

What is Statistics?

Chapter 1

Learning Objectives

- LOI-1 Explain why knowledge of statistics is important
- LOI-2 Define statistics and provide an example of how statistics is applied
- LOI-3 Differentiate between descriptive and inferential statistics
- LOI-4 Classify variables as qualitative or quantitative, and discrete or continuous
- LOI-5 Distinguish between nominal, ordinal, interval, and ratio levels of measurement
- LOI-6 List the values associated with the practice of statistics

Why Study Statistics

- ▶ Data are collected everywhere and require statistical knowledge to make the information useful
- ▶ Statistical techniques are used to make professional and personal decisions
- ▶ A knowledge of statistics is needed to understand the world and be conversant in your career
- ▶ In summary, statistics will help you make more effective personal and professional decisions

What is Meant by Statistics

- ▶ What is statistics?
- ▶ It's more than presenting numerical facts

STATISTICS The science of collecting, organizing, presenting, analyzing, and interpreting data to assist in making more effective decisions.

Example: The inflation rate for the calendar year was 0.7%. By applying statistics we could compare this year's inflation rate to past observations of inflation. Is it higher, lower, or about the same. Is there a trend of increasing or decreasing inflation?

Types of Statistics

- ▶ There are two types of statistics, descriptive and inferential
- ▶ Descriptive statistics can be used to organize data into a meaningful form
- ▶ You can summarize data and provide information that is easy to understand

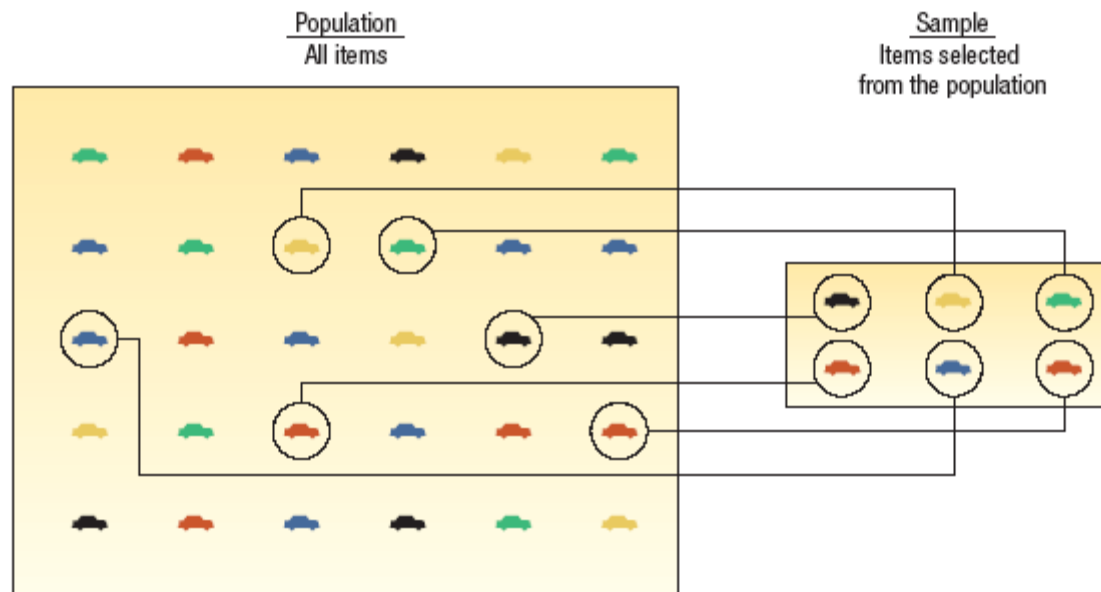
DESCRIPTIVE STATISTICS Methods of organizing, summarizing, and presenting data in an informative way.

- ▶ Example: There are a total of 46,837 miles of interstate highways in the U.S. The interstate system represents 1% of the nation's roads but carries more than 20% of the traffic. Texas has the most interstate highways and Alaska doesn't have any.

Types of Statistics

POPULATION The entire set of individuals or objects of interest or the measurements obtained from all individuals or objects of interest.

SAMPLE A portion or part of the population of interest.



Types of Statistics

- ▶ Inferential statistics can be used to estimate properties of a population
- ▶ You can make decisions based on a limited set of data

INFERENTIAL STATISTICS The methods used to estimate a property of a population on the basis of a sample.

- ▶ Example: TV networks constantly monitor the popularity of their programs by hiring Nielsen to sample the preferences of TV viewers. For example, 9% of a sample of households with television watched The Big Bang Theory during the week of November 2, 2015.

