

# **Chapter 1**

## **Introduction to Statistics**

### **LEARNING OBJECTIVES**

The primary objective of Chapter 1 is to introduce you to the world of statistics, thereby enabling you to:

1. List quantitative and graphical examples of statistics within a business context
2. Define important statistical terms, including population, sample, and parameter, as they relate to descriptive and inferential statistics
3. Explain the difference between variables, measurement, and data.
4. Compare the four different levels of data: nominal, ordinal, interval, and ratio

### **CHAPTER OUTLINE**

- 1.1 Statistics in Business
- 1.2 Basic Statistical Concepts
- 1.3 Variables and Data
- 1.4 Data Measurement
  - Nominal Level
  - Ordinal Level
  - Interval Level
  - Ratio Level
  - Comparison of the Four Levels of Data
  - Statistical Analysis Using the Computer: Excel and Minitab

## KEY TERMS

Census  
Data  
Descriptive Statistics  
Inferential Statistics  
Interval Level Data  
Measurement  
Metric Data  
Nominal Level Data  
Nonmetric Data  
Nonparametric Statistics

Ordinal Level Data  
Parameter  
Parametric Statistics  
Population  
Ratio Level Data  
Sample  
Statistic  
Statistics  
Variable

## STUDY QUESTIONS

1. A science dealing with the collection, analysis, interpretation, and presentation of numerical data is called \_\_\_\_\_.
2. One way to subdivide the field of statistics is into the two branches of \_\_\_\_\_ statistics and \_\_\_\_\_ statistics.
3. A collection of persons, objects or items of interest is a \_\_\_\_\_.
4. Data gathered from a whole population is called a \_\_\_\_\_.
5. If a population consists of all the radios produced today in the Akron facility and if a quality control inspector randomly selects forty of the radios, the group of forty is referred to as \_\_\_\_\_.
6. If data are used to reach conclusions only about the group from which the data are gathered, then the statistics are referred to as \_\_\_\_\_ statistics.
7. If data are gathered from a subgroup of a larger group and the data are used to reach conclusions about the larger group, then the statistics are said to be \_\_\_\_\_ statistics.
8. Another name for inferential statistics is \_\_\_\_\_ statistics.
9. Descriptive measures which are usually denoted by Greek letters are called \_\_\_\_\_.
10. A characteristic of any entity being studied that is capable of taking on different values is a \_\_\_\_\_.

11. When a standard process is used to assign numbers to particular attributes or characteristics of a variable, it is called a \_\_\_\_\_.
12. Recorded measurements are \_\_\_\_\_.
13. The highest level of data measurement is \_\_\_\_\_.
14. The level of data measurement used when ranking items is \_\_\_\_\_.
15. If a number represents the geographic location of a business, then the level of data represented by the number is probably \_\_\_\_\_.
16. If the data being gathered are only ordinal level data, then the researcher should only use \_\_\_\_\_ statistics to analyze the data.

For each of the following (17-28), the data gathered are most likely to be which level of data? Nominal, Ordinal, Interval, or Ratio?

17. The ages of managers of fast-food restaurants.
18. An employee's identification number.
19. The number of freight cars per train for five hundred trains.
20. The elevation of a town.
21. The number of feet it takes a car to stop going fifty miles per hour.
22. The number of ounces of orange juice consumed by each Floridian in the morning.
23. The volume of wheat in each silo in Nebraska in August.
24. A rating scale of the productivity of each worker which has as its adjectives: very poor, poor, average, good, outstanding.
25. A person's religious preference.
26. Weights of statistics' textbooks.
27. Years of experience on the job.
28. Number representing a worker's assignment to the red team, blue team, or green team at work where the red team is considered the top workers, the green team is considered the least productive workers, and the blue team is for workers in the middle.

