won the presidency without winning the most popular votes nationwide. The presidents elected in 1824, 1876, and 1888 also did not win the most popular votes. Explain how this is possible. Research one of the four elections and summarize what you find most interesting about it.
4. Research how television stations make projections for presidential elections. Include information about pre-election polls, exit polls, and actual votes reported. Also, describe how the sample precincts are chosen. How do they ensure that the sample data is representative of the state's population?



# 10.6 Puzzle Time

## What Did One Tuna Say To The Other When They Were Playing Cards?

Write the letter of each answer in the box containing the exercise number.

1. You want to know what students at your school would most like to attend: a professional football, basketball, or baseball game. Which sample should you choose for your survey?

**G.** 5 of your friends      **H.** the basketball team      **I.** 25 random students

2. You survey your 22 classmates on their favorite color. Six choose green as their favorite color. There are 396 students at your school. How many students in the school do you predict would choose green as their favorite color?

**S.** 108      **T.** 126      **U.** 198

3. A store wants to know how good their customer service is. Who should they survey?

**N.** the next 3 customers      **O.** 50 random customers      **P.** 50 random people

4. A summer camp surveys 40 campers to see if they would take tennis next week. Twelve campers say they would. If there are 250 campers, how many campers should the counselors plan on for next week's tennis lessons?

**F.** 60      **G.** 65      **H.** 75

5. You want to estimate how many teens in Florida get an allowance. Who should you survey?

**G.** 200 random Florida teens      **H.** every teen at your school      **I.** every teen in Florida

6. The art teacher wants to know if her art students would like to work on pottery. Who should she survey?

**E.** 2 random art students      **F.** all of her art class      **G.** the entire school

5	3		6	1	2	4
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**Extension  
10.6****Start Thinking!**

For use before Extension 10.6

Review with a partner how to make a box-and-whisker plot.

**Extension  
10.6****Warm Up**

For use before Extension 10.6

1. Make a box-and-whisker plot of the data.

<b>Scores on a Science Test</b>			
84	65	98	83
96	76	77	84
94	98	80	73

**Extension**  
**10.6****Practice**

1. Work with a partner. Mark 30 small pieces of paper with an A, a B, or a C. Put the pieces of paper in a bag. Trade bags with other students in the class.
  - a. Generate a sample by choosing a piece of paper from your bag 10 times, replacing the piece of paper each time. Record the number of times you choose each letter. Repeat this process to generate five more samples. Organize the results in a table.
  - b. Use each sample to make an inference about the number of As and Bs in the bag. Then describe the variation of the six inferences. Make inferences about the numbers of As, Bs, and Cs in the bag based on all the samples.
  - c. Take the pieces of paper out of the bag. How do your inferences compare to the population? Do you think you can make a more accurate prediction? If so, explain how.
  
2. Work with a partner. You want to know the mean number of hours students in band or orchestra practice their instruments each week. Prior research indicates that the maximum number of hours of practice is 14 hours per week.
  - a. Use the random number generator on a graphing calculator to simulate the hours of practice for 10 students in band or orchestra. Randomly generate 10 numbers from 0 to 14. Write down the results. Repeat this 9 more times, writing down the results each time.
  - b. Find the mean of each of the 10 samples.
  - c. Make a box-and-whisker plot of the sample means.
  - d. Use the box-and-whisker plot to estimate the actual mean number of hours students in band or orchestra practice their instruments each week. How does your estimate compare to the mean of the entire data set?

**Activity  
10.7****Start Thinking!**

For use before Activity 10.7

How do you find the mean of a data set?  
Explain by using an example.

How do you find the median of a data set?  
Explain by using an example.

**Activity  
10.7****Warm Up**

For use before Activity 10.7

**Find the median.**

1. 5, 7, 8, 8, 12, 12, 14, 17, 21
2. 56, 57, 57, 62, 65, 65, 65
3. 23, 34, 35, 37, 41, 43, 43
4. 76, 77, 78, 78, 79, 81, 83, 85
5. 43, 45, 32, 34, 42, 38, 35
6. 65, 67, 62, 61, 69, 65, 68, 66

**Lesson  
10.7****Start Thinking!**

For use before Lesson 10.7

Give an example of a data set that represents two populations that can be compared.

How would you compare that data of the two populations?

**Lesson  
10.7****Warm Up**

For use before Lesson 10.7

The tables show the numbers of baskets made by two basketball teams.

Team 1				
45	52	65	56	70
56	58	49	55	64

Team 2				
52	56	65	72	49
58	49	62	63	54

1. Find the mean, median, mode, range, interquartile range, and mean absolute deviation for each data set.
2. Compare the data sets.

