7. H_0: $\sigma = 0.0230$ g. H_1: $\sigma < 0.0230$ g. Test statistic: $\chi^2 = 18.483$. Critical value of χ^2 is between 18.493 and 26.509, so it is estimated to be 22.501 (Tech: 23.269). P-value < 0.05 (Tech: 0.0069). Reject H_0. There is sufficient evidence to support the claim that the population of weights has a standard deviation less than the specification of 0.0230 g.
9. The data appear to be from a normally distributed population. H_0: $\sigma = 10$. H_1: $\sigma \neq 10$. Test statistic: $\chi^2 = 41.375$. Critical values of χ^2 : 24.433 and 59.342 (approximately). P-value $>$ 0.20 (Tech: 0.7347). Fail to reject H_0. There is not sufficient evidence to warrant rejection of the claim that pulse rates of men have a standard deviation equal to 10 beats per minute.
11. H_0: $\sigma = 3.2$ mg. H_1: $\sigma \neq 3.2$ mg. Test statistic: $\chi^2 = 32.086$. Critical values: $\chi^2 = 12.401$ and 39.364. P-value > 0.20 (Tech: 0.2498). Fail to reject H_0. There is not sufficient evidence to support the claim that filtered 100-mm cigarettes have tar amounts with a standard deviation different from 3.2 mg. There is not enough evidence to conclude that filters have an effect.
13. The data appear to be from a normally distributed population. H_0: $\sigma = 22.5$ years. H_1: $\sigma < 22.5$ years. Test statistic: $\chi^2 = 1.627$. Critical value: $\chi^2 = 4.660$. P-value < 0.005 (Tech: 0.0000). Reject H_0. There is sufficient evidence to support the claim that the standard deviation of ages of all race car drivers is less than 22.5 years.
15. H_0: $\sigma = 32.2$ ft. H_1: $\sigma > 32.2$ ft. Test statistic: $\chi^2 = 29.176$. Critical value: $\chi^2 = 19.675$. P-value: 0.0021. Reject H_0. There is sufficient evidence to support the claim that the new production method has errors with a standard deviation greater than 32.2 ft. The variation appears to be greater than in the past, so the new method appears to be worse, because there will be more altimeters that have larger errors. The company should take immediate action to reduce the variation.
17. H_0: $\sigma = 0.15$ oz. H_1: $\sigma < 0.15$ oz. Test statistic: $\chi^2 = 10.173$. Critical value of χ^2 is between 18.493 and 26.509, so it is estimated to be 22.501 (Tech: 22.465). P-value < 0.01 (Tech: 0.0000). Reject H_0. There is sufficient evidence to support the claim that the population of volumes has a standard deviation less than 0.15 oz.
19. Critical $\chi^2 = 22.189$, which is reasonably close to the value of 22.465 obtained from STATDISK and Minitab.

Chapter 8: Quick Quiz

1. H_0: $\mu = 0$ sec. H_1: $\mu \neq 0$ sec.
2. a. Two-tailed. b. Student t.
3. a. Fail to reject H_0.
   b. There is not sufficient evidence to warrant rejection of the claim that the sample is from a population with a mean equal to 0 sec.
4. There is a loose requirement of a normally distributed population in the sense that the test works reasonably well if the departure from normality is not too extreme.
5. a. H_0: $p = 0.5$. H_1: $p > 0.5$. b. $z = 6.33$
   c. P-value: 0.0000000001263996. There is sufficient evidence to support the claim that the majority of adults are in favor of the death penalty for a person convicted of murder.
6. 0.0456 (Tech: 0.0455)
7. The only true statement is the one given in part (a).
8. No. All critical values of χ^2 are greater than zero.
9. True. 10. False.

Chapter 8: Review Exercises

1. a. False. b. True. c. False.
   d. False. e. False.
2. H_0: $p = 2/3$. H_1: $p \neq 2/3$. Test statistic: $z = -1.09$. Critical values: $z = \pm 2.575$ (Tech: ± 2.576). P-value: 0.2758 (Tech: 0.2756). Fail to reject H_0. There is not sufficient evidence to warrant rejection of the claim that 2/3 of adults are satisfied with the amount of leisure time that they have.
3. H_0: $p = 0.75$. H_1: $p > 0.75$. Test statistic: $z = 10.65$ (if using $x = 678$) or $z = 10.66$ (if using $\hat{p} = 0.92$). Critical value: $z = \pm 2.33$. P-value: 0.0001 (Tech: 0.0000). Reject H_0. There is sufficient evidence to support the claim that more than 75% of us do not open unfamiliar e-mail and instant-message links. Given that the results are based on a voluntary response sample, the results are not necessarily valid.
4. H_0: $\mu = 3369$ g. H_1: $\mu < 3369$ g. Test statistic: $t = -19.962$. Critical value: $t = -2.328$ (approximately). P-value < 0.005 (Tech: 0.0000). Reject H_0. There is sufficient evidence to support the claim that the mean birth weight of Chinese babies is less than the mean birth weight of 3369 g for Caucasian babies.
5. H_0: $\sigma = 567$ g. H_1: $\sigma \neq 567$ g. Test statistic: $\chi^2 = 54.038$. Critical values of χ^2 : 51.172 and 116.321. P-value is between 0.02 and 0.05 (Tech: 0.0229). Fail to reject H_0. There is not sufficient evidence to warrant rejection of the claim that the standard deviation of birth weights of Chinese babies is equal to 567 g.
6. H_0: $\mu = 1.5$ μg/m^3. H_1: $\mu > 1.5$ μg/m^3. Test statistic: $t = 0.049$. Critical value: $t = 2.015$. P-value > 0.10 (Tech: 0.4814). Fail to reject H_0. There is not sufficient evidence to support the claim that the sample is from a population with a mean greater than the EPA standard of 1.5 μg/m^3. Because the sample value of 5.40 μg/m^3 appears to be an outlier and because a normal quantile plot suggests that the sample data are not from a normally distributed population, the requirements of the hypothesis test are not satisfied, and the results of the hypothesis test are therefore questionable.
7. H_0: $\mu = 25$. H_1: $\neq 25$. Test statistic: $t = -0.567$. Critical values: $t = \pm 2.626$ (approximately). P-value > 0.20 (Tech: 0.5717). Fail to reject H_0. There is not sufficient evidence to warrant rejection of the claim that the sample is selected from a population with a mean equal to 25.
8. a. A type I error is the mistake of rejecting a null hypothesis when it is actually true. A type II error is the mistake of failing to reject a null hypothesis when in reality it is false.
   b. Type I error: Reject the null hypothesis that the mean of the population is equal to 25 when in reality, the mean is actually equal to 25. Type II error: Fail to reject the null hypothesis that the population mean is equal to 25 when in reality, the mean is actually different from 25.
9. The χ^2 test has a reasonably strict requirement that the sample data must be randomly selected from a population with a normal distribution, but the numbers are selected in such a way that they are all equally likely, so the population has a uniform distribution instead of the required normal distribution. Because the requirements are not all satisfied, the χ^2 test should not be used.