

1.5 The Power of Data—The Media

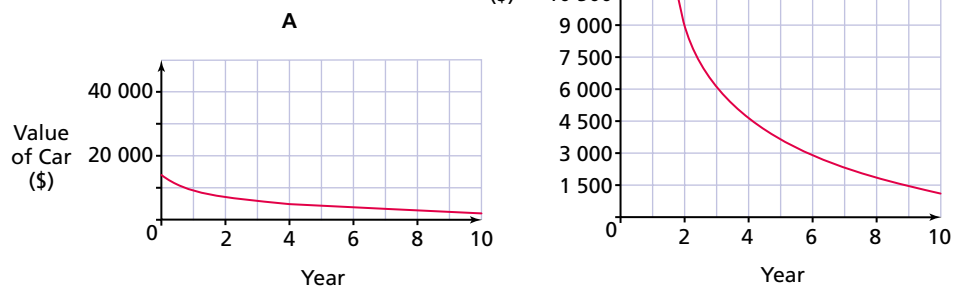
The media are major users of data. In addressing issues and presenting points of view, the media rely on information based on data. One of the main purposes of the media, as producers of mass communication, is to inform the general public about world events in as an objective manner as possible. Ideally, the information is accepted as being accurate; however, the media may sometimes provide misleading or false impressions to sway the public or to increase ratings or circulation.

An important reason to study statistics is to understand how information is represented or misrepresented. The ability to correctly interpret tables/charts, diagrams, and graphs presented in the media is an invaluable skill.

Example 1 Changing the Scale on the Axes

When you purchase a new vehicle, its value drops dramatically the moment it is driven off the car dealer's lot, and then continues to drop each year thereafter. A graph is used to show this change in value over time. It is possible to communicate different messages using the same data by changing the vertical scale.

These graphs show the change in the value of the same car from \$9000 in Year 2 to \$1000 in Year 10.



Project Connection

Changing the scales is one way to misrepresent data; however, it may be an effective way to support your point of view.

- Look quickly at each graph. What impression does graph A give you about the change in value of the car compared to graph B?
- Once you look more carefully at both graphs, how does your impression change? What information changed your first impression of the graphs?
- Who might prefer the look of graph A? Who might prefer the look of graph B? Give reasons for your answers.

Solution

- (a) The value of the car in graph A seems to be decreasing but at a much slower rate than the value of the car in graph B.
- (b) The change in the value of the car is actually the same. However, your impression likely changed when you looked at the scale provided for the two graphs.
- (c) Car dealers and bankers might use graph A to convince people to buy a car. The gradual decrease makes it seem as if the car holds its value longer. Environmentalists might prefer graph B because they would want to encourage people to use public transportation. Showing consumers the rapid decrease in the value of a car might discourage them from buying a new car. Insurance companies might also prefer graph B because it would help to justify paying lower replacement costs if a claim were made against the vehicle.

Example 2 Surveying a Small Sample of the Population

The following article appeared in a local newspaper.

York Region a great place to do business: Survey

York Region is ranked the second best place in the Greater Toronto Area (GTA) to start or expand a business, a study revealed this week.

The study was conducted by the Canadian Federation of Independent Business, a national lobby group, in the city of Toronto and across the GTA in March and April of 2001. About 650 people in Toronto and the GTA took part.

Respondents were asked to give opinions on a number of issues, including taxation and local administration, which affect their operations.

While Mississauga ranked first in terms of satisfaction with local government, York Region was second, with 10% of respondents saying they were very satisfied and another 65% saying they were somewhat satisfied with the local government's management and handling of the economy.

Source: *The Liberal*, Sunday, September 16, 2001.



Think about The Sample Size

How large must the sample be to be representative of the population?

- (a) What is the purpose of the article? Who might be interested in the information and why?
- (b) The article mentions that 650 people in Toronto and the GTA took part in the survey. What proportion of people in the population is represented by the sample?
- (c) Estimate the number of respondents who might have come from Toronto. From Mississauga. From York Region. Justify your answer.

- (d) Use your York Region numbers from part (c) to determine the number of respondents who were
 - (i) very satisfied
 - (ii) somewhat satisfied
- (e) Do your answers in part (d) suggest that the sample is not large enough to form a valid conclusion?
- (f) Suggest a more appropriate sample size.
- (g) What other characteristics of a sample result in sampling errors?

