## 13-4 Basic Skills and Concepts

### Statistical Literacy and Critical Thinking

**1. Arrival Delay Times** Example 2 in this section used samples of departure delay times from American Airlines Flights 19 and 21, but the table below lists simple random samples of arrival delay times (min) from those same flights. (The data are from Data Set 15 in Appendix B.) Are the requirements for using the Wilcoxon rank-sum test satisfied? Why or why not?

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flight 19 | −5 | −32 | −13 | −9 | −19 | 49 | −30 | −23 | 14 | −21 | −32 | 11 |
| Flight 21 | −23 | 28 | 103 | −19 | −5 | −46 | 13 | −3 | 13 | 106 | −34 | −24 |

**2. Rank Sum** After ranking the combined list of 24 arrival delay times, find the sum of the ranks for Flight 19.

**3. What Are We Testing?** Refer to the sample data in Exercise 1. Assuming that we use the Wilcoxon rank-sum test with those data, identify the null hypothesis and all possible alternative hypotheses.

**4. Efficiency** Refer to Table 13-2 in Section 13-1 and identify the efficiency of the Wilcoxon rank-sum test. What does that value tell us about the test?

**Wilcoxon Rank-Sum Test.** ***In Exercises 5–8, use the Wilcoxon rank-sum test.***

**5. Arrival Delay Times** Use the sample data given in Exercise 1 and test the claim that arrival delay times for Flight 19 and Flight 21 have the same median. Use a 0.05 significance level.

**6. Taxi-Out Times** Listed below are samples of taxi-out times (min) for American Airlines Flights 19 and 21 (from Data Set 15 in Appendix B). Use the sample data to test the claim that taxi-out times for Flight 19 and Flight 21 have the same median. Use a 0.05 significance level.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flight 19 | 15 | 12 | 19 | 18 | 21 | 20 | 13 | 15 | 43 | 18 | 17 | 19 |
| Flight 21 | 13 | 20 | 12 | 17 | 35 | 19 | 22 | 43 | 49 | 45 | 13 | 23 |

**7. Clinical Trials of Lipitor** The sample data below are changes in LDL cholesterol levels in clinical trials of Lipitor (atorvastatin). It was claimed that Lipitor had an effect on LDL cholesterol. (The data are based on results given in a Parke-Davis memo from David G. Orloff, M.D., the medical team leader for clinical trials of Lipitor. Pfizer declined to provide the author with the original data values.) Negative values represent decreases in LDL cholesterol. Use a 0.05 significance level to test the claim that for those treated with 20 mg of atorvastatin and those treated with 80 mg of atorvastatin, changes in LDL cholesterol have the same median. What do the results suggest?

Group treated with 20 mg of atorvastatin:

−28 −32 −29 −39 −31 −35 −25 −36 −35 −26 −29 −34 −30

Group treated with 80 mg of atorvastatin:

−42 −41 −38 −42 −41 −41 −40 −44 −32 −37 −41 −37 −34 −31

**8. Radiation in Baby Teeth** Listed below are amounts of strontium-90 (in millibecquerels, or mBq, per gram of calcium) in a simple random sample of baby teeth obtained from Pennsylvania residents and New York residents born after 1979 (based on data from "An Unexpected Rise in Strontium-90 in U.S. Deciduous Teeth in the 1990s," by Mangano et al., *Science of the Total Environment*). Use a 0.05 significance level to test the claim that the median amount of strontium-90 from Pennsylvania residents is the same as the median from New York residents.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pennsylvania | 155 | 142 | 149 | 130 | 151 | 163 | 151 | 142 | 156 | 133 | 138 | 161 |
| New York | 133 | 140 | 142 | 131 | 134 | 129 | 128 | 140 | 140 | 140 | 137 | 143 |