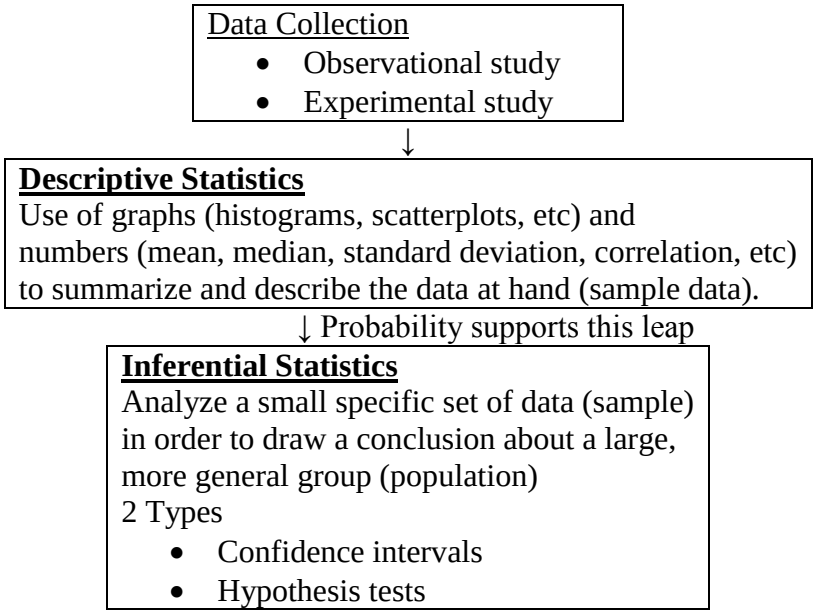
Chapter 1 – An Introduction to Statistics and Statistical Inference

What is statistics about?

- It's used to describe typical values and variability and to make decisions that affect everyone.
- The study of how best to …
  - … collect data
  - … summarize data (Descriptive statistics)
  - … draw conclusions from data (Inferential statistics)



Example (Exercise 1.5, p. 16) – Determine whether each of the following is a descriptive or an inferential statistics problem.

(a) The Nebraska Department of Transportation maintains records concerning all trucks stopped for inspection. A report of these inspections lists the proportion of all trucks stopped, by cargo.

(b) Eric Knudsen, a researcher at Stanford University Medical Center, obtains a random sample of wild owls and measures how far each can turn its neck. The data are used to conclude that an owl can turn its neck more than 120 degrees from the forward position.

(d) A safety inspector in Atlanta selects a sample of apartment buildings and checks the fire ladders on each. The proportion of broken ladders in the sample is used to estimate the proportion of broken fire ladders in the entire city.

(f) A report from the Louisiana Department of Agriculture and Forestry lists the prices paid for raw forest products at the first point of sale.

Terminology

- **Population** – the entire collection of individuals or objects to be considered or studied (typically very large)
- **Sample** – a small selection of individuals or objects taken from the population
- **Variable** – a characteristic of an individual or object in a population of interest

Example – Describe the population, sample, and variable of interest.

(a) (Example 1.5, p. 14) – A new study is concerned with the magnesium level in a slice of whole-grain bread. One hundred slices of whole-grain bread are selected at random from various markets, and the magnesium in each is carefully measured and recorded.

Population –

Sample –

Variable –

(b) A factory purchases a large lot of parts from a supplier. Before accepting the entire lot, a quality control engineer randomly selects 50 parts, identifies whether each part is good or bad, and then makes a decision whether the factory will keep the entire lot or reject it.

Population –

Sample –

Variable –

Terminology

- **Observational study** – we observe the response for a specific variable for each individual or object (but do not attempt to influence responses)
- **Experimental study** – we deliberately impose treatments (by manipulating one or more factors) on individuals or objects in the sample and observe their responses. Goal – to see if a treatment is effective or which of several treatments is most effective
- **Simple random sample (SRS) of size n** – a sample selected in such a way that every possible sample of size n has the same chance of being selected

Example (Exercise 1.27, p. 22) – The administration at the University of Nebraska in Lincoln is interested in student reaction to a planned parking garage on campus. A dormitory near the proposed site is selected and several Student Senate members volunteer to solicit responses. One Thursday evening, the volunteers each take a specific dorm wing, knock on doors, and record student answers to several prepared questions.

(a) Is this an observational or an experimental study?

(b) Describe the sample in this problem.

(c) Is this a random sample? Justify your answer.

Example (Exercise 1.37, p. 23) – Electric and plug-in electric cars are designed to save gasoline and help the environment. In addition, there are certain tax credits for these types of hybrid automobiles. Although there are certainly benefits to owning a hybrid car, many people complain about the slow acceleration, repair expense, and overall comfort. Thirty-five passengers are randomly selected. Each is blindfolded and taken for a ride in a traditional combustion-engine automobile and in a comparably sized hybrid car (over the same route). The passenger is then asked to select the car with the most comfortable ride.

(a) Is this an observational or an experimental study?

(b) What is the variable of interest?

(c) Describe possible sources of bias in these results.