Homework 14 Solution

10.17

(a) $H_0 : \mu_1 = \mu_2$ vs. $H_a : \mu_1 > \mu_2$

(b) Reject if $Z > 2.326$, where Z is the test statistic

(c) $Z = \frac{9017-5853}{\sqrt{7162^2/130+1961^2/80}} = 4.756$

(d) Reject H_0, there is sufficient evidence to indicate that the average number of meters per week spent practicing breaststroke is greater for exclusive breaststrokers than it is for those swimming individual medley

(e) Two groups have very different sample means.

10.18

$H_0 : \mu = 13.2$ vs. $H_a : \mu < 13.2$. $Z = \frac{12.2-13.2}{2.5/\sqrt{40}} = -2.53 < Z_{0.01} = -2.326$.

Reject the null hypothesis, there is evidence that the company is paying less than average.

10.21

$H_0 : \mu_1 = \mu_2$ vs. $H_a : \mu_1 \neq \mu_2$

$Z = \frac{1.65-1.43}{\sqrt{0.26^2/30+0.22^2/35}} = 3.648 > Z_{0.995} = 2.576$

Reject the null hypothesis, the soils don't have equal mean shear strengths.

10.33

Define p_1: proportion of republicans; p_2: proportion of democrats.

$H_0 : p_1 = p_2$ vs. $H_a : p_1 > p_2$

$\hat{p}_1 = 0.23, \hat{p}_2 = 0.17, \hat{\sigma}_1^2 = 0.23(1-0.23), \hat{\sigma}_2^2 = 0.17(1-0.17)$

$Z = \frac{\hat{p}_1-\hat{p}_2}{\sqrt{\hat{\sigma}_1^2/n_1+\hat{\sigma}_2^2/n_2}} = 1.504 < Z_{0.95} = 1.645$

We fail to reject the null hypothesis, under 95% confidence level there is no evidence that proportion for republicans are higher.

10.40

$H_0 : p_1 = p_2$ vs. $H_a : p_1 > p_2$

$\beta = 0.2$, minimum detection $= 0.1$: $\frac{\hat{p}_1 - \hat{p}_2 - 0.1}{\sqrt{p_1(1-p_1)/n + p_2(1-p_2)/n}} = Z_{0.2} = -0.842$

$\alpha = 0.05$: $\frac{\hat{p}_1 - \hat{p}_2}{\sqrt{p_1(1-p_1)/n + p_2(1-p_2)/n}} = Z_{0.95} = 1.645$

Thus $\frac{0.1}{\sqrt{p_1(1-p_1)/n + p_2(1-p_2)/n}} = 1.645 + 0.842$

Plugging in $p_1 = p_2 = 0.5$: $n = 308.76 = 309$

10.43

(a) $H_0 : \mu_1 = \mu_2$ vs. $H_a : \mu_1 > \mu_2$

$Z = \frac{32.19 - 31.68}{\sqrt{4.34^2/37 + 4.56^2/37}} = 0.49 < Z_{0.95} = 1.645$

Do not reject the null hypothesis, where is no difference.

(b) $\bar{Y}_1 - \bar{Y}_2 > Z_{0.95}\sqrt{4.34^2/37 + 4.56^2/37} = 1.702$

Rejection region: $(1.702, \infty)$

$\beta = P(\bar{Y}_1 - \bar{Y}_2 \leq 1.702 | \mu_1 - \mu_2 = 3) = P(Z \leq \frac{1.702 - 3}{\sqrt{4.34^2/37 + 4.56^2/37}}) = 0.105$