Chapter 1: Introduction to Statistics

Section 1-2

1. Statistical significance is indicated when methods of statistics are used to reach a conclusion that some treatment or finding is effective, but common sense might suggest that the treatment or finding does not make enough of a difference to justify its use or to be practical. Yes, it is possible for a study to have statistical significance but not a practical significance.
2. If the source of the data can benefit from the results of the study, it is possible that an element of bias is introduced so that the results are favorable to the source.
3. A voluntary response sample is a sample in which the subjects themselves decide whether to be included in the study. A voluntary response sample is generally not suitable for a statistical study because the sample may have a bias resulting from participation by those with a special interest in the topic being studied.
4. Even if we conduct a study and find that there is a correlation, or association, between two variables, we cannot conclude that one of the variables is the cause of the other.
5. There does appear to be a potential to create a bias.
6. There does not appear to be a potential to create a bias.
7. There does not appear to be a potential to create a bias.
8. There does appear a potential to create a bias.
9. The sample is a voluntary response sample and is therefore flawed.
10. The sample is a voluntary response sample and is therefore flawed.
11. The sampling method appears to be sound.
12. The sampling method appears to be sound.
13. Because there is a 30% chance of getting such results with a diet that has no effect, it does not appear to have statistical significance, but the average loss of 45 pounds does appear to have practical significance.
14. Because there is only a 1% chance of getting the results by chance, the method appears to have a statistical significance. The result of 540 boys in 1000 births is above the approximately 50% rate expected by chance, but it does not appear to be high enough to have practical significance. Not many couples would bother with a procedure that raises the likelihood of a boy from 50% to 54%.
15. Because there is a 23% chance of getting such results with a program that has no effect, the program does not appear to have statistical significance. Because the success rate of 23% is not much better than the 20% rate that is typically expected with random guessing, the program does not appear to have practical significance.
16. Because there is a 25% chance of getting such results with a program that has no effect, the program does not appear to have statistical significance. Because the average increase is only 3 IQ point, the program does not appear to have practical significance.
17. The male and female pulse rates in the same column are not matched in any meaningful way. It does not make sense to use the difference between any of the pulse rates that are in the same column.
18. Yes, the source of the data is likely to be unbiased.
19. The data can be used to address the issue of whether males and females have pulse rates with the same average (mean) value.
20. The results do not prove that the populations of males and females have the same average (mean) pulse rate. The results are based on a particular sample of five males and five females, and analyzing other samples might lead to a different conclusion. Better results would be obtained with larger samples.

21. Yes, each IQ score is matched with the brain volume in the same column, because they are measurements obtained from the same person. It does not make sense to use the difference between each IQ score and the brain volume in the same column, because IQ scores and brain volumes use different units of measurement. For example, it would make no sense to find the difference between an IQ score of 87 and a brain volume of 1035 cm^3.

22. The issue that can be addressed is whether there is a correlation, or association, between IQ score and brain volume.

23. Given that the researchers do not appear to benefit from the results, they are professionals at prestigious institutions, and funding is from a U.S. government agency, the source of the data appears to be unbiased.

24. No. Correlation does not imply causation, so a statistical correlation between IQ score and brain volume should not be used to conclude that larger brain volumes cause higher IQ scores.

25. It is questionable that the sponsor is the Idaho Potato Commission and the favorite vegetable is potatoes.

26. The sample is a voluntary response sample, so there is a good chance that the results are not valid.

27. The correlation, or association, between two variables does not mean that one of the variables is the cause of the other. Correlation does not imply causation.

28. The correlation, or association, between two variables does not mean that one of the variables is the cause of the other. Correlation does not imply causation.

29. a. The number of people is $(0.39)(1018) = 397.02$

    b. No. Because the result is a count of people among 1018 who were surveyed, the result must be a whole number.

    c. The actual number is 397 people

    d. The percentage is $\dfrac{255}{1018} = 0.25049 = 25.049\%$

30. a. The number of women is $(0.38)(427) = 162.26$

    b. No. Because the result is a count of women among 427 who were surveyed, the result must be a whole number.

    b. The actual number is 162 women.

    d. The percentage is $\dfrac{30}{427} = 0.07026 = 7.026\%$

31. a. The number of adults is $(0.14)(2302) = 322.28$

    b. No. Because the result is a count of adults among 2302 who were surveyed, the result must be a whole number.

    c. The actual number is 322 adults.

    d. The percentage is $\dfrac{46}{2302} = 0.01998 = 1.998\%$

32. a. The number of adults is $(0.76)(2513) = 1909.88$

    b. No. Because the result is a count of adults among 2513 who were surveyed, the result must be a whole number.

    b. The actual number is 1910 adults.

    d. The percentage is $\dfrac{327}{2513} = 0.13012 = 13.012\%$

33. Because a reduction of 100% would eliminate all of the size, it is not possible to reduce the size by 100% or more.

34. If the Club eliminated all car thefts, it would reduce the odds of car theft by 100%, so the 400% figure is impossible.

35. If foreign investment fell by 100% it would be totally eliminated, so it is not possible for it to fall by more than 100%.

36. Because a reduction of 100% would eliminate all plague, it is not possible to reduce it by more than 100%.

37. Without our knowing anything about the number of ATVs in use, or the number of ATV drivers, or the amount of ATV usage, the number of 740 fatal accidents has no context. Some information should be given so that the reader can understand the rate of ATV fatalities.

38. All percentages of success should be multiples of 5. The given percentage cannot be correct.

39. The wording of the question is biased and tends to encourage negative response. The sample size of 20 is too small. Survey respondents are self-selected instead of being selected by the newspaper. If 20 readers respond, the percentages should be multiples of 5, so 87% and 13% are not possible results.

Section 1-3

1. A parameter is a numerical measurement describing some characteristic of a population, whereas a statistic is a numerical measurement describing some characteristic of a sample.

2. Quantitative data consist of numbers representing counts or measurements, whereas categorical data can be separated into different categories that are distinguished by some characteristic that is not numerical.

3. Parts (a) and (c) describe discrete data.

4. The values of 1010 and 55% are both statistics because they are based on the sample. The population consists of all adults in the United States.

5. Statistic
6. Parameter
7. Parameter
8. Statistic
9. Parameter
10. Parameter
11. Statistic
12. Statistic
13. Continuous
14. Discrete
15. Discrete
16. Continuous
17. Discrete
18. Discrete
19. Continuous
20. Continuous
21. Nominal
22. Ratio
23. Interval
24. Ordinal
25. Ratio
26. Nominal
27. Ordinal
28. Interval

29. The numbers are not counts or measures of anything, so they are at the nominal level of measurement, and it makes no sense to compute the average (mean) of them.

30. The flight numbers do not count or measure anything. They are at the nominal level of measurement, and it does not make sense to compute the average (mean) of them.

31. The numbers are used as substitutes for the categories of low, medium, and high, so the numbers are at the ordinal level of measurement. It does not make sense to compute the average (mean) of such numbers.

32. The numbers are substitutes for names and are not counts or measures of anything. They are at the nominal level of measurement, and it makes no sense to compute the average (mean) of them.