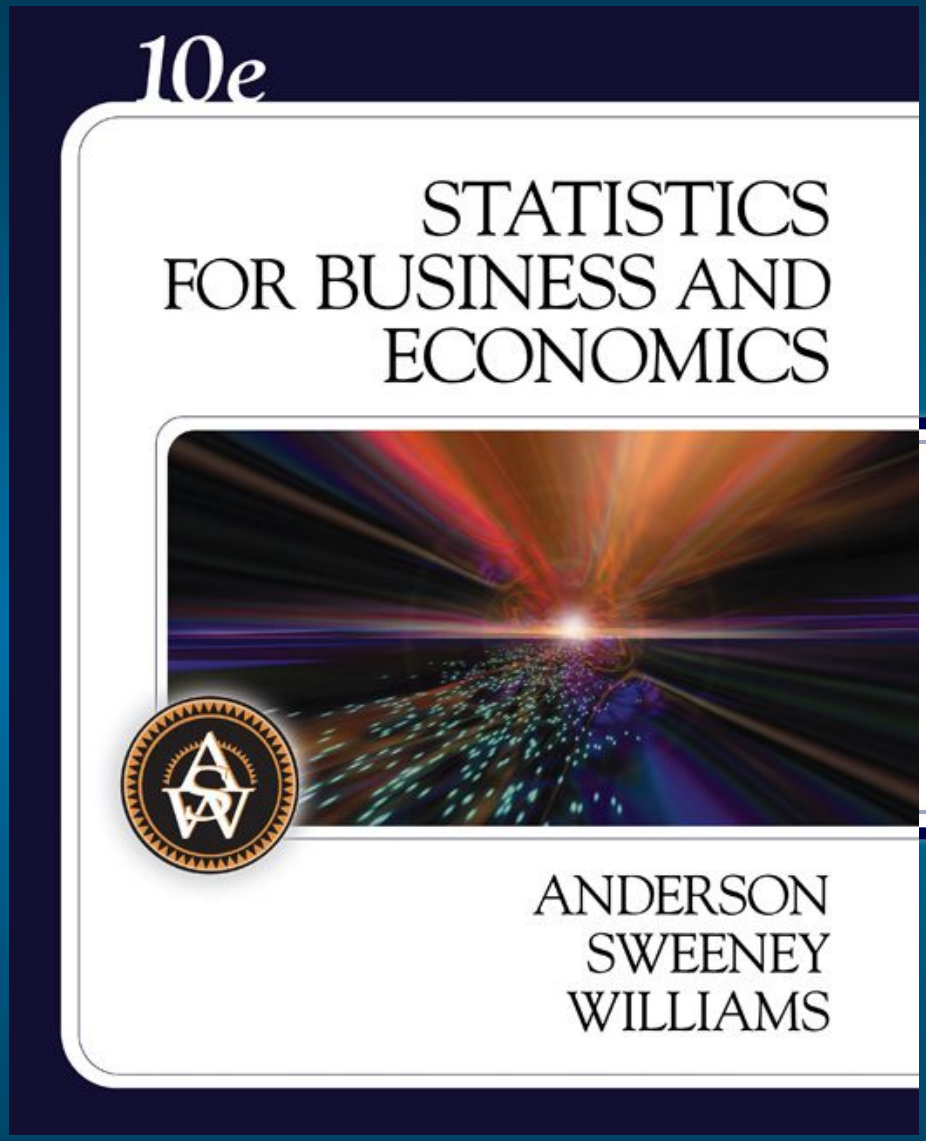


IS 310

Business Statistics

CSU
Long Beach

Why Study Statistics?

Because, you would like to know:

1. How does an instructor grade on a curve
2. How does a tire manufacturer determine mileage warranty
3. How does FDA verify that a new drug is more effective than the present drug
4. What does it mean when one says the median home price in southern California is $420,000
5. How does one select a sample for a survey

What is Statistics?

Statistics is a field of study that deals with **collection, organization, presentation, analysis and interpretation of data**.

Applications in Business and Economics

- Accounting

  Public accounting firms use statistical sampling procedures when conducting audits for their clients.



- Economics

  Economists use statistical information in making forecasts about the future of the economy or some aspect of it.



Applications in Business and Economics

- **Marketing**

  Electronic point-of-sale scanners at retail checkout counters are used to collect data for a variety of marketing research applications.



- **Production**

  A variety of statistical quality control charts are used to monitor the output of a production process.



Applications in Business and Economics

- Finance

  Financial advisors use price-earnings ratios and dividend yields to guide their investment recommendations.



