c. Boiling points (on the Celsius scale) for various caramel candies

d. The top ten Spring Break destinations as ranked by USA Today

Solution

a. The amount of time it takes for each runner to run the race is *quantitative* since calculations performed on these data are meaningful. A finishing time is a measurement, therefore the data are *continuous*. Differences between finishing times are meaningful, and a time of zero represents the absence of racing. We could also say that Andrew finished the race in half of Peyton's time; thus, the data are at the *ratio* level of measurement.

b. Colors are labels, so these data are *qualitative*. Qualitative data are *neither* discrete nor continuous. There are many ways to order colors, such as alphabetically or based on the color spectrum. However, when discussing colors of crayons, order is not the primary factor, as opposed to data such as rankings, in which order is important. Therefore, the data are at the *nominal* level of measurement.

c. Calculations can be performed on boiling points because they are measurements, making these data *quantitative*. Temperatures are measurements, so the data are *continuous*. For the Celsius scale, a temperature of zero degrees is simply a placeholder and does not indicate the absence of heat. Therefore, data from the Celsius scale are always at the *interval* level of measurement.

d. Since the rankings cannot be meaningfully added or subtracted, the data must be *qualitative*. Qualitative data are *neither* discrete nor continuous. The rankings are in a specific order, so the data are at the *ordinal* level of measurement.

1.2 Section Exercises

Data Classification

Determine the following classifications for the given data sets.

a. Qualitative or quantitative
b. Discrete, continuous, or neither
c. Level of measurement

1. Prices of a particular pair of jeans at various department stores
2. Widths of the doors in a home
3. Low temperatures in degrees Fahrenheit across the state for one evening in March
4. Total dollar value of all items placed in each safe deposit box at a local bank
5. Yearly amounts of snowfall in Cleveland over 10 years
6. Heights of orchids on a windowsill
7. Amount of weight gained by each person in a group of college freshmen
8. Number of antique cars collected by each member of a car club
9. Number of six-foot wooden boards it takes to build any given desk
10. Bank account PIN numbers
11. Heights of men entering the armed forces
12. Sizes of T-shirts on sale
13. Temperatures in Kelvin of various sites on the planet Mars

14. Numbers of siblings that students in Ms. Pitcock's third grade class have

15. Jersey numbers of players on a lacrosse team

16. Types of pets reported in a recent survey

17. Positions in line at the checkout counter of a grocery store

18. Letter grades on students' English essays

19. Birth order of children in a family

20. Titles that precede people's names (Dr., Mr., Ms., and so forth.)

21. Number of students enrolled in each section of College Algebra at The Ohio State University

22. Average temperatures in degrees Celsius of the water in the Bahamas for each month in 2020

23. Birth years of members of your immediate family

24. Numbers of people per household reported on census forms

Respond thoughtfully to the following exercises.

25. Instead of classifying data into the groups qualitative and quantitative, some statisticians classify data as categorical or measurement data. **Categorical data** can be placed into categories, but no meaningful order can be assigned to the categories. **Measurement data** have numerical values assigned to them, and the data can be ordered according to those values.

a. Classify "genders of puppies adopted from an animal shelter" as categorical or measurement data.

b. Classify "high temperatures of Juneau, AK measured in degrees Fahrenheit" as categorical or measurement data.

c. What would be the problem with using this classification system for the data "T-shirt sizes listed as S, M, L, XL"?

26. Often, continuous data are measured in "discrete" units. In other words, the way that we express the units makes us think that we have discrete data because we are rounding the continuous values to whole number units. Give an example of a type of continuous data that might cause this confusion.

27. Explain why qualitative data are not further classified as discrete or continuous.

28. Discuss why it is important for researchers to know the classification of data they are interested in before they design a study.