Types of Variables

► There are two basic types of variables

QUALITATIVE VARIABLE An object or individual is observed and recorded as a non-numeric characteristic or attribute.

Examples: gender, state of birth, eye color

QUANTITATIVE VARIABLE A variable that is reported numerically.

Examples: balance in your checking account, the life of a car battery, the number of people employed by a company

Types of Variables

- ▶ Quantitative variables can be discrete or continuous
- ▶ Discrete variables are typically the result of counting
 - ▶ Values have “gaps” between the values
 - ▶ Examples: the number of bedrooms in a house, the number of students in a statistics course
- ▶ Continuous variables are usually the result of measuring something
 - ▶ Can assume any value within a specific range
 - ▶ Examples: the air pressure in a tire, duration of flights from Orlando to San Diego

Types of Variables Summary

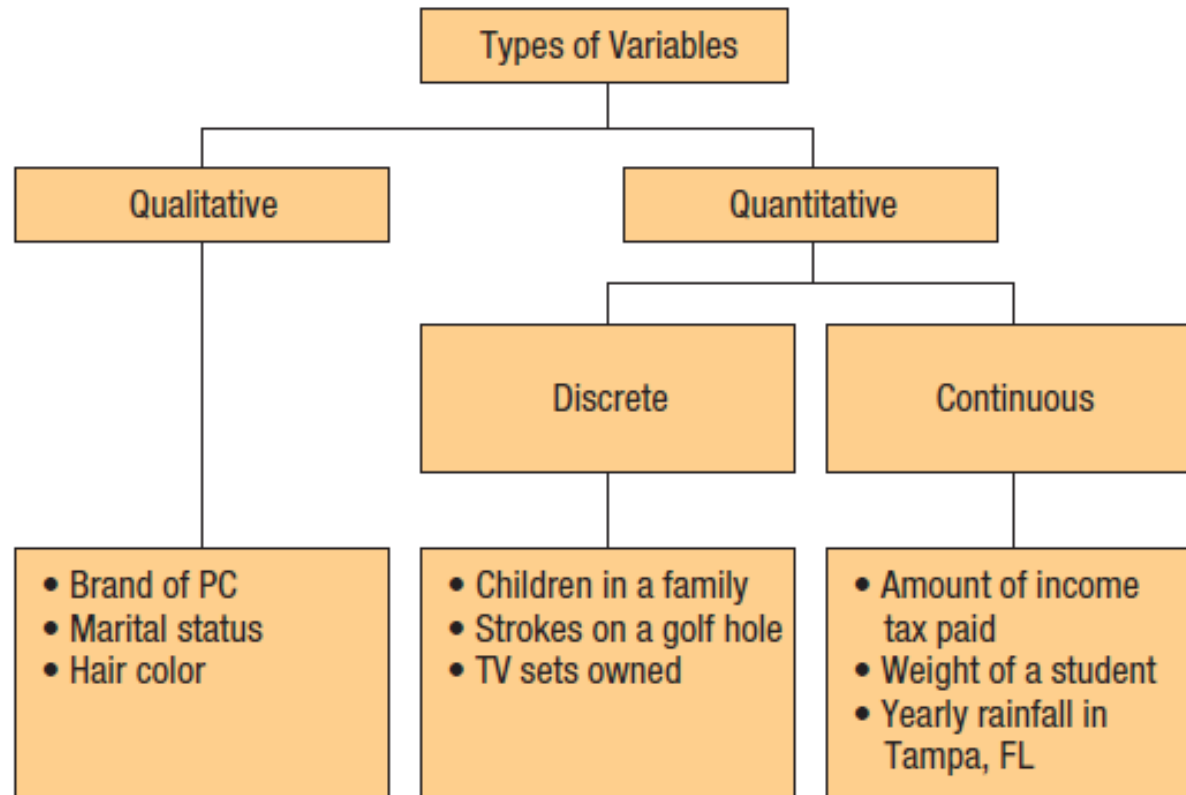


CHART 1-2 Summary of the Types of Variables

Levels of Measurement

- ▶ There are four levels of measurement
 - ▶ Nominal, ordinal, interval, and ratio
- ▶ The level of measurement determines the type of statistical analysis that can be performed
- ▶ Nominal is the lowest level of measurement

NOMINAL LEVEL OF MEASUREMENT Data recorded at the nominal level of measurement is represented as labels or names. They have no order. They can only be classified and counted.

- ▶ Examples: classifying M&M candies by color, identifying students at a football game by gender

Levels of Measurement

- ▶ The next level of measurement is the ordinal level
- ▶ The rankings are known but not the magnitude of differences between groups

ORDINAL LEVEL OF MEASUREMENT Data recorded at the ordinal level of measurement is based on a relative ranking or rating of items based on a defined attribute or qualitative variable. Variables based on this level of measurement are only ranked and counted.

