Random Samples and Populations

MODULE **10**

? ESSENTIAL QUESTION

How can you use random samples and populations to solve real-world problems?

Real-World Video

Scientists study animals like dolphins to learn more about characteristics such as behavior, diet, and communication. Acoustical data (recordings of dolphin sounds) can reveal the species that made the sound.

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Reading Start-Up

Visualize Vocabulary

Use the ✔ words to complete the right column of the chart.

Box Plots to Display Data	
Definition	**Review Word**
A display that uses values from a data set to show how the values are spread out.	
The middle value of a data set.	
The median of the lower half of the data.	
The median of the upper half of the data.	

Understand Vocabulary

Complete each sentence, using the preview words.

1. An entire group of objects, individuals, or events is a

   _____.

2. A _____ is part of the population chosen to represent the entire group.

3. A sample that does not accurately represent the population is a

   _____.

Vocabulary

Review Words
✔ box plot *(diagrama de caja)*
  data *(datos)*
  dot plot *(diagrama de puntos)*
  interquartile range *(rango entre cuartiles)*
✔ lower quartile *(cuartil inferior)*
✔ median *(mediana)*
  spread *(dispersión)*
  survey *(estudio)*
✔ upper quartile *(cuartil superior)*

Preview Words
  biased sample *(muestra sesgada)*
  population *(población)*
  random sample *(muestra aleatoria)*
 sample *(muestra)*

Active Reading

Tri-Fold Before beginning the module, create a tri-fold to help you learn the concepts and vocabulary in this module. Fold the paper into three sections. Label the columns "What I Know," "What I Need to Know," and "What I Learned." Complete the first two columns before you read. After studying the module, complete the third column.

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Are YOU Ready?

Complete these exercises to review skills you will need for this module.
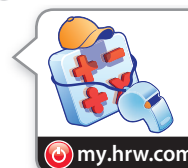
Solve Proportions

EXAMPLE

$$\frac{a}{1} = \frac{30}{1.5}$$

$a \times 1.5 = 1 \times 30$ Write the cross products.

$1.5a = 30$ Simplify.

$\frac{1.5a}{1.5} = \frac{30}{1.5}$ Divide both sides by 1.5.

$a = 20$

Solve for x.

1. $\frac{x}{16} = \frac{45}{40}$ _____

2. $\frac{x}{5} = \frac{1}{4}$ _____

3. $\frac{2.5}{10} = \frac{x}{50}$ _____

4. $\frac{x}{6} = \frac{2}{9}$ _____

Find the Range

EXAMPLE   29, 26, 21, 30, 32, 19   Order the data from least to greatest.
19, 21, 26, 29, 30, 32

range $= 32 - 19$ The range is the difference between the greatest and the least data items.
$= 13$

Find the range of the data.

5. 52, 48, 57, 47, 49, 60, 59, 51 _____

6. 5, 9, 13, 6, 4, 5, 8, 12, 12, 6 _____

7. 97, 106, 99, 97, 115, 95, 108, 100 _____

8. 27, 13, 35, 19, 71, 12, 66, 47, 39 _____

Find the Mean

EXAMPLE   21, 15, 26, 19, 25, 14

mean $= \frac{21 + 15 + 26 + 19 + 25 + 14}{6}$ The mean is the sum of the data items divided by the number of items.

$= \frac{120}{6}$

$= 20$

Find the mean of each set of data.

9. 3, 5, 7, 3, 6, 4, 8, 6, 9, 5 _____

10. 8.1, 9.4, 11.3, 6.7, 6.2, 7.5 _____

Complete these exercises to review skills you will need for this module.

Solve Proportions

11. A designer uses 8 clay beads for every 12 wooden beads to make a necklace. The designer has 42 wooden beads. He sets up the proportion $\frac{8}{42} = \frac{x}{12}$ to find the number of clay beads he will need to make necklaces. Is the proportion correct? How many clay beads does the designer need? Explain.

Find the Range

12. Students recorded the temperature at noon each day for a 10-day period at their school. The temperatures, in °F, are 53, 48, 52, 67, 60, 55, 58, 46, 63, and 58. What is the range of the temperatures? Show your work.