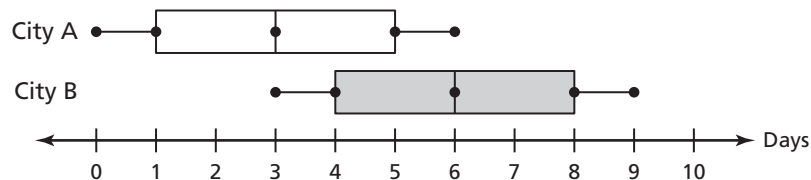
## 10.7 Practice A

1. The tables show the ages of the players on two basketball teams.

Varsity Team Ages					
18	16	17	16	18	17
19	18	18	18	18	17

Junior Varsity Team Ages					
16	17	15	16	17	15
18	14	17	16	17	17

- Find the mean, median, mode, range, interquartile range, and mean absolute deviation for each data set.
  - Compare the data sets.
  - When comparing the two populations using measures of center and variance, would you use the mean and the MAD, or the median and the IQR? Explain.
  - Express the difference in the measures of center as a multiple of the measure of variation.
2. The double box-and-whisker plot shows the number of inches of snow per week in two cities in a 16-week period.



- Compare the populations using measures of center and variation.
- Express the difference in the measures of center as a multiple of the measure of variation.

# 10.7

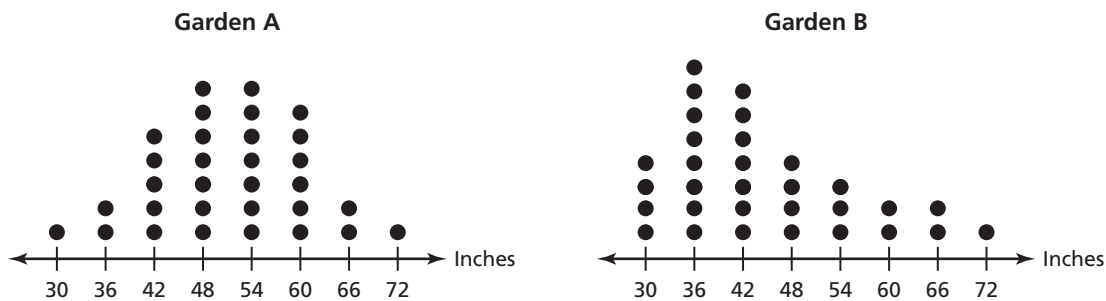
## Practice B

1. The tables show the numbers of attendees at pep rallies for football and basketball games at a school during the year.

Football Pep Rally Attendance					
174	175	200	169	178	171
165	187	159	170	184	196
205	231	198	310	152	178

Basketball Pep Rally Attendance					
143	178	154	167	204	199
254	147	179	162	189	203
217	214	187	210	288	287

- Find the mean, median, mode, range, interquartile range, and mean absolute deviation for each data set.
  - Compare the data sets.
  - When comparing the two populations using measures of center and variation, would you use the mean and the MAD, or the median and the IQR? Explain.
  - Express the difference in the measures of center as a multiple of the measure of variation.
2. The dot plots show the heights of corn stalks in two gardens.



- Compare the populations using measures of center and variation.
- Express the difference in the measures of center as a multiple of the measure of variation.

## 10.7 Enrichment and Extension

### Should I Keep Playing?

The **expected value** of an event is equal to the average of its outcomes—as long as all of the outcomes have an equal probability of occurring.

**Example:** John is playing a game where he rolls number cubes one at a time and adds the values to obtain a sum. The person scoring closest to 8 without going over wins the round. Each player can decide to continue his or her turn after two rolls. John's sum after two rolls is 5. Use the expected value of a number cube to determine if John should roll again.

$$\frac{1 + 2 + 3 + 4 + 5 + 6}{6} = 3.5$$

The average of the outcomes is the expected value.

The expected value of a number cube is 3.5, so John should not roll again because  $5 + 3.5 = 8.5$ . The sum 8.5 would put John over the limit of 8.

**Use expected value to help each person decide what to do in the situation described.**

1. Daulton is playing a game where he draws a random card from a deck with no face cards (Jack, Queen, King, Ace, or Joker). He receives points equal to the value of the card. If Daulton gets more than 4 points on his next turn he loses the game. Should Daulton draw a card or pass?
2. Ally is playing a card game with a friend. Each player draws a card, and the card with the higher value wins the round. Her friend's card is a 5. Ally has cards of 2, 5, 6, and 8 in her pile but does not know which is next. Should Ally be confident she will win the round?
3. Paxton must spin a value of 6 or greater on his next turn or he is out for the following round. The spinner has only even numbered sections from 2 through 10. Should he spin or pass?
4. Find the probability of a success in Exercises 1–3. Would using probability rather than expected value change your advice to each person? Explain.
5. Are expected value and probability the same thing? Which is better for predicting a success? Explain.

