CHAPTER 1

THE BENEFITS AND RISKS OF USING STATISTICS

SECTION 1.2

WHAT IS STATISTICS ALL ABOUT?

FREE RESPONSE QUESTIONS

1. Name one way in which the study of statistics is useful for every day life.
   ANSWER: ANY REASONABLE ANSWER OK. EXAMPLES: WEATHER PREDICTION, POLLS/SURVEYS, TEST SCORES, ETC.

2. Statistics is about collecting information and using it to help you make a decision. Give an example of a decision that could be made using statistics.
   ANSWER: ANY REASONABLE ANSWER OK. EXAMPLES: SHOULD I TAKE AN UMBRELLA TO SCHOOL TOMORROW? IS THE BANK GOING TO BE BUSY TODAY? WHAT IS THE MOST POPULAR TV SHOW THIS WEEK?

3. Name one way that you have used statistics in your own life.
   ANSWER: ANY REASONABLE ANSWER OK. EXAMPLES: TO DECIDE WHAT BRAND OF COMPUTER TO BUY, I CONSULTED STATISTICS FROM CONSUMER REPORTS; TO DECIDE WHICH APARTMENT TO RENT, I LOOKED AT THE RECENT CRIME STATISTICS FROM THE POLICE DEPARTMENT.

4. While you can learn a lot about the world just by observing it, you can learn even more by conducting a carefully controlled experiment involving statistics. Explain why.
   ANSWER: A CONTROLLED EXPERIMENT ALLOWS YOU TO MAKE CAREFUL COMPARISONS TO FIND OUT IF DIFFERENCES REALLY DO EXIST, AND IF SO, TO ATTRIBUTE A CAUSE FOR THE DIFFERENCE.

MULTIPLE CHOICE QUESTIONS

5. Which of these <u>does not</u> apply to the word ‘statistics’?
   a. Statistics are numbers measured for some purpose.
   b. Statistics is a collection of procedures for collecting and analyzing data.
   c. Statistics is a tool to help you make decisions when faced with uncertainty.
   d. All of the above apply to the word ‘statistics’.
   ANSWER: D

6. Which of the following <u>is not</u> an example of a situation involving statistics?
   a. A pie chart showing the percentage of males and females in your class.
   b. A designed experiment comparing the heights of left-handed vs. right-handed people.

c. A survey asking your opinion of whether or not college football players should be paid to play football.
d. All of the above are examples of situations involving statistics.

ANSWER: D

7. Which of the following questions cannot be addressed using statistics?
   a. What percentage of people in the U.S. are cell phone owners?
   b. Which of these two medicines has a better success rate at lowering cholesterol?
   c. Do mothers most often hold their babies in their arms so the baby is on the left side?
   d. All of the above can be addressed using statistics.

   ANSWER: D

8. Which of the following is not true about the subject of statistics?
   a. Statistics only represents numbers that are used for a specific purpose.
   b. Statistics is a collection of procedures and principles for dealing with information.
   c. Statistics appears in your every day life.
   d. Statistics has a great deal to do with decision making in the face of uncertainty.

   ANSWER: A

FILL-IN-THE-BLANK QUESTIONS

9. _____ is a collection of procedures and principles for gaining and analyzing information in order to help people make decisions when faced with uncertainty.
   ANSWER: STATISTICS

10. Statistics is a collection of procedures and principles for gaining and analyzing information in order to help people make decisions when faced with _____.
    ANSWER: UNCERTAINTY

SECTION 1.3

DETECTING PATTERNS AND RELATIONSHIPS

FREE RESPONSE QUESTIONS

11. Explain the difference between the statistical terms ‘population’ and ‘sample'.
    ANSWER: THE POPULATION IS THE ENTIRE GROUP FOR WHICH YOU PLAN TO DRAW CONCLUSIONS. THE SAMPLE IS THE GROUP THAT IS ACTUALLY STUDIED, AND IS CHOSEN FROM THE POPULATION.

