**Section 1.1 Introduction to the Practice of Statistics**

**Objectives**

1. Define Statistics and Statistical Thinking
2. Explain the Process of Statistics
3. Distinguish between Qualitative and Quantitative Variables
4. Distinguish between Discrete and Continuous Variables
5. Determine the Level of Measurement of a Variable

***Objective 1: Define Statistics and Statistical Thinking***

Objective 1, Page 1

 *Answer the following as you watch the video.*

1. Write the definition of statistics below the science of collect , organize, summarize, and analyze, information to draw conclusions or answer questions. In addition, stats is about providing a MEASURE of confidence in any conclustion.
2. Data describes CHARACTERISTICS of individuals and can be either group or within the individual himself.

**Note:** Data varies. Consider the students in your class. Is everyone the same height? No. Does everyone have the same color hair? No. So, within groups there is variation. Now consider yourself. Do you eat the same amount of food (as measured by calories) each day? No. Do you sleep the same number of hours each day? No. So, even considering individuals there is variation. One goal of statistics is to describe and understand sources of variation.

***Objective 2: Explain the Process of Statistics***

Objective 2, Page 1

 *Answer the following while watching the animation.*

1. What is the entire group to be studied called? Population
2. What do we call a person or object that is a member of the population being studied? individual

Objective 2, Page 1 (continued)

1. Give the definition of a sample. Subset of population being studied.
2. What do we call a numerical summary of a sample? A statistic.
3. What do we call a numerical summary of a population? Parameter.
4. Give the definition of descriptive statistics. Sample, extend to the Consists of organizing and summarizing data. It describes data through numerical summaries, tables, and graphs.
5. Give the definition of inferential statistics. Uses results from a sample, extends it to the population and measures reliability of result.
6. In the $100 experiment, what is the population? What is the sample?

Population: complete student body. parameter

Sample: chosen people in student body. statistic

Objective 2, Page 1 (continued)

1. Is the statement an example of descriptive statistics or inferential statistics? Circle the correct answer.
   1. The percent of students in the survey who would return the money to the owner is 78%.

Descriptive statistics right

Inferential statistics

* 1. We are 95% confident that between 74% and 82% of all students would return the money.

Descriptive statistics

Inferential statistics correct

1. Is the given measure a statistic or a parameter? Circle the correct answer.
   1. The percentage of all students on your campus who own a car is 48.2%.

Statistic

Parameter correct

* 1. Suppose a random sample of 100 students is obtained, and from this sample we find that 46% own a car.

Statistic correct

Parameter

Objective 2, Page 7

 *Fill in the following steps while watching the video.*

**The Process of Statistics**

1. **\_identify the problem\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** A researcher must determine the question(s) he or she wants answered. The question(s) must be detailed so that it identifies the population that is to be studied.
2. **\_Collect the Data\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** Conducting research on an entire population is often difficult and expensive, so we typically look at a sample. This step is vital to the statistical process because if the data are not collected correctly, the conclusions drawn are meaningless. Do not overlook the importance of appropriate data collection.
3. **\_\_Describe the data \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** Descriptive statistics allow the researcher to obtain an overview of the data and can help determine the type of statistical methods the researcher should use.
4. **Perform inference\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** Apply the appropriate techniques to extend the results obtained from the sample to the population and report a level of reliability of the results.

Objective 2, Page 8

**Example 1** ***The Process of Statistics: Gun Ownership***

The AP – National Constitution Center conducted a national poll to learn how adult Americans feel existing gun-control laws infringe on the second amendment to the U.S. Constitution.

The following statistical process allowed the researchers to conduct their study.

1. Identify the research objective. Determine % of adult Americans who believe gun control laws infringe on the publics right to bear arms. Population = ADULT AMERICANS
2. Collect the information needed to answer the question posed in (1). Surveyed a SAMPLE of 1007 ADULT AMERICANS. 51% believed existing gun control laws infringe on the publics right bear arms . Cannot survey 200 million americans
3. Describe the data. 51% believe it infringes. DESCRIPTIVE STATISTIC
4. Perform inference 95% chance that all adult americans is between 48% and 54%

***Objective 3: Distinguish between Qualitative and Quantitative Variables***

Objective 3, Page 1

Define the following terms.

1. Qualitative variable: **Qualitative**, or **categorical**, **variables** allow for the classification of individuals based on some attribute or characteristic.
2. Quantitative variable: **Quantitative variables** provide numerical measures of individuals. The values of a quantitative variable can be added or subtracted and provide meaningful results.