Find the Mean

13. Rehan scored 87 on two history tests this term. His other history test scores were 79, 82, and 90. Find the mean of Rehan's history test scores.

LESSON
10.1

7.5.10.1
Students will use a sample to gain information about a population.

Populations and Samples

? ESSENTIAL QUESTION

How can you use a sample to gain information about a population?

EXPLORE ACTIVITY Real World

Random and Non-Random Sampling

When information is being gathered about a group, the entire group of objects, individuals, or events is called the **population**. A **sample** is part of the population that is chosen to represent the entire group.

A vegetable garden has 36 tomato plants arranged in a 6-by-6 array. The gardener wants to know the average number of tomatoes on the plants. Each white cell in the table represents a plant. The number in the cell tells how many tomatoes are on that particular plant.

Because counting the number of tomatoes on all of the plants is too time-consuming, the gardener decides to choose plants at random to find the average number of tomatoes on them.

To simulate the random selection, roll two number cubes 10 times. Find the cell in the table identified by the first and second number cubes. Record the number in each randomly selected cell.

						First Number Cube
8	9	13	18	24	15	1
34	42	46	20	13	41	2
29	21	14	45	27	43	3
22	45	46	41	22	33	4
12	42	44	17	42	11	5
18	26	43	32	33	26	6
Second Number Cube	1	2	3	4	5	6	

A What is the average number of tomatoes on the 10 plants that were randomly selected?

_____

B Alternately, the gardener decides to choose the plants in the first row. What is the average number of tomatoes on these plants?

_____

Math Talk
Mathematical Processes
How do the averages you got with each sampling method compare?

Reflect

1. How do the averages you got with each sampling method compare to the average for the entire population, which is 28.25?

_____

_____

2. Why might the first method give a closer average than the second method?

_____

_____

Math On the Spot

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Random Samples and Biased Samples

A sample in which every person, object, or event has an equal chance of being selected is called a **random sample**. A random sample is more likely to be representative of the entire population than other sampling methods. When a sample does not accurately represent the population, it is called a **biased sample**.

EXAMPLE 1 · Real World

Identify the population. Determine whether each sample is a random sample or a biased sample. Explain your reasoning.

A Roberto wants to know the favorite sport of adults in his hometown. He surveys 50 adults at a baseball game.

The population is adults in Roberto's hometown.

The sample is biased.

> Think: People who don't like baseball will not be represented in this sample.

Math Talk

Mathematical Processes

Why do you think samples are used? Why not survey each member of the population?

B Paula wants to know the favorite type of music for students in her class. She puts the names of all students in a hat, draws 8 names, and surveys those students.

The population is students in Paula's class.

The sample is random.

> Think: Each student has an equal chance of being selected.

Reflect

3. How might you choose a sample of size 20 to determine the preferred practice day of all the players in a soccer league?

_____

_____

YOUR TURN

4. For a survey, a company manager assigned a number to each of the company's 500 employees, and put the numbers in a bag. The manager chose 20 numbers and surveyed the employees with those numbers. Did the manager choose a random sample?

_____

_____

Bias in Survey Questions

Once you have selected a representative sample of the population, be sure that the data is gathered without bias. Make sure that the survey questions themselves do not sway people to respond a certain way.

EXAMPLE 2   Real World

In Madison County, residents were surveyed about a new skateboard park. Determine whether each survey question may be biased. Explain.

A Would you like to waste the taxpayers' money to build a frivolous skateboard park?

This question is biased. It discourages residents from saying yes to a new skateboard park by implying it is a waste of money.

B Do you favor a new skateboard park?

This question is not biased. It does not include an opinion on the skateboard park.

C Studies have shown that having a safe place to go keeps kids out of trouble. Would you like to invest taxpayers' money to build a skateboard park?

This question is biased. It leads people to say yes because it mentions having a safe place for kids to go and to stay out of trouble.

YOUR TURN

Determine whether each question may be biased. Explain.

5. When it comes to pets, do you prefer cats?

_____

6. What is your favorite season?

_____

_____

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1. Follow each method described below to collect data to estimate the average shoe size of seventh grade boys. (Explore Activity)

Method 1

A Randomly select 6 seventh grade boys and ask each his shoe size. Record your results in a table like the one shown.

