

1.2

TYPES OF VARIABLES

Variables can be classified into one of two categories: **qualitative** or **quantitative**.

Definition **Qualitative variables** measure a quality or characteristic on each experimental unit. **Quantitative variables** measure a numerical quantity or amount on each experimental unit.

MY TIP

Qualitative \Leftrightarrow “quality”
or characteristic

Quantitative \Leftrightarrow
“quantity” or number

Qualitative variables produce data that can be categorized according to similarities or differences in kind; hence, they are often called **categorical data**. The variables gender, year, and major in Example 1.1 are qualitative variables that produce categorical data. Here are some other examples:

- Political affiliation: Republican, Democrat, Independent
- Taste ranking: excellent, good, fair, poor
- Color of an M&M’S[®] candy: brown, yellow, red, orange, green, blue

Quantitative variables, often represented by the letter x , produce numerical data, such as those listed here:

- x = Prime interest rate
- x = Number of passengers on a flight from Los Angeles to New York City
- x = Weight of a package ready to be shipped
- x = Volume of orange juice in a glass

Notice that there is a difference in the types of numerical values that these quantitative variables can assume. The number of passengers, for example, can take on only the values $x = 0, 1, 2, \dots$, whereas the weight of a package can take on any value greater than zero, or $0 < x < \infty$. To describe this difference, we define two types of quantitative variables: **discrete** and **continuous**.

Definition A **discrete variable** can assume only a finite or countable number of values. A **continuous variable** can assume the infinitely many values corresponding to the points on a line interval.

MY TIP

Discrete \Leftrightarrow “listable”

Continuous \Leftrightarrow
“unlistable”

The name *discrete* relates to the discrete gaps between the possible values that the variable can assume. Variables such as number of family members, number of new car sales, and number of defective tires returned for replacement are all examples of discrete variables. On the other hand, variables such as height, weight, time, distance, and volume are *continuous* because they can assume values at any point along a line interval. For any two values you pick, a third value can always be found between them!

EXAMPLE

1.2

Identify each of the following variables as qualitative or quantitative:

1. The most frequent use of your microwave oven (reheating, defrosting, warming, other)
2. The number of consumers who refuse to answer a telephone survey
3. The door chosen by a mouse in a maze experiment (A, B, or C)
4. The winning time for a horse running in the Kentucky Derby
5. The number of children in a fifth-grade class who are reading at or above grade level