

# Chapter 1 Getting Started

## Section 1.1

1. (a) The variable is the response regarding frequency of eating at fast-food restaurants.  
(b) The variable is qualitative. The categories are the number of times one eats in fast-food restaurants.  
(c) The implied population is responses for all adults in the U.S.
3. (a) The variable is student/faculty ratio at colleges.  
(b) The variable is quantitative because arithmetic operations can be applied to the ratios.  
(c) The implied population is student/faculty ratio at all colleges in the nation.
5. (a) The variable is the nitrogen concentration (mg nitrogen/l water).  
(b) The variable is quantitative because arithmetic operations can be applied to the time intervals.  
(c) The implied population is the nitrogen concentration (mg nitrogen/l water) in the entire lake.
7. (a) *Length of time to complete an exam* is a ratio level of measurement. The data may be arranged in order, differences and ratios are meaningful, and a time of 0 is the starting point for all measurements.  
(b) *Time of first class* is an interval level of measurement. The data may be arranged in order and differences are meaningful.  
(c) *Major field of study* is a nominal level of measurement. The data consists of names only.  
(d) *Course evaluation scale* is an ordinal level of measurement. The data may be arranged in order.  
(e) *Score on last exam* is a ratio level of measurement. The data may be arranged in order, differences and ratios are meaningful, and a score of 0 is the starting point for all measurements.  
(f) *Age of student* is a ratio level of measurement. The data may be arranged in order, differences and ratios are meaningful, and an age of 0 is the starting point for all measurements.
9. (a) *Species of fish* is a nominal level of measurement. Data consist of names only.  
(b) *Cost of rod and reel* is a ratio level of measurement. The data may be arranged in order, differences and ratios are meaningful, and a cost of 0 is the starting point for all measurements.  
(c) *Time of return home* is an interval level of measurement. The data may be arranged in order and differences are meaningful.  
(d) *Guidebook rating* is an ordinal level of measurement. Data may be arranged in order.  
(e) *Number of fish caught* is a ratio level of measurement. The data may be arranged in order, differences and ratios are meaningful, and 0 fish caught is the starting point for all measurements.  
(f) *Temperature of the water* is an interval level of measurement. The data may be arranged in order and differences are meaningful.

## Section 1.2

1. Essay
3. Answers vary. Use groups of 4 digits.
5. (a) Assign a distinct number to each subject. Then use a random number table. Group assignment methods vary.  
(b) Repeat part (a) for 22 subjects.  
(c) Answers vary.

7. (a) Yes, it is appropriate that the same number appears more than once because the outcome of a die roll can repeat. The outcome of the 4th roll is 2.  
(b) No, we do not expect the same sequence because the process is random.
9. (a) Reasons may vary. For instance, the first four students may make a special effort to get to class on time.  
(b) Reasons may vary. For instance, four students who come in late might all be nursing students enrolled in an anatomy and physiology class that meets the hour before in a far-away building. They may be more motivated than other students to complete a degree requirement.  
(c) Reasons may vary. For instance, four students sitting in the back row might be less inclined to participate in class discussions.  
(d) Reasons may vary. For instance, the tallest students might all be male.
11. In all cases, assign distinct numbers to the items, and use a random-number table.
13. Answers vary. Use single digits with correct answer placed in corresponding position.
15. (a) This technique is simple random sampling. Every sample of size  $n$  from the population has an equal chance of being selected and every member of the population has an equal chance of being included in the sample.  
(b) This technique is cluster sampling. The state, Hawaii, is divided into regions using, say, the first 3 digits of the Zip code. Within each region a random sample of 10 Zip code areas is selected using, say, all 5 digits of the Zip code. Then, within each selected Zip codes, all businesses are surveyed. The sampling units, defined by 5 digit Zip codes, are clusters of businesses, and within each selected Zip code, the benefits package the businesses offer their employees differs business to business.  
(c) This technique is convenience sampling. This technique uses results or data that are conveniently and readily obtained.  
(d) This technique is systematic sampling. Every  $k^{\text{th}}$  element is included in the sample.  
(e) This technique is stratified sampling. The population was divided into strata (10 business types), then a simple random sample was drawn from each stratum.

### Section 1.3

1. (a) This is an observational study because observations and measurements of individuals are conducted in a way that doesn't change the response or the variable being measured.  
(b) This is an experiment because a treatment is deliberately imposed on the individuals in order to observe a possible change in the response or variable being measured.  
(c) This is an experiment because a treatment is deliberately imposed on the individuals in order to observe a possible change in the response or variable being measured.  
(d) This is an observational study because observations and measurements of individuals are conducted in a way that doesn't change the response or the variable being measured.
3. (a) Sampling was used because measurements from a representative part of the population were used.  
(b) A simulation was used because computer programs that mimic actual flight were used.  
(c) A census was used because data for all scores are available.  
(d) An experiment was used. A treatment is deliberately imposed on the individuals in order to observe change in the response or variable being measured.
5. (a) Use random selection to pick 10 calves to inoculate. Then test all calves to see if there is a difference in resistance to infection between the two groups. There is no placebo being used.

- (b) Use random selection to pick 9 schools to visit. Then survey all the schools to see if there is a difference in views between the two groups. There is no placebo being used.
- (c) Use random selection to pick 40 volunteers for skin patch with drug. Then survey all volunteers to see if a difference exists between the two groups. A placebo for the remaining 35 volunteers in the second group is used.

## Chapter 1 Review

1. Answers vary.
3. Essay
5. In the random number table use groups of 2 digits. Select the first six distinct groups of 2 digits that fall in the range from 01 to 42. Choices vary according to the starting place in the random number table.
7. (a) This is an observational study because observations and measurements of individuals are conducted in a way that doesn't change the response or the variable being measured.  
(b) This is an experiment because a treatment is deliberately imposed on the individuals in order to observe a possible change in the response or variable being measured.
9. This is a good problem for class discussion. Some items such as age and grade point average might be sensitive information. You could ask the class to design a data form that can be filled out anonymously. Other issues to discuss involve the accuracy and honesty of the responses.
11. (a) This is an experiment, since a treatment is imposed on one colony.  
(b) The control group receives normal daylight/darkness condition. The treatment group has light 24 hours per day.  
(c) The number of fireflies living at the end of 72 hours.  
(d) The variable is a ratio level of measurement. The data may be arranged in order, differences and ratios are meaningful, and the number 0 fireflies is the starting point for all measurements.