_____

Random Sample of Seventh Grade Male Students	
Student	Shoe Size

B Find the mean of this data. Mean:

_____

Method 2

A Find the 6 boys in your math class with the largest shoes and ask their shoe size. Record your results in a table like the one shown in Method 1.

_____

B Find the mean of this data. Mean: _____

2. Method 1 produces results that are | **more / less** | representative of the entire student population because it is a | **random / biased** | sample. (Example 1)

3. Method 2 produces results that are | **more / less** | representative of the entire student population because it is a | **random / biased** | sample. (Example 1)

4. Heidi decides to use a random sample to determine her classmates' favorite color. She asks, "Is green your favorite color?" Is Heidi's question biased? If so, give an example of an unbiased question that would serve Heidi better. (Example 2)

_____

? ESSENTIAL QUESTION CHECK-IN

5. How can you select a sample so that the information gained represents the entire population?

_____

_____

10.1 Independent Practice
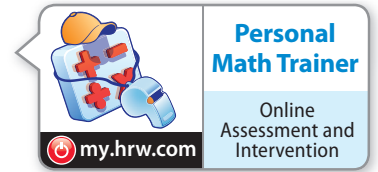
6. Paul and his friends average their test grades and find that the average is 95. The teacher announces that the average grade of all of her classes is 83. Why are the averages so different?

_____

_____

_____

7. Nancy hears a report that the average price of gasoline is $2.82. She averages the prices of stations near her home. She finds the average price of gas to be $3.03. Why are the averages different?

_____

_____

_____

_____

For 8–10, determine whether each sample is a random sample or a biased sample. Explain.

8. Carol wants to find out the favorite foods of students at her middle school. She asks the boys' basketball team about their favorite foods.

_____

_____

9. Dallas wants to know what elective subjects the students at his school like best. He surveys students who are leaving band class.

_____

_____

_____

10. To choose a sample for a survey of seventh graders, the student council puts pieces of paper with the names of all the seventh graders in a bag, and selects 20 names.

_____

_____

_____

11. Members of a polling organization survey 700 of the 7,453 registered voters in a town by randomly choosing names from a list of all registered voters. Is their sample likely to be representative?

_____

_____

For 12–13, determine whether each question may be biased. Explain.

12. Joey wants to find out what sport seventh grade girls like most. He asks girls, "Is basketball your favorite sport?"

_____

_____

_____

13. Jae wants to find out what type of art her fellow students enjoy most. She asks her classmates, "What is your favorite type of art?"

_____

_____

_____

Work Area

14. Draw Conclusions Determine which sampling method will better represent the entire population. Justify your answer.

Student Attendance at Football Games	
Sampling Method	**Results of Survey**
Collin surveys 78 students by randomly choosing names from the school directory.	63% attend football games.
Karl surveys 25 students that were sitting near him during lunch.	82% attend football games.

_____

_____

_____

_____

_____

15. Multistep Barbara surveyed students in her school by looking at an alphabetical list of the 600 student names, dividing them into groups of 10, and randomly choosing one from each group.

a. How many students did she survey? What type of sample is this?

_____

b. Barbara found that 35 of the survey participants had pets. About what percent of the students she surveyed had pets? Is it safe to believe that about the same percent of students in the school have pets? Explain your thinking.

_____

_____

_____

16. Communicating Mathematical Ideas Carlo said a population can have more than one sample associated with it. Do you agree or disagree with his statement? Justify your answer.

_____

_____

_____

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LESSON
10.2
Making Inferences from a Random Sample

7.5.10.2
Students will use a sample to make inferences about a population.

EXPLORE ACTIVITY 1 Real World

Using Dot Plots to Make Inferences

After obtaining a random sample of a population, you can make inferences about the population. Random samples are usually representative and support valid inferences.

Rosee asked students on the lunch line how many books they had in their backpacks. She recorded the data as a list: 2, 6, 1, 0, 4, 1, 4, 2, 2. Make a dot plot for the books carried by this sample of students.

STEP 1 Order the data from least to greatest. Find the least and greatest values in the data set.

STEP 2 Draw a number line from 0 to 6. Place a dot above each number on the number line for each time it appears in the data set.

Notice that the dot plot puts the data values in order.

