Section 7-2

13. a. $\hat{p} = \frac{531}{1002} = 0.530$

b. $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}} = 1.96\sqrt{\frac{\left(\frac{531}{1002}\right)\left(\frac{471}{1002}\right)}{1002}} = 0.0309$

c. $\hat{p} - E < p < \hat{p} - E \Rightarrow 0.530 - 0.0309 < p < 0.530 - 0.0309 \Rightarrow 0.499 < p < 0.561$

d. We have 95% confidence that the interval from 0.499 to 0.561 actually does contain the true value of the population proportion.

14. a. $\hat{p} = \frac{490}{806} = 0.610$

b. $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}} = 2.58\sqrt{\frac{\left(\frac{490}{806}\right)\left(\frac{316}{806}\right)}{806}} = 0.0443$

c.
$$\hat{p} - E < p < \hat{p} - E$$
$$0.610 - 0.0443 < p < 0.610 - 0.0443$$
$$0.566 < p < 0.654$$

d. We have 99% confidence that the interval from 0.566 to 0.654 actually does contain the true value of the population proportion.

18. a. $\hat{p} = \frac{239}{291} = 0.821$

b. $\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}} = \frac{239}{291} \pm 2.56\sqrt{\frac{\left(\frac{239}{291}\right)\left(\frac{52}{291}\right)}{945}}$

$$0.763 < p < 0.879$$

c. Yes. The true proportion of boys with the YSORT method is substantially greater than the proportion of (about) 0.5 that is expected when no method of gender selection is used.

Section 7-3

2. a. df = 39
   b. 2.023
   c. In general, the number of degrees of freedom for a collection of sample data is the number of sample values that can vary after certain restrictions have been imposed on all data values.

9. Because the sample size is greater than 30, the confidence interval yields a reasonable estimate of μ , even though the data appear to be from a population that is not normally distributed.

$$\bar{x} \pm t_{\alpha/2}\frac{s}{\sqrt{n}} = 9.808 \pm 2.403 \cdot \frac{5.013}{\sqrt{50}}$$

$$8.104 \text{ km} < \mu < 11.512 \text{ km}$$

$$(\text{Tech: } 8.103 \text{ km } < \mu < \text{ } 513 \text{ km})$$

10. $\bar{x} \pm t_{\alpha/2}\frac{s}{\sqrt{n}} = 0.719 \pm 1.943 \cdot \frac{0.366}{\sqrt{7}}$ (If the original values are used, the upper limit is 0.987 ppm.)

    $0.450 \text{ ppm} < \mu < 0.988 \text{ ppm}$

11. The \$1 salary of Jobs is an outlier that is very far away from the other values, and that outlier has a dramatic effect on the confidence interval.

$$\bar{x} \pm t_{\alpha/2}\frac{s}{\sqrt{n}} = 12898 \pm 2.776 \cdot \frac{7719.05}{\sqrt{5}}$$

$$3315.1 \text{ thousand dollars} < \mu < 22480.9 \text{ thousand dollars}$$

$$(\text{Tech: } 3313.5 \text{ thousand dollars} < \mu < 6\ 22{,}482.5 \text{ thousand dollars})$$

Section 7-4

5. df = 24. $\chi_L^2 = 9.886$ and $\chi_R^2 = 45.559$.

$$\sqrt{\frac{(n-1)s^2}{\chi_R^2}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi_L^2}}$$

$$\sqrt{\frac{(25-1)0.24^2}{45.559}} < \sigma < \sqrt{\frac{(25-1)0.24^2}{9.886}}$$

$$0.17 \text{ mg} < \sigma < 0.37 \text{ mg}$$

6. df = 19. $\chi_L^2 = 6.844$ and $\chi_R^2 = 38.582$.

$$\sqrt{\frac{(n-1)s^2}{\chi_R^2}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi_L^2}}$$

$$\sqrt{\frac{(20-1)0.04111^2}{38.582}} < \sigma < \sqrt{\frac{(20-1)0.04111^2}{6.844}}$$

$$0.02885 \text{ g} < \sigma < 0.06850 \text{ g}$$

13.

$$\sqrt{\frac{(n-1)s^2}{\chi_R^2}} < \sigma < \sqrt{\frac{(n-1)s^2}{\chi_L^2}}$$

$$\sqrt{\frac{(7-1)0.36576^2}{12.592}} < \sigma < \sqrt{\frac{(7-1)0.36576^2}{1.635}}\ 0$$

$$0.252 \text{ ppm} < \sigma < 0.701 \text{ ppm}$$