Objective 3, Page 2

**Example 2** ***Distinguishing between Qualitative and Quantitative Variables***

Determine whether the following variables are qualitative or quantitative.

1. Gender--qualitative
2. Temperature quantitative
3. Number of days during the past week that a college student studied -quantitative
4. Zip code qualitative

***Objective 4: Distinguish between Discrete and Continuous Variables***

Objective 4, Page 1

Define the following terms.

1. Discrete variable: A **discrete variable** is a quantitative variable that has either a finite number of possible values or a countable number of possible values. A discrete variable cannot take on every possible value between any two possible values.
2. Continuous variable:

A **continuous variable** is a quantitative variable that has an infinite number of possible values that are not countable. A continuous variable may take on every possible value between any two values.

Objective 4, Page 2

**Example 3** ***Distinguishing between Discrete and Continuous Variables***

Determine whether the quantitative variables are discrete or continuous.

1. The number of heads obtained after flipping a coin five times. Discrete
2. The number of cars that arrive at a McDonald’s drive-through between 12:00 P.M. and 1:00 P.M. Discrete
3. The distance a 2011 Toyota Prius can travel in city driving conditions with a full tank of gas. Continuous

Objective 4, Page 4

Define the following terms.

1. Data: The list of observed values for a variable is **data.**
2. Qualitative data: **Qualitative data** are observations corresponding to a qualitative variable.
3. Quantitative data: **Quantitative data** are observations corresponding to a quantitative variable.
4. Discrete data: **Discrete data** are observations corresponding to a discrete variable.
5. Continuous data: **Continuous data** are observations corresponding to a continuous variable.

Objective 4, Page 5

**Example 4** ***Distinguishing between Variables and Data***

The following table presents a group of selected countries and information regarding these countries as of September, 2010.

| **Country** | **Government Type** | **Life Expectancy (years)** | **Population (in millions)** |
| --- | --- | --- | --- |
| Australia | Federal parliamentary democracy | 81.63 | 21.3 |
| Canada | Constitutional monarchy | 81.23 | 33.5 |
| France | Republic | 80.98 | 64.4 |
| Morocco | Constitutional monarchy | 75.47 | 31.3 |
| Poland | Republic | 75.63 | 38.5 |
| Sri Lanka | Republic | 75.14 | 21.3 |
| United States | Federal republic | 78.11 | 307.2 |

Identify the individuals, variables, and data.

***Objective 5: Determine the Level of Measurement of a Variable***

Objective 5, Page 1

List the characteristics used to determine what level of measurement a variable is.

1. Nominal: if the values of the variable name, label, or categorize. In addition, the naming scheme does not allow for the values of the variable to be arranged in a ranked or specific order
2. Ordinal: if it has the properties of the nominal level of measurement. However, the naming scheme allows for the values of the variable to be arranged in a ranked or specific order

Objective 5, Page 1 (continued)

1. Interval: if it has the properties of the ordinal level of measurement and the differences in the values of the variable have meaning. A value of zero does not mean the absence of the quantity. Arithmetic operations such as addition and subtraction can be performed on the values of the variable
2. Ration: if it has the properties of the interval level of measurement and the ratios of the values of the variable have meaning. A value of zero means the absence of the quantity. Arithmetic operations such as multiplication and division can be performed on the values of the variable.

Objective 5, Page 2

**Example 5 *Determining the Level of Measurement of a Variable***

For each of the following variables, determine the level of measurement.

1. Gender nominal
2. Temperature interval
3. Number of days during the past week that a college student studied ratio
4. Letter grade earned in your statistics class Ordinal

**Section 1.2 Observational Studies versus Designed Experiments**

**Objectives**

1. Distinguish between an Observational Study and a Designed Experiment
2. Explain the Various Types of Observational Studies

***Objective 1: Distinguish between an Observational Study and a Designed Experiment***

Objective 1, Page 1

*Answer the following as you watch the video.*

1. Why is the Danish study mentioned in the video an observational study and not a designed experiment? Because statisticians just measured what was already normal behavior without their outside influence.
2. Why is the “rat” study mentioned in the video a designed experiment and not an observational study? Because the researchers introduced KNOWN and DIFFERENT outside variables to different groups of rats and recorded the results.

What is the response variable in each study, and what is the explanatory variable? In both studies, the goal

was to determine if radio frequencies from cellphones

increase the risk of contracting brain tumors.

Whether the individual contracted a brain tumor or not

was the response variable

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