Math Talk
Mathematical Processes
No students in Rosee's sample carry 3 books. Do you think this is true of all the students at the school? Explain.

Reflect

1. **Critical Thinking** How are the number of dots you plotted related to the number of data values?

    _____

2. **Draw Conclusions** Complete each qualitative inference about the population.

    Most students have _____ 1 book in their backpacks.

    Most students have fewer than _____ books in their backpacks.

    Most students have between _____ books in their backpacks.

3. **Analyze Relationships** What could Rosee do to improve the quality of her data?

    _____

Real World

Using Box Plots to Make Inferences

You can also analyze box plots to make inferences about a population.

The number of pets owned by a random sample of students at Park Middle school is shown below. Use the data to make a box plot.
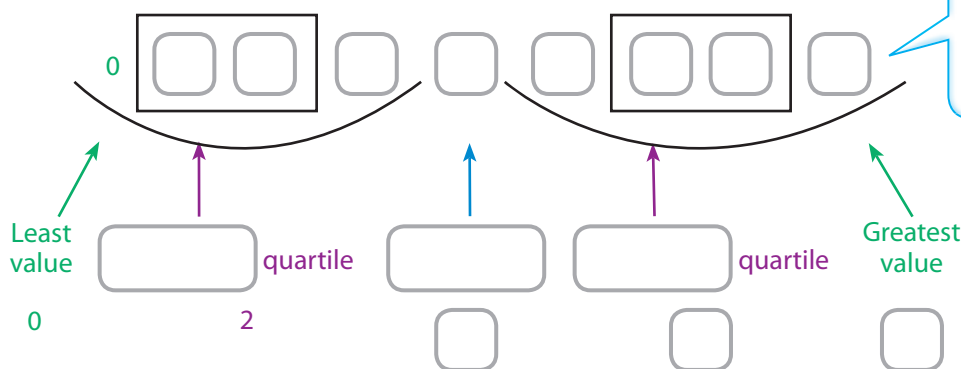
9, 2, 0, 4, 6, 3, 3, 2, 5

STEP 1 Order the data from least to greatest. Then find the least and greatest values, the median, and the lower and upper quartiles.

STEP 2 The lower and upper quartiles can be calculated by finding the medians of each "half" of the number line that includes all the data.

> The lower quartile is the mean of 2 and 2. The upper quartile is the mean of 5 and 6.

0 ▢ ▢ ▢   ▢ ▢ ▢ ▢ ▢

Least value | quartile | quartile | Greatest value

0 | 2

Draw a number line that includes all the data values.

Plot a point for each of the values found in Step 1.

STEP 3 Draw a box from the lower to upper quartile. Inside the box, draw a vertical line through the median. Finally, draw the whiskers by connecting the least and greatest values to the box.

Reflect

4. **Draw Conclusions** Complete each qualitative inference about the population.

A good measure for the most likely number of pets is _____.

50% of the students have between _____ and 3 pets.

Almost every student in Parkview has at least _____ pet.

Math Talk
Mathematical Processes

What can you see from a box plot that is not readily apparent in a dot plot?

Using Proportions to Make Inferences

You can use data based on a random sample, along with proportional reasoning, to make inferences or predictions about the population.

EXAMPLE 1 Real World

A shipment to a warehouse consists of 3,500 MP3 players. The manager chooses a random sample of 50 MP3 players and finds that 3 are defective. How many MP3 players in the shipment are likely to be defective?

It is reasonable to make a prediction about the population because this sample is random.

STEP 1 Set up a proportion.

$$\frac{\text{defective MP3s in sample}}{\text{size of sample}} = \frac{\text{defective MP3s in population}}{\text{size of population}}$$

STEP 2 Substitute values into the proportion.

$$\frac{3}{50} = \frac{x}{3,500}$$ *Substitute known values. Let x be the number of defective MP3 players in the population.*

$$\frac{3\cdot70}{50\cdot70} = \frac{x}{3,500}$$ *50 · 70 = 3,500, so multiply the numerator and denominator by 70.*

$$\frac{210}{3,500} = \frac{x}{3,500}$$

$$210 = x$$

Based on the sample, you can predict that 210 MP3 players in the shipment would be defective.

