

Chapter 1

Introduction to Statistics

1-2 The Nature of Data

1. Statistic, since 20.7 refers to the selected sample.
3. Parameter, since 30 refers to the entire population.
5. Discrete, since the number of absent students must be an integer.
7. Discrete, since the number owning answering machines must be an integer.
9. Ratio, since differences are meaningful and zero height has a natural meaning.
11. Interval, since differences are meaningful but ratios are not. Refer to exercise #19.
13. Interval, since differences are meaningful but ratios are not. Years are not data at the ratio level of measurement because the year zero has been arbitrarily assigned so that the year 0 does not indicate the absence of time. The year 1900, for example, does not represent twice as much time as 950 -- and the ratio would be different using the Chinese or Jewish numerical representations for those years. Since the time difference between 1900 and 1920 is the same as the time difference between 1920 and 1940, however, years are data at the interval level of measurement.
15. Ordinal, since the ratings give relative position in a hierarchy.
17. Ratio, since differences are meaningful and zero ounces has a natural meaning.
19. Temperature ratios are not meaningful because a temperature of 0° does not represent the absence of temperature in the same sense that \$0 represents the absence of money. The zero temperature in the example (whether Fahrenheit or Centigrade) was determined by a criterion other than "the absence of temperature."

1-3 Uses and Abuses of Statistics

1. Because the 186,000 respondents were self-selected and not randomly chosen, they are not necessarily representative of the general population and provide no usable information about the general population. In addition, the respondents were self-selected from a particular portion of the general population -- persons watching "Nightline" and able to spend the time and money to respond.
3.
 - a. $500 + (.05)(500) = 500 + 25 = 525$
 - b. $525 - (.05)(500) = 525 - 26.25 = 498.75$. No, because the 5% decrease is based on a larger amount than was the previous year's 5% increase.

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5. That healthier babies are born to mothers who eat lobsters doesn't mean that eating lobster caused the babies to be healthier. Mothers who eat lobster are probably more affluent than the general population and would tend to eat better, be more knowledgeable about proper pre-natal care, have better health care, etc.
7. Motorcyclists that died in crashes in which helmets may have saved their lives could not be present to testify.
9. There are several possible answers. (1) Since tallness is perceived to be a favorable attribute, people tend to overstate their heights; at the very least, people would tend to round to the next highest inch and not to the nearest inch. (2) Many people do not really accurately know their height. (3) Because Americans tend to express height in feet and inches, errors might occur either in converting heights to all inches or in misstatements like 52" for 5'2". (4) Because many cultures express height in centimeters, some people might not know or be able to readily calculate their heights in inches.
11. No. Since the second 5% price cut would be based on a lower price, two consecutive 5% price cuts yield a smaller price reduction than a single 10% price cut. Mathematically, the two consecutive 5% cuts yield a reduction of $.05x + .05(x-.05x) = .0975x$, or a 9.75% price cut.
13. Assuming that each of the 20 individual subjects is ultimately counted as a success or not (i.e., that there are no "dropouts" or "partial successes"), the success rates in fraction form must be one of 0/20, 1/20, 2/20, ..., 19/20, 20/20. In percentages, these rates are multiples of 5 (0%, 5%, 10%, ..., 95%, 100%), and values such as 53% and 58% are not mathematical possibilities.
15. a. Since 100% is the totality of whatever is being measured, removing 100% of some quantity means that none of it is left.
b. Reducing plaque by over 300% would mean removing three times as much plaque as is there, and then removing even more!

1-4 Design of Experiments

1. Observational study, since specific characteristics are measured on unmodified subjects.
3. Experiment, since the effect of an applied treatment is measured.
5. Random, since each 212 area code telephone number has an equal chance of being selected. But this is a really a complex situation, as indicated by the following NOTES.
NOTE 1: This ignores the fact that some residences may have more than one phone number. A residence with two different phone numbers (e.g., one for the parents and one for the teenagers) has twice the chance of being selected as does a residence with a single phone number.
NOTE 2: The scenario stated the organization sought to poll "residents" with the 212 area code. If the organization polls all residents at each selected number, this is cluster sampling. If the organization polls one resident at each selected number, the sample is not a random sample of "residents" because a resident living alone and having his own phone number has a higher chance of being selected than a resident living with others (e.g., in a