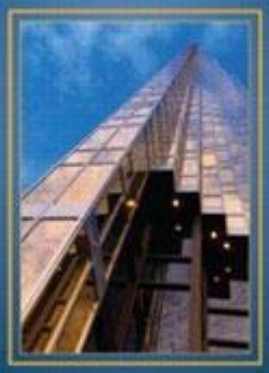
SOLUTIONS MANUAL

BUSINESS STATISTICS

A First Course



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Chapter 2 – Data

1. **The news.** Answers will vary.

2. **Investments.** The description of the study has to be broken down into its components in order to understand the study. *Who*– who was actually sampled–30 similar companies; *What*–what is being measured–401(k) employee participation rates (in percent); *When*–not specified; *Where*–United States (assumed); *Why*–the company in question is concerned that its employee participation rate is lower than the rates of similar companies; *How*–how was the study conducted–companies were sampled using an unspecified method; *Variables*–what is the variable being measured–one quantitative variable, the 401(k) employee participation rate; *Concerns*–how was the sample of companies selected?

3. **Oil spills.** The description of the study has to be broken down into its components in order to understand the study. *Who*–50 tankers having recent oil spills; *What*–what is being measured–date, spillage amount (no specified unit) and cause of puncture; *When*–recent years; *Where*–United States; *Why*–not specified but probably to determine whether or not spillage amount per oil spill has decreased since Congress passed the 1990 Oil Pollution Act and use that information in the design of new tankers; *How*–how was the study conducted–not specified, although it is mentioned that the data is online; *Variables*–what is the variable being measured–there are 3 variables–the date, the spillage amount which is quantitative, and the cause of the puncture which is categorical; *Concerns*–more detail needed on the specifics of the study.

4. **Sales.** The description of the study has to be broken down into its components in order to understand the study. *Who*– who or what was actually sampled–months at a major U.S. company; *What*–what is being measured–money spent on advertising ($ thousand) and sales ($ million); *When*–monthly from 2004–2006; *Where*–United States (assumed); *Why*–to compare money spent on advertising to sales; *How*–how was the study conducted–not specified; *Variables*–what is the variable being measured–there are 3 variables–the date, the amount of money spent on advertising which is quantitative, and sales which is quantitative; *Concerns*–none.

5. **Food store.** *Who*– who or what was actually sampled–existing stores; *What*– what is being measured–weekly sales ($), town population (thousands), median age of town (years), median income of town($), and whether or not the stores sell beer/wine; *When*–not specified; *Where*–United States; *Why*–the food retailer is interested in understanding if there is an association amongst these variables to help determine where to open the next store; *How*–how was the study conducted–data collected from their stores; *Variables*–what is the variable being measured– sales ($), town population (thousands), median age of town (years), median income of town($), which are all quantitative. Whether or not the stores sell beer/wine is categorical; *Concerns*–none.

6. **Sales II.** *Who*– who or what was actually sampled–quarterly data from a major U.S. company; *What*–what is being measured–quarterly sales ($ million), unemployment rate (%), inflation rate (%); *When*–quarterly from 2004–2006; *Where*–United States; *Why*–to determine how sales are affected by the unemployment rate and inflation rate; *How*–how was the study conducted–not specified; *Variables*–what is the variable being measured–quarterly sales ($ million), unemployment rate (%), and inflation rate (%) which are quantitative; *Concerns*–none.

7. **Arby's menu.** *Who*–Arby's sandwiches; *What*–type of meat, number of calories (in calories), and serving size (in ounces); *When*–not specified; *Where*–Arby's restaurants; *Why*–assess the nutritional value of the different sandwiches; *How*–information gathered on each of the sandwiches offered on the menu; *Variables*–the number of calories and serving size (ounces) are quantitative, and the type of meat which is categorical; *Concerns*–none.