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YOUR TURN

5. **What If?** How many MP3 players in the shipment would you predict to be damaged if 6 MP3s in the sample had been damaged?

_____

Reflect

6. **Check for Reasonableness** How could you use estimation to check if your answer is reasonable?

_____

_____

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Patrons in the children's section of a local branch library were randomly selected and asked their ages. The librarian wants to use the data to infer the ages of all patrons of the children's section so he can select age appropriate activities. In 3–6, complete each inference. (Explore Activities 1 and 2)

7, 4, 7, 5, 4, 10, 11, 6, 7, 4

1. Make a dot plot of the sample population data.

←——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——→
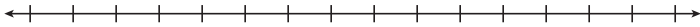
2. Make a box plot of the sample population data.

←——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——┼——→

3. The most common ages of children that use the library are _____ and _____.

4. The range of ages of children that use the library is from _____ to _____.

5. The median age of children that use the library is _____.

6. A manufacturer fills an order for 4,200 smart phones. The quality inspector selects a random sample of 60 phones and finds that 4 are defective. How many smart phones in the order are likely to be defective? (Example 1)

About _____ smart phones in the order are likely to be defective.

7. Part of the population of 4,500 elk at a wildlife preserve is infected with a parasite. A random sample of 50 elk shows that 8 of them are infected. How many elk are likely to be infected? (Example 1)

_____

? ESSENTIAL QUESTION CHECK-IN

8. How can you use a random sample of a population to make predictions?

_____

_____

_____

_____

_____

10.2 Independent Practice
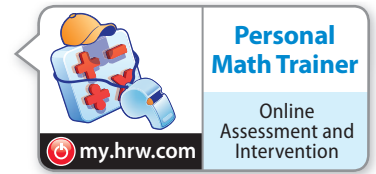
9. A manager samples the receipts of every fifth person who goes through the line. Out of 50 people, 4 had a mispriced item. If 600 people go to this store each day, how many people would you expect to have a mispriced item?

_____

10. Jerry randomly selects 20 boxes of crayons from the shelf and finds 2 boxes with at least one broken crayon. If the shelf holds 130 boxes, how many would you expect to have at least one broken crayon?

_____

11. A random sample of dogs at different animal shelters in a city shows that 12 of the 60 dogs are puppies. The city's animal shelters collectively house 1,200 dogs each year. About how many dogs in all of the city's animal shelters are puppies?

_____

12. Part of the population of 10,800 hawks at a national park are building a nest. A random sample of 72 hawks shows that 12 of them are building a nest. Estimate the number of hawks building a nest in the population.

_____

13. In a wildlife preserve, a random sample of the population of 150 raccoons was caught and weighed. The results, given in pounds, were 17, 19, 20, 21, 23, 27, 28, 28, 28 and 32. Jean made the qualitative statement, "The average weight of the raccoon population is 25 pounds." Is her statement reasonable? Explain.

_____

_____

_____

14. Greta collects the number of miles run each week from a random sample of female marathon runners. Her data are shown below. She made the qualitative statement, "25% of female marathoners run 13 or more miles a week." Is her statement reasonable? Explain. Data: 13, 14, 18, 13, 12, 17, 15, 12, 13, 19, 11, 14, 14, 18, 22, 12

_____

_____

_____

15. A random sample of 20 of the 200 students at Garland Elementary is asked how many siblings each has. The data are ordered as shown. Make a dot plot of the data. Then make a qualitative statement about the population. Data: 0, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 6

_____

_____

16. Linda collects a random sample of 12 of the 98 Wilderness Club members' ages. She makes an inference that most wilderness club members are between 20 and 40 years old. Describe what a box plot that would confirm Linda's inference should look like.

_____

_____

_____

17. **What's the Error?** Kudrey was making a box plot. He first plotted the least and greatest data values. He then divided the distance into half, and then did this again for each half. What did Kudrey do wrong and what did his box plot look like?

_____

_____

_____

_____

18. **Communicating Mathematical Ideas** A dot plot includes all of the actual data values. Does a box plot include any of the actual data values?

_____

_____

_____

_____

19. **Make a Conjecture** Sammy counted the peanuts in several packages of roasted peanuts. He found that the bags had 102, 114, 97, 85, 106, 120, 107, and 111 peanuts. Should he make a box plot or dot plot to represent the data? Explain your reasoning.

