Q29 : single policyholders — Married Policyholders

$n_1 = 400$ — $n_2 = 900$

# of making claims $= 76$ — # of making claims $= 90$.

a. $\alpha = 0.05$

$H_0 : \pi_1 = \pi_2$ — π_1 : pop. prop. of single policyholders making claims

$H_1 : \pi_1 \neq \pi_2$. — π_2 : pop. prop of Married " "

$$P_1 = \frac{76}{400} = 0.19 \qquad P_2 = \frac{90}{900} = 0.10$$

$$P = \frac{n_1 P_1 + n_2 P_2}{n_1 + n_2} = \frac{76 + 90}{15000} = 0.13$$

$$Z = \frac{0.19 - 0.10}{\sqrt{0.13(1-0.13)\left(\frac{1}{400} + \frac{1}{900}\right)}} = 4.45$$

$\Rightarrow Z_{\frac{\alpha}{2}} = 1.96 \rightarrow \mp Z_{\frac{\alpha}{2}} = \pm 1.96$ — Reject; -1.96, 1.96

$df = \infty$
$\alpha = 0.05$
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$|Z| > Z_{\frac{\alpha}{2}}$ so Reject H_0 ($\alpha = 0.05$)

$\Rightarrow (\pi_1 \neq \pi_2)$ ($\alpha = 0.05$).

b. 95% CI:

$$0.95 \text{ CI} = (P_1 - P_2) \mp Z_{\frac{\alpha}{2}} \sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}$$

$$= 0.09 \mp 1.96 \sqrt{\text{بعوض الارقام}}$$

$$= 0.09 \mp 0.04 \qquad = (0.05, 0.13).$$

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Exercises:

Q23: $n_1 = 400$ $n_2 = 300$

$P_1 = 0.48$ $P_2 = 0.36$

a. what is the point estimater of the difference between two pop. proportion.

point estimater = $P_1 - P_2 = 0.48 - 0.36 = 0.12$.

b. construct a 90 percent CI for the difference between the two pop. proportions.

$0.90\ CI = (P_1 - P_2) \mp E$

$1-\alpha = 0.9 \rightarrow \alpha = 0.1,\ \frac{\alpha}{2} = 0.05$

$$E = Z_{\frac{\alpha}{2}} \sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}} = Z_{0.05} \sqrt{\frac{0.48(0.52)}{400} + \frac{0.36(0.64)}{300}}$$

$$= 1.645 \sqrt{0.001392} = 0.037309516$$

$$\boxed{E = 0.061}$$

$\Rightarrow 0.90\ CI = 0.12 \mp 0.061$

$= (0.059, 0.181)$.

c. construct a 95% CI for the difference between the two pop. proportions:

$1-\alpha = 0.95 \rightarrow \alpha = 0.05$

$\frac{\alpha}{2} = 0.025$

$E = Z_{\frac{\alpha}{2}} (0.037309516)$

$= Z_{0.025} (0.037309516)$

$= 1.96 (0.037309516) = 0.073$

$\rightarrow 0.95\ CI = 0.12 \mp 0.073$

$= (0.047, 0.193)$.

Q24: consider the Hypotheses test $H_0: \pi_1 - \pi_2 \le 0$ upper tail test

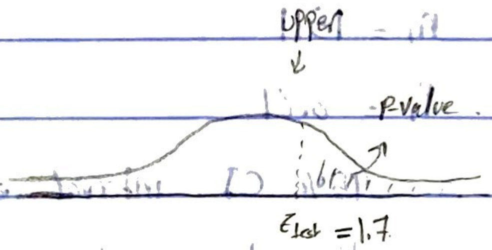
$H_1: \pi_1 - \pi_2 > 0$

The following results are for independent samples taken from the two pop.

