Statistics

- *Statistics* is the art and science of gathering, analyzing, and making inferences (predictions) from numerical information, data, obtained in an experiment.

- Statistics is divided into two main braches.

  – *Descriptive statistics* is concerned with the collection, organization, and analysis of data.

  – *Inferential statistics* is concerned with making generalizations or predictions from the data collected.

Statisticians

- A statistician's interest lies in drawing conclusions about possible outcomes through observations of only a few particular events.

  - The *population* consists of **all** items or people of interest.

  - The *sample* includes *some* of the items in the population.

- When a statistician draws a conclusion from a sample, there is always the possibility that the conclusion is incorrect.

- Does the "Census" come from a sample or a population?

Statistical Study Steps

Step 1: State the goal of your study precisely; that is, determine the population you want to study and exactly what you'd like to learn about it.

Step 2: Choose a sample from the population.

Step 3: Collect raw data from the sample and summarize these data by finding sample statistics of interest.

Step 4: Use the sample statistics to make inference about the population.

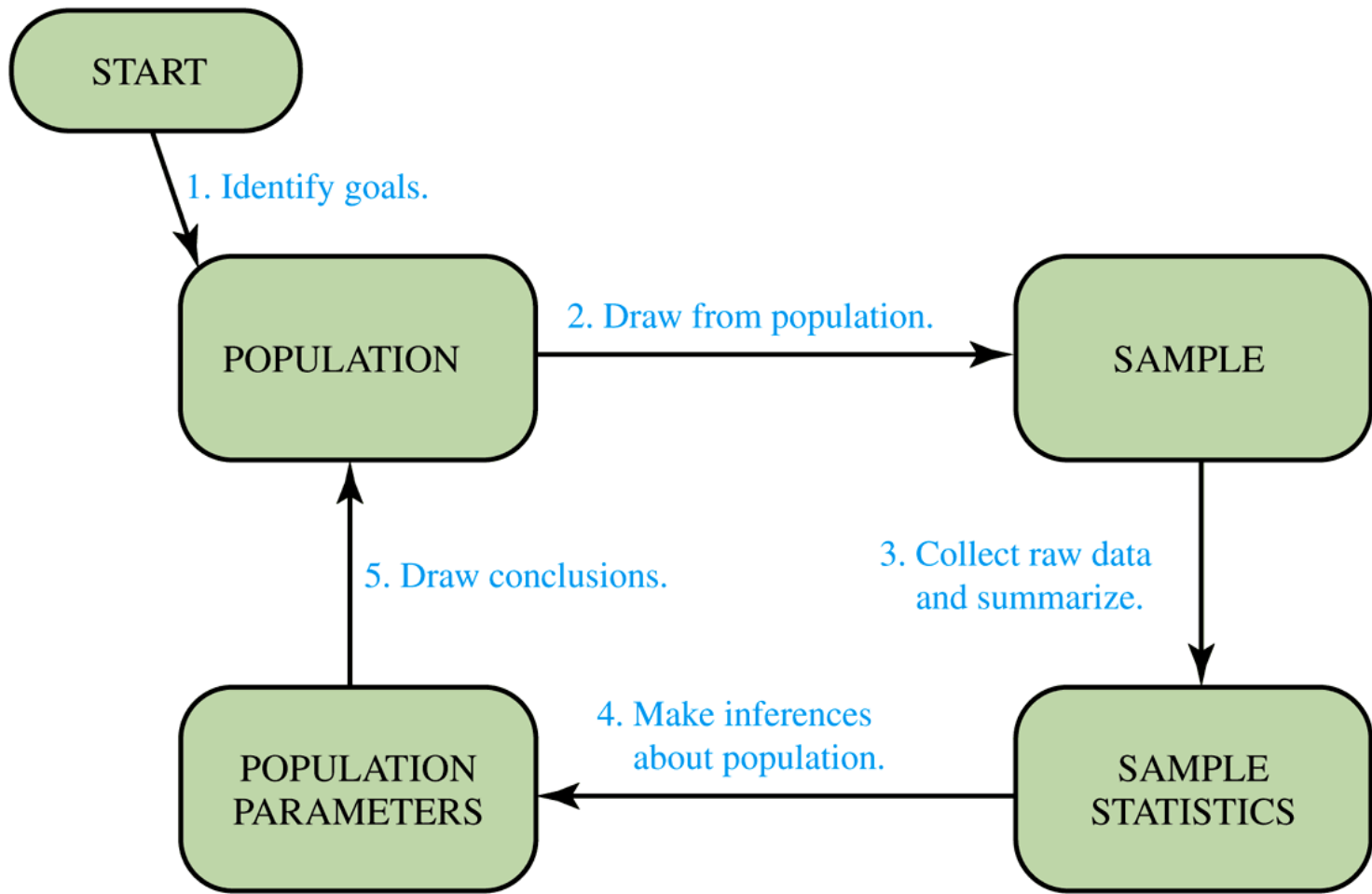**Step 5**: Draw conclusions; determine what you learned and whether you achieved your goal.