8. **MBA admissions.** *Who*–MBA applicants; *What*–sex, age, whether or not accepted, whether or not they attended, and the reasons for not attending (if they did not accept); *When*–not specified; *Where*–a school in the northeastern United States; *Why*–the researchers wanted to investigate any patterns in female student acceptance and attendance in the MBA program; *How*–data obtained from the admissions office;

Variables—sex, whether or not the students accepted, whether or not they attended, and the reasons for not attending if they did not accept (all categorical) and age (years) which is quantitative; *Concerns*–none.

9. **Climate.** *Who*–385 species of flowers; *What*–date of first flowering (in days); *When*–data gathered over the course of 47 years; *Where*–southern England; *Why*–the researchers wanted to investigate if the first flowering is indicating a warming of the overall climate; *How*–not specified; *Variables*—date of first flowering is a quantitative variable; *Concerns*–date of first flowering should be measured in days from January 1 to address leap year issues.

10. **MBA Admissions II.** *Who*–MBA students; *What*–each student's standardized test scores and GPA in the MBA program; *When*–2000–2005; *Where*–London; *Why*–to investigate the association between standardized test scores and performance in the MBA program over five years (2000–2005); *How*–not specified; *Variables*—standardized test scores and GPA, both quantitative variables; *Concerns*–none.

11. **Schools.** *Who*–students; *What*–age (years or years and months), race or ethnicity, number of days absent, grade level, reading score, math score, and any disabilities/special needs; *When*–ongoing and current; *Where*–a state in the US; *Why*–keeping this information is a state requirement; *How*–data collected and stored as part of school records; *Variables*—there are 7 variables. Race or ethnicity, grade level, and disabilities/special needs are categorical variables. Number of absences, age (years or years and months), reading scores, and math scores are quantitative variables; *Concerns*–what tests are used to measure reading and math ability and what are the units of measurement?

12. **Pharmaceutical firm.** *Who*–experimental participants; *What*–herbal cold remedy or sugar solution, and cold severity; *When*–not specified; *Where*–major pharmaceutical firm; *Why*–scientists were testing the effectiveness of an herbal compound on the severity of the common cold; *How*–scientists conducted a controlled experiment; *Variables*—there are 2 variables. Type of treatment (herbal or sugar solution) is categorical, and severity rating is quantitative; *Concerns*–the severity of a cold might be difficult to quantify (beneficial to add actual observations and measurements, such as body temperature). Also, scientists at a pharmaceutical firm could have a predisposed opinion about the herbal solution or may feel pressure to report negative findings about the herbal product.

13. **Start-up company.** *Who*–customers of a start-up company; *What*–customer name, ID number, region of the country, date of last purchased, amount of purchase ($), and item purchased; *When*–present day; *Where*–United States (assumed); *Why*–the company is building a database of customers and sales information; *How*–assumed that the company records the needed information from each new customer; *Variables*—there are 6 variables: name, ID number, region of the country, and item purchased which are categorical and date and amount of purchase ($) are quantitative; *Concerns*–although region is coded as a number, it is still a categorical variable.

14. **Cars.** *Who*–cars parked in executive and staff lots at a large company; *What*–make, country of origin, type of vehicle (car, van, SUV, etc.), and age of vehicle (probably in years); *When*–not specified; *Where*–a large company; *Why*–not specified; *How*–data recorded in executive and staff lots of a large company; *Variables*—make, country of origin, and type of vehicle are 3 categorical variables. Age is the single quantitative variable. Whether or not the vehicle is in an executive or staff lot is also a categorical variable; *Concerns*–none.

15. **Vineyards.** *Who*–vineyards; *What*–size (acres), number of years in existence, state, varieties of grapes grown, average case price ($), gross sales ($), and percent profit; *When*–not specified; *Where*–assume United States as state is recorded; *Why*–business analysts hope to provide information that would be helpful to grape growers in the United States; *How*–not specified; *Variables*—size of vineyard (acres), number of years in existence, average case price ($), gross sales ($), and percent profit are 5 quantitative variables. State and variety of grapes grown are categorical variables; *Concerns*–none.

