the median. There is not universal agreement on a single procedure for calculating percentiles, but we will describe two relatively simple procedures for (1) finding the percentile of a data value and (2) converting a percentile to its corresponding data value. We begin with the first procedure.

Finding the Percentile of a Data Value The process of finding the percentile that corresponds to a particular data value x is given by the following (round the result to the nearest whole number):

$$\text{Percentile of value } x = \frac{\text{number of values less than } x}{\text{total number of values}} \cdot 100$$

Example 3 Finding a Percentile

Table 3-4 lists the same counts of chocolate chips in 40 Chips Ahoy regular cookies listed in Table 3-1, but in Table 3-4 those counts are arranged in increasing order. Find the percentile for a cookie with 23 chocolate chips.

Table 3-4 *Sorted* Counts of Chocolate Chips in Chips Ahoy (Regular) Cookies

19	19	20	20	20	20	22	22	22	22
23	23	23	23	23	23	23	24	24	24
24	24	25	25	25	25	25	25	25	26
26	26	26	26	26	27	27	28	28	30

Solution

From the sorted list of chocolate chip counts in Table 3-4, we see that there are 10 cookies with fewer than 23 chocolate chips, so

$$\text{Percentile of } 23 = \frac{10}{40} \cdot 100 = 25$$

Interpretation

A cookie with 23 chocolate chips is in the 25th percentile. This can be interpreted loosely as: A cookie with 23 chocolate chips separates the lowest 25% of cookies from the highest 75%.

Example 3 shows how to convert from a given sample value to the corresponding percentile. There are several different methods for the reverse procedure of converting a given percentile to the corresponding value in the data set. The procedure we will use is summarized in Figure 3-5, which uses the following notation.

Notation

- n total number of values in the data set
- k percentile being used (Example: For the 25th percentile, $k = 25$.)
- L locator that gives the *position* of a value (Example: For the 12th value in the sorted list, $L = 12$.)
- P_k kth percentile (Example: P_{25} is the 25th percentile.)

Example 4 Converting a Percentile to a Data Value

Refer to the sorted chocolate chip counts in Table 3-4 and use the procedure in Figure 3-5 to find the value of the 18th percentile, P_{18}.

Cost of Laughing Index

There really is a Cost of Laughing Index (CLI), which tracks costs of such items as rubber chickens, Groucho Marx glasses, admissions to comedy clubs, and 13 other leading humor indicators. This is the same basic approach used in developing the Consumer Price Index (CPI), which is based on a weighted average of goods and services purchased by typical consumers. While standard scores and percentiles allow us to compare different values, they ignore any element of time. Index numbers, such as the CLI and CPI, allow us to compare the value of some variable to its value at some base time period. The value of an index number is the current value, divided by the base value, multiplied by 100.