12. Suppose you want to determine whether taking vitamins every day helps people lose weight. You survey 200 people who had been on a weight loss program for six months, and ask them whether or not they take vitamins every day, and how much weight they lost. Suppose you found that the people who lost the most weight were more likely to have taken vitamins every day. Does this mean vitamins caused the additional weight loss? Explain why or why not.
    ANSWER: NO; THIS WAS AN OBSERVATIONAL STUDY, NOT A CONTROLLED EXPERIMENT. OTHER FACTORS COULD EXPLAIN THE WEIGHT LOSS, SUCH AS

A HEALTHY LIFESTYLE (PEOPLE WHO ARE HEALTH CONSCIOUS MAY BE MORE LIKELY TO TAKE VITAMINS).

13. Suppose you participate in an 'instant poll' on an Internet website which asks, "What is your favorite network TV program at 8 pm (Eastern time) on Thursday night?" After answering the question, you look at the results of the entire poll, and find that 6,423 people have responded to it. Should the results of this poll be a good indicator of what the most popular network TV program is on Thursday nights at 8pm (Eastern time)? Explain why or why not.
ANSWER: NO. THE SAMPLE OF 6,423 PEOPLE IS A CONVENIENCE SAMPLE, AND IS NOT A REPRESENTATIVE SAMPLE OF THE POPULATION OF ALL TV WATCHERS.

14. Suppose researchers who conduct a vitamin study conclude in an evening news sound byte that "Daily vitamin use is good for everyone." You get a copy of the study they referred to, and find that the participants were all healthy young males who exercised regularly. Explain why the headline is misleading from a statistical standpoint.
ANSWER: THE CONCLUSION IN THE HEADLINE SHOULD NOT REFER TO EVERYONE. THE RESULTS ONLY APPLY TO HEALTHY YOUNG MALES WHO EXERCISE REGULARLY.

MULTIPLE CHOICE QUESTIONS

For Questions 15-16, use the following narrative
Narrative: Babysitting
Suppose a recent study of 1,000 teenagers in the U.S. found that 33% of them do babysitting to earn extra money.

15. {Babysitting Narrative} Which of the following describes the population for this example?
    a. All teenagers in the U.S.
    b. The 1,000 teenagers who participated in the study.
    c. All teenagers in the U.S. who do babysitting for extra money.
    d. The 33% of teenagers who do babysitting to earn extra money.
    ANSWER: A

16. {Babysitting Narrative} Which of the following describes the sample for this example?
    a. All teenagers in the U.S.
    b. The 1,000 teenagers who participated in the study.
    c. All teenagers in the U.S. who do babysitting for extra money.
    d. The 33% of teenagers who do babysitting to earn extra money.
    ANSWER: B

17. Which of the following statements is true?
    a. The more variable the groups within a population are, the larger the sample needs to be to detect any real difference between the groups.
    b. The more variable the groups within a population are, the smaller the sample needs to be to detect any real difference between the groups.
    c. No matter how variable the groups within a population are, the size of the sample needed to detect a real difference between the groups is the same.
    d. None of the above statements are true.
    ANSWER: A

18. Which of the following is necessary to conduct a study properly?
    a. Get a representative sample.
    b. Get a large enough sample.

c. Decide whether or not the study should be an observational study or a randomized (controlled) experiment.
d. All of the above.

ANSWER: D

FILL-IN-THE-BLANK QUESTIONS

19. To conduct a good statistical study, you have to be sure that your _____ is representative and large enough.
ANSWER: SAMPLE

20. Most statistical studies fall into one of two types, either an observational study or a randomized _____.
ANSWER: EXPERIMENT

SECTION 1.4

DON'T BE DECEIVED BY IMPROPER USE OF STATISTICS

FREE RESPONSE QUESTIONS

21. Explain why you cannot make causal connections with an observational study.
ANSWER: AN OBSERVATIONAL STUDY DOES NOT CONTROL FOR OTHER VARIABLES THAT MAY INFLUENCE THE OUTCOME. THAT MEANS THERE MAY BE OTHER FACTORS THAT THE RESEARCHERS DID NOT MEASURE THAT COULD ACCOUNT FOR ANY CONNECTIONS FOUND.