16. **Environment.** *Who*–streams; *What*–name of stream, substrate of the stream (limestone, shale, or mixed), acidity of the water (measured in PH), temperature (degrees Celsius), and BCI (a measure of biological diversity – unknown units); *When*–not specified; *Where*–upstate New York; *Why*–research conducted for

an ecology class; *How*–not specified; *Variables*— there are 5 variables. Name of stream and substrate of the stream (limestone, shale, or mixed) are categorical variables. Acidity of the water (PH), temperature (degrees Celsius), and BCI (a measure of biological diversity – unknown units) are quantitative variables; *Concerns*–none.

17. **Gallup Poll.** *Who*–1,180 American voters; *What*–region (Northeast, South, etc.), age (in years), party affiliation, whether or not the person owned any shares of stock, and their attitude (scale 1 to 5) toward unions; *When*–not specified; *Where*–United States; *Why*–the information was gathered as part of a Gallup public opinion poll; *How*–telephone survey; *Variables*— there are 5 variables. Region (Northeast, South, etc.), party affiliation, and whether or not the person owned any shares of stock are categorical variables. Age (in years), and their attitude (scale 1 to 5) toward unions are quantitative variables; *Concerns*–none.

18. **FAA.** *Who*–all airline flights in the United States; *What*–type of aircraft, number of passengers, whether departures and arrivals were on schedule, and mechanical problems; *When*–the information is currently recorded; *Where*–United States (assumed); *Why*–the information is required by the FAA; *How*–data is collected from airline flight information; *Variables*— there are 4 variables. Type of aircraft, whether departures and arrivals were on schedule, and mechanical problems are categorical variables. Number of passengers is a quantitative variable; *Concerns*–none.

19. **EPA.** *Who*–every model of automobile in the United States; *What*–vehicle manufacturer, vehicle type (car, SUV, etc.), weight (probably pounds), horsepower (units of horsepower), and gas mileage (miles per gallon) for city and highway driving; *When*–the information is currently collected; *Where*–United States; *Why*–the EPA uses the information to track fuel economy of vehicles; *How*– among the data EPA analysts collect from the automobile manufacturers are the name of the manufacturer (Ford, Toyota, etc.), vehicle type…."; *Variables*— there are 6 variables. Vehicle manufacturer and vehicle type (car, SUV, etc.) are categorical variables. Weight (probably pounds), horsepower (units of horsepower), and gas mileage (miles per gallon) for both city and highway driving are quantitative variables; *Concerns*–none.

20. **Consumer Reports.** *Who*–41 refrigerators; *What*–brand, cost (probably $), size (cu ft), type (such as top-freezer), estimated annual energy cost (probably $), overall rating (good, excellent, etc.), and repair history (in percent requiring repair over the past five years); *When*–2002; *Where*–United States; *Why*–the information was compiled to provide information to readers of Consumer Reports; *How*–not specified; *Variables*— there are 7 variables. Brand, type (such as top-freezer), and overall rating (good, excellent, etc.) are categorical variables. Cost (probably $), size (cu ft), estimated annual energy cost (probably $), and repair history (in percent requiring repair over the past five years) are quantitative variables; *Concerns*–none.

21. **Lotto.** *Who*–states in the United States; *What*–state name, whether or not the state sponsors a lottery, the number of numbers in the lottery, the number of matches required to win, and the probability of holding a winning ticket; *When*–1998; *Where*–United States; *Why*–not specified but likely that the study was performed in order to compare the chances of winning the lottery in each state; *How*–not specified but data could be gathered from a number of different sources, such as the state lottery; *Variables*— there are 5 variables. State name, whether or not the state sponsors a lottery are categorical variables. The number of numbers in the lottery, the number of matches required to win, and the probability of holding a winning tickets are quantitative variables; *Concerns*–none.

