September weight	67	53	64	74	67	70	55	74	62	57
April weight	66	52	68	77	67	71	60	82	65	58

2. Freshman 15 For the matched pairs listed in Exercise 1, identify the following components used in the Wilcoxon signed-ranks test:

a. Differences d

b. The ranks corresponding to the nonzero values of $|d|$

c. The signed ranks

d. The sum of the positive ranks and the sum of the absolute values of the negative ranks

e. The value of T

f. The critical value of T (assuming a 0.05 significance level in a test of no difference between September weights and April weights)

3. Sign Test vs. Wilcoxon Signed-Ranks Test Using the data in Exercise 1, we can test for no difference between September weights and April weights by using the sign test or the Wilcoxon signed-ranks test. In what sense does the Wilcoxon signed-ranks test incorporate and use more information than the sign test?

4. Efficiency of the Wilcoxon Signed-Ranks Test Refer to Table 13-2 in Section 13-1 and identify the efficiency of the Wilcoxon signed-ranks test. What does that value tell us about the test?

Using the Wilcoxon Signed-Ranks Test. *In Exercises 5–8, refer to the sample data for the given exercises in Section 13-2. Use the Wilcoxon signed-ranks test to test the claim that the matched pairs have differences that come from a population with a median equal to zero. Use a 0.05 significance level.*

5. Exercise 9   **6.** Exercise 10

7. Exercise 11   **8.** Exercise 12

Appendix B Data Sets. *In Exercises 9–12, refer to the sample data for the given exercises in Section 13-2. Use the Wilcoxon signed-ranks test for the claim about the median of a population.*

9. Exercise 17   **10.** Exercise 18

11. Exercise 19   **12.** Exercise 20

13-3 Beyond the Basics

13. Rank Sums

a. If we have sample paired data with 75 nonzero differences, what are the smallest and largest possible values of T?

b. If we have sample paired data with 75 nonzero differences, what is the expected value of T if the population consists of matched pairs with differences having a median of 0?

c. If we have sample paired data with 75 nonzero differences and the sum of the positive ranks is 850, find the absolute value of the sum of the negative ranks.

d. If we have sample paired data with n nonzero differences and one of the two rank sums is k, find an expression for the other rank sum.