_____

_____

_____

_____

_____

20. **Represent Real-World Problems** The salaries for the eight employees at a small company are $20,000, $20,000, $22,000, $24,000, $24,000, $29,000, $34,000 and $79,000. Make a qualitative inference about a typical salary at this company. Would an advertisement that stated that the average salary earned at the company is $31,500 be misleading? Explain.

_____

_____

_____

Work Area

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Generating Random Samples

? ESSENTIAL QUESTION

How can you generate and use random samples to represent a population?

EXPLORE ACTIVITY 1 *Real World*

Generating a Random Sample Using Technology

In an earlier lesson, you generated random samples by rolling number cubes. You can also generate random samples by using technology. In Explore Activity 1, you will generate samples using a graphing calculator.

Each of the 200 students in a school will have a chance to vote on one of two names, Tigers or Bears, for the school's athletic teams. A group of students decides to select a random sample of 20 students and ask them for which name they intend to vote. How can the group choose a random sample to represent the entire population of 200 students?

A One way to identify a random sample is to use a graphing calculator to generate random integers.

To simulate choosing 20 students at random from among 200 students:

• Press **MATH**, scroll right and select **PRB**, then select **5: randInt(**.

• Enter the least value, comma, greatest possible value.

In this specific case, the students will enter **randInt** (☐ , ☐)

because there are _____ students in school.

• Hit **ENTER** _____ times to generate _____ random numbers.

```
randInt (1, 200)
                43
                93
                75
               178
```

The group gets a list of all the students in the school and assigns a number to each one. The group surveys the students with the given numbers.

Of the 20 students surveyed, 9 chose Tigers. The percent choosing

Tigers was _____. What might the group infer?

_____

_____
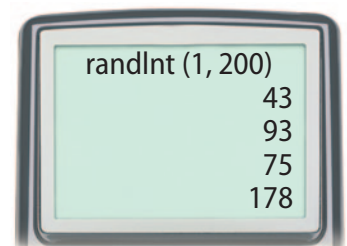
B You can simulate multiple random samples to see how much statistical measures vary for different samples of size 20.

Assume that the 200 students are evenly divided among those voting for Tigers and those voting for Bears. You can generate random numbers and let each number represent a vote. Let numbers from 1 to 100 represent votes for Tigers, and numbers from 101 to 200 represent votes for Bears. For each simulated sample, use randInt(1, 200) and generate 20 numbers.

Perform the simulation 10 times and record how many numbers from 1 to 100 are generated. How many of the samples indicated that there were 9 or fewer votes for Tigers?

_____

Combine your results with those of your classmates. Make a dot plot showing the number of numbers from 1 to 100 generated in each simulation.

_____

Reflect

1. **Communicate Mathematical Reasoning** Assume that it was accurate to say that the 200 students are evenly divided among those voting for Tigers and those voting for Bears. Based on your results, does it seem likely that in a sample of size 20, there would be 9 or fewer votes for Tigers?

_____

2. **Make a Prediction** Based on your answers, do you think it is likely that Tigers will win? Explain.

_____

3. **Multiple Representations** Suppose you wanted to simulate a random sample for the situation in Explore Activity 1 without using technology. One way would be to use marbles of two different colors to represent students choosing the different names. Describe how you could perform a simulation.

_____

_____

_____

_____

_____

_____

EXPLORE ACTIVITY 2 🌐 Real World

Generating a Random Sample without Technology

A tree farm has a 100 acre square field arranged in a 10-by-10 array. The farmer wants to know the average number of trees per acre. Each cell in the table represents an acre. The number in each cell represents the number of trees on that acre.

22	24	27	29	31	24	27	29	30	25
37	22	60	53	62	42	64	53	41	62
61	54	57	34	44	66	39	60	65	40
45	33	64	36	33	51	62	66	42	42
37	34	57	33	47	43	66	33	61	66
66	45	46	67	60	59	51	46	67	48
53	46	35	35	55	56	61	46	38	64
55	51	54	62	55	58	51	45	41	53
61	38	48	48	43	59	64	48	49	47
41	53	53	59	58	48	62	53	45	59

The farmer decides to choose a random sample of 10 of the acres.

