QUICK QUIZ

Choose the best answer to each of the following questions. Explain your reasoning with one or more complete sentences.

1. You read about an issue that was the subject of an observational study when clearly it should have been studied with a double-blind experiment. The results from the observational study are therefore

   a. still valid, but a little less reliable.

   b. valid, but only if you first correct for the fact that the wrong type of study was done.

   c. essentially meaningless.

2. A study conducted by the oil company Exxon Mobil shows that there was no lasting damage from a large oil spill in Alaska. This conclusion

   a. is definitely invalid, because the study was biased.

   b. may be correct, but the potential for bias means that you should look very closely at how the conclusion was reached.

   c. could be correct if it falls within the confidence interval of the study.

3. Consider a study designed to learn about the social networks of all college freshmen, in which researchers randomly interviewed students living in on-campus dormitories. The way this sample was chosen means the study will suffer from

   a. selection bias.

   b. participation bias.

   c. confounding variables.

4. The show *American Idol* selects winners based on votes cast by anyone who wants to vote. This means that the winner

   a. is the person most Americans want to win.

   b. may or may not be the person most Americans want to win, because the voting is subject to participation bias.

   c. may or may not be the person most Americans want to win, because the voting should have been double-blind.

5. Consider an experiment in which you measure the weights of 6-year-olds. The variable of interest in this study is

   a. the size of the sample.

   b. the weights of 6-year-olds.

   c. the ages of the children under study.

6. Consider a survey in which 1000 people are asked "How often do you go to the dentist?" The variable of interest in this study is

   a. the number of visits to the dentist.

   b. the 1000-person size of the sample.

   c. the integers 0 through 5.

7. Imagine that a survey of randomly selected people finds that people who used sunscreen were *more* likely to have been sunburned in the past year. Which explanation for this result seems most likely?

   a. Sunscreen is useless.

   b. The people in the study all used sunscreen that had passed its expiration date.

   c. People who use sunscreen are more likely to spend time in the sun.

8. You want to know whether people prefer Smith or Jones for mayor, and you are considering two possible ways to word the question. Wording X is "Do you prefer Smith or Jones for mayor?" Wording Y is "Do you prefer Jones or Smith for mayor?" (That is, the names are reversed in the two wordings.) The best approach is to

   a. use Wording X for everyone.

   b. use the same wording for everyone—it doesn't matter whether it is Wording X or Wording Y.

   c. use Wording X for half the people and Wording Y for the other half.

9. A *self-selected survey* is one in which

   a. the people being surveyed decide which question to answer.

   b. people decide for themselves whether to be part of the survey.

   c. the people who design the survey are also the survey participants.

10. If a statistical study is carefully conducted in every possible way, then

    a. its results must be correct.

    b. we can have confidence in its results, but it is still possible that they are not correct.

    c. we say that the study is perfectly biased.

Exercises 5B

REVIEW QUESTIONS

1. Briefly describe each of the eight guidelines for evaluating statistical studies. Give an example to which each guideline applies.

2. Describe and contrast selection bias and participation bias in sampling. Give an example of each.

3. What do we mean by variables of interest in a study?

4. What are confounding variables, and what problems can they cause?

DOES IT MAKE SENSE?

Decide whether each of the following statements makes sense (or is clearly true) or does not make sense (or is clearly false). Explain your reasoning.

5. The TV survey got more than 1 million phone-in responses, so it is clearly more valid than the survey by the professional pollsters, which involved interviews with only a few hundred people.

6. The survey of religious beliefs suffered from selection bias because the questionnaires were handed out only at Catholic churches.

7. My experiment proved beyond a doubt that vitamin C can reduce the severity of colds, because I controlled the experiment carefully for every possible confounding variable.

8. Everyone who jogs for exercise should try the new training regimen, because careful studies suggest it can increase your speed by 1%.

BASIC SKILLS AND CONCEPTS

9–20: Should You Believe This Study? Based solely on the information given, do you have reason to question the results of the following hypothetical studies? Explain your reasoning.

9. A study of the academic preparation of middle-school mathematics teachers used as data the teachers' SAT mathematics scores.

10. An experimental, double-blind study investigates whether people who eat more fast food are more likely to feel tired throughout the day.