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Figure 1.2   The process of a statistical study.

Parameter vs. Statistic

Parameter - A numerical value that is equivalent to an entire population.

Ex. What percent of people in household like sweet potatoes?

Statistic – A numerical value that represents a sample of an entire population.

Ex. How many people in the world like sweet potatoes? (impossible to do)

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Definitions

- A **representative sample** is a sample in which the relevant characteristics of the sample members are generally the same as the characteristics of the population.

- A statistical study suffers from **bias** if its design or conduct tends to favor certain results.

Summary of Sampling Methods

Keep in mind the following three key ideas:

- A study can be successful only if the sample is representative of the population.

- A biased sample is unlikely to be a representative sample.

- Even a well-chosen sample may still turn out to be unrepresentative just because of bad luck in the actual drawing of the sample.

***There will always be some level of error in your sample**

Types of Sampling

- A *random sampling* occurs if a sample is drawn in such a way that each time an item is selected, each item has an equal chance of being drawn.

- When a sample is obtained by drawing every nth item on a list or production line, the sample is a *systematic sample*.

- A *cluster sample* is sometimes referred to as an area sample because it is frequently applied on a geographical basis.

Types of Sampling continued

- *Stratified sampling* involves dividing the population by characteristics called *stratifying factors* such as gender, race, religion, or income.

- *Convenience sampling* uses data that are easily or readily obtained, and can be extremely biased.

Example: Identifying Sampling Techniques

- A raffle ticket is drawn by a blindfolded person at a festival to win a grand prize.

■ *Random ?* ✔

■ *Systematic ?*

■ *Cluster ?*

■ *Stratified ?*

■ *Convenience ?*

Example: Identifying Sampling Techniques

- Students at an elementary school are classified according to their present grade level. Then, a random sample of three students from each grade are chosen to represent their class.

■ *Random ?*

■ *Systematic ?*

■ *Cluster ?*

■ *Stratified ?* ✔

■ *Convenience ?*

Example: Identifying Sampling Techniques

- Every sixth car on highway is stopped for a vehicle inspection.

■ *Random ?*

■ *Systematic ?* ✅

■ *Cluster ?*

■ *Stratified ?*

■ *Convenience ?*

Example: Identifying Sampling Techniques

- Voters are classified based on their polling location. A random sample of four polling locations are selected. All the voters from the precinct are included in the sample.

■ *Random ?*

■ *Systematic ?*

■ *Cluster ?*   ✅

■ *Stratified ?*

■ *Convenience ?*

Example: Identifying Sampling Techniques

- The first 20 people entering a water park are asked if they are wearing sunscreen.

■ *Random ?*

■ *Systematic ?*

■ *Cluster ?*

■ *Stratified ?*

■ *Convenience ?* ✔

Basic Types of Statistical Studies

1. In an **observational study**, researchers observe or measure characteristics of the subjects but do not attempt to influence or modify these characteristics.

2. In an **experiment**, researchers apply some **treatment** and observe its effects on the subjects of the experiment.

3. In a **Meta analysis** results from several different studies are used to draw conclusions

Observation, experiment or meta analysis?

- In a study to determine if Vitamin C can effect the length of a common cold 48 males who have common cold symptoms are randomly given either a placebo pill or a vitamin C pill. The length of their cold symptoms is recorded in days.

Experimental

Observation, experiment or meta analysis?

- Researchers placed cameras in major super market check out lines and observed how many customers the cashier greeted before beginning their check out

Observational Study

Observation, experiment or meta analysis?

Results from 15 major studies regarding weight loss looks to determine the most effective methods

Meta Analysis