A To simulate the random selection, number the table columns 1–10 from left to right, and the rows 1–10 from top to bottom. Write the numbers 1–10 on identical pieces of paper. Place the pieces into a bag. Draw one at random, replace it, and draw another. Let the first number represent a table column, and the second represent a row. For instance, a draw of 2 and then 3 represents the cell in the second column and third row of the table, an acre containing 54 trees. Repeat this process 9 more times.

B Based on your sample, predict the average number of trees per acre. How does your answer compare with the actual mean number, 48.4?

_____

_____

C Compare your answer to **B** with several of your classmates' answers. Do they vary a lot? Is it likely that you can make a valid prediction about the average number of trees per acre? Explain.

_____

Reflect

4. **Communicate Mathematical Ideas** Suppose that you use the method in Ⓐ to collect a random sample of 25 acres. Do you think any resulting prediction would be more or less reliable than your original one? Explain.

_____

_____

5. **Multiple Representations** How could you use technology to select the acres for your sample?

_____

_____

Guided Practice

A manufacturer gets a shipment of 600 batteries of which 50 are defective. The store manager wants to be able to test random samples in future shipments. She tests a random sample of 20 batteries in this shipment to see whether a sample of that size produces a reasonable inference about the entire shipment. (Explore Activities 1 and 2)

1. The manager selects a random sample using the formula

   randInt $\left(\boxed{},\boxed{}\right)$ to generate _____ random numbers.

2. She lets numbers from 1 to _____ represent defective batteries, and

   _____ to _____ represent working batteries. She generates this list: 120, 413, 472, 564, 38, 266, 344, 476, 486, 177, 26, 331, 358, 131, 352, 227, 31, 253, 31, 277.

3. Does the sample produce a reasonable inference?

   _____

   _____

❓ **ESSENTIAL QUESTION CHECK-IN**

4. What can happen if a sample is too small or is not random?

   _____

   _____

10.3 Independent Practice
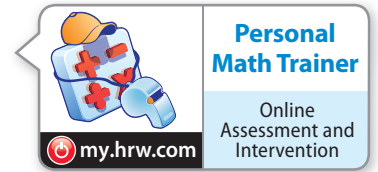
Maureen owns three bagel shops. Each shop sells 500 bagels per day. Maureen asks her store managers to use a random sample to see how many whole-wheat bagels are sold at each store each day. The results are shown in the table. Use the table for 5–7.

	Total bagels in sample	Whole-wheat bagels
Shop A	50	10
Shop B	100	23
Shop C	25	7

5. If you assume the samples are representative, how many whole-wheat bagels might you infer are sold at each store?

_____

6. Rank the samples for the shops in terms of how representative they are likely to be. Explain your rankings.

_____

_____

7. Which sample or samples should Maureen use to tell her managers how many whole-wheat bagels to make each day? Explain.

_____

_____

_____

8. In a shipment of 1,000 T-shirts, 75 do not meet quality standards. The table below simulates a manager's random sample of 20 T-shirts to inspect. For the simulation, the integers 1 to 75 represent the below-standard shirts.

124	876	76	79	12	878	86	912	435	91
340	213	45	678	544	271	714	777	812	80

In the sample, how many of the shirts are below quality standards? _____

If someone used the sample to predict the number of below standard shirts in the shipment, how far off would the prediction be?

_____

_____

9. Multistep A 64-acre coconut farm is arranged in an 8-by-8 array. Mika wants to know the average number of coconut palms on each acre. Each cell in the table represents an acre of land. The number in each cell tells how many coconut palms grow on that particular acre.

56	54	40	34	44	66	43	65
66	33	42	36	33	51	62	63
33	34	66	33	47	43	66	61
46	35	48	67	60	59	52	67
46	32	64	35	55	47	61	38
45	51	53	62	55	58	51	41
48	38	47	48	43	59	64	54
53	67	59	59	58	48	62	45

a. The numbers in green represent Mika's random sample of 10 acres. What is the average number of coconut palms on the randomly selected acres?

_____

b. Project the number of palms on the entire farm.

