1 – 1 Descriptive and Inferential Statistics

To learn this subject, we need to speak the same language. So, first we spend time learning the definitions of terms we use.

What is Statistics?

Statistics is the science of conducting studies to collect, \_\_\_\_\_\_\_\_\_\_, summarize, \_\_\_\_\_\_\_\_\_\_\_, and draw conclusions from data.

Why do we use Statistics?

Statistical studies are performed within most professions. To understand the results, you will need to know the \_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_, and procedures used.

You may conduct research in your field. You need to be able to design experiments, select samples, collect data, organize, analyze and summarize the data, make reliable predictions, and communicate the results of the study.

Use, understand, and analyze statistics presented by governmental and commercial entities in order to make informed decisions.

Objective 1. Demonstrate Knowledge of Statistical Terms

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a characteristic or attribute that can assume different values (measurements or observations). Customer names, amount of daily sales, favorite television programs, are variables.

When these values are determined by chance, the variables are called \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Result of the *roll of a die* or *a lottery winner* are examples of random variables.

Values, measurements or observations that variables can assume are called \_\_\_\_\_\_\_\_\_\_.

Measurements include values such as the height of customers, time between eruptions of a geyser, circumference of a tree trunk, weight of a package and A1C levels.

Observations include hair color, number of shirts on a rack, or number of behavioral incidents within a specific amount of time.

A collection of these \_\_\_\_\_\_\_\_\_\_ values forms a data set. Each single value in the data set is called a data value or datum. (That is, data is plural.)

## Objective 2. Differentiate Between the Two Branches of Statistics

Statistics is divided into two main areas, determined by the way the data is used.

Descriptive statistics

*Descriptive statistics* consists of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and presentation of data. No conclusions are drawn; the data are merely described.

Your personal activity monitor may collect data about the number of steps taken in a day, the number of active minutes per day, the type of exercise completed. When results of several days or several different people are considered, the charts displaying the data and the averages of the variables are descriptive statistics.

Inferential statistics

*Population* – \_\_\_\_\_\_\_ subjects of interest or being studied. Subjects may be humans, animals, business entities, products, etc. The size of the population usually makes gathering data from every subject difficult due to expense or time.

*Sample* – a group of \_\_\_\_\_\_ subjects selected from the population.

*Inferential statistics* consists of generalizing from samples to populations, making estimates, performing hypothesis tests, determining relationships among variables and making predictions.

Thus, inferential statistics involves using probability to make \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and draw \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Hypothesis testing is a decision-making process used to evaluate claims about a population using randomly selected sample data.

Example:

Owners of comic book shops are concerned that sales of comic books are declining. A study revealed that women currently account for 53% of comic readers, (Graphic Policy & Facebook). Three years ago women accounted for 40% of readers. Over time, depiction of women in comics has changed. Further study to evaluate whether the perception of women is affected by the rise in strong, confident female comic characters depicted as heroes in movies.

Also, currently, according to WSC professor Joe Salzman, fewer than 30% of comic characters and writers are female. (Fermoso, J. September 11, 2014, *The Rise of the Woman Comic Buyer*, OZY.com). It has been predicted that comic book publishers will focus on comics that lure the female comic book reader.

What are the variables under study?

What data have been collected?

Have descriptive, inferential, or both types of statistics used?

What is the population under study?

Was a sample collected? If so, from where?

From the information given, comment on the relationship between the variables.

# **1 – 2** Variables and Types of Data

## Objective 3. Identify Types of Data

### A **variable** is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ or a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that can assume \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_.

Variables may be categorical, also called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variables, or they may be numerical, called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variables.

Eye color, gender, location, and satisfaction rankings are examples of \_\_\_\_\_\_\_\_\_\_\_ variables. Temperature, age, number of pets owned by a family, and weights are examples of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variables.

Quantitative variables are numerical and can be ranked or ordered. Quantitative variables can be classified in two groups: \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ quantitative variables assume values that can be counted, such as the number of people in a household, the number of eggs needed for a recipe, or the number of chairs at a table.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ quantitative variables can assume an infinite number of values in an interval between any two specific values, such as temperature, amount of baking soda needed for a recipe, or weight of a book. Quantitative variables are obtained by measuring and can include fractions or decimals.

Continuous variables may be recorded as the nearest inch, nearest ounce or nearest unit of measurement, so values could have taken on any value in an interval from half a unit below the recorded value up to but not including half a unit above the recorded value. 4 feet may actually mean any length from 3.5 - 4.5 feet, not including 4.5 feet (. A value recorded as 8.3 may be any value from \_\_\_\_\_\_ up to, but not including, \_\_\_\_\_\_\_\_.