Data and Data Sets

- Data are the facts and figures collected, summarized, analyzed, and interpreted.
- The data collected in a particular study are referred to as the data set.

Elements, Variables, and Observations

- The elements are the entities on which data are collected.
- A variable is a characteristic of interest for the elements.
- The set of measurements collected for a particular element is called an observation.
- The total number of data values in a complete data set is the number of elements multiplied by the number of variables.

Data, Data Sets, Elements, Variables, and Observations

Observation

Variables

Element Names

Company	Stock Exchange	Annual Sales($M)	Earn/ Share($)
Dataram	NQ	73.10	0.86
EnergySouth	N	74.00	1.67
Keystone	N	365.70	0.86
LandCare	NQ	111.40	0.33
Psychemedics	N	17.60	0.13

Data Set

Scales of Measurement

- Scales of measurement include:
  - Nominal
  - Interval
  - Ordinal
  - Ratio
- The scale determines the amount of information contained in the data.
- The scale indicates the data summarization and statistical analyses that are most appropriate.

Scales of Measurement

- Nominal
  - Data are labels or names used to identify an attribute of the element.
  - A nonnumeric label or numeric code may be used.

Scales of Measurement

- Nominal

Example:

Students of a university are classified by the school in which they are enrolled using a nonnumeric label such as Business, Humanities, Education, and so on.

Alternatively, a numeric code could be used for the school variable (e.g. 1 denotes Business, 2 denotes Humanities, 3 denotes Education, and so on).

Scales of Measurement

- Ordinal
  - The data have the properties of nominal data and the order or rank of the data is meaningful.
  - A nonnumeric label or numeric code may be used.

Scales of Measurement

- Ordinal

Example:

Students of a university are classified by their class standing using a nonnumeric label such as Freshman, Sophomore, Junior, or Senior.

Alternatively, a numeric code could be used for the class standing variable (e.g. 1 denotes Freshman, 2 denotes Sophomore, and so on).

Scales of Measurement

- Interval

The data have the properties of ordinal data, and the interval between observations is expressed in terms of a fixed unit of measure.

Interval data are always numeric.

Scales of Measurement

- Interval

Example:
Melissa has an SAT score of 1205, while Kevin has an SAT score of 1090. Melissa scored 115 points more than Kevin.

Scales of Measurement

- Ratio

The data have all the properties of interval data and the ratio of two values is meaningful.

Variables such as distance, height, weight, and time use the ratio scale.

This scale must contain a zero value that indicates that nothing exists for the variable at the zero point.

Scales of Measurement

- Ratio

Example:

Melissa's college record shows 36 credit hours earned, while Kevin's record shows 72 credit hours earned. Kevin has twice as many credit hours earned as Melissa.

Qualitative and Quantitative Data

- Data can be further classified as being qualitative or quantitative.
- The statistical analysis that is appropriate depends on whether the data for the variable are qualitative or quantitative.
- In general, there are more alternatives for statistical analysis when the data are quantitative.

