Chapter 2: Reasoning with Data

Answers to Questions and Problems

1. Reasoning is the process of forming conclusions, judgments, or inferences from facts or premises.

2. a. Inductive reasoning. You are starting with a specific observation and ending with a general conclusion.

   b. Deductive reasoning. You are starting with an assumption and ending with a conclusion.

   c. Deductive reasoning. You are starting with an assumption and ending with a conclusion.

   d. Inductive reasoning. You are starting with a specific observation and ending with a general conclusion.

3. a. If a demand curve is downward sloping, then quantity demanded is always declining with increases in price by definition. A change in price from $20 to $25 is a price increase, and so must result in a decline in quantity demanded. Since quantity demanded was 4,000 before the price increase, it must be less than 4,000 after the price increase.

   b. Suppose increasing price from $20 to $25 resulted in sales at least as high as 4,000. Then, this represents a price increase where quantity demanded did not fall. This means that the demand curve is not downward sloping, at least across these price points; hence, demand cannot be generally characterized as downward-sloping.

4. There is one definitive problem with this argument: There is no basis for the degree of support being 1%. In other words, this is a subjective degree of support. An additional possible problem is that the results from early polling may be a selected sample consisting of people relatively in favor of, or against, a candidate compared to the mean overall. This would potentially invalidate any conclusions that are based on an assumption of a random sample.

5. Reasoning provides the framework that allows all involved to clearly see how to go from a dataset to a meaningful conclusion. Reasoning allows for a rigorous argument, in contrast to using instincts or feelings.

6. a. This is neither a direct proof nor transposition. Here, we are trying to prove the statement by claiming "If B, then A," where B is "our margins will increase" and A is "we target our advertising to a younger audience." Showing B implies A does not necessarily mean A implies B, so this is not a valid proof.

   b. This is transposition. Here, we are assuming the opposite of the conclusion and showing the assumption cannot hold.

   c. This is a direct proof. We start with the assumption and move directly to the conclusion.

7. a. Transposition. By walking backward from assuming the conclusion is not true, we are forced to think through the set of assumptions that might consequently be refuted.

   b. One simple hidden assumption is that the targeted advertising is effective for a younger audience. If the younger audience does not respond to the targeted advertising, the proof breaks down.

8. An empirically testable conclusion resulting from your friend being a faster sprinter is that your friend would defeat you in a sprinting race. You could then test this conclusion by actually running the race and see who wins.

9. These data likely suffer from both collector selection bias and member selection bias. For collector selection bias, the people in the data being collected are those that the manager has not let go from the firm; hence, there is selection in terms of which employees the manager allows to stay. For member selection bias, the employees in the data are those who chose to stay with the firm and not go work somewhere else. Both types of selection, which are likely present in these data, could lead to biased conclusions about the average monthly sales for new hires in general.

10. A subjective degree of support is based on opinion and does not have a statistical foundation. In contrast, an objective degree of support does have a statistical foundation. Hence, the objective degree of support is grounded in an associated statistical model that generates concrete figures capturing the level of certainty.

11. a. Inductive reasoning.

    b. Deductive reasoning.

    c. Inductive reasoning.

12. a. This is empirically testable. You can have the teams play any number of times, and compare the proportion of wins for Team A to 65%.

    b. This is not empirically testable. Bruce Lee did not compete in the 1970 tournament, and we cannot go back to observe his performance if he had. Hence, there are no observations currently available, or possible to collect, that could evaluate this conclusion.

    c. This is empirically testable. You can observe profits at each store next year, and compare the proportion of stores that had increased profits to 75%.

13. Observe the car salesman's number of sales for the next five customers in the store. If he makes no sales, you could inductively reason that he does not in fact have a 50% success rate in general.

14. a. The empirically testable conclusion consists of the probabilities in the table. For example, if your assumption holds, the probability of 8 correct picks is 4.4%.

    b. You could test this conclusion by comparing the number of correct picks the broker makes against the probabilities. In particular, if you observed a very high (e.g., 9 or 10) or very low (e.g., 0 or 1) number of correct picks, you may question whether this conclusion is accurate.

    c. The line of reasoning is as follows. First, using deductive reasoning, we go from the assumption of a 50% likelihood of success to the probability table in the problem, which is the empirically testable conclusion. Next, using inductive reasoning, we observe the number of correct picks and decide whether or not to reject the probability table as being true. Last, if we decide to reject the probability table, we use deductive reasoning (in the form of transposition) to reject the assumption of a 50% likelihood of success.

15. One possible source of selection bias is via collector selection bias. The broker may have sent you picks for stocks for which she had some inside knowledge, and she may not generally possess this type of knowledge when making picks. Another possible source of selection bias is member selection bias. A clever scam artist would simply make all 2^{10} possible combinations of stock picks and send each different set

of picks to 2^{10} different people. Then, the picks you receive is a selection of one set of picks out of the 2^{10} that were actually made. You are then basing your reasoning on the one set of picks you observed, and not the full sample of picks that were made.