LESSON 1

Statistics and Probability

Population Sampling

The media often present data from polls and sample populations—data intended to help sway or justify a variety of actions or positions. It is important for students to understand the processes associated with population sampling and the mathematics involved in analyzing the data. In this activity, students will simulate a survey of a wildlife population by collecting and analyzing a series of representative samples.

Objective

Estimate the size of a subgroup by sampling the larger population.

Common Core State Standards

- **7.SP.1** Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
- **7.SP.2** Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *What does the container of colored cubes represent? What does it mean to "take a sample"? When you take a sample, what data do you need to record?*
- Have the various groups of students report their findings. Then reveal that there are 165 frogs in the pond and that 15 (9.09%) of them have mutations. Have students discuss how different groups of researchers might get different results, even though everyone followed the same directions.

Solve It

Reread the problem with students. Ask them to write to Chen explaining their procedure for answering his question. Have them include their results.

More Ideas

For other ways to teach about population sampling—

- Encourage students to look for examples of the use of population sampling (wildlife studies, election polls, and so forth) in the media. Whenever possible, discuss the sample size and number of samples taken in relation to the size of the total population.
- Have students repeat the exercise. This time, however, they should take 10 samples instead of four. Are the results the same? **Ask:** *Do you think your results are likely to be more accurate this time, less accurate, or about the same? Explain.*

Formative Assessment

Have students try the following problem.

In a sampling of 63 squirrels observed in a forest preserve, 9 were red squirrels. If the total squirrel population is estimated to be 550, approximately how many of them are red squirrels?

A. 14 **B.** 80 **C.** 470 **D.** 540

Try It! 40 minutes | Groups of 4

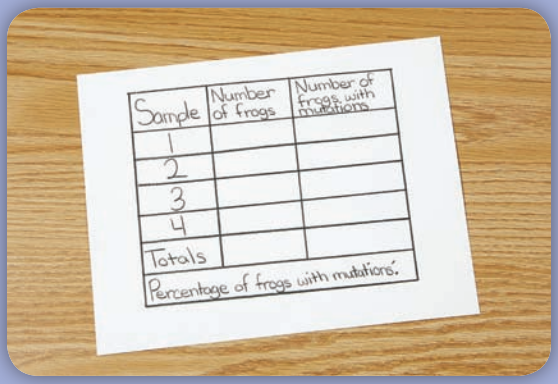
Here is a problem about population sampling.

Chen has noticed that some of the frogs in a nearby pond have malformed legs. He wants to know what percentage of the frog population has these mutations, but he realizes that he can't catch and examine every frog. How can Chen determine the percentage of mutant frogs in the pond without counting every frog?

Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

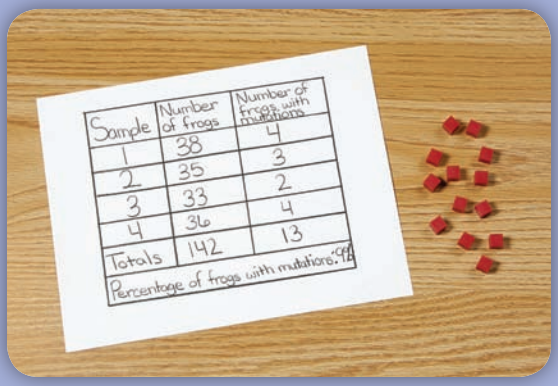
Materials

- Centimeter Cubes (165 cubes, 15 of which are red)
- $\frac{1}{4}$-cup measuring cup



1. Explain to students that they are going to simulate a sampling process. Tell them that the red cubes will represent the mutant frogs. Have students set up a table for recording their data. The table should accommodate four samples.

2. Have students scoop out a sample of Centimeter Cubes with the measuring cup, count them, and record the total number of cubes and the number of red cubes in the sample. Then have them return the cubes to the container and mix them together. (You may explain that this is the equivalent of "catch and release.") Have students repeat the process three more times.



3. Have students calculate the total number of frogs captured and the total number of mutant frogs in all four samples. **Ask:** *According to your research, what percentage of frogs in the pond has mutations?*

⚠ Look Out!

Remind students as necessary to return the sample to the container and mix the cubes thoroughly before taking another sample.

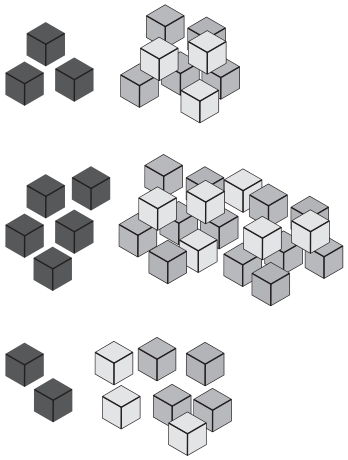
Some students will report mutation rates of more or less than 9 percent. Have them confirm that they followed the procedure and that their calculations are correct. Reassure them that a sampling is not a literal count of every individual in the population and that samples will vary.

Answer Key

Use Centimeter Cubes to represent votes from a subgroup of a larger population. In the sample shown, the red cubes are modeled by the dark cubes and represent a *yes* vote. Record your results.

1. Three samples are shown. Complete the table.

(Check students' work.)



Sample	Number of Votes	Number of *Yes* Votes	Number of *No* Votes
1	11	3	8
2	23	5	18
3	9	2	7

How many votes were cast based on the samples? 43

How many votes were *yes*? 10

What percent of the votes cast were *yes* votes? 23.3%

Using Centimeter Cubes, represent votes from a subgroup of a larger population. Take three samples from a large pile of cubes. Choose a color to represent *yes* votes. Record your results.

2.

Sample	Number of Votes	Number of *Yes* Votes	Number of *No* Votes
1			
2			
3			

Answers will vary.

How many votes were cast based on the samples? _____

How many votes were *yes*? _____

What percent of the votes cast were *yes* votes? _____

3.

Sample	Number of Votes	Number of *Yes* Votes	Number of *No* Votes
1			
2			
3			

Answers will vary.

How many votes were cast based on the samples? _____

How many votes were *yes*? _____

What percent of the votes cast were *yes* votes? _____

Answer Key

Challenge! Why it is necessary to use a sample when seeking results from a large poplulation?

Challenge: (Sample) A population is often too large to test or survey. A sample can be tested or surveyed and the results can be used to generalize the results of the larger population.

Name _____

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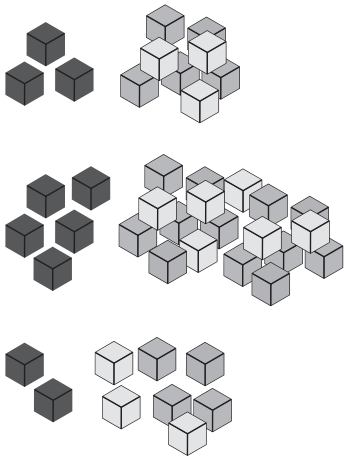
1. Three samples are shown. Complete the table.



Sample	Number of Votes	Number of *Yes* Votes	Number of *No* Votes
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3	9		

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How many votes were cast based on the samples? _____

How many votes were *yes*?_____

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Name _____

Challenge! Why it is necessary to use a sample when seeking results from a large poplulation?