Types of Studies and Randomization Practice

1. A scientist selects 500 smokers to test how long they can hold their breath. Not surprisingly, the smokers can't hold their breath for long. The average result was a measly 23 seconds. What kind of study was this?

   (A) Randomized trial
   (B) Double blind study
   (C) Observational study
   (D) An experiment

   Correct Answer: Observational study

   Answer Explanation: No randomization is noted, nor any evidence of double blinding. That means (A), (B), and (D) are out of the question (since (A) and (B) are types of experiments). This is clearly just an observational study designed to measure something specific about smokers.

2. Which of the following is a random sample?

   (A) Picking out the best athletes from a track team to measure average performance
   (B) Selecting the closest people sitting next to you in class to determine the average GPA of the entire class
   (C) Neither (A) nor (B)
   (D) Both (A) and (B)

   Correct Answer: Neither (A) nor (B)

   Answer Explanation: Selecting the best athletes is giving preferential treatment and will give the average of the best athletes not the entire track team's average. Even

though (B) is a "random" selection of the closest people to you, it's not random throughout the class. (For instance, if you're the class clown and constantly disturbing people sitting next to you, their GPA is likely to be lower than those sitting farther away.)

3. Which of the following is rarely, if ever, random?

(A) Observational study
(B) Experiment
(C) Sample Survey
(D) All of the above

Correct Answer: Observational study

Answer Explanation: Experiments and sample surveys should be random for statistical validity. Observational studies cannot (and sometimes do not) concern themselves with randomization for temporal, ethical, legal, financial, or other reasons.

4. Which of the following sample types are valid for a study that measures the average time on the job for all workers of a company?

(A) Randomly selected workers
(B) Workers selected by a boss who likes them
(C) Workers who work more than forty hours per week
(D) (A) and (C)

Correct Answer: Randomly selected workers

Answer Explanation: Workers who are liked by their boss may work fewer hours than those who are disliked

by their boss or vice versa, so (B) is invalid. Sampling from workers who work for over forty hours a week explicitly and directly affects the results of the study and is therefore biased. The only valid sample is (A).

5. You decide to play a prank on your friends (in the name of science, of course) and give them laxative brownies. You then time how long it takes for each to have to go to the bathroom. What is this an example of?

(A) A legitimate scientific study
(B) An observational study
(C) A sample survey
(D) Cruel and unusual punishment

Correct Answer: An observational study

Answer Explanation: We doubt any digestively regular scientist would excuse laxative brownies as a legitimate scientific study. Sample surveys consist of sampling a randomly selected portion of a population in order to draw inferences about the entire population. This clearly isn't the case. You observed what happened to your friends, so (C) is right. We don't blame you if you answered (D), though.

6. Why would it be a bad idea to claim the above question was a sample survey?

(A) A sample survey would mean that laxative brownies would be fed to a randomly selected group of people
(B) The sample selected with a fair amount of bias
(C) There was no defined population
(D) All of the above

Correct Answer: All of the above

Answer Explanation: Is your population in question your class? All your friends? In order to conduct a sample survey, the study must be thought out. After defining your population, a group of people must be *randomly* selected from that pool, something you didn't do before. (Also, feeding laxative brownies to random strangers would be a bad idea in and of itself.)

7. Randomization, or better yet, the lack of proper randomization, may be most influenced by which of the following?

    (A) Sponsorship of a survey from a non-independent entity
    (B) Lack of verification by another group of scientists after the study is published
    (C) Improper system of checks and balances to ensure no bias occurs
    (D) (A) and (C)

Correct Answer:(A) and (C)

Answer Explanation: While (B) is something that maybe necessary after a study is published, and may catch randomization errors as well, (A) and (C) are likely to *introduce* bias. Unfortunately both (A) and (C) do happen somewhat often.

8. Which of the following is *not* randomly chosen?

    (A) Blindly reaching into a bag of skittles to pick out random colors
    (B) Picking out a folded piece of paper with a number on it

from a hat
(C) Both (A) and (B)
(D) None of the above

Correct Answer: None of the above

Answer Explanation: Both (A) and (B) are randomly chosen. That is, unless there are ways you can cheat, which the question and answers do not imply.

9. You decide to conduct an experiment to see which type of engine oil will make your car run better. Where does this experiment make a mistake with respect to bias?

Step 1: Randomly pick four different types of engine oil from the local auto shop.

Step 2: Change out the old oil as best you can to avoid residue.

Step 3: Pour in the new oil, always the same amounts as the previous oil.

Step 4: Drive around for the same distance and amount of time for each different type of oil.

(A) Steps 1 and 2
(B) Steps 2 and 3
(C) Steps 3 and 4
(D) Steps 1 and 4

Correct Answer: Steps 3 and 4

Answer Explanation: Bias was introduced in Step 3 by not randomizing which oil you pour in. This can subconsciously affect driving habits if you have a preference for a particular

brand of oil. Step 4 mentions nothing about keeping driving habits the same. You might be driving for the same distance and time, but whether you drive smoothly or erratically will affect results.