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Sampling Techniques

Statistics involves _____, _____, and _____ data. Statistics are often used by businesses, advertisers, governments, and the media, both to inform us and persuade us.

In the context of mathematics, a _____ includes all members (people or objects) of a group that possess common characteristics from which information is being collected. A _____ is a part of the population chosen for participation in a study. Samples are often used because they are _____, _____ and _____. The accuracy of any statistical study depends on how the sample is chosen. The following are some of the different sampling methods available to researchers:

- cluster sample
- convenience sample
- simple random sample
- stratified sample
- systematic sample
- voluntary sample

SAMPLING METHOD	DEFINITION	EXAMPLE
	Every item in the population has an equal chance of being selected.	Drawing five names to survey from a hat containing 30 names.
	The population is divided into subgroups (by age, gender, nationality, etc.) and a random sample is selected from each subgroup in proportion to its size in the population.	A school is divided into 4 groups by grade. There are 300 grade nines, 350 grade tens, 270 grade elevens and 320 grade twelves. 10% of each group chosen to be a part of the sample.
	The population is divided into clusters and a certain number of clusters are chosen. Every member of these clusters is part of the sample.	A VP enters the cafeteria and randomly selects two tables. All students at those two tables are surveyed.
	The sample contains those members of the population from which data are most easily collected.	To survey woodworkers in Ontario, we ask people at several lumber yards and home improvement stores scattered about the province.
	The sample contains those members of the population who have chosen to respond to the survey. Often a reward is offered to those who participate in the survey.	The psychology students at University of Toronto are given an extra 2% at the end of the year if they volunteer for any two upper-year psychology surveys.
	Every n^{th} member of the population is selected.	Ronald McDonald hands out coupons for free Cheeseburger Happy Meals to every 10^{th} kid who enters the restaurant.

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Example 1

Alicia wants to know which band Ontario high school students think is the best. Alicia's friend Jason goes to a different school, so they each survey students at their own school. Alicia uses the completed surveys from both schools to draw conclusions.

a. Identify the population and the sample.

b. Is the sample representative of the population?

Example 2

Determine the best sampling technique for each survey. Provide a reason for your answer

a. The school newspaper wants to determine which presidential candidate in the upcoming student council elections is supported by the majority of students.

b. A light bulb manufacturer wants to determine the lifespan of a certain type of light bulb, in hours.

c. The Parent – Teacher Association wants to determine the average number of hours per week that students spend on homework.

d. The producers of "Canadian Idol" want to determine which of the two remaining candidates should be the next Canadian Idol.

Example 3

There are 570 students taking mathematics this semester. The table below shows the number of math students in each grade. A total of 90 math students are to be surveyed using a stratified random sample. How many students from each grade level should be surveyed?

Grade	# of Math students	% of Math students	# of students to be surveyed
9	115		
10	125		
11	150		
12	180		
total	570	100	90

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To make an accurate prediction about a population, it is necessary to use a **representative sample**. The characteristics of a representative sample are:

- _____ - every member of the population has an equal chance at being selected
- _____ - fair and impartial.

Bias is the intentional or unintentional prejudice of data collected in a survey. There are several types of bias:

TYPE OF BIAS	DEFINITION	EXAMPLE
Sampling Bias		A survey asks students at a high school football game whether a fund for extra curricular activities should be used to buy new equipment for the football team or instruments for the school band.
Response Bias		A group of professional football players are asked if they have ever taken banned performance enhancing substances.
Measurement Bias		A highway engineer suggests that an economical way to survey traffic speeds on an expressway would be to have police officers who patrol the highway record the speed of the traffic around them every 30 minutes.
Non-Response Bias		You hand out surveys to your classmates to be returned to you next week.

Example 4

Favourite Subject Survey

☺ Sponsored by the "Friends of Mathematics" Society ☺

Circle the most appropriate response.

Gender: Male Female

Grade: 9 10 11 12

My favourite subject is: MATH English Science

Please return the survey by the end of the day.

a. Identify the types of bias that *might* result from the survey.

b. Re-write the survey in a way that does not present the bias identified in part (a).