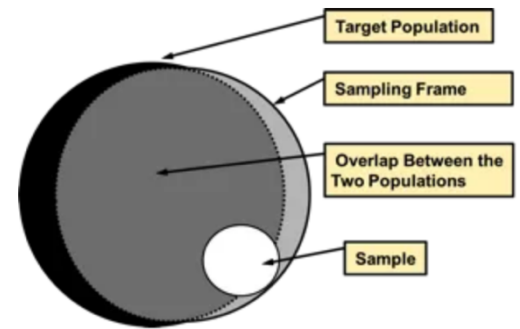




Unit 5: Organization of Data

Lesson 5.2 (Chapter 2.3): Sampling Techniques & Bias

Learning Goal: Understand how sampling techniques are used to collect data and how reduce sampling bias.



Terminologies/Definitions:

Sampling techniques: The method used to select a group from a population you wish to study.

Population: all the _____ or _____ being studied.

Sample: the group of people or items that are selected from the _____ to be studied

Sampling frame: members of a population that actually have a _____ of being selected for a study.

Statistical bias: systematic _____ in a survey or sampling method which favors certain outcomes.

Sampling Techniques: Sampling techniques fall into two categories: Random techniques and Non-random techniques.

In random sampling, all members of the population have an equal chance being selected for the sample, but this is not the case in non-random sampling.

Random sampling:

1. **Simple random sample:** randomly select individuals/items to study
2. **Systematic sample:** puts the population in an ordered list and select members at regular intervals (every n^{th} individual)
3. **Stratified sample:** Divides sample into groups proportional to those groups in the population



4. **Cluster sample:** Divides the population into groups and then randomly selects certain groups to study EVERY member in the group.

5. **Multi-stage Sample:** Divide the population into a hierarchy and choose a random sample at each level

Non-random sampling (Prone to bias)

1. **Convenience sample:** sample selected because it is easily accessible

2. **Judgement sample:** researcher uses their knowledge/judgement to select individuals/items

3. **Voluntary sample:** Participation is at the discretion of the respondent
(This may lead to response bias and non-response bias, not responding or responding intentionally incorrect, may cause the result overestimated or underestimated)

Example 1: For each situation, identify the type of sampling technique used.

- a) You want to find out if your town is in favour of starting a composting pickup service. You ask everyone on your street.



- b) A university is polling students. It selects 200 students at random in the same proportions as the enrollment in each department.

- c) There are 149 swim clubs in Ontario. Swim Ontario conducts a survey to vote on its new logo. The organization randomly selects 10 swim clubs and surveys every member in each of those clubs.

- d) A coach puts the names of all the basketball players into a hat and draws one name for a free basketball.

- e) A questionnaire is sent to every ninth person on an alphabetical list of a store's credit card customers. The first person chosen from the list is picked randomly.

- f) The student's council invites all students to provide ideas for activities.

- g) A marketing firm wants to collect information on certain products in a city of 800 000 people. The researcher randomly selects 10 neighbourhoods. In each neighbourhood they randomly select five streets, and on each street they randomly select 10 households.

Example 2: Designing a systematic sample. A telephone company is planning a marketing survey of its 760 000 customers. For budget reasons, the company wants a sample size of about 250. Suggest a method for selecting a systematic sample.



Example 3: Before booking bands for the school dances, Students Council wants to survey the music preferences of the student body. The following table shows the enrollment at the school. Design a stratified sample for a survey of ...

Grade	# of students	25% of the population	100 people
9	255		
10	232		
11	209		
12	184		
Total	880		

Bias: Bias occurs when the _____ of the sample are not representative of the population. Bias can come from the sampling method, or it can come from the survey.

Sampling method Bias:

1. **Sampling Bias:** Bias resulting from a sample that does not adequately reflect the characteristics of the population.

2. **Measurement Bias:** Bias resulting from a data collection method that consistently either under- or over-estimates a characteristic of the population.

Survey Bias:

1. **Leading question:** a form of measurement bias which use questions which prompts a particular answer (such as multiple choice options)



2. **Loaded questions:** a form measurement bias which use questions containing information or language intended to influence a response.

3. **Response bias:** bias that occurs when participants in a survey give false or misleading answers (intentional or not)

4. **Non-response bias:** bias occurs when particular groups are under-represented in a survey because they chose not to participate or to complete one or more questions in the survey.

Example 4: Identify type of bias that man occur in the following situations.

- a) A survey questions asks, "How many words per minute can you read"

- b) A survey is sent to parents of school-age children that asks whether bus safety lanes should be installed.

- c) A phone company surveys its customers via text message about which services people like the best.

- d) A survey asks, "Now that the city is in debt, do you think the current mayor will win the next election?"

- e) A survey asks, "What is your favorite make of vehicle: Ford, Honda, Toyota, or Chevrolet?"