11. A study by the liberal Center for American Progress is designed to assess a new Republican tax cut plan.

12. A study financed by a major pharmaceutical company is intended to determine whether its new cholesterol drug is more effective than similar drugs of competing companies.

13. A TV talk show host asks the TV audience, "Do you support new national mileage standards for automobiles?" and asks people to vote by telephone at a toll-free number.

14. A state Democratic Party polls 2000 of its members to determine whether its candidate for the U.S. Senate is likely to win against the Republican candidate.

15. Researchers design five survey questions to determine whether Norwegian citizens are happier than American citizens.

16. A government study is designed to find, based on people who had their tax returns audited, the percentage of taxpayers who understate their income.

17. In a study designed to determine whether people who wear helmets while riding a bicycle have fewer accidents, researchers tracked 500 riders with helmets for one month.

18. A study seeks to learn about obesity among children. The researchers monitor the eating and exercise habits of the children in the study, carefully recording everything they eat and all their activity.

19. Sociologists studying domestic violence circulate a questionnaire asking each respondent if she or he has ever abused a spouse or partner.

20. To gauge public opinion on whether there should be a constitutional amendment to ban flag burning, a survey asked people, "Do you support the American flag?"

21–26: Should You Believe This Claim? Based solely on the information given about the following hypothetical studies, decide whether you would believe the stated claim. Justify your conclusion.

21. A research group that tracks tuition rates at colleges and universities compares the tuition at a small college today and 10 years ago and claims that tuition has increased 150% during that period.

22. A new diet program claims that 200 randomly selected participants lost an average of 24.3 pounds in six weeks and that the program works for anyone with enough discipline.

23. Citing a higher incidence of cell-phone-related accidents among teens, the governor's office claims that banning the use of hand-held cell phones among drivers under 20 years of age will save lives.

24. In a new national poll by ABC News, the BBC, ARD German TV, and the Japanese broadcaster NHK, 55% of Iraqis say things in their own lives are going well, up from 39% six months ago. The number of people who expect conditions to improve nationally in the year ahead has doubled to 46%.

25. A study (in the *Canadian Medical Association Journal*) of 20 nations discovered that Germany has the most mean annual visits to a doctor (8.5), while Finland has the fewest (3.2).

26. According to a *New York Times*/CBS News poll, 60% of baseball fans are bothered by steroid use by players, and 44% say Yankees third baseman Alex Rodriguez should not be allowed in the Hall of Fame.

FURTHER APPLICATIONS

27–34: Bias. Identify at least one potential source of bias in the following studies. Explain why the bias would or would not affect your view of the study.

27. From a poll of people who recently bought cold medicine at all stores of a large drugstore chain, investigators concluded that the mean time between colds for all Americans is 5.6 months.

28. Based on a survey of 2718 people, the National Opinion Research Center concluded that 32% of Americans *always* make a special effort to sort and recycle glass, cans, plastic, or papers. Twenty-four percent of Americans *often* make such an effort.

29. An exit poll designed to predict the winner of a local election uses interviews with everyone who votes between 7:00 and 7:30 a.m.

30. An exit poll designed to predict the winner of a national election uses interviews with randomly selected voters in New York.

31. In order to determine the opinions of people in the 18- to 24-year age group on controlling illegal immigration, researchers survey a random sample of 1000 National Guard members in this age group.

32. A college mails survey forms to all current seniors, asking for the students' choice of their all-time best and worst professors. Students are asked to return the survey in the campus mail.

33. Planned Parenthood members are surveyed to determine whether American adults prefer abstinence, counseling and education, or morning-after pills for high school students.

34. A Fox News poll of 900 registered voters discovered that 55% of Americans are either extremely or very concerned about the safety of the food they eat, and an additional 30% are somewhat concerned. Lower-income households are the most concerned about the safety of their food.

35. **It's All in the Wording.** Princeton Survey Research Associates did a study for *Newsweek* magazine illustrating the effects of wording in a survey. Two questions were asked:

    - Do you personally believe that abortion is wrong?

    - Whatever your own personal view of abortion, do you favor or oppose a woman in this country having the choice to have an abortion with the advice of her doctor?