Solution

- (a) The purpose is to get the message out that York Region is a great place to do business. It is meant to encourage businesses to establish their operations in the area. Current or prospective business owners might be interested in this information. If current businesses in the area are happy, then new establishments might also be happy. Members of the York Region business community would also be interested—it gives them “bragging rights” at national meetings.
- (b) If the population of Toronto and the GTA is approximately 4 500 000 people and 650 people were surveyed, the percent of the population that answered the survey is $650 \div 4\,500\,000 \times 100 = 0.014\%$. This means that relatively few people were surveyed.
- (c) Assuming the populations of Toronto, Mississauga, and York Region are approximately 2 500 000, 550 000, and 450 000, respectively, and that the respondents for the survey were chosen based on regional proportional representation of the total population, the number of respondents from each region is calculated as follows:

$$\text{Toronto} = 2\,500\,000 \div 4\,500\,000 \times 650 = 361$$

$$\text{Mississauga} = 550\,000 \div 4\,500\,000 \times 650 = 79$$

$$\text{York Region} = 450\,000 \div 4\,500\,000 \times 650 = 65$$

- (d) The number of respondents who were
 - (i) very satisfied = $65 \times 10 \div 100 = 6.5$. This means that approximately seven people were satisfied.
 - (ii) somewhat satisfied = $65 \times 65 \div 100 = 42.25$. This means that approximately 42 people were somewhat satisfied.
- (e) The results of the survey are very suspect because so few people have actually responded to the survey. If even a few of the respondents were to change their mind and decide that they are dissatisfied, the title of the article could be “York Region: An awful place to do business!”
- (f) A sample size of between 800 and 1000 is appropriate to ensure strong representation in York Region.
- (g) If all of the people surveyed came from one geographical area, their responses may be representative of what is happening in their area but may not reflect what is happening in other areas. If the respondents are all from a particular age group, they may have a different view of what is happening. If the geographical region is overrepresented in the sample, bias will result.

KEY IDEAS

ways to display data properly—use the most appropriate type of graph; use proper scales on the axes

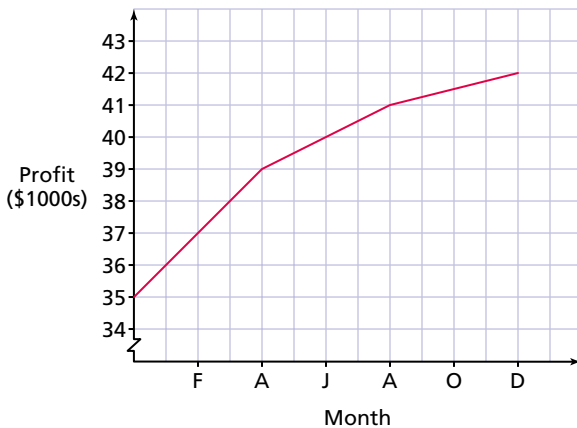
ways to misrepresent data—sample size is too small; sample is not representative of the population; there is insufficient information

making sense of misrepresented data—interpret charts/tables, diagrams, and graphs carefully

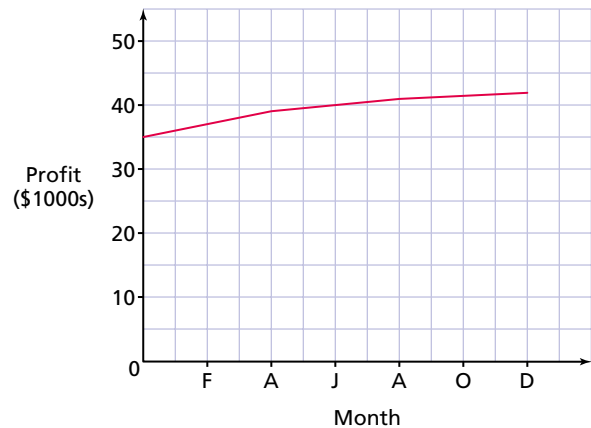
1.5 Exercises

- A** 1. **Knowledge and Understanding** The two graphs below show the profits of the Crazy Car Company.
- (a) How are the graphs similar? How are they different?
 - (b) How much has the profit increased on each graph?
 - (c) What false impressions are conveyed by the two graphs?

