APPLICATIONS

1. Scientists randomly select ten groups from a population of men over 50 years old. They calculate the mean weights of each of these groups. The variability between these means can be best attributed to

   (1) measurement variability   (3) induced variability
   (2) natural variability       (4) sampling variability

2. Max and Daniel are measuring the amount of time it takes for a ball to roll down a ramp at different heights. For each trial, both Max and Daniel take turns rolling the ball and working the stop watch. They do this in order to quantify which of the following sources of variability?

   (1) measurement variability   (3) induced variability
   (2) natural variability       (4) sampling variability

3. Which of the following scenarios would be an attempt to quantify induced variability?

   (1) a phone survey of political preferences during election season
   (2) multiple random samples of products from an assembly line to check for defects
   (3) random assignment of people to a control group and a group taking a drug to lower cholesterol
   (4) recording the variability in the measurement of a soil sample's weight by the same machine

4. Which of the following research questions would involve collecting data through a survey?

   (1) Watching people exit a grocery store to see the percent who use reusable bags.
   (2) Assigning people to two groups to see the effect of a particular amount of sleep.
   (3) Calling people on the telephone to see if they will be voting in the upcoming election.
   (4) Dropping salt cubes into two different liquids to determine which dissolves faster.

5. In which of the following cases would an observational study be necessary as compared to an experimental study?

   (1) The study of how increased nutrient levels affect plant growth.
   (2) The study of how educational levels affect median household income.
   (3) The study of how a vaccine affects the percent of mice that get a particular disease.
   (4) The study of how noise level affects the sleep patterns of volunteers in a sleep study.
FLUENCY

6. Which of the following formulas, written in summation notation, would represent the mean of the data set \( \{ x_1, x_2, ..., x_n \} \)? Explain your choice.

\[
\begin{align*}
(1) \quad & \sum_{i=1}^{n} x_i \\
(2) \quad & \frac{1}{n} \sum_{i=1}^{n} x_i^2 \\
(3) \quad & \sum_{i=1}^{n} x_i \\
(4) \quad & \frac{1}{n} \sum_{i=1}^{n} x_i
\end{align*}
\]

7. The standard deviation of a population characteristic measures

(1) The difference between the maximum and minimum values.
(2) The difference between the third quartile and first quartile values.
(3) The average distance a data value is away from the mean.
(4) The average distance a data value is away from the median.

8. The interquartile range of the data set \( \{4, 7, 10, 13, 18, 22, 30\} \) is

\[
\begin{align*}
(1) \quad & 15 \\
(2) \quad & 18 \\
(3) \quad & 7 \\
(4) \quad & 10
\end{align*}
\]

APPLICATIONS

9. If 348 freshmen out of 622 have cell phones, then the population proportion, \( p \), for freshmen cell phone ownership is

\[
\begin{align*}
(1) \quad & 0.56 \\
(2) \quad & 0.35 \\
(3) \quad & 0.72 \\
(4) \quad & 0.44
\end{align*}
\]

10. If a population has 824 subjects, then about how many would have characteristics in the upper quartile?

\[
\begin{align*}
(1) \quad & 412 \\
(2) \quad & 280 \\
(3) \quad & 368 \\
(4) \quad & 206
\end{align*}
\]