_____

H.O.T. FOCUS ON HIGHER ORDER THINKING

Work Area

10. Draw Conclusions A random sample of 15 of the 78 competitors at a middle school gymnastics competition are asked their height. The data set lists the heights in inches: 55, 57, 57, 58, 59, 59, 59, 59, 59, 61, 62, 62, 63, 64, 66. What is the mean height of the sample? Do you think this is a reasonable prediction of the mean height of all competitors? Explain.

_____

_____

_____

11. Critical Thinking The six-by-six grid contains the ages of actors in a youth Shakespeare festival. Describe a method for randomly selecting 8 cells by using number cubes. Then calculate the average of the 8 values you found.

12	15	16	9	21	11
9	10	14	10	13	12
16	21	14	12	8	14
16	20	9	16	19	18
17	14	12	15	10	15
12	20	14	10	12	9

_____

_____

_____

_____

_____

12. Communicating Mathematical Ideas Describe how the size of a random sample affects how well it represents a population as a whole.

_____

_____

Ready to Go On?

10.1 Populations and Samples

1. A company uses a computer to identify their 600 most loyal customers from its database and then surveys those customers to find out how they like their service. Identify the population and determine whether the sample is random or biased.

_____

_____

10.2 Making Inferences from a Random Sample

2. A university has 30,330 students. In a random sample of 270 students, 18 speak three or more languages. Predict the number of students at the university who speak three or more languages.

_____

10.3 Generating Random Samples

A store receives a shipment of 5,000 MP3 players. In a previous shipment of 5,000 MP3 players, 300 were defective. A store clerk generates random numbers to simulate a random sample of this shipment. The clerk lets the numbers 1 through 300 represent defective MP3 players, and the numbers 301 through 5,000 represent working MP3 players. The results are given.

13   2,195   3,873   525   900   167   1,094   1,472   709   5,000

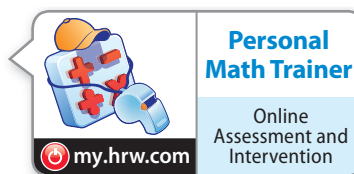**3.** Based on the sample, how many of the MP3 players might the clerk predict would be defective?

_____

4. Can the manufacturer assume the prediction is valid? Explain.

_____

? ESSENTIAL QUESTION

5. How can you use random samples to solve real-world problems?

_____

_____

Assessment Readiness

Personal Math Trainer

Online Assessment and Intervention

my.hrw.com

Selected Response

1. A farmer is using a random sample to predict the number of broken eggs in a shipment of 3,000 eggs. Using a calculator, the farmer generates the following random numbers. The numbers 1–250 represent broken eggs.

477	2,116	1,044	81	619	755
2,704	900	238	1,672	187	1,509

Based on this sample, how many broken eggs might the farmer expect?

Ⓐ 250 broken eggs

Ⓑ 375 broken eggs

Ⓒ 750 broken eggs

Ⓓ 900 broken eggs

2. A middle school has 490 students. Mae surveys a random sample of 60 students and finds that 24 of them have pet dogs. How many students are likely to have pet dogs?

Ⓐ 98

Ⓑ 196

Ⓒ 245

Ⓓ 294

3. A pair of shoes that normally costs $75 is on sale for $55. What is the percent decrease in the price, to the nearest whole percent?

Ⓐ 20%

Ⓑ 27%

Ⓒ 36%

Ⓓ 73%

4. Which of the following is a random sample?

Ⓐ A radio DJ asks the first 10 listeners who call in if they liked the last song.

Ⓑ 20 customers at a chicken restaurant are surveyed on their favorite food.

Ⓒ A polling organization numbers all registered voters, then generates 800 random integers. The polling organization interviews the 800 voters assigned those numbers.

Ⓓ Rebecca used an email poll to survey 100 students about how often they use the internet.

Mini-Task

5. Each cell in the table represents the number of people who work in one 25-square-block section of the town of Middleton. The mayor uses a random sample to estimate the average number of workers per block.

47	61	56	48	(56)
(60)	39	63	60	46
51	58	49	63	45
55	58	(50)	(43)	48
(62)	(53)	44	66	55

a. The circled numbers represent the mayor's random sample. What is the mean number of workers in this sample?

_____

b. Predict the number of workers in the entire 25-block section of Middleton.

_____