Quiz CHAPTER 11  Name:

1. A number of anomalies can cause misleading correlations. Name two problems that can cause distortion with correlations.
   ANSWER: 1) OUTLIERS CAN SUBSTANTIALLY INFLATE OR DEFLATE THEM; 2) GROUPS COMBINED INAPPROPRIATELY MAY MASK RELATIONSHIPS.

2. Suppose the correlation between height and weight for all the students in your class is found to be 0.20. You think that you must be overlooking something, because the relationship should be stronger than that. What additional variable may be masking an underlying relationship here?
   ANSWER: ANY REASONABLE ANSWER OK. EXAMPLE: GENDER.

3. Explain how (if) an outlier can affect the correlation of a data set.
   ANSWER: AN OUTLIER CAN SEVERELY INFLATE OR DEFLATE THE CORRELATION.

4. What impact can an outlier have on a correlation?
   a. An outlier that is consistent with the trend of the rest of the data will inflate the correlation.
   b. An outlier that is not consistent with the rest of the data can deflate the correlation.
   c. An outlier in a smaller sample has an especially large impact on a correlation, compared to an outlier in a larger sample.
   d. All of the above.
   ANSWER: D

5. In which case(s) should you be suspicious of a correlation that is presented?
   a. When the data is likely to contain outliers.
   b. When the sample size is small.
   c. When removing one point in the data set actually reverses the direction of the trend.
   d. All of the above.
   ANSWER: D

6. Suppose a correlation is found to be very weak. What does this mean about the relationship between the two variables?
   a. There is no linear relationship between the two variables being measured.
   b. There may be separate linear relationships that are being masked by a third variable that was not accounted for.
   c. There may be a different type of relationship between the variables; just not a linear one.
   d. All of the above.
   ANSWER: D

7. A data point that is far removed from the rest of the data is called a(n)_________.
   ANSWER: OUTLIER

8. Why, in the absence of any other evidence, can’t you use data from an observational study to establish a causal link between two measurement variables?
   ANSWER: THE SUBJECTS ARE NOT RANDOMLY ASSIGNED TO TREATMENTS; THERE COULD BE CONFOUNDING VARIABLES.
9. Researchers noticed that happier heart patients are much more likely to still be alive 10 years down the road than unhappy heart patients. Does this mean that if an unhappy heart patient suddenly decides to start being happy, this will cause them to live longer?

**Answer:** No. This is an observational study, not a controlled experiment. Many confounding variables exist, for example, exercise.

10. Which of the following can get in the way of concluding a causal connection between two measurement variables?

   a. A weak correlation.
   b. An observational study.
   c. Confounding variables.
   d. All of the above.

**Answer:** D

11. When is it appropriate to draw a causal connection between two measurement variables?

   a. When there is a strong correlation between them.
   b. When the data were collected through an observational study.
   c. When the observed association between the variables makes sense.
   d. None of the above.

**Answer:** D

12. Which of the following statements is true?

   a. Legitimate correlation never implies causation.
   b. Legitimate correlation does not necessarily imply causation.
   c. Legitimate correlation is equivalent to causation.
   d. Legitimate correlation implies causation in the case of a single observational study, as long as the researchers tried to control for confounding variables.

**Answer:** B

13. Give an example where the explanatory variable is the direct cause of the response variable.

   **Answer:** Any similar example to the following is ok: amount of food consumed in the past hour and level of hunger.

14. Give an example where the response variable is causing a change in the explanatory variable.

   **Answer:** Any similar example to the following is ok: low occupancy rates in hotels cause higher advertising revenues (rather than the other way around).

15. Give an example where the explanatory variable is a contributing (but not the only) cause of the response variable.

   **Answer:** Any similar example to the following is ok: diet and developing a certain type of cancer.

16. There is a strong correlation between verbal SAT scores and college GPAs. This does not mean however, that higher SAT scores cause higher grades in college. But what could explain this relationship?

   a. The confounding variable gender.
   b. The high (low) SAT scores and high (low) GPAs both result from a common cause.
   c. Both SAT scores and GPAs change over time.
   d. The relationship is purely coincidental.

