Homework #12

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8.1

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a)

Given $\sigma_{\overline{x}} = \frac{.2}{\sqrt{25}} = .04$ and $\mu = 10$:
$P[Z \geq \phi(\frac{10.1004-10}{.04})] + P[Z \leq \Phi(\frac{9.8940-10}{.04})] = .006 + 004 = .01 = \alpha$

b)

$\mu = 10.1 : \beta(10.1) = P(9.8940 < \overline{x} < 10.1004) = P(-5.15 < Z.01) = .504$
$\mu = 9.9 : \beta(9.9) = P(-.15 < Z < 5.01) = .5596.$

This is not desirable. A difference from μ in either direction is equally important so we want $\beta(\mu + k) = \beta(\mu - k)$.

8.2

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a)

For d.f. $= 15$, $\alpha = P(t \leq 3.73) = .001$.

b)

For d.f. $= 23$, $\alpha = P(t \leq 2.5) = .01$.

c)

For d.f. $= 30$, $\alpha = P(t \leq 1.697) + P(t \leq 1.697) = .05 * 2 = .1$.

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a)

$\left|\frac{72.3-75}{1.8}\right| = 1.5$ SDs

b)

$Z = -1.5 > 2.33$. Don't reject.

c)

$\alpha = \Phi(-2.88) = .002$

d)

$\Phi\left(-2.88 + \frac{75-70}{\frac{9}{5}}\right) = \Phi(-.1) = .46 \Rightarrow \beta(70) = .5398$

e)

$n = \left(\frac{9(2.88+2.33)}{75-70}\right)^2 = 87.95 \Rightarrow n = 88$

f)

$\alpha(76) = P(Z < -2.33) = P(\overline{X} < 72.9) = \phi\left(\frac{72.9-76}{.9}\right) = .0003$

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At $\alpha = .05$, H_0 is rejected if $z < 1.645. z = -2.14$, so H_0 is rejected. At .01, $z < -2.33$ rejects and so we don't reject. Given the very favorable price, I'd choose .01.

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$H_0 : \mu = 15. H_a : \mu < 15; t = \frac{\overline{X}-15}{s/\sqrt{115}}; t = -6.17$
$t_{.005,114} = -1.66 > -6.17.$
The data indicate that the observed daily intake is below the DRI.

8.3

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a)

$H_0 : p = .1; H_a : p \neq .1$; Reject H_0 if $z \geq 1.96. \hat{p} = \frac{14}{100}, z = 1.33$. Null hypothesis cannot be rejected.

b)

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c)

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$H_0 : p = \frac{2}{3}; H_a : p \neq \frac{2}{3}; \hat{p} = \frac{80}{124}; Z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = -.508; P(Z < -.508) = .306$. This value rejects H_0.

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$p_0 = .035; \hat{p} = .03; Z = -.61; Z_{.01} = 2.33$. Therefore the null hypothesis that humans and robots have the same defect rate cannot be rejected.