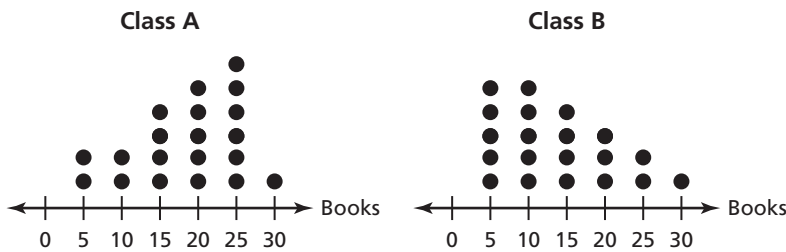


# 10.7 Puzzle Time

## What Kind of House Weighs The Least?

Write the letter of each answer in the box containing the exercise number.

The dot plots show the numbers of books that students read during the school year for two classes.



1. What is the median for Class A?
2. What is the median for Class B?
3. What is the IQR for Class A?
4. What is the IQR for Class B?
5. Compare the populations using measures of center and variation.

The tables show the numbers of books that have been signed out of the library during the school year for two classes.

Class A (Books)			
8	6	8	4
8	12	10	6
6	2	10	12
14	10	4	8

Class B (Books)			
12	12	14	9
12	12	13	9
12	7	9	13
12	6	14	10

6. What is the mean for Class A?
7. What is the mean for Class B?
8. What is the MAD for Class A?
9. What is the MAD for Class B?
10. Compare the populations using measures of center and variation.

10	5	9	4	8	2	6	1	7	3
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### Answers

- U. 20
- H. 12.5
- T. 2.5
- G. 2
- H. 12.5
- O. 8
- S. 11
- E. 10
- I. The variation in the number of books is the same but Class A has a greater number of books.
- L. The variation in the number of books is the same but Class B has a greater number of books.

# Chapter 10

## Technology Connection

For use after Section 10.5

### Exploring Internet-based Simulations

Although calculating the experimental probability of an event by hand may give you an intuition of the expected outcome, many times you may find that it is too time consuming to perform the simulation a high number of times. Fortunately, a computer is perfectly suited to perform these repeated simulations in a very small amount of time. The simulation for this lesson can be found at the National Library of Virtual Manipulatives in the Data Analysis & Probability section at <http://nlvm.usu.edu>.

**EXAMPLE** Find the experimental probability of rolling a 5 on a number cube using 500 trials.

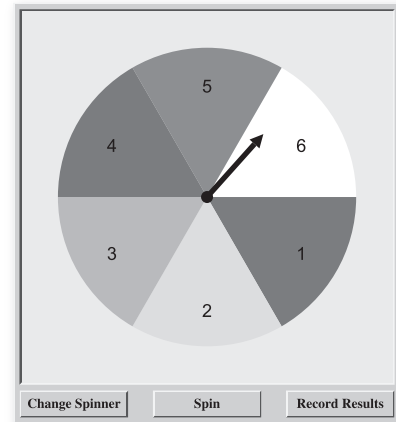
#### SOLUTION

**Step 1** In the Data Analysis & Probability section at the NLVM website, choose the “Spinners” activity.

**Step 2** Customize the spinner by clicking the “Change Spinner” option. Then rename each category “1,” “2,” ... “6” to represent the numbers on a number cube. When you add the “6” category, be sure to change the spinner section from 0 to 1. Then click “Apply.”

**Step 3** Although you could then click the “Spin” button 500 times, it is much more efficient to click the “Record Results” button and then set the number of spins to 500. Then click “Spin.”

**Step 4** Your spinner will show the results of your 500 spins in a bar graph in the Results window.



**Use a spinner simulation to answer the following questions.**

1. Change the spinner so that it represents a coin toss consisting of two outcomes, heads or tails. Run a simulation of 1000 spins and record the results. If you divide the spinner into 4 sections (heads, tails, heads, tails), do you achieve similar results? Explain your results in terms of area.
2. Change the spinner so that it models the sums of rolling two number cubes. Weight the sections according to the theoretical probability of achieving each sum. Run a simulation of 1000 spins and compare the results to the theoretical probability of the trials.