    To the first question, 57% of the respondents replied yes, and 36% responded no. In response to the second question, 69% of the respondents favored allowing women to have the choice, and 24% opposed allowing women to have the choice. Discuss why the two questions produced seemingly contradictory results. How could the results of the questions be used selectively by various groups?

36. **Tax or Spend?** A Gallup poll asked the following two questions:

    - Do you favor a tax cut or "increased spending on other government programs"? *Result:* 75% favored a tax cut.

    - Do you favor a tax cut or "spending to fund new retirement savings accounts, as well as increased spending on education, defense, Medicare and other programs"? *Result:* 60% were in favor of the spending.

    Discuss why the two questions produced seemingly contradictory results. How could the results of the questions be used selectively by various groups?

37–42: Stat-Bytes. Much like sound bytes of news stories, statistical studies are often reduced to one- or two-sentence stat-bytes. For the following stat-bytes taken from various news sources, discuss what crucial information is missing and what more you would want to know before acting on the study.

37. *USA Today* reports that over 60% of adults avoid visits to the dentist because of fear.

38. A Fox News poll reveals that 77% of Americans say "Merry Christmas" rather than "Happy Holidays."

39. *USA Today* reports that two-thirds of adults say that cell phone use during a dinner for two at a nice restaurant is unacceptable.

40. Only 2% of the estates of Americans who died in the past year paid estate taxes, while 60% of Americans favor repealing estate taxes.

41. According to *USA Today*, 26% of Americans rate potatoes their favorite vegetable, making it the most popular vegetable.

42. Thirty percent of newborns in India would qualify for intensive care if they were born in the United States.

43–45: Accurate Headlines? Consider the following headlines, each followed by a brief summary of a study. Discuss whether the headline accurately represents the study.

43. Headline: "Drugs shown in 98 percent of movies"

    Story summary: A "government study" claims that drug use, drinking, or smoking was depicted in 98% of the top movie rentals (Associated Press).

44. Headline: "Sex more important than jobs"

    Story summary: A survey found that 82% of 500 people interviewed by phone ranked a satisfying sex life as

important or very important, while 79% ranked job satisfaction as important or very important (Associated Press).

45. Headline: "Grape juice may fight disease"

    Story summary: A study of 15 people, partially funded by Welch Foods, found that grape juice helps to expand blood vessels and increase the levels of HDL cholesterol. Both constricted blood vessels and low HDL levels are risk factors for heart disease (*Milwaukee Journal Sentinel*).

46. **Exercise and Dementia.** A recent study in the *Annals of Internal Medicine* was summarized by the Associated Press, in part, as follows:

    > The study followed 1740 people aged 65 and older who showed no signs of dementia at the outset. The participants' health was evaluated every two years for six years. Out of the original pool, 1185 were later found to be free of dementia, 77 percent of whom reported exercising three or more times a week; 158 people showed signs of dementia, only 67 percent of whom said they exercised that much. The rest either died or withdrew from the study.

    a. How many people completed the study?

    b. Fill in the following two-way table (with numbers of individuals), using the figures given in the above passage:

	Exercise	No Exercise	Total
Dementia			
No dementia			
Total			

    c. Draw a Venn diagram with two overlapping circles to illustrate the data.

WEB PROJECTS

47. **Polling Organization.** Go to the Web site for a major professional polling organization. Study results from a recent poll, and evaluate the poll according to the guidelines in this section.

48. **Harper's Index.** Go to the Web site for the Harper's Index and study a few of the recently quoted statistics. Be sure to select the option on the page that allows you to see the sources for the statistics. Choose three statistics that you find particularly interesting, and discuss whether, in accord with the guidelines given in this section, you believe them.

IN YOUR WORLD

49. **Applying the Guidelines.** Find a recent news report about a statistical study on a topic that you find interesting. Write a short critique of the study, in which you apply each of the eight guidelines given in this section. (Some of the guidelines may not apply to the particular study you are analyzing. In that case, explain why the guideline is not applicable.)

50. **Believable Results.** Find a recent news report about a statistical study whose results you believe are meaningful and important. In one page or less, summarize the study and explain why you find it believable.