22. **L.L. Bean.** *Who*–LL Bean catalog recipients; *What*–number of catalogs mailed out, square inches in catalog, and sales ($ million) in 4 weeks following mailing; *When*–this information is currently reported; *Where*–United States; *Why*–to investigate association among catalog characteristics, timing, and sales; *How*–collect internal data; *Variables*— there are 3 variables. Number of catalogs, square inches in catalog, and sales ($ million) are all quantitative; *Concerns*–none.

23. **Stock market.** *Who*–students in an MBA statistics class; *What*–total personal investment in stock market ($), number of different stocks held, total invested in mutual funds ($), and the name of each mutual fund; *When*–not specified; *Where*–a business school in the northeast US; *Why*–the information was collected for use in classroom illustrations; *How*–an online survey was conducted, participation was probably required

for all members of the class; *Variables*— there are 4 variables. Total personal investment in stock market ($), number of different stocks held, total invested in mutual funds ($) are quantitative variables. The name of each mutual fund is a categorical variable; *Concerns*–none.

24. Theme park sites. *Who*–potential theme park locations; *What*–country of site, estimated cost ($), potential population size (counts), size of site (hectares), whether or not mass transportation within 5 minutes of site; *When*–2008; *Where*–Europe; *Why*–to to present to potential developers on the feasibility of various sites; *How*–not specified; *Variables*— there are 5 variables. Country of site and whether or not mass transportation within 5 minutes of site are both categorical variables. Estimated cost (€), potential population size (counts) and size of site (hectares) are quantitative; *Concerns*–none.

25. Indy. *Who*–Indy 500 races; *What*–year, winner, car model, time (hrs), speed (mph), and car number; *When*–1911-2007; *Where*–Indianapolis, Indiana; *Why*–examine trends in Indy 500 race winners; *How*–official statistics kept for each race every year; *Variables*— there are 6 variables. Winner, car model, and car number are categorical variables. Year, time (hrs) and speed (mph) are quantitative variables; *Concerns*–none.

26. Kentucky Derby. *Who*–Kentucky Derby races; *What*–date, winner, winning margin (in lengths), jockey, winner's payoff ($), duration of the race (minutes and seconds), and track conditions; *When*–1875-2004; *Where*–Churchill Downs, Louisville, Kentucky; *Why*–examine trends in Kentucky Derby winners; *How*–official statistics kept for each race every year; *Variables*— there are 7 variables. Winner, winning jockey, and track conditions are categorical variables. Date, winning margin (in lengths), winner's payoff ($), and duration of the race (minutes and seconds) are quantitative variables; *Concerns*–none.

27. Mortgages. Each row represents each individual mortgage loan. Headings of the columns would be: borrower name, mortgage amount.

28. Employee performance. Each row represents each individual employee. Headings of the columns would be: Employee ID Number (to identify the row instead of name), contract average ($), supervisor's rating (1-10), and years with the company.

29. Company performance. Each row represents a week. Headings of the columns would be: week number of the year (to identify each row), sales prediction ($), sales ($), and difference between predicted sales and realized sales ($).

30. Command performance. Each row represents a Broadway show. Headings of the columns would be: the show name (identifies the row), profit or loss ($), number of investors, and investment total ($).

31. Car sales. Cross-sectional are data taken from situations that vary over time but measured at a single time instant is said to be a cross-section of the time series. This problem focuses on data for September only which is a single time period. Therefore, the data are cross-sectional.

32. Motorcycle sales. Time series data are measured over time. Usually the time intervals are equally-spaced (e.g. every week, every quarter, or every year). This problem focuses on the number of motorcycles sold by the dealership in each month of 2008; therefore, the data are measure over a period of time and are time series data.

33. Cross sections. Time series data are measured over time. Usually the time intervals are equally-spaced (e.g. every week, every quarter, or every year). This problem focuses on the average diameter of trees brought to a sawmill in each week of a year; therefore, the data are measure over a period of time and are time series data.

34. Series. Cross-sectional are data taken from situations that vary over time but measured at a single time instant is said to be a cross-section of the time series. This problem focuses on data for attendance of the third World Series game. Therefore, the data are cross-sectional.