☆

1. 95% CI $\quad p_1 = \frac{344}{430} = 0.8 \quad p_2 = \frac{369}{450} = 0.82$

point estimate $\quad p_1 - p_2 = 0.8 - 0.82 = -0.02$

$$se(\bar{p}_1 - \bar{p}_2) = \sqrt{\frac{(0.8)(0.2)}{430} + \frac{(0.82)(0.18)}{450}} = \sqrt{0.0007} = 0.0265$$

$$z^*_{0.025} = 1.96$$

$$ME = 1.96 \times 0.0265 = 0.0519$$

$[-0.0719, 0.0319]$

We are 95% confident that the interval $[-0.0719, 0.0319]$ contains the true difference between the population proportions of boys and girls.

$H_0: p_1 - p_2 = 0$
$H_A: p_1 - p_2 \neq 0$

Do not reject the null hypothesis. The study's claim is not supported by the data at the 5% level of significance.

2. $n_1 = 120$ $\quad p_1 = 0.146 \quad p_2 = .0.068$
$n_2 = 120$

2008 1980

$H_0: p_1 - p_2 \leq 0$
$H_A: p_1 - p_2 > 0$

Test if there is an increase in the proportion of people who marry outside their race or ethnicity. p_1 is 2008 so $p_1 - p_2$ would be positive - right-tailed test.

$$Z = \frac{0.146 - 0.068}{\sqrt{(0.107)(0.893)(0.0167)}}$$

$$\bar{p} = \frac{(120)(0.146) + (120)(0.068)}{240} = 0.107$$

$$Z = \frac{0.078}{0.0399} = 1.95$$

p-value $= 0.026$

Reject the null hypothesis. There is enough evidence at the 5% level of significance to conclude that the porportion of people who marry outside their race or ethnicity has increased since 1980.

3. $p_1 = \frac{67}{150}$ recent survey $n_1 = 150$ $p_1 = 0.447$ ☆

$p_2 = \frac{58}{140}$ Three years ago $n_2 = 140$ $p_2 = 0.414$

$H_0: p_1 - p_2 \leq 0$

$H_A: p_1 - p_2 > 0$

Test if more people use LinkedIn in the recent survey and p_1 is the recent survey proportion so $p_1 - p_2$ would be positive - right-tailed test.

$$Z = \frac{0.447 - 0.414}{\sqrt{(0.43)(0.57)(0.0138)}} = \frac{0.033}{0.0582} = 0.57$$

$$\bar{p} = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2} = \frac{67 + 58}{290} = 0.43$$

Critical value 1.645

Do not reject the null hypothesis. There is not enough evidence at the 5% level of significance to conclude that there is an increase in the number of people using LinkedIn.

☆

4. $p_1 = 0.5 \quad n_1 = 350$

$p_2 = 0.26 \quad n_2 = 300$

$H_0: p_1 - p_2 \leq 0.2$

$H_A: p_1 - p_2 > 0.2$

$$Z = \frac{0.5 - 0.26 - 0.2}{\sqrt{\frac{(0.5)(0.5)}{350} + \frac{(0.26)(0.74)}{300}}} = \frac{0.04}{0.0368} = 1.09$$

p-value $= 0.1379$

Do not reject the null hypothesis. There is not enough evidence at the 5% level of significance to conclude that the proportion of satisfied accounting mayors differs from psychology mayors by more than 20%.

5. $p_1 = \frac{20}{120} = 0.167$ $p_2 = \frac{48}{150} = 0.32$

business majors non business majors

$n_1 = 120$ $n_2 = 150$

$H_0: p_1 - p_2 \geq 0$

$H_A: p_1 - p_2 < 0$

If business majors are p_1 and we are testing if the proportion who study hard is less than that of non-business majors, $p_1 - p_2$ would be negative so this is a left-tailed test.

$$Z = \frac{0.167 - 0.32}{\sqrt{(0.25)(0.75)(0.015)}} = \frac{-0.153}{0.0530} = -2.89$$

$$\bar{p} = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2} = \frac{20+48}{270} = \frac{68}{270} = 0.25$$

P-value $= 0.0019$ =NORM.S.DIST(-2.89, 1)

Reject the null hypothesis. There is enough evidence at the 5% level of significance to conclude that the proportion of business majors who study hard is less than the proportion of non-business majors who study hard.