Homework 5

10.2 Note that Y is binomial with parameters $n = 20$ and p.

(a) If the experimenter concludes that less than 80% of insomniacs respond to the drug when actually the drug induces sleep in 80% of insomniacs, a type I error has occured.

(b) $\alpha = P(rejectH_0|H_0true) = P(Y \leq 12|p = .8) = .032$ (using Appendix III)

(c) If the experimenter does not reject the hypothesis that 80% of insomniacs respond to the drug when actually the drug induces sleep in fewer than 80% of insomniacs, a type II error has occured.

(d) $\beta(.6) = P(failtorejectH_0|H_\alpha true) = P(Y > 12|p = .6) = 1 - P(Y \leq 12|p = .6) = .416$.

(e) $\beta(.4) = P(failtorejectH_0|H_\alpha true) = P(Y > 12|p = .4) = .021$.

10.20 $H_0 : \mu \geq 64$, $H_\alpha : \mu < 64$. Using the large sample test for a mean, $z = -1.77$, and with $\alpha = .01$, $-z_{.01} = -2.326$. So, H_0 is not rejected: there is not enough evidence to conclude the manufacturer's claim is false.

10.38 With $H_0 : \mu \geq 64$, this is rejected if $z = \frac{\bar{y}-64}{\sigma/\sqrt{n}} < -2.326$, or if $\bar{y} < 64 - \frac{2.326\sigma}{\sqrt{n}} = 61.36$. If $\mu = 60$, then $\beta = P(\bar{Y} > 61.36|\mu = 60) = P(Z > \frac{61.36-60}{8/\sqrt{50}} = P(Z > 1.2) = .1151$.

10.42 Using the sample size of formula given in this section, we have

$$n = \frac{(z_\alpha + z_\beta)^2\sigma^2}{(\mu_\alpha - \mu_0)^2} = 607.37,$$

so a sample size of **608** will provide the desired levels.

10.54 (a) The hypotheses are $H_0 : p = .85$, $H_\alpha : p > .85$, where p=proportion of right-handed executives of large corporations. The computed test statistic is $z = 5.34$, and with $\alpha = .01$, $z_{.01} = 2.346$. So, we reject H_0 and conclude that the proportion of right-handed executives at large corporations is greater than 85%.

(b) Since $p - value = P(Z > 5.34) < .000001$, we can safely reject H_0 for any significance level of .000001 or more. This represents strong evidence against H_0.

10.70 (a) The hypotheses are $H_0 : \mu_1 - \mu_2 = 0$ vs. $H_\alpha : \mu_1 - \mu_2 > 0$. The computed test statistic is $t = 2.97$ (here, $s_p^2 = .0001444$). With 21 degrees of freedom, $t_{.05} = 1.721$ so we reject H_0.

(b) For this problem, the hypotheses are $H_0 : \mu_1 - \mu_2 = .01$ vs. $H_\alpha : \mu_1 - \mu_2 > 0.01$. Then, $t = \frac{(.041-.026)-.01}{\sqrt{s_p^2(\frac{1}{9}+\frac{1}{12})}} = .989$ and $p - value > .10$.