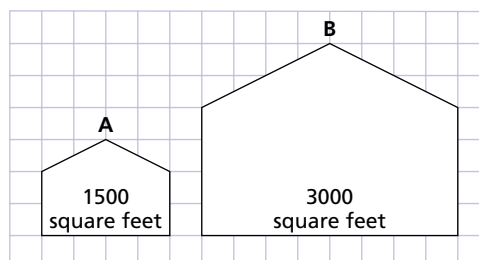
Crazy Car Company Profit



Crazy Car Company Profit

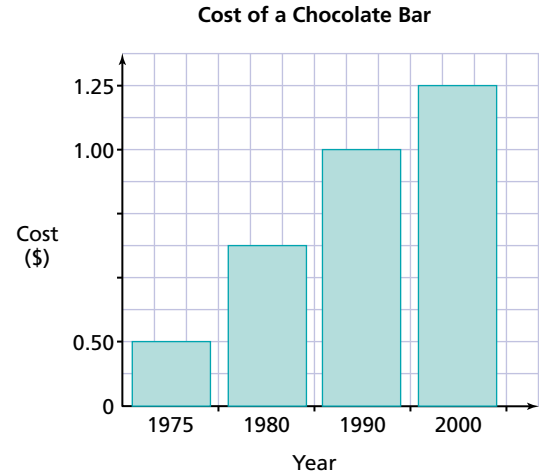


2. The increase in the size of homes purchased is shown in the graph.

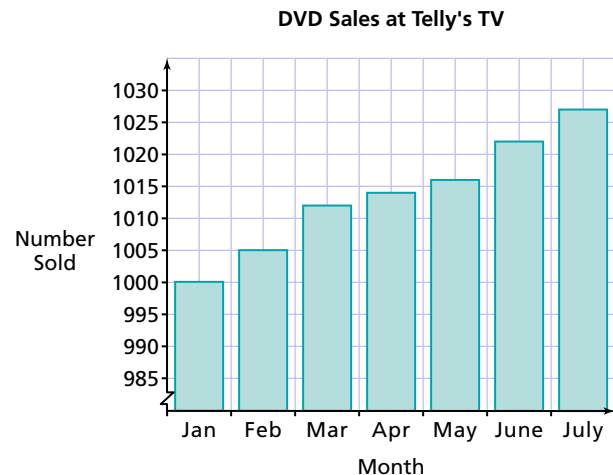


- (a) What is similar about the homes?
- (b) How many times bigger is the area of house B than the area of house A?
- (c) By how much has home size increased?
- (d) List any false impressions conveyed by the graph.

3. List the false impressions conveyed by this graph. How would you change the graph to correct the false impressions?



4. Use the data in the graph to construct a graph that distorts the information and gives a false impression.

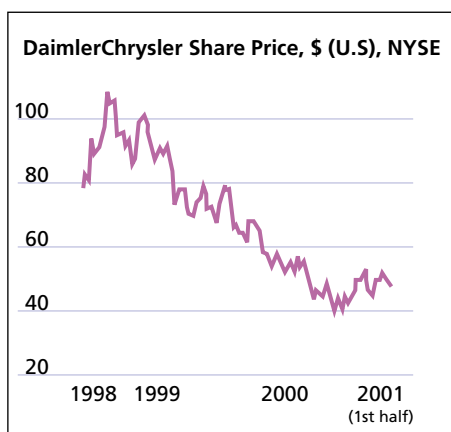


5. On December 4, 1999, the following headlines appeared in three different Canadian newspapers: “Boom pushes jobless rate to 18-year low” (*The Globe and Mail*), “Golden era: Jobless rate at 19-year low” (*National Post*), “Jobless rate sinks to near 20-year low” (*The Kingston Whig-Standard*). The writers of the articles had interviewed the same economist and had access to the same data. Give reasons for the differences in the data in the headlines.



