

Tutorial Session 9 - Chi-Square Test

Q 12.7 - Twitter user (P. 663)

Twitter Type	IS	OC	RT	ME	O	Total
Observed count	51	61	64	101	73	350
Expected count	70	70	70	70	70	350

$$\text{Expected data} = \frac{350}{5} = 70$$

H_0 : The data meet the expected distribution

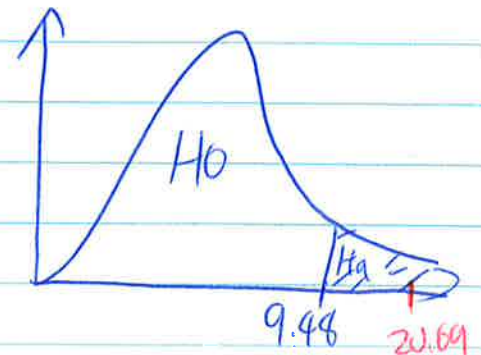
H_a : The data do not meet the expected distribution

Critical χ^2 value (Table value)

$$df = (n-1) = 5-1 = 4, \quad \alpha = 0.05 \Rightarrow 9.48$$

$$\begin{aligned}\chi^2 &= \frac{(51-70)^2}{70} + \frac{(61-70)^2}{70} + \frac{(64-70)^2}{70} + \frac{(101-70)^2}{70} + \frac{(73-70)^2}{70} \\ &= 5.157 + 1.157 + 0.514 + 13.729 + 0.129 \\ &= 20.69\end{aligned}$$

\therefore Reject H_0 . There is enough evidence to conclude that the data do not meet the expected distribution.



Q12.21 - Education Level and Earnings (P. 677)

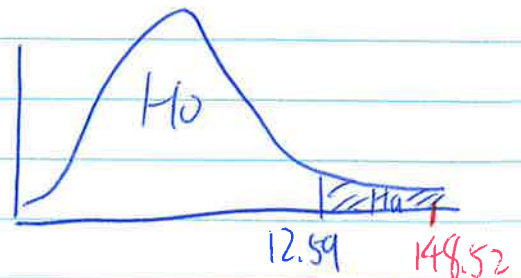
	< \$20,000	\$20,000 - \$39,999	\$40,000 - \$59,999	> \$60,000	Total
Diploma	8 (28.02)	68 (120.58)	106 (111.66)	243 (167.74)	425
Associate Degree	11 (12.26)	56 (52.77)	56 (48.87)	63 (72.10)	186
Bachelor's Degree	47 (25.71)	160 (110.65)	101 (102.47)	82 (151.17)	390
Total	66	284	263	388	1,001.00

Expected Data = $\frac{66 \times 425}{1,001}$, $\frac{66 \times 186}{1,001}$ -----, $\frac{388 \times 186}{1,001}$, $\frac{388 \times 390}{1,001}$
 = 28.02 = 12.26 = 72.1 = 151.71

H₀: Education level and earnings are independent
 H_a: Education level and earnings are dependent

Critical χ^2 value: $df = (4-1)(3-1) = 3 \times 2 = 6$, $\alpha = 0.05 \Rightarrow 12.59$

$\chi^2 = \frac{(8-28.02)^2}{28.02} + \frac{(11-12.26)^2}{12.26} + \dots + \frac{(63-72.1)^2}{72.1} + \frac{(82-151.17)^2}{151.17}$
 = 14.31 + 0.13 + ----- + 1.15 + 31.65
 = 148.52



∴ Reject H₀. There is enough evidence to conclude that education level and earnings are dependent.

Q12.28 - ID and Nose views. (P. 67d)

Sex ID		View			Total
		Front	Profile	$\frac{3}{4}$	
Correct		23	26	29	78
		(26)	(26)	(26)	
Incorrect		17	14	11	42
		(14)	(14)	(14)	
Total		40	40	40	120

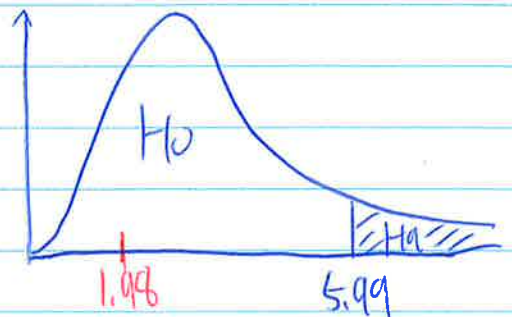
Expected Data: $\frac{40 \times 78}{120}$, $\frac{40 \times 42}{120}$, ..., $\frac{40 \times 78}{120}$, $\frac{40 \times 42}{120}$
 $= 26, 14, \dots, 26, 14$

H_0 : The proportions of Correct Sex ID are the same for all three nose views.
 H_a : The proportions of correct sex ID are not the same for all three nose views.

Critical χ^2 value:

$df = (3-1)(2-1) = 2 \times 1 = 2$, $\alpha = 0.05$, $\Rightarrow 5.99$

$\chi^2 = \frac{(23-26)^2}{26} + \frac{(17-14)^2}{14} + \dots + \frac{(29-26)^2}{26} + \frac{(11-14)^2}{14}$
 $= 0.35 + 0.64 + \dots + 0.35 + 0.64$
 $= 1.98$



\therefore Fail to reject H_0 . There is insufficient evidence to conclude that the proportions of correct sex ID are not the same for all three nose views.