Lesson 8.2

Surveys are often conducted to gather data about a population.

A **population** is the entire group of people or objects that you want information about.

A **census** is a survey of an entire population. When it is too difficult, expensive, or time-consuming to conduct a census, a **sample**, or part of the population, is surveyed.

A car factory just manufactured a load of 6,000 cars. The quality control team randomly chooses 60 cars and tests the air conditioners. They discover that 2 of the air conditioners do not work.
Identify the population and the sample.

Population: 6,000 total cars Sample: 60 cars

A wildlife researcher is studying the effects of certain pollutants on different types of fish in a lake. Because it is difficult or impossible to catch every fish in the lake, the researcher decides to use a random sample. She catches 5 groups of 10 fish each from random spots in the lake, examines them, and returns them to the lake. The table shows the numbers of perch and walleye from each group.

	Perch	Walleye
Group 1	5	5
Group 2	6	4
Group 3	3	7
Group 4	5	5
Group 5	1	9

Identify the population and sample in the researcher's study.
pop: total # of fish Sample: 50 fish caught in the lake.

Use the table to estimate the ratio of perch to walleye in the lake.
20 perch
30 walleye
2:3

Sampling Method	Description
Random	Each individual in the population has an equal chance of being selected.
Self-Selected	Individuals volunteer to be part of the sample.
Convenience	Individuals are selected based on how accessible they are.
Systematic	Members of the sample are chosen according to a rule, such as every *n*th individual in the population.
Stratified	The individuals are organized into groups, and individuals from each group are selected (typically through a random sample within each group).
Cluster	The individuals are organized into groups, and all of the individuals in just some of the groups are selected (typically through a random sample of the groups).

The salaries (in thousands of dollars) of all 30 employees at a small company are listed in the table.

Salaries at a Small Company									
21 1	24 2	26 3	28 4	30 5	32 6	33 7	35 8	37 9	41 10
44 11	46 12	47 13	49 14	50 15	51 16	52 17	54 18	55 19	57 20
58 21	62 22	62 23	64 24	64 25	65 26	70 27	71 28	73 29	80 30

Suppose individuals whose salaries are 51, 57, 58, 65, 70, and 73 volunteer to be in the sample. Compute the self-selected sample's mean, rounding to the nearest whole number.

$\bar{x}$: 62

Take a convenience sample by choosing the 6 numbers in the first two columns of the table. Record the salaries, and then compute the sample's mean, rounding to the nearest whole number.

21, 24, 44, 46, 58, 62

$\bar{x}$: 43

Take a systematic sample by choosing every fifth number in the list, reading from left to right in each row. Record the salaries, and then compute the sample's mean, rounding to the nearest whole number. 30, 41, 50, 57, 64, 80 $\bar{x}$: 54	Take a random sample using your graphing calculator. 55, 33, 80, 62, 41, 35 $\bar{x}$: 51
Compute the mean of the population. Then list the four samples from best to worst ☐ in terms of how well each sample mean estimates the population mean. pop. $\bar{x}$: 49 Random = 51 Convenience: 43 Systematic = 54 Self-Select: 62	Which sampling method do you think is most likely to result in a representative sample? Why? Random Sample - its unbiased & each individual has the same chance of being selected.
Which sampling method do you think would be least likely to result in a representative sample? Why? Self-Selected - its biased toward individuals that have an interest in the results.	Explain why a researcher might use a sampling method rather than a census to gather information about a population. A census may be too expensive, impractical or even impossible to obtain.
Underrepresented 1 or more of the parts of a population are left out when choosing the sample.	Overrepresented A greater emphasis is placed on 1 or more of the parts when choosing the sample.

Decide whether the sampling method could result in a biased sample. Explain your reasoning.

A survey is conducted by calling 100 people randomly chosen from the phone book and asking how long each person has lived at the current residence Biased - Anyone that may have just moved may not be listed yet. Thus people new to the neighborhood are underrepresented.	A survey of students at a school is conducted by contacting every 10th student from the complete roster and asking whether he or she plans to go to college. Unbiased - Sample is selected from the entire school population.
A survey of a city's residents is conducted by asking 20 randomly selected people at a grocery store whether the city should impose a beverage tax. Biased - Residents that don't shop at the grocery store are underrepresented.	A survey of students at a school is conducted by asking 30 randomly selected students in an all-school assembly whether they walk, drive, or take the bus to school. Unbiased - No group is over or underrepresented.

The owner of a health club wants to determine the percent of adults in his area who exercise for at least 20 minutes three times a week. He asks the first 25 adults he sees at a mall on a weekday around 10:00 A.M. Are the results of the survey likely to be representative of the population? Explain.

Convenience Sample, thus not likely to be representative.

A car dealer wants to know what percentage of the population in the area is planning to buy a car in the next year. The dealer surveys the next 15 people who come to the car lot. Are the results of the survey likely to be representative of the population?

Biased (convenience sample) people @ a car lot are more likely to be car shopping.

A restaurant owner wants to know how often families in his area go out for dinner. He surveys 25 families who eat at his restaurant on Tuesday night. Are his results likely to be representative of the population? Explain

No, people in a restaurant on a Tuesday night are more likely to eat out.

Random samples are less likely to be biased, while nonrandom samples are more likely to be biased. Bias in a sample is not always obvious at first glance.

A **statistic** is a number that describes a sample. A **parameter** is a number that describes a population. You can use a statistic from a survey to estimate a parameter. In this way, surveys can be used to make predictions about a population

A researcher is gathering information on the gender of prairie dogs at a wildlife preserve. The researcher samples the population by catching 10 animals at a time, recording their genders, and releasing them,
How can he use this data to estimate the ratio of males to females in the population?

$24:16 = 3:2$

	Male	Female
Sample 1	5	5
Sample 2	7	3
Sample 3	4	6
Sample 4	8	2

24 16

In a survey of 40 employees at a company, 18 said they were unhappy with their pay. The company has 180 employees. Predict the number of employees who are unhappy with their pay.

$\frac{18}{40} = \frac{x}{180}$ $40x = 3240$ $x = 81$

About 81 employees are unhappy

In a random sample of phone calls to a police station, 11 of the 25 calls were for emergencies. Suppose the police station receives 175 calls in one day. Predict the number of calls that will be for emergencies.

$\frac{11}{25} = \frac{x}{175}$ $25x = 1925$ $x = 77$

About 77 calls are for emerg

The manager of a store randomly surveys 20 customers. Of the 12 staff members, 3 had shifts on the day of the survey. Of the 20 people surveyed, 15 thought the staff was not attentive enough. The manager decides to close the store for a day and hire a consultant to come in and train the whole staff on customer service skills. Did the manager make a good decision? Why or why not?

NO, The sample was taken from customers that may have only interacted w/ 3 of the 12 staff members

A promotion on a cereal box says that 1 in 4 boxes will have a prize inside. Marion has bought 5 boxes but hasn't opened a prize. He decides the advertised prize rate must be wrong. Is he justified in this evaluation? What are the chances, to the nearest percent, of not opening a prize in 5 boxes?

$(.75)^5 = 24\%$

No, he has about a 24% chance of not opening a prize in 5 boxes.