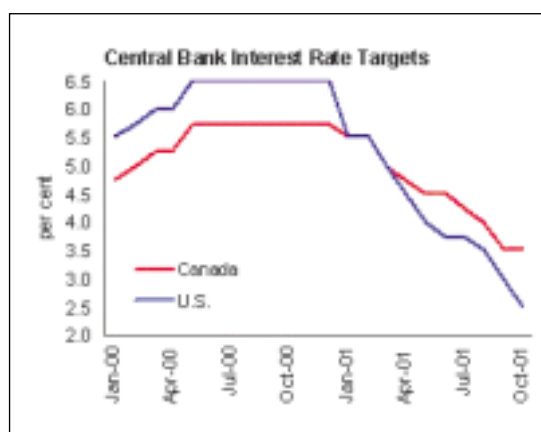
6. Read the following statements and decide if each is misleading or not. Explain your answers.
 - (a) A toothpaste company boasts four out of five dentists recommend product X.
 - (b) A drug company claims that 80% of the residents of Bruce Mines use their product.
 - (c) A local high school claims that 75% of its graduates go on to obtain a university degree.
 - (d) Fifty-three percent of Canadians want closer ties to the United States.
 - (e) Canadian students ranked 21st in the latest international math test. The previous ranking was 20th. This means our students are doing poorly in math.
 7. **Communication** Find data that have been misrepresented. There is no need to limit your search exclusively to graphs. Explain what caused the misinformation.
 8. A report appearing in the December 7, 2000, issue of *Nature* outlined the results of an experiment conducted to examine reasons for the confusion associated with the 2000 presidential election ballots in Florida. The experiment sample consisted of 324 Edmonton college students who used either a regular ballot or a butterfly ballot to vote in a mock federal election. The experiment was repeated in a local mall and involved 116 shoppers. A number of international newspapers picked up on the *Nature* story and subsequently used the results of the experiment to suggest how the outcome of the election might have been altered. Were the media duped?
- B**
9. Examine the graphs below. Then, complete the activities in parts (a) through (c) for each graph.

(i)



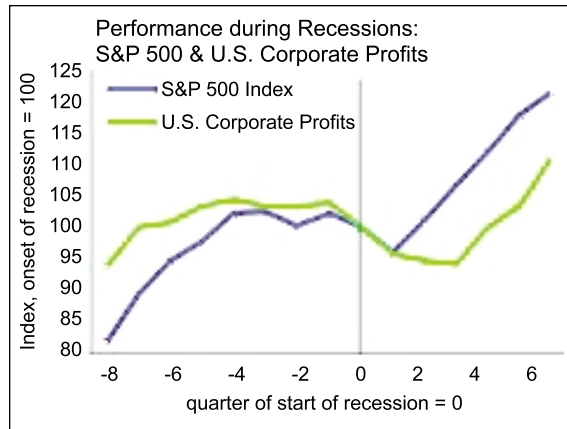
Source: ROB magazine, October 2001

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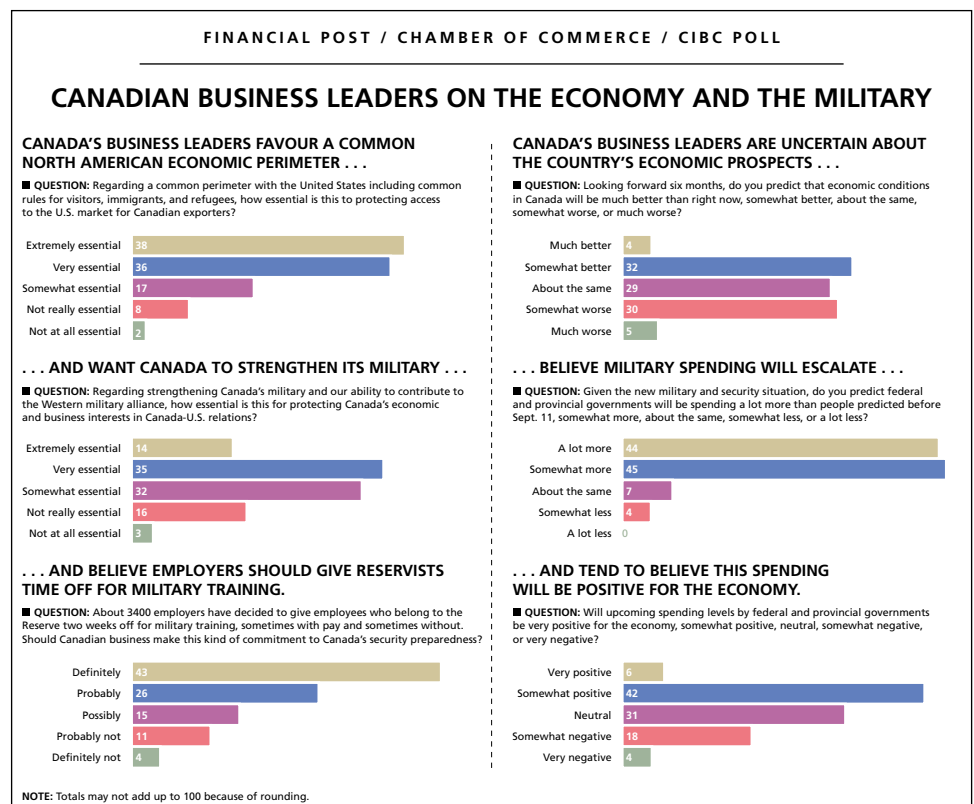
Source: Phillips, Hager & North
Investment Management Ltd.

