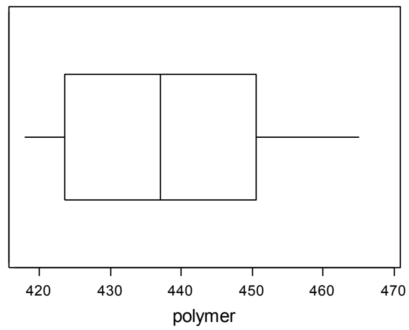
7.33

a. The boxplot indicates a very slight positive skew, with no outliers. The data appears to



center near 438.

b. Based on a normal probability plot, it is reasonable to assume the sample observations came from a normal distribution.

c. With df = n – 1 = 16, the critical value for a 95% CI is $t_{.025,16} = 2.120$, and the interval is $438.29 \pm (2.120)\left(\frac{15.14}{\sqrt{17}}\right) = 438.29 \pm 7.785 = (430.51, 446.08)$. Since 440 is within the interval, 440 is a plausible value for the true mean. 450, however, is not, since it lies outside the interval.

7.34

n = 14, $\bar{x} = 8.48$, s = .79; $t_{.05,13} = 1.771$

A 95% lower confidence bound: $8.48 - 1.771\left(\frac{.79}{\sqrt{14}}\right) = 8.48 - .37 = 8.11$. With 95% confidence, the value of the true mean proportional limit stress of all such joints is greater than 8.11 MPa. We must assume that the sample observations were taken from a normally distributed population.

8.16

a. $\alpha = P(T \geq 3.733$ when T has a t distribution with 15 df$) = .001$.

b. df = n – 1 = 23 $\Rightarrow$ $\alpha = P(T_{23} \leq -2.500) = .01$.

c. df = 30 $\Rightarrow$ $\alpha = P(T_{30} \geq 1.697$ or $T_{30} \leq -1.697) = .05 + .05 = .10$.

8.25

2.

a. H_0: $\mu = 5.5$ v. H_a: $\mu \neq 5.5$; for a level .01 test, (not specified in the problem description), reject H_0 if either $z \geq 2.58$ or $z \leq -2.58$. Since $z = \dfrac{5.25 - 5.5}{.075} = -3.33 \leq -2.58$, reject H_0.

b. $1 - \beta(5.6) = 1 - \Phi\left(2.58 + \dfrac{(-.1)}{.075}\right) + \Phi\left(-2.58 + \dfrac{(-.1)}{.075}\right) = 1 - \Phi(1.25) + \Phi(-3.91) = .105$.

c. $n = \left[\dfrac{.3(2.58 + 2.33)}{-.1}\right]^2 = 216.97$, so use $n = 217$.

8.26

Reject H_0 if $z \geq 1.645$; $\dfrac{s}{\sqrt{n}} = .7155$, so $z = \dfrac{52.7 - 50}{.7155} = 3.77$. Since 3.77 is ≥ 1.645, reject H_0 at level .05 and conclude that true average penetration exceeds 50 mils.

8.29

a. The hypotheses are H_0: $\mu = 200$ versus H_a: $\mu > 200$. H_0 will be rejected at level $\alpha = .05$ if $t \geq t_{.05,12-1} = t_{.05,11} = 1.796$. With the data provided, $t = \dfrac{\bar{x} - \mu_0}{s/\sqrt{n}} = \dfrac{249.7 - 200}{145.1/\sqrt{12}} = 1.19$. Since $1.19 < 1.796$, H_0 is not rejected at the $\alpha = .05$ level. We have insufficient evidence to conclude that the true average repair time exceeds 200 minutes.

8.37

a. The parameter of interest is p = the proportion of the population of female workers that have BMIs of at least 30 (and, hence, are obese). The hypotheses are H_0: $p = .20$ versus H_a: $p > .20$.
With $n = 541$, $np_0 = 541(.2) = 108.2 \geq 10$ and $n(1 - p_0) = 541(.8) = 432.8 \geq 10$, so the "large-sample" z procedure is applicable. Hence, we will reject H_0 if $z \geq z_{.05} = 1.645$.
From the data provided, $\hat{p} = \dfrac{120}{541} = .2218$, so $z = \dfrac{\hat{p} - p_0}{\sqrt{p_0(1 - p_0)/n}} = \dfrac{.2218 - .20}{\sqrt{.20(.80)/541}} = 1.27$.
Since $1.27 < 1.645$, we fail to reject H_0 at the $\alpha = .05$ level. We do not have sufficient evidence to conclude that more than 20% of the population of female workers is obese.

b. A Type I error would be to incorrectly conclude that more than 20% of the population of female workers is obese, when the true percentage is 20%. A Type II error would be to fail to recognize that more than 20% of the population of female workers is obese when that's actually true.

c. The question is asking for the chance of committing a Type II error when the true value of p is .25, i.e. $\beta(.25)$. Using the textbook formula,

$$\beta(.25) = \Phi\left[\frac{.20 - .25 + 1.645\sqrt{.20(.80)/541}}{\sqrt{.25(.75)/541}}\right] = \Phi(-1.166) \approx .121.$$

8.51

3. Use Table A.8.

a. $P(t > 2.0)$ at 8df = .040.

b. $P(t < -2.4)$ at 11df = .018.

c. $2P(t < -1.6)$ at 15df = 2(.065) = .130.

d. by symmetry, $P(t > -.4) = 1 - P(t > .4)$ at 19df = 1 – .347 = .653.

e. $P(t > 5.0)$ at 5df < .005.

f. $2P(t < -4.8)$ at 40df < 2(.000) = .000 to three decimal places.

8.55

Here we might be concerned with departures above as well as below the specified weight of 5.0, so the relevant hypotheses are H_0: $\mu = 5.0$ v. H_a: $\mu \neq 5.0$. Since $\frac{s}{\sqrt{n}} = .035$, $z = \frac{-.13}{.035} = -3.71$. Because 3.71 is "off" the z-table, P-value < 2(.0002) = .0004, so H_0 should be rejected.

8.58

μ = the true average percentage of organic matter in this type of soil, and the hypotheses are H_0: $\mu = 3$ v. H_a: $\mu \neq 3$. With $n = 30$, and assuming normality, we use the t test: $t = \frac{\bar{x} - 3}{s/\sqrt{n}} = \frac{2.481 - 3}{.295} = \frac{-.519}{.295} = -1.759$. The P-value = $2[P(\, t > 1.759\,)] = 2(\,.041\,) = .082$. At significance level .10, since .082 ≤ .10, we would reject H_0 and conclude that the true average percentage of organic matter in this type of soil is something other than 3. At significance level .05, we would not have rejected H_0.