Homework #10 Solutions

Problem 7.117

(a) Let μ_1 = mean blood cholesterol level for pets

μ_2 = " " " " for clinic dogs

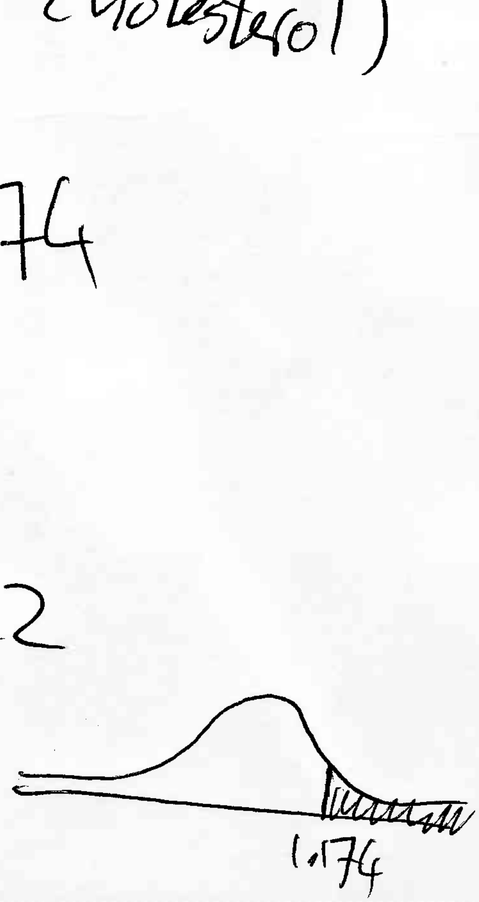
$H_0: \mu_1 - \mu_2 \leq 0$ (ie pets have lower or equal cholesterol)

$H_A: \mu_1 - \mu_2 > 0$ (ie pets have higher cholesterol)

$$t = \frac{193 - 174}{\sqrt{\frac{68^2}{26} + \frac{44^2}{23}}} = 1.174$$

$df = \min(26, 23) - 1 = 22$

Pvalue $= P(T > 1.174)$



from table

$1.061 < 1.174 < 1.321$

$.15 > P(T > 1.174) > .1$

so since $.1 < \text{Pvalue} < .15$ cannot reject H_0. ie no evidence to show pets have higher cholesterol.

b) A 95% CI for $\mu_1 - \mu_2$ is given by

$$193 - 174 \pm (2.074)\sqrt{\frac{68^2}{26} + \frac{44^2}{23}}$$

$$\Rightarrow 19 \pm 33.572$$

$$\Rightarrow (-14.572, 52.572)$$

c) A 95% CI for μ_2 is given by

$$174 \pm (2.074)\frac{\cancel{48}\,44}{\sqrt{23}}$$

$$\Rightarrow 174 \pm 19.028 \Rightarrow (154.97, 193.03)$$

d) Normality, independence, random sample

least likely to be true

③

Problem 8.37

Let p_1 = proportion who lie in first six months

p_2 = proportion who lie in next six months

$$\hat{p}_1 = \frac{15}{84} = .179 \qquad \hat{p}_2 = \frac{21}{106} = .198$$

So a 95% CI for $p_1 - p_2$ is

$$\hat{p}_1 - \hat{p}_2 \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

$$.179 - .198 \pm 1.96 \sqrt{\frac{.179(1-.179)}{84} + \frac{(1-.198)(.198)}{106}}$$

$$-0.019 \pm .1115$$

$$(-.130, 0.093)$$

Since 0 is in the interval it means that a 5% level of significance test of $H_0\ \mu_1 = \mu_2$ $H_A\ \mu_1 \neq \mu_2$ would not reject the null hypothesis. ie no evidence to show proportion who lie changed between two time periods.