- ▶ Examples: the list of top ten states for best business climate, student ratings of professors

Levels of Measurement

- ▶ The next level of measurement is the interval level
- ▶ This data has all the characteristics of ordinal level data plus the differences between the values are meaningful
- ▶ There is no natural 0 point

INTERVAL LEVEL OF MEASUREMENT For data recorded at the interval level of measurement, the interval or the distance between values is meaningful. The interval level of measurement is based on a scale with a known unit of measurement.

- ▶ Examples: the Fahrenheit temperature scale, dress sizes

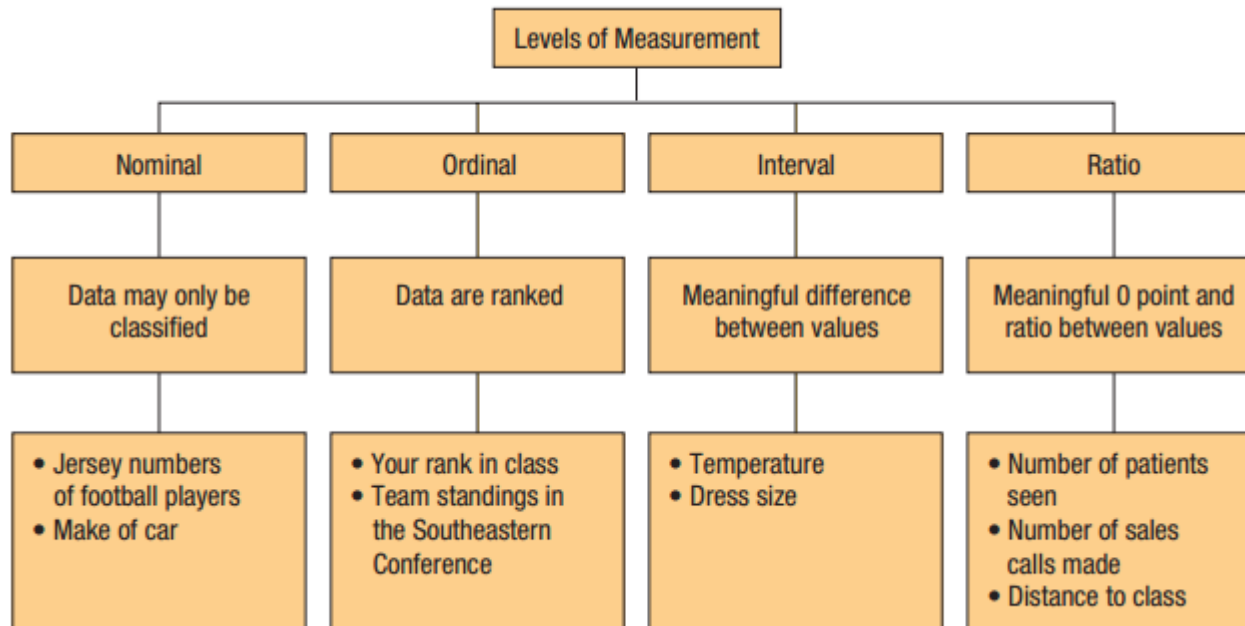
Levels of Measurement

- ▶ The highest level of measurement is the ratio level
- ▶ The data has all the characteristics of the interval scale and ratios between numbers are meaningful
- ▶ The 0 point represents the absence of the characteristic

RATIO LEVEL OF MEASUREMENT Data recorded at the ratio level of measurement are based on a scale with a known unit of measurement and a meaningful interpretation of zero on the scale.

- ▶ Examples: wages, changes in stock prices, and weight

Levels of Measurement Summary



Ethics and Statistics

- ▶ Practice statistics with integrity and honesty when collecting, organizing, summarizing, analyzing, and interpreting numerical information
- ▶ Maintain an independent and principled point of view when analyzing and reporting finding and results
- ▶ Question reports that are based on data that
 - ▶ do not fairly represent the population
 - ▶ does not include all relevant statistics
 - ▶ introduces bias in an attempt to mislead or misrepresent

Exercise

	Discrete	Continuous
Nominal	Gender, Color	
Ordinal	Soft drink preference Student rank in class Rating of a stat professor Regions in Lebanon	
Interval	SAT score, IQ test score	Temperature Air pressure in a tire
Ratio	Sales volume of MP3 players Number of home computers Number of students at LU	Salary Duration of a flight