## Objective 4. Identify the Level of Measurement for Each Variable

Qualitative and quantitative variables can also be classified, or categorized, using measurement scales. The four common types of scales for classifying variables are \_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_.

The lowest level of measurement is **nominal**, classifying qualitative variables in non-overlapping categories that cannot be \_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_.

**Examples:** These are labels for which there is no meaningful order or rank.

Zip codes (27013 locates Cleveland, NC)

Address

Social Security Number

Gender

Ethnicity

Company/Corporation name

ISBN

Tracking Numbers

Television channel

The second level of measurement is **ordinal**, classifying \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variables into categories that can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_.

**Examples:** These can be put in a natural order, but precise differences between values cannot be measured.

Satisfaction ratings (superior, average, poor)

Football team rankings (first, second, third …)

Some clothing sizes (small, medium, large)

Pain level (0 – 10)

Ranking preference for vacation sites (Rank from 1 – 10)

*Levels or rankings by one person may not have the same meaning for another person who selects that same ranking.*

The third level of measurement is **interval**, the first level that classifies \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variables. These can be ranked or ordered, have precise differences between units of measurement, but have no meaningful zero. That is, the placement of zero on the measuring scale is arbitrary.

**Examples:** These values have a natural order, differences have meaning, but zero is not meaningful.

Fahrenheit temperature (98° is hotter than 43°, but 0° does not mean no heat)

Celsius temperature (98° is hotter than 43°, but 0° does not mean no heat, and 0° is not the same temperature as it is on the Fahrenheit temperature scale.)

Calendar years

Time of day (but not length of time).

Scales, such as the standardized scale of political orientation, that are constructed to have equal intervals.

The fourth, and highest, level of measurement is **ratio**, which has the same characteristics as interval and has a \_\_\_\_\_ zero, a zero \_\_\_\_\_ \_\_\_\_\_\_\_\_\_. Weights can be ordered ascending or descending, have precise differences (for instance, 200 pounds is 90 pounds heavier than 110 pounds), and objects weighing zero pounds have no weight.

**Examples:** These values can be ranked or ordered, have precise differences between values, and have a true zero. Ratios make sense. For instance, 12 miles is twice as far as 6 miles.

Distance (on any scale – kilometers, miles, etc.)

Volume.

Number of books in a library.

GPA (grade point average).

Years of work experience.

Household size.

Weight of recyclables discarded each week.

**Classify** each of the following variables first as **qualitative or quantitative**, then determine the level of measurement (**nominal, ordinal, interval or ratio**):

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Eye color

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Number of years employed by a company

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ranking of a tennis player

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ The year you graduated from high school

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ IQ

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Time elapsed

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade (A, B, C, D, F)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Street address

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Items on a menu

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ The number of pasta dishes on a menu

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ The price of menu items

# **1 – 3** Data Collection and Sampling Techniques

## Objective 5. Identify the Four Basic Sampling Techniques

Data can be used to describe situations or events. Data can be collected in numerous ways, the most common is surveys, such as telephone surveys, mailed questionnaires, personal interviews, observation, or reviewing records. Researchers use \_\_\_\_\_\_\_\_\_\_\_\_ to collect data about variables from a large population. However, samples cannot be collected haphazardly because the data collected might be \_\_\_\_\_\_\_\_\_\_\_\_. To obtain unbiased samples, that is, samples that give each subject in the population an \_\_\_\_\_\_\_\_\_\_\_\_\_\_ likely chance of being selected, statisticians use four basic methods of sampling: random, systematic, stratified, and cluster sampling.

### Random Sampling

\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ are selected by using chance methods or random numbers.

One method is to associate numbered cards with each item in the population, mixing the cards and selecting all the cards needed. Another is to select numbers, such as for lotteries, by mixing balls marked with possible numbers with forced air and selecting the one that rises to the top.

Select a coin you have with you. Flip it 5 times, recording Heads or Tails for each.

How many Heads? \_\_\_\_\_\_\_\_\_\_

How many Heads did 5 of your classmates toss? \_\_\_\_\_\_\_\_\_\_\_\_\_

Were they the same? \_\_\_\_\_\_\_

Flipping coins is an example of a random experiment.

Populations are often too large for the previous method, so random numbers are generated using a computer or calculator.

**Example:** Suppose the company for which you work has 9863 employees and your department needs a sample of employees for a study. You have determined that the sample must have at least 842 subjects. A sample of 842 numbers between 1 and 9863, without repetition, could be generated using a computer’s random number generator and the employees associated with the selected numbers would be in the sample.

