1. A simple random sample of size n is selected in such a way that.
   a. Each member of the population has an equal chance of being selected.
   b. Each member of the population is given an opportunity to respond to the survey.
   c. All samples of size n have the same chance of being selected.
   d. The sample is guaranteed to represent the entire population.

2. In sample survey, bias can be controlled by all of the following except
   a. Using a probability or chance sampling procedure.
   b. Wording a question so they are not confusing or misleading.
   c. Carefully training and supervising interviewers.
   d. Prompting respondents so that they give correct responses.
   e. Reducing non-response and under-coverage.

3. A graduate student is conducting a study to determine whether a new activity-based method is better than the traditional lecture method of teaching statistics. He found two teachers to help him in his study for one semester. Mr. Dull volunteered to continue teaching with tradition lectures and Ms. Perky agreed to try the new activity-based method. Each teacher planned to teach two sections of approximately forty students each for adequate replication. At the end of the semester, all sections would take the same final exam and their scores would be compared. What is the treatment variable in this study?
   a. Teacher
   b. Section of the course
   c. Teaching method
   d. Final exam score
   e. Student

4. In a study on the effect of reinforcement on learning from programmed text, two experimental treatments are planned: reinforcement given after every frame of programmed text or reinforcement given after every three frames. Which one of the following control groups would serve best in this study?
   a. A group which does not read the programmed text material.
   b. A group that reads the programmed material in prose formats.
   c. A group which reads the programmed material but does not receive reinforcement.
   d. A group that reads the programmed text material and reinforcement is given at random.
   e. A group which watches the video of the programmed material.

5. We say that the design of a study is biased if which of the following is true?
   a. A racial or sexual preference is suspected.
   b. Random placebos have been used.
   c. The research designer has received a grant from a special interest group.
   d. The correlation is greater than 1 or less than –1
   e. Certain outcomes are systematically favored.
6. Which of the following are true?
   I. While observation studies gather information on an already existing condition, they still often involve intentionally forcing some treatment to note the response.
   II. In an experiment, researchers decide on the treatment, but typically allow the subjects to self-select into the control group.
   III. If properly designed, either observational studies or controlled experiments can easily be used to establish cause and effect.
   a. I only  b. II only  c. III only  d. All are true.  E. None are true

7. Consider the following studies being run by three different AP Statistics instructors.
   I. One rewards students every day with lollipops for relaxation, encouragement, and motivation to learn the material.
   II. One promises that all student will receive A’s as long as they give their best efforts to learn the material.
   III. One is available every day after school and on weekends so that students with questions can come in and learn the material.
   a. None of these studies use randomization.
   b. None of these studies use control groups.
   c. None of these studies use blinding.
   d. Important information can be found from all these studies, but none can establish causal relationships.
   e. All of the above.

8. In one study half of a class were instructed to watch exactly 1 hour of television per day, the other half were told to watch 5 hours per day, and then their class grades were compared. In a second study, students in a class responded to a questionnaire asking about their television usage and their class grades.
   a. The first study was an experiment without a control group, while the second was an observational study.
   b. The first study was an observation study, while the second was a controlled experiment.
   c. Both studies were controlled experiments.
   d. Both studies were observational studies.
   e. Each study was part controlled experiment and part observational study.

9. To test whether extensive exercise lowers the resting heart rate, a study is performed by randomly selecting half of a group of volunteers to exercise each morning, while the rest are instructed to perform no exercise. Is this study an experiment or an observational study?
   a. An experiment with a control group and blinding.
   b. An experiment with blocking
   c. An observational study with comparison and randomization.
   d. An observational study with little if any bias
   e. None of the above.
To study the effect of alcohol on reaction time, subjects were randomly selected and given three beers to consume. Their reaction time to a simple stimulus was measured before and after drinking the alcohol. Which of the following statements are true?
I. This study was an observational study.
II. This study was an experiment with no controls.
III. This study was an experiment in which the subjects were used as their own controls.
IV. The researcher should be concerned about a placebo effect.

a. I only   b. II only   c. III only   d. II and IV  e. III and IV

A teacher believes that giving her students a practice quiz every week will motivate them to study harder, leading to a greater overall understanding of the course material. She tries this technique for a year, and everyone in the class achieves a grade of at least C. Is this an experiment or an observational study?

a. An experiment, but with no reasonable conclusion possible about cause and effect.
b. An experiment, thus making cause and effect a reasonable conclusion.
c. An observational study, because there was no use of a control group.
d. An observational study, but a poorly designed one because randomization was not used.
e. An observational study, and thus a reasonable conclusion of association but not of cause and effect.

