

Answer all questions using complete sentences.

1. Sudoku is a puzzle consisting of squares arranged in 9 rows and 9 columns. The 81 squares are further divided into nine  $3 \times 3$  square boxes. The object is to fill in the squares with numerals 1 through 9 so that each column, row, and box contains all nine numbers. However, there is a requirement that each number appear only once in any row, column, or box. Each puzzle already has numbers in some of the squares. Would it be appropriate to use a random-number table to select a digit for each blank square? Explain.

A random-number table would be very inefficient given the puzzle requirements.

2. Alisha wants to do a statistical study to determine how long it takes people to complete a Sudoku puzzle (see Problem 1 for a description of the puzzle). Her plan is as follows:
  - Download 10 different puzzles from the Internet.
  - Find 10 friends willing to participate.
  - Ask each friend to complete one of the puzzles and time him- or herself.
  - Gather the completion times from each friend.

Describe some of the problems with Alisha's plan for the study. (Note: Puzzles differ in difficulty, ranging from beginner to very difficult.) Are the results from Alisha's study anecdotal, or do they apply to the general population?

are the puzzles all the same?  
How reliable is self-timing?  
Why only her friends?

3. You are conducting a study of students doing work-study jobs on your campus. Among the questions on the survey instrument are:
  - A. How many hours are you scheduled to work each week? Answer to the nearest hour.
  - B. How applicable is this work experience to your future employment goals?  
Respond using the following scale: 1 = not at all, 2 = somewhat, 3 = very
  - a. Suppose you take random samples from the following groups: freshmen, sophomores, juniors, and seniors. What kind of sampling technique are you using (simple random, stratified, systematic, cluster, multistage, convenience)?

Stratified

- b. Describe the individuals of this study.

Students on campus with work study jobs.

- c. What is the variable for question A? Classify the variable as qualitative or quantitative. What is the level of the measurement?

Hours scheduled; quantitative; Ratio level

- d. What is the variable for question B? Classify the variable as qualitative or quantitative. What is the level of the measurement?

Rating of applicability of work experience to future employment; qualitative; ordinal level

- e. Is the proportion of responses "3 = very" to question B a statistic or a parameter?

Statistic

- f. Suppose only 40% of the students you selected for the sample respond. What is the nonresponse rate? Do you think the nonresponse rate might introduce bias into the study? Explain.

60%

The nonrespondents may not work many hours.

- g. Would it be appropriate to generalize the results of your study to all work-study students in the nation? Explain.

No. The sample frame is restricted to 1 campus.

4. A radio talk show asked listeners to respond either yes or no to the question, "Is the candidate who spends the most on a campaign the most likely to win?" Fifteen people called in and nine said yes. What is the implied population? What is the variable? Can you detect any bias in the selection of the sample?

The implied population is all listeners of the radio talk show.

Most money spent on campaign likely to win

Radio station may favor one candidate over another.

5. In your own words, give a complete and careful description of the four levels of measurement. Which level is the highest? Which is the lowest? What are the different suitable uses for each level of measurement?

The lowest level of measurement is the Nominal level. At this level your data can be put into categories. The ordinal level is the 2<sup>nd</sup> level of measurement. Here you can order your data from "best" to "worst." The 3<sup>rd</sup> level is the Interval level where differences between values can be determined. At the highest level - the ratio level - differences and ratios between data can be found.

6. Lotto is the name of the Colorado lottery. The Lotto boards consist of 42 numbers (from 1 to 42). To play, you select six distinct numbers. Every week a drawing machine randomly selects six numbered Ping-Pong balls. If one of your boards contains all six winning numbers, in any order, you've hit the jackpot! you can pick your numbers any way you wish. However, suppose you want to use a random-number table to pick your six numbers. Describe how you would do so, and list your selected numbers. (To play, you must pay \$1 to have your selections entered into a computer for a specified week's drawing.)

Using a random-number table you would look for 2-digit numbers between 1 and 42, inclusive.

Block 4, Row 2

23501 22642 63081 08191

23 ~~50~~ 12 26 42 ~~63~~ 08 10

7. Categorize the type of sampling (simple random, stratified, systematic, cluster, or convenience) used in each of the following situations.
- a. To conduct a pre-election opinion poll on a proposed amendment to the state constitution, a random sample of 10 telephone prefixes (first three digits of the phone number) was selected, and all household from the phone prefixes selected were called.

Cluster

- b. To conduct a study on depression among the elderly, a sample of 30 patients in one nursing home was used.

Convenience

- c. To maintain quality control in a brewery, every 20<sup>th</sup> bottle of beer coming off the production line was opened and tested.

Systematic

- d. Subscribers to the magazine *Sound Alive* were assigned numbers. Then a sample of 30 subscribers was selected by using a random-number table. The subscribers in the sample were invited to rate new compact disc players for a "What the Subscribers Thing" column.

Random.

- e. To judge the appeal of a proposed television sitcom, a random sample of 10 people from each of three different age categories was selected and those chosen were asked to rate a pilot show.

Stratified

8. Which technique (observational study or experiment) for gathering data do you think was used in the following studies? *Explain your answer.*
- a. The U.S. Census Bureau tracks population age. In 1900, the percentage of the population that was nineteen years old or younger was 44.4%. In 1930, the percentage was 38.8%; in 1970, the percentage was 37.9%; and in 2000, the percentage in the age group was down to 28.5%.

Observational Study

- b. After receiving the same lessons, a class of 100 students was randomly divided into two groups of 50 each. One group was given a multiple-choice exam covering the material in the lessons. The other group was given an essay exam. The average test scores for the two groups were then compared.

Experiment

9. Suppose you are conducting a study to compare firefly populations exposed to normal daylight/darkness conditions with firefly populations exposed to continuous light (24 hours a day). You set up two firefly colonies in a laboratory environment. The two colonies are identical except that one colony is exposed to normal daylight/darkness conditions and the other is exposed to continuous light. Each colony is populated with the same number of mature fireflies. After 72 hours, you count the number of living fireflies in each colony.
- a. Is this an experiment or an observation study? Explain.

Experiment, since a treatment is imposed on one colony.

- b. Is there a control group? Is there a treatment group?

The control group receives normal daylight/darkness conditions.

The treatment group has light 24 hours per day.

- c. What is the variable in this study?

The number of fireflies living after 72 hours.

- d. What is the level of measurement (nominal, interval, ordinal, or ratio) of the variable?

Ratio.