

Example 1 Genetics

Although the Chapter Problem involves 945 births, let’s consider a simpler example that involves only two births with the following random variable:

x = number of girls in two births

The above x is a random variable because its numerical values depend on chance. With two births, the number of girls can be 0, 1, or 2, and Table 5-1 is a probability distribution because it gives the probability for each value of the random variable x and it satisfies the three requirements listed earlier:

- 1. The variable x is a numerical random variable and its values are associated with probabilities, as in Table 5-1.
- 2. $\sum P(x) = 0.25 + 0.50 + 0.25 = 1$
- 3. Each value of $P(x)$ is between 0 and 1. (Specifically, 0.25 and 0.50 and 0.25 are each between 0 and 1 inclusive.)

The random variable x in Table 5-1 is a *discrete* random variable, because it has three possible values (0, 1, 2), and 3 is a finite number, so this satisfies the requirement of being finite or countable.

Table 5-1 Probability Distribution for the Number of Girls in Two Births

Number of Girls x	$P(x)$
0	0.25
1	0.50
2	0.25

Notation

In tables such as Table 5-1 or the Binomial Probabilities in Table A-1 in Appendix A, we sometimes use 0+ to represent a probability value that is positive but very small, such as 0.000000123. (When rounding a probability value for inclusion in such a table, a rounded value of 0 would be misleading because it incorrectly suggests that the event is impossible.)

Probability Distribution: Graph

There are various ways to graph a probability distribution, but we will consider only the **probability histogram**. Figure 5-3 is a probability histogram corresponding to Table 5-1. Notice that it is similar to a relative frequency histogram (described in Section 2-3), but the vertical scale shows *probabilities* instead of relative frequencies based on actual sample results.

In Figure 5-3, we see that the values of 0, 1, 2 along the horizontal axis are located at the centers of the rectangles. This implies that the rectangles are each 1 unit wide, so the areas of the rectangles are 0.25, 0.50, and 0.25. The *areas*

Figure 5-3 Probability Histogram for Number of Girls in Two Births