In a study on the effect of music on worker productivity, employees are told that a different genre of background music would be played each day and the corresponding production outputs noted. Every change in music resulted in an increase in production. This is an example of:

a. the effect of a treatment unit.
b. the placebo effect
c. the control group effect
d. sampling error
e. voluntary response bias

The ministry of Health in the province of Ontario, Canada, wants to know whether the national health care system is achieving its goals in the province. Much information about health care comes from patient records, but that source doesn’t allow us to compare people who use health services with those who don’t. So the Ministry of Health conducted the Ontario Health Survey, which interviewed a random sample of 61,239 people who live in the province of Ontario.

a) What is the population for this sample survey? What is the sample?

b) The survey found that 76% of males and 86% of females in the sample had visited a general practitioner at least once in the past year. Do you think these estimates are close to the truth about the entire population? Why?
14. What is the name for each of the study designs?
   a) A study to compare two methods of preserving wood started with boards of southern white pine. Each board was ripped from end to end to form two edge-matched specimens. One was assigned to Method A and the other, to Method B.
   
b) A survey on youth and smoking contacted by telephone 300 smokers and 300 non-smokers, all 14 to 22 years of age.
   
c) Does air pollution induce DNA mutation in mice? Starting with 40 male and 40 female mice, 20 of each sex were housed in a polluted industrial area downwind from a steel mill. The other 20 of each sex were housed at an unpolluted rural location 30 kilometers away.

15. Will case bonuses speed unemployed people’s return to work? The Illinois Department of Employment Security designed an experiment to find out. The subjects were 10,065 people aged 20 to 54 who were filing claims for unemployment insurance. Some were offered $500 if they found a job within 11 weeks and held it for a least 4 months. Others could tell potential employers that the state would pay the employer $500 for hiring them. A control group got neither kind of bonus.
   a) Outline the design of the experiment.
   
b) How will you label the subjects for random assignment? Use Table B at line 167 to choose the first 3 subjects for the first treatment.

16. We often see players on the sidelines of a football game inhaling oxygen. Their coaches think it will speed their recovery. We might measure recovery from intense exercise as follows. Have a football player run 100 yards three times in a quick succession. Then allow three minutes to rest before running 100 yards again. Time the final run. Because players vary greatly in speed, you plan a matched pairs experiment using 25 football players as subjects. Discuss the design of such an experiment to investigate the effect of inhaling oxygen during the rest period.
17. Do consumers prefer the taste of a cheeseburger from McDonald’s or from Wendy’s in a blind test in which neither burger is identified? Describe briefly the design of a matched pairs experiment to investigate this question.

18. For years, scientists have suspected that a chemical in many household deodorizing products may cause short term lung problems. A 2006 study by scientists at the National Institutes of Health say they’ve found that people with relatively high blood concentrations of the substance – 1,4-dichlorobenzene, an organic chemical – show signs of slightly reduced lung function. The study followed 953 Americans, average age 37, for six years.

a) From the above description of this study, would you say it was an experiment or an observational study? Justify your answer.

b) The number of subjects in this study is relatively large – almost 1,000 people. Does the large sample size lend credence to the notion that having household deodorizing products around is dangerous to your lungs? Justify your answer.

c) A newspaper article announcing these results stated, “Other studies have had similar findings, which suggests that chronic exposure to a chemical in air fresheners can cause lung problems.” Based on the NIH study, can we conclude that exposure to products that contain 1,4-dichlorobenzene causes lung problems? Why or why not?
19. Vocabulary:

- Voluntary response sample
- Confounded
- Population
- Sample
- Design
- Convenience sampling
- Biased
- Simple random sample
- Table of random digits
- Probability sample
- Stratified random sample
- Strata
- Undercoverage
- Response bias
- Sampling frame
- Systematic random sample
- Observation study
- Experimental units
- Subjects
- Treatment
- Factor
- level
- Placebo effect
- Control group
- Randomization
- Completely randomized experiment
- Replication
- Double-blind experiment
- Block design
- Matched pairs design

20. Why are voluntary response samples unreliable?

21. Explain the difference between a population and a sample.

22. Why might convenience sampling be unreliable?

23. What is a biased study?

24. What is meant by the design of a sample?

25. Define simple random sample.

26. What is a stratified random sample?

27. Give an example of undercoverage in a sample.

28. Give an example of response bias in a sample.
29. How can the wording of questions cause bias in a sample?

30. Explain the difference between an observational study and an experiment.

31. Explain the difference between experimental units and subjects.

32. Define treatment.

33. Give an example of at least two levels of a factor in an experiment.

34. Describe the placebo effect.

35. What is the significance of using a control group?

36. Define randomization.

37. Define statistically significant.

38. What are the advantages of a double-blind study?

39. Describe a block design.

40. Describe a matched pairs design.
Selected Answers
Multiple Choice

Free Response
13 a. population is all people of Ontario Canada; 61239 people who were interviewed
b.
14. a) matched pairs b) stratified sample c) blocked design
15. a) b) 00850, 02182, 00681 16. 17.
18. a) observation b) No c) No