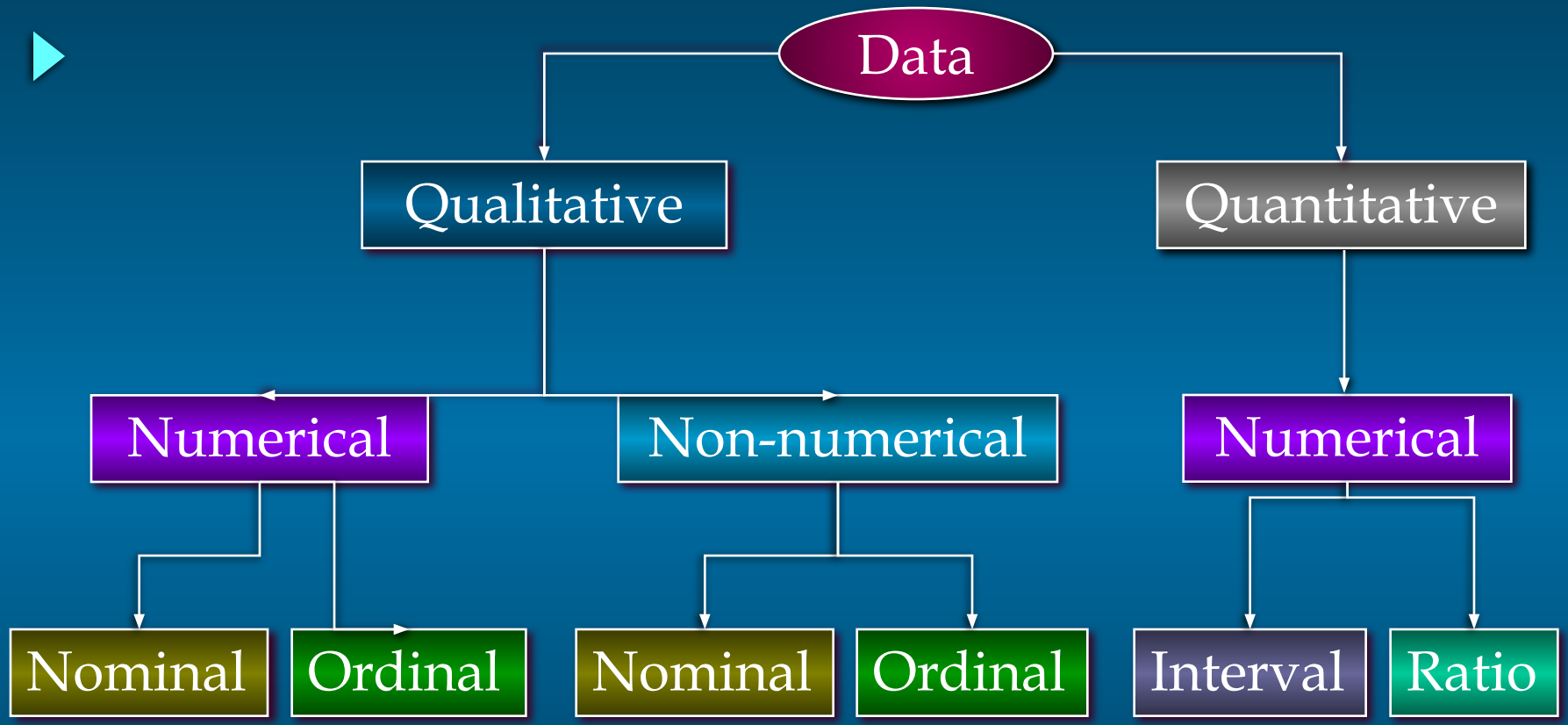
Qualitative Data

- Labels or names used to identify an attribute of each element
- Often referred to as categorical data
- Use either the nominal or ordinal scale of measurement
- Can be either numeric or nonnumeric
- Appropriate statistical analyses are rather limited

Quantitative Data

- Quantitative data indicate how many or how much:
  - discrete, if measuring how many
  - continuous, if measuring how much
- Quantitative data are always numeric.
- Ordinary arithmetic operations are meaningful for quantitative data.

Scales of Measurement



Cross-Sectional Data

- Cross-sectional data are collected at the same or approximately the same point in time.
- Example: data detailing the number of building permits issued in June 2007 in each of the counties of Ohio

Time Series Data

- Time series data are collected over several time periods.
- Example: data detailing the number of building permits issued in Lucas County, Ohio in each of the last 36 months

Data Sources

- Existing Sources

  - Within a firm – almost any department
  - Business database services – Dow Jones & Co.
  - Government agencies - U.S. Department of Labor
  - Industry associations – Travel Industry Association of America
  - Special-interest organizations – Graduate Management Admission Council
  - Internet – more and more firms

Data Sources

- Statistical Studies

In experimental studies the variable of interest is first identified. Then one or more other variables are identified and controlled so that data can be obtained about how they influence the variable of interest.

In observational (nonexperimental) studies no attempt is made to control or influence the variables of interest.

a survey is a good example

Data Acquisition Considerations

Time Requirement

- Searching for information can be time consuming.
- Information may no longer be useful by the time it is available.

Cost of Acquisition

- Organizations often charge for information even when it is not their primary business activity.

Data Errors

- Using any data that happen to be available or were acquired with little care can lead to misleading information.

Descriptive Statistics

- Descriptive statistics are the tabular, graphical, and numerical methods used to summarize and present data.

Example: Hudson Auto Repair

- The manager of Hudson Auto would like to have a better understanding of the cost of parts used in the engine tune-ups performed in the shop. She examines 50 customer invoices for tune-ups. The costs of parts, rounded to the nearest dollar, are listed on the next slide.



Example: Hudson Auto Repair



- Sample of Parts Cost ($) for 50 Tune-ups

91	78	93	57	75	52	99	80	97	62
71	69	72	89	66	75	79	75	72	76
104	74	62	68	97	105	77	65	80	109
85	97	88	68	83	68	71	69	67	74
62	82	98	101	79	105	79	69	62	73

Inferential Statistics

Inferential Statistics involves analyzing a set of data to make conclusions. This branch of statistics is more difficult than Descriptive Statistics.

