Chapter 1

INTRODUCTION TO STATISTICS

Learning objectives

1. To create familiarity with basic statistical concepts

2. To define the concepts of variance and error

3. To identify criteria for defining good statistics

4. To specify the ways in which statistics differ

**Key Concepts**

*quantitative*: numerical summary of information

*descriptive statistics*: statistics that focus on the characteristics of variables, asking “What’s there?”

*inferential statistics*: statistics that focus on whether one variable effects another or whether a single variable matches a hypothetical distribution, asking “How is this different?”

*predictive statistics*: statistics that focus on the strength of relationships or covariation, asking “What causes it?”

*variance*: how things vary, caused by measurement inaccuracies and true measurement differences

*error*: degree of measurement that is not “real”

*constant*: unchanging measurement, getting the same number repeatedly

*power*: an estimate of the ability of a statistic to find something that is really there

*robustness*: the ability of a statistic to withstand violations of its assumptions

**Multiple Choice Questions**

1. Which of the following is more likely to be true?

a. small differences between things are associated with small amounts of error

 b. large differences between things are associated with large amounts of error

c. small differences between things are probably real; large differences are probably error

\*d. large differences between things are probably real; small differences are probably error

2. Why do we have many kinds of statistics?

 a. because of many statisticians creating tools for handling special problems

 b. because of the need for different types of samples

 c. it is simply a product of 200 years of historical development

 \*d. because of the many types of error and variance

3. What are most statistics primarily designed for?

 \*a. to tell us something about error

 b. to provide the best measurement possible

 c. to provide estimates of probability

 d. to predict outcomes

4. Which of the following best describes the concept of “variance”?

 a. change is inevitable and all around us

 \*b. differences in measurement results

 c. real fluctuations in measurement

 d. a and c above

5. Foundation concepts underlying the reason for, and the use of, statistics are:

 \*a. error and variance

 b. probability and error

 c. variance and probability

 d. variance and chance

6. Accuracy:

 a. is always possible

 b. always results in larger amounts of variance

 c. solves all measurement problems

 \*d. none of the above

7. There are two basic types of variance. They are:

 a. constants and variables

 \*b. error variance and real variance

 c. systematic variance and random variance

 d. none of the above

8. There are three general types of statistics. Which of the following is NOT one of those?

 \*a. graphic

 b. predictive

 c. descriptive

 d. inferential

9. A constant is best characterized as:

 a. a variable that only changes under certain circumstances

 b. a dependable phenomenon

 \*c. unchanging measurement

 d. the absence of error

10. Before taking a statistics course, everyone has already used statistics. Which of these is (are) an example of these statistics?

a. hash marks

 b. bar graph

 c. percentages

 \*d. all of the above

11. Chapter 1 in your textbook focuses on:

 \*a. the foundation of statistics

 b. the application of mathematical formulas

 c. strategies for studying statistics

 d. all of the above

12. A “good” statistic is characterized by which of the following?

 \*a. provides a quick and relatively accurate “picture” of the data

 b. has the ability to reduce data to the nominal level of measurement

 c. requires a minimum of calculation

 d. all of the above

13. The power of a statistic refers to

 a. the ability to withstand violations of assumptions

 b. the ability to be calculated quickly

 \*c. the ability to find something that is really there

 d. the ability to locate error variance

14. The robustness of a statistic refers to

 a. the ability to be calculated quickly

 \*b. the ability to withstand violations of assumptions

 c. the ability to locate error variance

 d. the ability to find something that is really there

15. The two basic reasons for variance are

 a. estimates of error and measuring instruments

 b. robustness and power

 c. simple statistics and poor understanding of statistical assumptions

 \*d. measurement inaccuracy and true differences between measurements

**True/False Questions**

1. T Statistics are merely ways to make sense of and understand quantitative information.

2. T The related concepts of variance and error are the backbone of statistics.

3. F Any two identical measurements are sufficient to identify a constant.

4. F Estimates of error will always have error in them.

5. T The different statistics we use to tell us about variance and error have different capabilities, particularly in regard to their accuracy and ability to withstand problems in the data.

6. F A constant is a variable that always demonstrates a relationship with another variable.

7. T Predictive statistics measure the strength of a relationship.

8. F Inferential statistics are used to establish the accuracy of measurement.

9. F Descriptive statistics are designed to describe statistical significance of a relationship.

10. T Predictive statistics are related to the explanatory phase of knowledge.

**Short Essay Questions**

1. What are the two foundational concepts of statistics? Explain what they are and how they relate to measurement.

2. There are three basic types, or families, of statistics. What are they and what kinds of questions do they answer?

3. Explain why power and robustness are important considerations in making a choice of which statistic to use.

4. Discuss what makes any statistic a “good” statistic.