$n_1 = 200 \qquad n_2 = 300$

$p_1 = 0.22 \qquad p_2 = 0.16$

a. What is the p-value?



$$Z = \frac{(p_1 - p_2)}{\sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$p = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2} = \frac{\overset{44}{200(0.22)} + 300(0.16)}{500} = \frac{92}{500} = 0.184$$

$$\Rightarrow Z = \frac{0.22 - 0.16}{\sqrt{0.184(1-0.184)\left(\frac{1}{200} + \frac{1}{300}\right)}} = 1.7$$

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$$\text{p-value} = P(Z \ge Z_{test})$$
$$= P(Z > 1.7)$$
$$= 1 - P(Z < 1.7) \qquad \text{By z-table.}$$
$$= 1 - 0.9554$$

$$\boxed{\text{p-value} = 0.0446}$$

b. With $\alpha = 0.05$, What is your hypothesis testing conclusion :

$P\text{-value} \ \square \ \alpha$

$0.0446 \leq 0.05$

So we Reject H_0 $(\alpha = 0.05)$.

Q25 : $n_1 = 1511$ $n_2 = 1050$

$P_1 = 0.61$ $P_2 = 0.78$

provide a 95% CI interval estimate for the difference between pop. proportion in the two contries.

$1-\alpha = 0.95$

$\alpha = 0.05$ $/\frac{\alpha}{2} = 0.025$

$$E = Z_{\frac{\alpha}{2}} \sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}$$

$$= Z_{0.025} \sqrt{\frac{0.61(0.39)}{1511} + \frac{0.78(0.22)}{1050}}$$

$$= 1.96 \ (0.017912955)$$

$$E = 0.035$$

$\Rightarrow 0.95 \ CI = (P_1 - P_2) \pm E$

$= -0.17 \mp 0.035$

$= (-0.135 , -0.205)$ $\leftarrow \alpha$

$= (-0.205 , -0.135)$ $\leftarrow$ هيك الترتيب

Q26 :

$n_1 = 400$ $n_2 = 700$

$P_1 = 0.69$ $P_2 = 0.57$.

Construct 95 % CI for the difference between the proportion - - .

$$E = Z_{\frac{\alpha}{2}} \sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}$$

$$= Z_{0.025} \sqrt{\frac{0.69(0.31)}{400} + \frac{0.57(0.43)}{700}}$$

t-table
df = ∞
$\alpha = 0.025$

$$= 1.96 \quad (0.029747148)$$

$$E = 0.058 .$$

$$\Rightarrow 0.95 \text{ CI} = (0.69 - 0.57) \mp 0.058$$

$$= 0.12 \mp 0.058$$

$$= (0.062 , 0.178) .$$

Q27 :

Q28 :

$n_1 = 1103$ $\qquad$ $n_2 = 1065$

$P_1 = 0.74$ $\qquad$ $P_2 = 0.66$

Test the hypothesis $\pi_1 - \pi_2 = 0$ with $\alpha = 0.05$.
What is p-value? What is your conclusion?

Two tail test :

$H_0 : \pi_1 - \pi_2 = 0$

$H_1 : \pi_1 - \pi_2 \neq 0$

$$\rightarrow \quad \bar{P} = \frac{n_1 P_1 + n_2 P_2}{n_1 + n_2} = \frac{1103(0.74) + 1065(0.66)}{2168} = \frac{1519.12}{2168} = \underline{\underline{0.7}}$$

$$\rightarrow \quad Z = \frac{(P_1 - P_2)}{\sqrt{\bar{P}(1-\bar{P})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{0.08}{\sqrt{0.7(0.3)\left(\frac{1}{1103} + \frac{1}{1065}\right)}} = \frac{0.08}{0.019686872} = \underline{4.06}$$

$\rightarrow$ بروح على جدول t فبشوف وين أكبر قيمة مع الجدول مع $df = \infty$

	0.005	
∞	2.576	$\boxed{4.06}$

So p-value < 0.005

Two tailed $\quad$ 2p-value < 0.01 < α

So we reject H_0 $(\alpha = 0.05)$