2. We record only the *sign* of the difference found in Step 1. We exclude *ties:* that is, we throw out any matched pairs in which both values are equal.

The main concept underlying this use of the sign test is as follows:

If the two sets of data have equal medians, the number of positive signs should be approximately equal to the number of negative signs.

Example 2 Flight Data

Table 13-3 includes taxi-out times and taxi-in times for a sample of American Airlines Flight 21 (from Data Set 15 in Appendix B). Use the sign test with the sample data in Table 13-3 to test the claim that there is no difference between taxi-out times and taxi-in times. Use a 0.05 significance level.

Table 13-3 Taxi-Out Times and Taxi-In Times for American Airlines Flight 21

Taxi-out time (min)	13	20	12	17	35	19	22	43	49	45	13	23
Taxi-in time (min)	13	4	6	21	29	5	27	9	12	7	36	12
Sign of difference	0	+	+	−	+	+	−	+	+	+	−	+

Solution

Requirement check The only requirement of the sign test is that the sample data are a simple random sample, and that requirement is satisfied. ✔

If there is no difference between taxi-out times and taxi-in times, the numbers of positive and negative signs should be approximately equal. In Table 13-3 we have 8 positive signs, 3 negative signs, and 1 difference of 0. The sign test tells us whether or not the numbers of positive and negative signs are approximately equal.

The null hypothesis is the claim of no difference between taxi-out times and taxi-in times, and the alternative hypothesis is the claim that there is a difference.

H_0: There is no difference. (The median of the differences is equal to 0.)

H_1: There is a difference. (The median of the differences is not equal to 0.)

Following Figure 13-1, we let $n = 11$ (the total number of positive and negative signs) and we let $x = 3$ (the number of the less frequent sign, or the smaller of 8 and 3).

The sample data do not contradict H_1, because there is a difference between the 8 positive signs and the 3 negative signs. The sample data show a difference, and we need to continue with the test to determine whether that difference is significant.

Figure 13-1 shows that with $n = 11$, we should proceed to find the critical value from Table A-7. We refer to Table A-7 where the critical value of 1 is found for $n = 11$ and $\alpha = 0.05$ in two tails.

Since $n \leq 25$, the test statistic is $x = 3$ (and we do not convert x to a z score). With a test statistic of $x = 3$ and a critical x value of 1, we fail to reject the null hypothesis of no difference. (See Note 2 included with Table A-7: "Reject the null hypothesis if the number of the less frequent sign (x) is less than or equal to the