**Example**: Use your TI-83/84 calculator, generate 10 random numbers between 1 and 85.

Screen shot of menu that shows when the MATH key is pressed and the PROB or PRB menu is selected.  In this case the fifth option for generating random integers is highlighted for selection. On the TI-84, the input for randInt is the least positive integer to include (in this case 1), the largest positive integer to include (in this case 85), and the number of integers to generate (in this case 10).  The next screen shows the command and 10 generated integers. The command shown on the calculator screen is randInt(1,85,10) meaning to generate 10 integers between 1 and 85.  The next line shows 10 integers randomly generated  These values will be different each time the command is used.

Use the right arrow on the calculator to see the rest of the randomly selected numbers. If any occur more than once, repeat the procedure to generate as many more randomly selected values as you need.

Historically, before computers were available, random numbers were selected using tables.

**Example:** Use the Random Number Table below to select 10 subjects from a population of 85 items.

This is a two digit random number table used for illustration purposes in this example.  The table is a copy of a two digit random number table that can be used to generate a sample of random numbers between given values.

Number items in the population with numbers between 1 and 85. (This works for populations of 85.) Close your eyes and place your finger on the table. The number closest to your finger is the starting place. Beginning with this number, proceed downward until you have selected 10 numbers. If you get to the bottom of the column, go to the top of the next column and continue. Compare your set of 10 numbers with your neighbor’s.

### Systematic Sampling

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ are random samples obtained by numbering each subject of the population and choosing every kth subject. The first subject is selected by randomly choosing a number between 1 and k. Then every kth subject in the list is also selected.

Systematic sampling has the advantage of selecting subjects throughout an ordered population. This sampling method is fast and convenient if the population can be easily numbered.

Suppose there is a list of 350 subjects and a sample of 35 is needed. 350 divided by 35 is 10, so each group includes 10 subjects.

Use your calculator to randomly select a number between 1 and 10, \_\_\_\_\_\_. This is the first subject selected.

The sample includes the first, \_\_\_\_, and each one following by adding 10 to each following.

List your systematic sample:

Compare your sample with the samples chosen by your classmates.

### Stratified Sampling

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ are obtained by dividing the population into groups according to a characteristic important to the study. A random sample is taken from each group.

A marketing firm samples a population by income level. The population is separated into three income categories, lower income, middle income, and upper income. The marketing firm selects some subjects from the lower income group, some from the middle income group and some from the upper income group.

### Cluster Sampling

To select a \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_, the population is also divided into groups, but these groups, or clusters, are intact or geographic groups. Once the groups are determined, a few groups are randomly selected and everyone in the chosen groups become subjects.

A school district wants to survey the opinions of elementary students. Clusters are the intact classes for each elementary school. Several cluster/classrooms are randomly selected and all of the students in each of the classes (clusters) chosen become the sample.

**Note:**

The main difference between stratified sampling and cluster sampling is that although in both types of sampling the population is divided into groups, the subjects in the groups for stratified sampling are more or less homogeneous, that is, they have similar charac­teristics, while the subjects in the clusters form “miniature populations.” That is, they vary in characteristics as does the larger population. For example, if a researcher wanted to use the freshmen class at a university as the population, he or she might use a class of students in a freshman orientation class as a cluster sample. If the researcher were using a stratified sample, she or he would need to divide the students of the freshman class into groups according to their major field, gender, age, etc., or other samples from each group.

Cluster samples save the researcher time and money, but the researcher must be aware that sometimes a cluster does not represent the population.

### Convenience Sampling

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are samples that consist of subjects that are available or easy to find. The sample is not random, the population is unknown, and selection of subjects is haphazard. Results are biased, or flawed, so this type of sampling is best for pilot studies.

### Sampling Error

Samples are not \_\_\_\_\_\_\_\_\_\_\_\_\_\_ representatives of the populations from which they are selected, therefore there is always some \_\_\_\_\_\_\_\_\_\_\_ in the results. Other errors that exist in samples occur for other reasons.

### Definition: Sampling error

Sampling error is the difference between the results obtained from a sample and the results obtained from the population from which the sample is selected.

A sample of full-time students indicates that 56% of the student body is female. However, the admissions office states that of all fill-time students, 54% are female. The difference of 2% is due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

### Definition: Nonsampling Error

Nonsampling error occurs when the data are obtained erroneously or the sample is biased or nonrepresentative.

A researcher interviews subjects who enter the mall through a particular entrance to determine the reason for their visit. This sample is most likely not representative of general customers for several reasons, such as, the sample was likely taken at a specific time of day when not all customers to the mall were shopping and the sample was taken at a particular entrance through which all customers do not enter. Therefore, all customers to the mall did not have an equal chance of being selected. The difference between the sample and the population is due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

# **1 – 4** Observational and Experimental Studies

## Objective6**.** Explain the Difference between Observational and Experimental Studies

There are two typical types of statistical studies, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

### Observational Studies

Researchers observe what is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or what has \_\_\_\_\_\_\_\_\_\_\_\_ in the past and draw conclusions based on the observations.