**Answer:** B
17. If two measurement variables are both found to be changing over time, what does this mean?
   a. It means there is a causal link between the two variables.
   b. It means there is a common cause of the changes in both variables (possibly other than time).
   c. It means that even though the two variables may be highly correlated, they could be completely unrelated in terms of cause and effect.
   d. None of the above.
   **ANSWER:** C

18. One of the ways two variables could be related without a causal connection is the existence of _______ variables.
   **ANSWER:** CONFOUNDING

19. Sometimes an association between two variables is due to __________, even though the odds of it happening appear to be very small.
   **ANSWER:** COINCIDENCE

20. What is the only legitimate way to try to establish a causal connection statistically between two measurement variables?
   **ANSWER:** THROUGH THE USE OF RANDOMIZED EXPERIMENTS.

21. Even in a well designed experiment, there will always be confounding variables that we have neglected to measure. How can we reduce the chances that an observed association is due to those confounding variables? Name two ways.
   **ANSWER:** 1) USE A LARGE SAMPLE OF SUBJECTS; 2) RANDOMLY ASSIGN SUBJECTS TO TREATMENTS.

22. Give an example where a randomized experiment cannot be done, even though we know that is the best way to try to establish a causal connection between two measurement variables.
   **ANSWER:** ANY REASONABLE ANSWER OK. EXAMPLES: DOES SMOKING CAUSE LUNG CANCER?

23. If a randomized experiment cannot be done, then three non-statistical considerations must be used (all together) to establish evidence of a possible causal connection between two measurement variables. Name them.
   **ANSWER:** 1) THERE IS A REASONABLE EXPLANATION OF CAUSE AND EFFECT; 2) THE CONNECTION HAPPENS UNDER VARYING CONDITIONS; AND 3) POTENTIAL CONFOUNDING VARIABLES ARE RULED OUT.

24. Which of the following will strengthen the evidence for a causal connection?
   a. Many observational studies conducted under different conditions all find the same link between two variables.
   b. Many observational studies with different confounding variables all find the same link between the two variables.
   c. The same type of relationship holds when the explanatory variables fall into different ranges for different studies.
   d. All of the above.
   **ANSWER:** D
25. Which of the following, if left to stand alone, is the weakest evidence of a possible causal connection?
   a. There is a reasonable explanation for a cause and effect relationship.
   b. The data appear to have a pattern on the scatterplot.
   c. The connection was shown to hold under varying conditions.
   d. Potential confounding variables have been ruled out.
   ANSWER: B

26. Suppose you heard on the radio that women who overuse antibiotics have a higher chance of developing breast cancer. You look into the literature on this, and find ten observational studies done by different researchers under different conditions, all of which confirm the results that you heard on the radio. What do you conclude?
   a. The evidence for a causal connection between overuse of antibiotics and increased risk of breast cancer is strengthened by these varying studies.
   b. These studies have too many different confounding variables that together weaken the evidence for a causal connection.
   c. Since the studies were all done under different conditions, there is not enough information to make a conclusion.
   d. None of the above.
   ANSWER: A

27. Which of the following cannot be obtained from observational studies?
   a. Definitive evidence of a causal connection.
   b. A reasonable explanation for a causal connection.
   c. Any evidence of a causal connection.
   d. Definitive evidence of a correlation.
   ANSWER: A

28. The _________ the number of confounding factors that can be ruled out, the _________ convincing the evidence for a causal connection.
   ANSWERS (RESPECTIVELY): GREATER AND MORE; OR FEWER AND LESS.

29. It is very difficult to establish a causal connection between two variables without the use of anything except a ________.
   ANSWER: RANDOMIZED EXPERIMENT