<u>For Questions 22-23, use the following narrative</u>
Narrative: Marijuana and brain
Researchers at the University of Iowa College of Medicine reported that a test showed those who smoked seven or more marijuana joints per week had lower math scores than non-marijuana users. A related headline says "New study confirms too much pot impairs brain".

22. {Narrative: Marijuana and brain} Explain why these results must have been based on an observational study, and not an experiment.
ANSWER: PEOPLE CANNOT BE RANDOMLY ASSIGNED TO EITHER SMOKE MARIJUANA OR NOT.

23. {Narrative: Marijuana and brain} Explain why the headline is misleading.
ANSWER: IT IMPLIES THAT THERE IS A CAUSAL CONNECTION BETWEEN SMOKING MARIJUANA AND BRAIN FUNCTION. IT COULD BE THE CASE THAT PEOPLE WHO CHOOSE TO SMOKE MARIJUANA ARE THOSE WHO WOULD SCORE LOWER ON THE TESTS ANYWAY.

24. Suppose it is reported that the state of Texas has the highest number of tornadoes in the U.S. each year, and thus it is more dangerous to live in Texas than other states if you are worried about tornadoes. Explain why these results are misleading and how they need to be recalculated.
ANSWER: TEXAS IS AN EXTREMELY LARGE STATE, AND THEREFORE HAS A GREATER CHANCE OF HAVING MORE TORNADOES. THE STATISTIC NEEDS TO

BE BASED ON A 'PER SQUARE MILE' RATING, RATHER THAN SIMPLY THE NUMBER OF TORNADOES PER YEAR IN EACH STATE, REGARDLESS OF SIZE.

MULTIPLE CHOICE QUESTIONS

25. Suppose you are conducting an experiment that involves assigning each of 100 participants to one of two groups: Group A or Group B. Which of the following would not be considered to be a random assignment of participants to groups?
    a. For each participant, flip a coin. If the coin lands heads up, assign him/her to Group A. If the coin lands tails up, assign him/her to Group B.
    b. Put all 100 names in a hat and mix them up thoroughly. Draw 50 names from the hat and assign them to Group A. Everyone else is assigned to Group B.
    c. As the participants show up for the study, assign the first 50 of them to Group A, and the last 50 to Group B.
    d. All of the above methods are considered to be random assignments of participants to groups.

    ANSWER: C

26. Suppose you want to conduct a survey to determine who is most likely to win the next presidential election. Which of the following would be considered to be a representative (unbiased) sample?
    a. 1,000 likely voters who called in to a local radio talk show.
    b. 1,000 likely voters who returned surveys sent to everyone on a Democrat or Republican newsletter mailing list.
    c. 1,000 likely voters who replied to an Internet website survey.
    d. None of these would be considered to be representative samples.

    ANSWER: D

27. Which of the following is not a misuse of statistics?
    a. Taking a statistic out of context.
    b. Neglecting to take the proper units into account (such as crime rate vs. number of crimes).
    c. Reporting a number that you didn't expect.
    d. All of these are examples of misleading statistics.

    ANSWER: C

28. Suppose you want to determine how Americans feel about reality TV. Which of the following samples contains the least amount of bias?
    a. All the people who phone in their opinion on reality TV to a CBS Evening News call-in poll.
    b. All those who were randomly selected to receive a reality TV survey in the mail.
    c. People who call the networks during reality TV programs to voice their opinion.
    d. People who respond to an Internet survey at www.realitytv.com.

    ANSWER: B

FILL-IN-THE-BLANK QUESTIONS

29. The conclusions that can be drawn from an observational study are not as strong as the conclusions that can be drawn from a(n) _____.

    ANSWER: RANDOMIZED (OR CONTROLLED) EXPERIMENT

30. Suppose you wanted to find out what percentage of all Americans approve of the job the president is doing and you mailed questionnaires to 2,000 readers of The Wall Street Journal and compiled the results. This is a(n) _____ sample of all American voters.
ANSWER: BIASED (NONRANDOM OR NONREPRESENTATIVE)