Example A:

Employees are rated as more competitive and less competitive. A researcher checks resting blood pressure and finds that more competitive employees have higher blood pressure.

### Experimental Studies

In an experimental study, the researcher \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ one of the variables of interest and tries to determine how that manipulation influences the other variables of interest.

Example B:

A group of patients diagnosed with a particular condition are randomly assigned to two groups. One group is given a traditional treatment that has been moderately successful. The second group is given a new treatment that shows the possibility of being more successful. The doctors providing the treatment and the patients are not told which treatment they are being given. At the end of the experiment, researchers will compare the two groups to determine if the group receiving the new treatment have better results. This is a true \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ study in which the participants are assigned to groups \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Example C:

In one yoga class, participants were asked to hold a position known as a plank as long as possible during two classes per week for four weeks. In another similar yoga class, participants were asked to increase the length of time the position was held by 15 seconds each day. During the last class of the experiment, the average length of time the 32 participants of the first group held the position was 4.5 minutes, while the average length of time the 37 participants of the second group who were asked to attempt to increase their time by 15 seconds each day was 6.1 minutes. The conclusion was drawn that the group who were challenged to improve performed better. The researcher manipulated the variable of the type of instruction given to the participants. The yoga classes chosen were intact groups, so the researcher did not have the option of randomly assigning the class participants to each group, making this example a \_\_\_\_\_\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ study.

### Independent and Dependent variables

The variable being manipulated is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variable or the explanatory variable.

The variable or variables being measured, the resultant variable(s), are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or outcome variable(s).

In Example B, the independent variable is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the dependent variable is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

In Example C, the independent variable is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the dependent variable is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

### Treatment and Control groups

In an experimental study, the group for which the independent variable receives manipulation is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ group and the group for which the independent variable is not manipulated is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ group.

### Advantages and Disadvantages of Experimental Studies

Advantages

Participants can be assigned randomly to the treatment and control groups.

The independent variable can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Disadvantages

They often occur in laboratories or special classrooms rather than natural settings.

The Hawthorne Effect, a phenomenon that occurs when participants’ behavior changes because they are involved in an experimental study, may occur.

A variable, known as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variable, that is not being studied, recorded, or manipulated, may actually influence the outcome of the dependent variable(s).

### Advantages and Disadvantages of Observational Studies

Advantages

The study occurs in a \_\_\_\_\_\_\_\_\_\_\_\_\_ setting.

This type of study can be used when it would be unethical or \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to manipulate the independent variable.

Variables that \_\_\_\_\_\_\_\_\_\_\_\_\_ be manipulated, such as ethnicity or left- or right- handedness, can be studied.

Disadvantages

Cause and effect cannot be shown.

Studies may be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or time consuming.

Results are subject to inaccuracies due to dependence on those who collect the data.

Keep in mind that two different studies regarding the same independent and dependent variables may result in different or conflicting \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

## Objective 7. Explain How Statistics Can Be Used and Misused.

Statistical studies are sometimes reported in a way to sell products that do not work, prove something that the study did not address (besides statistical studies do not really prove anything, rather they provide evidence to support or not support the premise), or engender fear, shock, or outrage.

Even though the results of a statistical study are reported does not mean that the results are reliable.

The sample may have been too \_\_\_\_\_\_\_\_\_\_\_.

The subjects may not have been selected \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The results may be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

### Use of Poor Sampling Methods

The sample may not be large enough.

The participants may be volunteers, perhaps those with strong feelings for or against the premise, with a built-in bias.

Certain sections of the population, such as those who work or the elderly, may have been systematically excluded.

Convenience sampling may have been used, such as intact classrooms.

### Ambiguous Averages

Several values, including the value that occurs most often, the middle value of an ordered list, the arithmetic average, or the midrange, could be reported as the average or typical value. The “average” that lends the most evidence in support of the researcher’s position is likely to be reported.

### Detached Statistics

A \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ is one in which no comparison is made.

*95% of dentists recommend Brand A toothpaste.* This brand is recommended instead of what brand or do the dentists recommend several brands including Brand A.

*Cookie B has fewer calories.* This cookie has fewer calories than what, than it used to have, than another brand?

### Other types of misuses:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ connections: use of words such as “*may help”*.

Misleading \_\_\_\_\_\_\_\_\_\_\_\_\_

Faulty survey questions: how questions are \_\_\_\_\_\_\_\_\_\_\_\_\_.

# 1 – 5 Computers and Calculators

## Objective 8. Explain the Importance of Computers and Calculators to Statistics.

Your instructor will provide instructions on what computer software or calculator will supported during this class.

Computers and Calculators provide numerical answers, saving time and effort, but do not provide interpretation of those values. You must understand and interpret the statistical concepts.