**ANSWERS TO STUDY QUESTIONS**

- |                             |                   |
|-----------------------------|-------------------|
| 1. Statistics               | 15. Nominal       |
| 2. Descriptive, Inferential | 16. Nonparametric |
| 3. Population               | 17. Ratio         |
| 4. Census                   | 18. Nominal       |
| 5. Sample                   | 19. Ratio         |
| 6. Descriptive              | 20. Interval      |
| 7. Inferential              | 21. Ratio         |
| 8. Inductive                | 22. Ratio         |
| 9. Parameters               | 23. Ratio         |
| 10. Variable                | 24. Ordinal       |
| 11. Measurement             | 25. Nominal       |
| 12. Data                    | 26. Ratio         |
| 13. Ratio                   | 27. Ratio         |
| 14. Ordinal                 | 28. Ordinal       |

## SOLUTIONS TO THE ODD-NUMBERED PROBLEMS IN CHAPTER 1

### 1.1 Examples of data in functional areas:

accounting - cost of goods, salary expense, depreciation, utility costs, taxes, equipment inventory, etc.

finance - World bank bond rates, number of failed savings and loans, measured risk of common stocks, stock dividends, foreign exchange rate, liquidity rates for a single-family, etc.

human resources - salaries, size of engineering staff, years experience, age of employees, years of education, etc.

marketing - number of units sold, dollar sales volume, forecast sales, size of sales force, market share, measurement of consumer motivation, measurement of consumer frustration, measurement of brand preference, attitude measurement, measurement of consumer risk, etc.

information systems - CPU time, size of memory, number of work stations, storage capacity, percent of professionals who are connected to a computer network, dollar assets of company computing, number of "hits" on the Internet, time spent on the Internet per day, percentage of people who use the Internet, retail dollars spent in e-commerce, etc.

production - number of production runs per day, weight of a product; assembly time, number of defects per run, temperature in the plant, amount of inventory, turnaround time, etc.

management - measurement of union participation, measurement of employer support, measurement of tendency to control, number of subordinates reporting to a manager, measurement of leadership style, etc.

### 1.3 Descriptive statistics in recorded music industry -

- 1) RCA total sales of compact discs this week, number of artists under contract to a company at a given time.
- 2) total dollars spent on advertising last month to promote an album.
- 3) number of units produced in a day.
- 4) number of retail outlets selling the company's products.

Inferential statistics in recorded music industry -

- 1) measure the amount spent per month on recorded music for a few consumers then use that figure to infer the amount for the population.
- 2) determination of market share for rap music by randomly selecting a sample of 500 purchasers of recorded music.
- 3) Determination of top ten single records by sampling the number of requests at a few radio stations.
- 4) Estimation of the average length of a single recording by taking a sample of records and measuring them.

The difference between descriptive and inferential statistics lies mainly in the usage of the data. These descriptive examples all gather data from every item in the population about which the description is being made. For example, RCA measures the sales on all its compact discs for a week and reports the total.

In each of the inferential statistics examples, a sample of the population is taken and the population value is estimated or inferred from the sample. For example, it may be practically impossible to determine the proportion of buyers who prefer rap music. However, a random sample of buyers can be contacted and interviewed for music preference. The results can be inferred to population market share.

- 1.5
- 1) Size of sale (\$) per customer in men's formal wear. Either by taking a sample or using a census, management could compute the average sale in men's formal wear of a weekly period and compare the number to the same average taken a year ago or a month ago to determine if more is being sold per customer. Other variables might include number of sales per hour, number of people entering the department per day, number of dress shirts sold per day, etc.
  - 2) Number of employees working per day. This variable could indicate the day of the week (certain days have more or less sales), sales activity (how sales are doing overall), or even health of associates. Other variables might include percent of employees absent due to illness, average number of hours worked per week per employee, number of open positions, etc.
  - 3) Inventory turnover rate. How fast are items in the store selling? Other variables might include reorder rate, percent of storage space utilized, number of stockouts per week, etc.
  - 4) Number of customers that enter the store per hour. This figure will vary by day, time of day, and season. Compare figures on this variable from period to period can give some indication of sales trends which can help

drive human resource planning, etc. Other variables might include amount of time spent per customer in the store per visit, distance that customers travel to shop in the store, number of referrals that customers make to other people annually, etc.

- 5) Percentage of people paying with cash. Percentage of people using credit cards. These can be used to expedite pay systems, investigate employee theft, calculate surcharges associated with credit cards, etc. Other variables might include average time per checkout, average wait time in pay line, etc.

- 1.7
- a) ratio
  - b) ratio
  - c) ordinal
  - d) nominal
  - e) ratio
  - f) ratio
  - g) nominal
  - h) ratio

- 1.9
- a) The population for this study is the 900 electric contractors who purchased Rathburn wire.
  - b) The sample is the randomly chosen group of thirty-five contractors.
  - c) The statistic is the average satisfaction score for the sample of thirty-five contractors.
  - d) The parameter is the average satisfaction score for all 900 electric contractors in the population.