

MAY 31, 2017

**UNIT 9: PROBABILITY AND
STATISTICS**

**9.3: USING SAMPLES AND
POPULATIONS TO COLLECT
DATA**

AND

9.4: SELECTING A SAMPLE

**M. MALTBY INGERSOLL
*MATH 9***



WHAT'S THE POINT OF TODAY'S LESSON?

We will begin working on the Math 9 Specific Curriculum Outcome (SCO) "Statistics and Probability 2" OR "SP2" which states:

"Select and defend the choice of using either a population or a sample of a population to answer a question."

HOMEWORK QUESTIONS?
(pages 435 / 436, #3, 5, 6, 7, 8, 9, 10 &13)

b

13. Privacy - make the survey anonymous

Timing - between Sept. and June;
yearly instead of monthly,

Ethics - Why? Tell why she's
collecting this data.

When Collecting Data...

POPULATION: The group about which you are collecting information.

CENSUS: When data is collected from **EACH** member of a population.



EXAMPLE:

Suppose you are tasked with testing brake systems in cars that are made in a particular factory for defects. ALL of the cars made in that factory are the POPULATION of your investigation. If you were to test EACH car's brakes, then you conducted a CENSUS.

NOTE:

A census can be costly, time consuming and difficult or impossible to complete. It is only used for important issues, especially in life or death situations, or when a population is small.

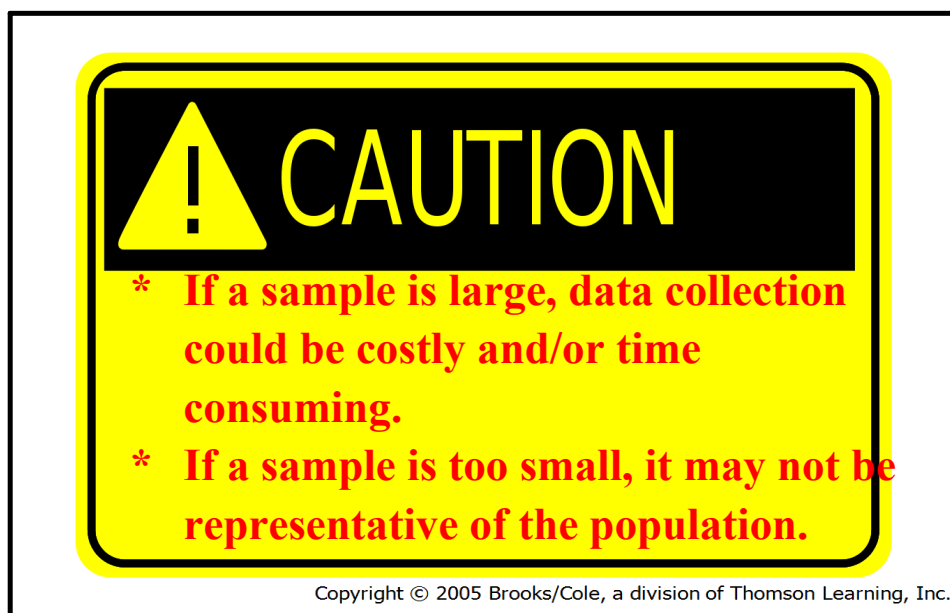
SAMPLE: When a census is not feasible or necessary, a small portion of the population is used to collect data.

VALID CONCLUSIONS: When a sample is representative of a population, valid conclusions can be drawn about the population based on data collected from the sample.

EXAMPLE:

Testing the windshield wipers on 20 out of 100 cars made each day for defective wipers is a sample. If the wipers tested represent the typical quality of the wipers made in the factory, the conclusions of the data collection will be valid.

Sampling (i.e. selecting a sub-set of a whole population) is often done for reasons of *COST* (it's less expensive to sample 1,000 television viewers than 100 million TV viewers) and *PRACTICALITY* (e.g. performing a crash test on every automobile produced is impractical).



In each example, explain why data are collected from a census instead of a sample.

i) To determine the average number of siblings of his classmates, Carlos surveyed each person in the class.

A SOLUTION:

- * Surveying the entire population produces EXACT results (no estimates).
- * It would not be time consuming.
- * It would not cost him anything.

ii) Every 5 years, Statistics Canada conducts a census. One question in the survey is used to determine the ages of the people in each household.

A SOLUTION:

A census was completed because of the importance of the question. The government requires data about the ages of Canadians so that it can budget for services such as day-care centres, schools, and senior citizens' homes.

Reasoning Why & When Samples Should Be Used

The student council is planning a school dance. To attract more grade 9 students to the dance, the council decided to collect data about the preferred music of the grade 9 students. The council members set up in the hallway to collect data. By the end of the day, they had surveyed 73% of the grade 9 students.



- i) Why do you think the data were collected from a sample and not a census?

A SOLUTION:

- * There was probably not enough time available to ask ALL grade 9 students.
- * It would take a lot of time and effort to find ALL grade 9 students, especially with absences.

- ii) Will the opinions of the sample reflect those of the population? Explain.

