10.1b Significance Tests for Comparing Two Proportions

$H_0: p_1 = p_2$ $\quad H_0: p_1 - p_2 = 0$

Method: 2-sample Z Test for a difference between 2 proportions

$$\text{test statistic} = \frac{\text{statistic} - \text{parameter}}{\text{st. dev. of statistic}}$$

$$= \frac{\hat{p}_1 - \hat{p}_2 - 0}{\sqrt{\frac{\hat{p}_c(1-\hat{p}_c)}{n_1} + \frac{\hat{p}_c(1-\hat{p}_c)}{n_2}}}$$

on calc: Stat → Tests → 6: 2-prop Z Test

Side note:
assuming $p_1 = p_2 = p$ ← estimated with $\hat{p}_c$ (combined (pooled))

$$\hat{p}_c = \frac{x_1 + x_2}{n_1 + n_2}$$

ex:

Step 1 State $H_0: p_1 = p_2$ or $p_1 - p_2 = 0$ $\quad \alpha = 0.05$

$H_a: p_1 \neq p_2$ or $p_1 - p_2 \neq 0$

p_1 = the true proportion of students @ School I who didn't eat breakfast

p_2 = " " " " " @ School II who didn't eat breakfast

Step 2

Plan: Use a 2-sample Z Test for $p_1 - p_2$

Conditions: 1. Random – one SRS was taken from each school.

2. Normal – $n_1\hat{p}_1 = 19 \geq 10$
$n_1(1-\hat{p}_1) = 61 \geq 10$
$n_2\hat{p}_2 = 26 \geq 10$
$n_2(1-\hat{p}_2) = 124 \geq 10$

3. Independent – 2 samples were taken independently and more than 800 students @ School I, more than 1500 students @ School II.

Step 3

Do: $z = 1.168$

p-value $= 0.243$

$\hat{p}_1 = .24$ $\quad \hat{p}_c = 0.196 = \frac{19+26}{80+150}$

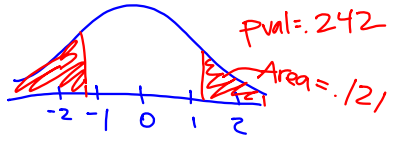
$\hat{p}_2 = .173$ $\quad n_1 = 80$

$n_2 = 150$

Step 3: by hand:

$$z = \frac{.2375 - .1733}{\sqrt{.1957(.8043)\left(\frac{1}{80} + \frac{1}{150}\right)}} = 1.17$$

$$\hat{p}_c = \frac{x_1 + x_2}{n_1 + n_2} = \frac{19+26}{80+150} = \frac{45}{230} = .1957$$



Step 4

Conclude

Since our p-value (.243) is greater than α (.05) we fail to reject the Null Hypothesis. We cannot conclude that there is a difference in the proportion of students who ate breakfast at School I & School II.