Chapter 20 – Inference about a Population Mean

20.1 The standard error of the mean is $s/\sqrt{n} = 56.9/\sqrt{1000}$ = 1.7993 minutes.

20.5 (a) df = 12 – 1 = 11, so t^* = 2.201. **(b)** df = 2 – 1 = 1, so t^* = 63.657. **(c)** df = 1001 – 1 = 1000, so t^* = 1.646.

20.9 (a) df = 5 – 1 = 4 **(b)** t = 2.50 is bracketed by t^* = 2.132 (with two-tail probability 0.10) and t^* = 2.776 (with two-tail probability 0.05). Since this is a two-sided significance test, 0.05 < P < 0.10. **(c)** This test is significant at the 10% level since P < 0.10. It is not significant at either the 5% or 1% levels since P > 0.05.
(d) From software, P = 0.0668.

20.17 (b) We virtually never know the value of σ.

20.18 (b) $t = \dfrac{98-100}{3/\sqrt{9}} = -2$

20.19 (c) df = 16 – 1 = 15

20.20 (b) From software, P = 0.0251.

20.21 (b) 1.476. Here, df = 5.

20.22 (b) t < –6.869 or t > 6.869

20.23 (a) \$38,808 to \$51,192. The interval is computed as $45{,}000 \pm 2.064\dfrac{15{,}000}{\sqrt{25}}$.

20.24 (a) The t procedures are robust against mild skew, and they are used when σ is unknown.

20.25 (b) If you sample 225 unmarried male students, and then sample 225 unmarried female students, no matching is present.

20.26 (c) The data can be regarded as an SRS from the population.

20.29 (a) The sample size is very large, so the only potential hazard is extreme skewness. Because scores range only from 0 to 500, there is a limit to how skewed the distribution could be. **(b)** From Table C, we take t^* = 2.581 (df = 1000); or using software, take t^* = 2.579. For either value of t^*, the 99% confidence interval is 248 ± $t^*(1)$ = 245.4 to 250.6, when rounded to one decimal place. **(c)** Because the 99%

confidence interval for μ does not contain 243 and is entirely above 243, we can believe the mean for all Dallas children is above basic (above 243).

20.30 (a) We have df = 23 – 1 = 22, so t^* = 2.074. A 95% confidence interval for the mean solution time is 11.58 ± 2.074$\left(\frac{4.37}{\sqrt{23}}\right)$ = 11.58 ± 1.89 = 9.69 to 13.47 seconds.

(b) We must assume that the 23 individuals in the neutral group can be regarded as an SRS from the population. Since the sample size is at least 15, we don't need to assume that the population is Normal. Indeed, *t* procedures can be used as long as the distribution of solution times for the neutral group is not heavily skewed, and as long as there are no strong outliers in the sample.

20.31 (a) A subject's responses to the two treatments would not be independent. Some people react more to medications than others. **(b)** This is a two-sided test because the placebo could stimulate activity or suppress activity at this point in the brain. We have $t = \frac{-0.326 - 0}{0.181/\sqrt{6}}$ = –4.41. With df = 5, *P* = 0.0069, there is significant evidence of a difference.

20.42 (a) Weather conditions that change day to day can affect spore counts. So the two measurements made on the same day form a matched pair. **(b)** Take the differences (kill room counts – processing counts). For these differences, $\bar{x}$ = 1824.5 and *s* = 834.1 CFU/m³. For the population mean difference, the 90% confidence interval for μ is 1824.5 ± 2.353$\left(\frac{834.1}{\sqrt{4}}\right)$ = 1824.5 ± 981.3 = 843.2 to 2805.8 CFU/m³. The interval is so wide because the sample size is very small, but we are confident that the mean counts in the kill room are higher. (c) The data are counts, which are, at best, only approximately Normal, and we have only a small sample.