

CHAPTER 1

Statistics mainly involves summarizing, collecting and interpreting data. Statistics helps making informed decisions in presence of uncertainty.

Foundation of Statistics

Population

Population is a set of all units of interest.

Examples:

- The height of Canadians {149 cm, 170 cm, ..., 182 cm}.
- The number of cars each Canadian bought in 2012 {1, 3, ..., 0}.
- The annual income of those who graduated from Carleton in 2012 {\$25,000, \$0, \$50,000, ..., \$100,000}.
- The gender of each Canadian {Male, Female, ..., Female}.

Variable

Any characteristic of a population unit is called a variable (source of uncertainty). Variables vary from one population unit to another or it varies over time. When the value of the variable is observed, we have a measurement or observation.

Types of variables:

- Qualitative - When the variable of interest is a quality.
- Quantitative - When the variable of interest is a quantity (i.e. Number).

Sample

Often in practice we cannot observe the whole population, in this case we draw a sample from the population. Any subset of the population is called a sample.

Example:

- $n = 5,000$ is the sample size.

Sampling

How to Draw a Sample (From a Population)

A sample should be chosen randomly. A random sample is a sample that is selected in such a way that the remaining units in the population have the same chance of being selected.

Simple Random Sampling

Sampling with replacement is when each chosen unit is returned into the population. Sampling without replacement is when each chosen unit is not returned to the population.

A process is a sequence of operations' that takes input (labour, materials, machines, etc.), and returns outputs (products, services, etc.).

Levels of Measurements

Qualitative:

- Nominal.
 - The population is given labels, i.e. male = 1, female = 2
- Ordinal.
 - The population is given ranks, i.e. fried chicken = 1, pasta = 2, and steak = 3 where $1 > 2 > 3$.

Quantitative:

- Interval.
 - The distance between the numbers is a constant and is meaningful, i.e. rating a professor's performance on a scale from 1-5.
- Ratio.
 - There is a meaningful zero, i.e. $\$5 - \$5 = \$0$

In general any quantitative measurement is either discrete or continuous:

- Discrete can assume a finite (countable) number of values.
- Continuous assumes infinite (uncountable) number of values.

Survey (Questionnaire)

The main purpose of a survey is to elicit a response from the participants.

Methods of conducting a survey is:

- Mail.
- Telephone.
- In person.