Section 13-5

1. $R_1 = 36.5, R_2 = 52.5, R_3 = 47$
3. $n_1 = 5, n_2 = 6, n_3 = 5$, and $N = 16$.
5. Test statistic: $H = 9.9800$. Critical value: $\chi^2 = 5.991$. (Tech: P-value $= 0.0068$.) Reject the null hypothesis of equal medians. The data suggest that the different miles present different levels of difficulty.
7. Test statistic: $H = 4.9054$. Critical value: $\chi^2 = 5.991$. (Tech: P-value $= 0.0861$.) Fail to reject the null hypothesis of equal medians. The data do not suggest that larger cars are safer.
9. Test statistic: $H = 8.0115$. Critical value: $\chi^2 = 9.210$. (Tech: P-value $= 0.0182$.) Fail to reject the null hypothesis of equal medians. The data do not suggest that lead exposure has an adverse effect.
11. Test statistic: $H = 27.9098$. Critical value: $\chi^2 = 5.991$. (Tech: P-value: 0.0000.) Reject the null hypothesis of equal medians. There is sufficient evidence to warrant rejection of the claim that the three different types of cigarettes have the same median amount of nicotine. It appears that the filters do make a difference.
13. Using $\Sigma T = 16{,}836$ and $N = 75$, the corrected value of H is 29.0701, which is not substantially different from the value found in Exercise 11. In this case, the large numbers of ties do not appear to have a dramatic effect on the test statistic H.

Section 13-6

1. The methods of Section 10-3 should not be used for predictions. The regression equation is based on a linear correlation between the two variables, but the methods of this section do not require a linear relationship. The methods of this section could suggest that there is a correlation with paired data associated by some nonlinear relationship, so the regression equation would not be a suitable model for making predictions.
3. r represents the linear correlation coefficient computed from sample paired data; ρ represents the parameter of the linear correlation coefficient computed from a population of paired data; r_s denotes the rank correlation coefficient computed from sample paired data; ρ_s represents the rank correlation coefficient computed from a population of paired data. The subscript s is used so that the rank correlation coefficient can be distinguished from the linear correlation coefficient r. The subscript does not represent the standard deviation s. It is used in recognition of Charles Spearman, who introduced the rank correlation method.
5. $r_s = 1$. Critical values are -0.886 and 0.886. Reject the null hypothesis of $\rho_s = 0$. There is sufficient evidence to support a claim of a correlation between distance and time.
7. $r_s = 0.821$. Critical values: -0.786, 0.786. Reject the null hypothesis of $\rho_s = 0$. There is sufficient evidence to support the claim of a correlation between the quality scores and prices. These results do suggest that you get better quality by spending more.
9. $r_s = -0.929$. Critical values: -0.786, 0.786. Reject the null hypothesis of $\rho_s = 0$. There is sufficient evidence to support the claim of a correlation between the two judges. Examination of the results shows that the first and third judges appear to have opposite rankings.
11. $r_s = 1$. Critical values: -0.886, 0.886. Reject the null hypothesis of $\rho_s = 0$. There is sufficient evidence to conclude that there is a correlation between overhead widths of seals from photographs and the weights of the seals.
13. $r_s = 0.394$. Critical values: -0.314, 0.314. Reject the null hypothesis of $\rho_s = 0$. There is sufficient evidence to conclude that there is a correlation between the systolic and diastolic blood pressure levels in males.
15. $r_s = 0.651$. Critical values: -0.286, 0.286. Reject the null hypothesis of $\rho_s = 0$. There is sufficient evidence to conclude that there is a correlation between departure delay times and arrival delay times.
17. a. ± 0.707 is not very close to the values of ± 0.738 found in Table A-9.
    b. ± 0.463 is quite close to the values of ± 0.467 found in Table A-9.

Section 13-7

1. No. The runs test can be used to determine whether the sequence of World Series wins by American League teams and National League teams is not random, but the runs test does not show whether the proportion of wins by the American League is significantly greater than 0.5.
3. a. Answers vary, but here is a sequence that leads to rejection of randomness because the number of runs is 2, which is very low: W W W W W W W W W W W W E E E E E E E E
    b. Answers vary, but here is a sequence that leads to rejection of randomness because the number of runs is 17, which is very high: W E W E W E W E W E W E W E W E W W W W
5. $n_1 = 19, n_2 = 15, G = 16$, critical values: 11, 24. Fail to reject randomness. There is not sufficient evidence to support the claim that we elect Democrats and Republicans in a sequence that is not random. Randomness seems plausible here.
7. $n_1 = 20, n_2 = 10, G = 16$, critical values: 9, 20. Fail to reject randomness. There is not sufficient evidence to reject the claim that the dates before and after July 1 are randomly selected.
9. $n_1 = 24, n_2 = 21, G = 17, \mu_G = 23.4, \sigma_G = 3.3007$. Test statistic: $z = -1.94$. Critical values: $z = \pm 1.96$. (Tech: P-value $= 0.05252$.) Fail to reject randomness. There is not sufficient evidence to reject randomness. The runs test does not test for disproportionately more occurrences of one of the two categories, so the runs test does not suggest that either conference is superior.
11. The median is 2453, $n_1 = 23, n_2 = 23, G = 4$, $\mu_G = 24, \sigma_G = 3.3553$. Test statistic: $z = -5.96$. Critical values: $z = \pm 1.96$. (Tech: P-value $= 0.0000$.) Reject randomness. The sequence does not appear to be random when considering values above and below the median. There appears to be an upward trend, so the stock market appears to be a profitable investment for the long term, but it has been more volatile in recent years.
13. b. The 84 sequences yield these results: 2 sequences have 2 runs, 7 sequences have 3 runs, 20 sequences have 4 runs, 25 sequences have 5 runs, 20 sequences have 6 runs, and 10 sequences have 7 runs.
    c. With $P(2 \text{ runs}) = 2/84$, $P(3 \text{ runs}) = 7/84$, $P(4 \text{ runs}) = 20/84$, $P(5 \text{ runs}) = 25/84$, $P(6 \text{ runs}) = 20/84$, and