(iii)



Source: Phillips, Hager & North Investment Management Ltd.

(iv)



Adapted from *The National Post*, Oct. 29, 2001, A2.

Source: COMPAS Inc.

- (a) **Application** Have the data been misrepresented to bias the reader? Give reasons for your answer.
- (b) **Application** If you answered *yes* to part (a), then modify the graph to display the data accurately.
- (c) **Communication** Explain why your graph is more appropriate.

10. Find two examples of an appropriate representation of data.
 - (a) **Thinking, Inquiry, Problem Solving** For each example, state a conclusion from the data.
 - (b) **Application** Modify the representation of data in a way such that it will give a biased impression.
 - (c) **Communication** How could the new representation still be used to support the initial conclusion?
11. Find a recent biased article. Identify the bias and outline specific changes that would make the article bias-free.
12. Consider the information that follows.

Newspapers: On any given day, 65% of Canadians read a daily newspaper, and 72% read a newspaper on weekends. Canadians spend an average of 45 min a day reading the daily newspaper and almost 90 min on weekend editions.

Books and Magazines: Almost 40% of adult Canadians spend about 40 min a day reading books and 10 min a day reading magazines.

Radio: The average adult listener tunes in for about 21 h a week. The youth population segment (12 to 17 years old) listens for only half that amount of time.

Television: On average, adult Canadians watch more than 22 h of television a week, or slightly more than 3 h a day. Canadian children between the ages of 2 and 11 watch approximately 18 h a week, or 2.57 h daily. Adolescents between the ages of 12 and 17 watch an average of 17.3 h a week, or 2.47 h daily.

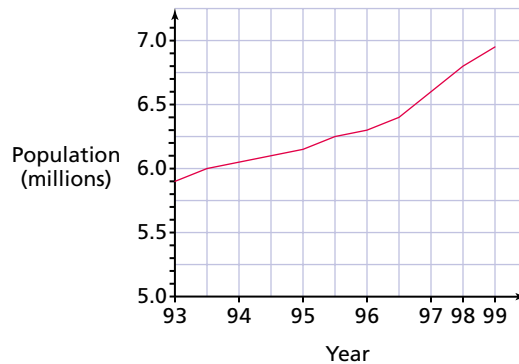
For each type of media, the information gives comparative data within that category.

- (a) Create graphs to represent the data properly for each media type.
- (b) Write a statement in the form of a conclusion for each media type.
- (c) Use a technique for misrepresenting the data to support each conclusion in part (b).

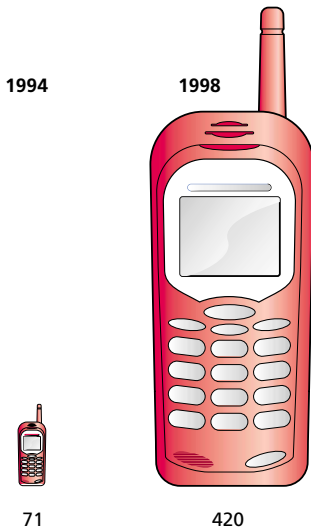
ADDITIONAL ACHIEVEMENT CHART QUESTIONS

- 13. Knowledge and Understanding** Find an example of an appropriate representation of data and explain what was done correctly. Find another example that shows a misrepresentation of data and identify the errors in it.
- 14. Application** The graph below shows the population of Hong Kong from 1993 to 1999. Explain why this graph would cause incorrect interpretations of the data.

Population of Hong Kong



Mobile Phones per 1000 Population



- 15. Thinking, Inquiry, Problem Solving** Why would a media source willingly distort information and misrepresent data in articles and reports? Research to find out when, where, and why this happens.
- 16. Communication** Suppose that in a recent magazine article, the graphic in the margin was used to show how the use of cell phones changed between 1994 and 1998. Explain why this picture is misleading.

Chapter Problem

Trends in Canada's Population

It was recently reported that the life expectancy of Canadians is on the rise.

- CP15.** Does this information agree or disagree with the trends you have observed? Explain.
- CP16.** Research the life expectancy of Canadians and find data that supports the claim above. Describe any changes you see. Comment on the impact that these data have had on the Age Structure of the Population data you have been analyzing.
- CP17.** Provide some contributing factors that account for the changes in the life expectancy of Canadians.