

Chi Square test

1)

- (a) H_0 : The (average) number of meals per day a student has and gender are independent

(A1) [1 mark]

Note: For “independent” accept “not associated” but do not accept “not related” or “not correlated”.

- (b) 2

(A1) [1 mark]

- (c) 5.99 (accept 5.991)

(A1)(ft) [1 mark]

Note: Follow through from their part (b).

- (d) $\frac{28 \times 45}{100} = 12.6 = 13$ or $\frac{28}{100} \times \frac{25}{100} \times 100 = 12.6 = 13$

(M1)(A1)(AG) [2 marks]

Notes: Award (M1) for correct formula and (A1) for correct substitution. Unrounded answer must be seen for the (A1) to be awarded.

- (e) 0.0321

(G2) [2 marks]

Note: For 0.032 award (G1)(G1)(AP).
For 0.03 with no working award (G0).

-) $0.0321 < 5.99$ or $0.984 > 0.05$
accept H_0

(R1)
(A1)(ft) [2 marks]

Note: If reason is incorrect both marks are lost, do not award (R0)(A1).

Total [24 marks]

2)

- (a) (i) H_0 = wearing of a seat belt and the time a driver has held a licence are independent.

(A1)

For independent accept ‘not associated’ but do not accept ‘not related’ or ‘not correlated’

- (ii) 2

(A1)

- (iii) $\frac{98 \times 45}{200} = 22.05 = 22$ (correct to the nearest whole number)

(M1)(A1)(AG)

(M1) for correct formula and (A1) for correct substitution. Unrounded answer must be seen for the (A1) to be awarded.

- (iv) $\chi^2 = 8.12$

(G2)

For unrounded answer award (G1)(G0)(AP)

If formula used award (M1) for correct substituted formula with correct substitution (6 terms) (A1) for correct answer.

- (v) “Does not accept H_0 ”

(A1)(ft)

$\chi^2_{crit} < 8.12$ or $p\text{-value} < 0.05$

(R1)(ft)

Allow “Reject H_0 ” or equivalent. Follow through from their χ^2 statistic. Award (R1)(ft) for comparing the appropriate values. The (A1)(ft) can be awarded only if the conclusion is valid according to the comparison given. If no reason given or if reason is wrong the two marks are lost.

[8 marks]

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3)	(i)	(a)	(i) $\frac{280}{400}(0.7, 70 \% \text{ or equivalent})$ <i>(A1) for correct numerator, (A1) for correct denominator.</i>	(A1)(A1)(G2)	
			(ii) $\frac{57}{210}\left(\frac{19}{70}, 0.271, 27.1\%\right)$ <i>(A1) for correct numerator, (A1) for correct denominator.</i>	(A1)(A1)(G2)	[4 marks]
		(b)	$\frac{180}{400} \times \frac{179}{399}$ <i>(A1) for correct values seen, (M1) for multiplying their two values (A1) for correct answer.</i>	(A1)(M1)	
			$= \frac{537}{2660} (= 0.202)$	(A1)(G3)	[3 marks]
		(c)	H_0 : ‘the preference of brand of cereal is independent of the city’.	(A1)	
			OR		
			H_0 : ‘there is no association between the brand of cereal and city’.		[1 mark]
		(d)	$df = 2$	(A1)	[1 mark]
		(e)	$\frac{210 \times 120}{400}$ <i>(M1) for substituting in correct formula, (A1) for correct values.</i> $= 63$ <i>Final line must be seen or previous (A1) mark is lost.</i>	(M1)(A1)	[2 marks]
				(AG)	
		(f)	39.3 <i>Award (G1)(A0)(AP) if answers not to 3 significant figures.</i>	(G2)	[2 marks]
		(g)	$39.3 > \chi^2_{\text{crit}}$ or $p - \text{value} < 0.05$ Do not accept H_0 . <i>Allow ‘Reject H_0 or equivalent’. (ft) from their χ^2 statistic.</i> <i>Award (R1)(ft) for comparing the appropriate values.</i> <i>(A1)(ft) can be awarded only if the conclusion is valid according to the comparison given. If no reason given or if reason is wrong both marks are lost. Note that (R1)(A0)(ft) can be awarded but (R0)(A1)(ft) cannot.</i>	(R1)(ft) (A1)(ft)	[2 marks]

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4)

(a)	Choice of music is independent of age.	(A1)	(C1)
(b)	$(3 - 1)(3 - 1)$ $= 4$	(A1)	(C1)
(c)	$\chi^2 = 51.6$ <i>52 is an accuracy penalty (A1)(A0)(AP).</i>	(A2)	(C2)
(d)	$p\text{-value} < 0.05$ for 5 % level of significance or $51.6 > \chi^2_{crit}$ Reject the null hypothesis (<i>do not accept the null hypothesis</i>). <i>Do not award (R0)(A1).</i>	(R1)(ft) (A1)(ft)	(C2)
		[6 marks]	