A SOLUTION:

Since the majority of students (73%) were asked, it is likely that their opinions will reflect those of the entire population.

Identifying & Critiquing the Use of Samples

Identify if the data were collected from a sample or a census. When a sample was used, explain if you think the conclusions would be valid.

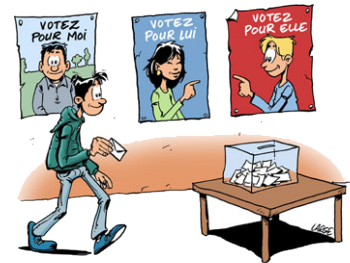


- i) A province considers banning cell phones in all of its schools. To determine the opinions of students on this issue, you poll each student in your school.

SAMPLE: The population is really ALL students of ALL schools in the province. By asking only the students in YOUR school, your results are based on a sample. If the students in your school do not represent typical students in the province, the conclusion will NOT be valid. For example, if all students in your school own cell phones, your conclusion would probably be not to ban cell phones; however, not every student in the province owns a cell phone. Because of this, your results would not be representative of the population.

- ii) To determine which politician is expected to win the municipal election, EVERY person over 18 and who is eligible to vote in the election is polled.

CENSUS: All possible voters are polled.



- iii) To determine the average lifetime of a type of light bulb, 150 light bulbs were selected randomly from the production line and tested.

SAMPLE: Since not all bulbs were tested, the results are based on a sample. It would not make sense for the whole population to be tested since all bulbs would be destroyed in the process. There would be no light bulbs left to sell.

Since a large number of bulbs were tested, the results will likely give a valid estimate of the lifetime of a light bulb.

Selecting A Sample

As you know, we choose a sample of a population when we are unable to do a census. To do this, you must know the different types of **sampling methods**.

We will discuss 6 sampling methods.



SIMPLE RANDOM SAMPLING

**Each member of the population
has an equal chance of
being selected.**

EXAMPLE:

**To select a random sample of 5
students from your math class,
each student is assigned a number,
and 5 numbers are drawn from a hat.**



SYSTEMATIC OR INTERVAL SAMPLING

**Everyⁿth member of the
population is selected.**



**This method is often used in
manufacturing, for example,
every 20th product in an assembly
line is tested for quality. If the item
is destroyed or unusable after
being sampled, then the sample
is a destructive sample.**

CLUSTER SAMPLING

Every member of each randomly chosen group of the population is selected.

For example, each grade represents a group of the school population. One grade in your school is chosen randomly, and all students in that grade are selected.



SELF-SELECTED SAMPLING

Only members who are interested and voluntarily participate.

For example, if a radio station conducts a telephone survey, only people who are interested will call.



CONVENIENCE SAMPLING

**Only members of the population
who are convenient to include
are selected.**

**For example, for a survey about
grocery shopping habits, people
in a grocery store are
approached and questioned.**



STRATIFIED RANDOM SAMPLING

Some members from each group of the population are randomly selected.

For example, 5 randomly chosen students from each grade in a school could be selected, even if each grade has a different number of students.



Identifying Appropriate Samples

The student leadership class wants to find out if students would like the cafeteria to have longer hours. Several sampling methods were suggested.

Determine the **type of sampling method** in each suggestion and explain whether each method suggested is **appropriate**.

- a) Every student's name is put into a box, and 100 names are selected randomly to be surveyed.
- b) Every 5th person entering the school is selected.
- c) Each person on the leadership team asks his or her friends.
- d) An announcement is made asking anyone who wishes to participate to fill in a ballot.

SUGGESTED SOLUTIONS:

- | | |
|---|--|
| a) Type: Simple Random Sampling
Appropriate?
Yes, every student has an equal chance of being selected. | c) Type: Convenience Sampling
Appropriate?
No, friends often have similar views. |
| b) Type: Systematic Sampling
Appropriate?
Yes depending on WHEN you ask the students. If the student is arriving early, then they would appreciate longer hours. | d) Type: Self-selected Sampling
Appropriate?
No, only students who have strong opinion about this topic may respond. |

Choosing Appropriate Samples

A company packages boxes of granola bars. The quality-control manager inspects the first 5 boxes each morning to ensure that each has the same number and type of granola bars.

a) Is this a good way of ensuring quality control? Explain.

b) Suggest 2 other methods of sampling that would be appropriate. Explain why each is appropriate.

a) No, the people working on the assembly line may be more alert in the morning, so the boxes they fill in the mornings may be more likely to meet standards and pass inspection; however, the boxes filled later in the day, which may not meet standards, are never inspected.

b) i) **Systematic sampling:** Allows the manager to inspect several boxes throughout the day. (EXAMPLE: Every 50th box is inspected.)

ii) **Simple Random Sampling:** Ensures each box has an equal chance of being selected.

CONCEPT REINFORCEMENT:

MMS9:

PAGE 440: #4 & #6

PAGE 441: #7, #9 & #10

PAGE 448: #3 & #6

PAGE 449: #7, #8, #10 & #12a