Problem 8.39

Let p_1 = proportion of female bicyclists who test positive
p_2 = " " male " " " "

$\hat{p}_1 = \frac{27}{191} = .141$ $\hat{p}_2 = \frac{515}{1520} = .339$

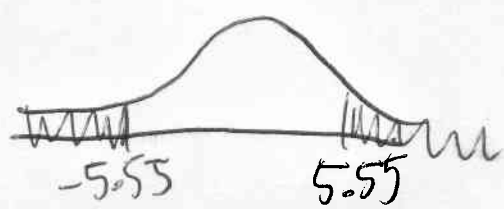
pooled proportion $\hat{p} = \frac{27+515}{191+1520} = \frac{542}{1711} = .317$

$SE_{\hat{D}p} = \sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)} = \sqrt{.317(1-.317)\left(\frac{1}{191}+\frac{1}{1520}\right)} = .0357$

$H_0: p_1 = p_2$ (i.e. no difference between genders)

$H_A: p_1 \neq p_2$ (there is a difference)

$z = \frac{.141 - .339}{.0357} = -5.55$



Pvalue $= 2P(Z > 5.55)$
$< 2P(Z > 3.49) = .001 \Rightarrow$ reject H_0. The proportion differs between genders.

Problem 8.41

Let p_1 = proportion of rural households with natural trees
p_2 = " " urban " " " "

$\hat{p}_1 = \frac{64}{160} = .4$ $\hat{p}_2 = \frac{89}{261} = .3409$

pooled proportion $\hat{p} = \frac{64+89}{160+261} = \frac{153}{421} = .3634$

$SE_{\hat{D}_p} = \sqrt{.3634(1-.3634)\left(\frac{1}{160} + \frac{1}{261}\right)} = .0483$

a) $H_0: p_1 = p_2$ (no difference in preference)

$H_A: p_1 \neq p_2$ (difference between urban/rural preferences)

b) $z = \frac{.4 - .3409}{.0483} = 1.22$

$$\text{P value} = 2P(Z > 1.22) = 2(.1112) = .2224$$

Since P-value is large cannot reject H_0. ie no evidence to show difference between urban and rural households

(c) A 95% CI for $p_1 - p_2$ is given by

$$.4 - .3409 \pm 1.96\sqrt{\frac{.4(1-.4)}{160} + \frac{.3409(1-.3409)}{261}}$$

$$\Rightarrow .059 \pm .095$$

$$\Rightarrow (-.036, .154)$$

Problem 8.48

Let p_1 = proportion of XY men who are criminals

p_2 = proportion of XYY or XXY men who are criminals

$$\hat{p}_1 = \frac{381}{4096} = .093 \quad \hat{p}_2 = \frac{8}{28} = .286$$

Pooled proportion $\hat{p} = \dfrac{381+8}{4096+28} = .094$

⑦

$H_0: P_1 \geq P_2$ (normal men have higher or same criminal rate as abnormal men)

$H_A: P_1 < P_2$ (abnormal men have higher criminal rate then normal men)

$$SE_{\hat{p}_p} = \sqrt{.094(1-.094)\left(\frac{1}{4096}+\frac{1}{28}\right)}$$

$$= .055$$

$$Z = \frac{.093 - .286}{.055} = -3.509$$

$$\text{Pvalue} = P(Z < -3.51)$$
$$< P(Z < -3.49) = .0002$$

Since P-value is small can reject H_0. Therefore conclude that abnormal men have higher criminal rate then normal men.

Problem 8.76

Let p_1 = proportion who receive gastric surgery who improve

p_2 = proportion who are control patients who improve

$\hat{p}_1 = \frac{28}{82} = .341$ $\hat{p}_2 = \frac{30}{78} = .385$

$$\hat{p} = \frac{28+30}{82+78} = .3625$$

(a) $H_0: p_1 - p_2 \leq 0$ (no difference from gastric surgery).

$H_A: p_1 - p_2 > 0$ (gastric surgery is better)

$$SE_{\hat{D}_p} = \sqrt{.3625(1-.3625)\left(\frac{1}{82} + \frac{1}{78}\right)}$$

$$= .0742$$

$$z = \frac{.341 - .385}{.0742} = -.5818$$

P value $= P(Z > -.58)$

$= .7190$

b) Since P-value is so large no evidence to reject H_0. Therefore we conclude that gastric surgery is no more effective than control.