In the study of Inferential Statistics, two basic concepts are important:

- Population
- Sample

Population and Sample

Population refers to all possible subjects for a given study.

Sample refers to part (subset) of a population.

Population and Sample

- Let's take a few examples.
- Example 1
- We are interested in knowing the proportion of CSULB students are in favor of legalizing the use of marijuana.

- Population consists of **all** CSULB students.

- Sample is 250 students selected at random.

Population and Sample

- Example 2
- We want to know what percentage of Los Angeles County residents are supportive of a half-percent increase in sales tax.

- Population consists of **all** Los Angeles County residents who are at least 18 years old.

- Sample is 1000 Los Angeles County residents selected randomly.

Population and Sample

- Example 3
- We want to test if a new brand of tires manufactured by Goodyear is better than existing tires.

- Population consists of **all** tires of the new brand manufactured by Goodyear.

- Sample is 100 tires of the new brand chosen at random.

Population and Sample

- Example 4
- We would like to know if a new perfume will be preferred by American women over 35 years.
- Population consists of **all** American women who are over 35 years.
- Sample is 500 American women of over 35 years selected randomly.

Population and Sample

- Example 5
- A restaurant has undergone extensive remodeling and wants to know if customers will like the new décor.
- Population consists of **all** customers who have visited the restaurant in the past.
- Sample consists of customers who visited the restaurant during a specific month.

Population and Sample

- Example 6
- American Airlines is planning to introduce a new policy on flying hours by its pilots.
- Population consists of **all** American Airlines pilots.
- Sample consists of 50 American Airlines pilots selected at random.

Population and Sample

- Example 7
- A workers union has reached a new contract with management. It wants to know the opinion of its members on the terms and conditions of the new contract.
- Population consists of **all** members of the union.
- Sample consists of 50 union members selected at random.

Population and Sample

- Example 8

- FDA wants to compare the average nicotine content of two brands of cigarettes: Brand A and Brand B.

- There are two populations: **all** cigarettes of Brand A and **all** cigarettes of Brand B.

- Sample A consists of 100 cigarettes chosen randomly from all Brand A cigarettes.
- Sample B consists of 100 cigarettes chosen randomly from all Brand B cigarettes.

Population and Sample

- Example 9

- You want to compare home prices between Costa Mesa and Fountain Valley.

- There are two populations: Population A consists of **all** homes in Costa Mesa. Population B consists of **all** homes in Fountain Valley.
- Sample A consists of 100 homes selected at random from all homes in Costa Mesa. Sample B consists of 100 homes from all homes in Fountain Valley.

Population and Sample

- Example 10

- A research firm wants to compare the average fat content used in meat between McDonald's Big Mac and Burger King's Whopper during the month of September in Los Angeles county.
- There are two populations: Population A consists of **all** Big Macs made by McDonald in the month of September in Los Angeles County. Population B consists of **all** Whoppers made by Burger King in September in Los Angeles County.

- Sample A consists of 200 Big Macs selected randomly from Population A and Sample B consists of 200 Whoppers selected at random from Population B.

More on Population and Sample

Answer if the following questions deal with population or sample.

- What is the average MPG of cars driven by all CSULB students?
- What percent of 500 students selected at random support off-shore drilling for oil?
- What is the range of income of all residents of Long Beach?
- What is the average weight of chickens raised in a farm?

Sample Problems

- Problem # 11 on page 21

- A. Annual sales – Quantitative and ratio.
- B. Soft drink size – Qualitative and ordinal.
- C. Employee classification – Qualitative and nominal.
- D. Earnings per share – Quantitative and ratio.
- E. Method of payment – Qualitative and nominal.

Sample Problems

- Problem # 22 on page 24

- A. All registered voters in California.
- B. Those registered voters who were contacted by the policy Institute of California.
- C. A sample was reduced to reduce the cost and time.

Statistical Inference

- Statistical inference is a statistical procedure to determine the characteristics of a population by studying a sample.

- Let's the case of Norris Electronics mentioned in your book. Norris developed a new light bulb that increases its useful life. In this case, all new light bulbs comprise the population. To test if the new light bulb really has a longer life, a sample of 200 bulbs was tested and the average life of these bulbs was calculated. This average life will be used to conclude if the new bulb has a longer useful life. This is an example of statistical inference.

Statistical Inference

- Statistical inference allows us to make conclusions about a population. This conclusion is made by studying a sample.

- In the Norris case, the population was all new light bulbs whose life expectancy we wanted to verify.

- Do all the new bulbs have a longer life?
- We answered this question by studying a sample and calculating the average life of this sample of bulbs.

End of Chapter 1

