

QQQ – Further Statistics 1 – Chapter 6 – Chi-Squared Tests (Version 1)

Total Marks: 25

(25 = Platinum, 23 = Gold, 20 = Silver, 17 = Bronze)

1. Sharma believes that each computer game he sells appeals equally to all age ranges.

To investigate this, he takes a random sample of 100 people who play these games and asks them which of the games A , B or C they prefer.

The results are summarised in the table below.

Computer game		A	B	C
Age range	< 20	8	15	6
	$20 - 30$	21	12	9
	> 30	6	10	13

(a) Write down hypotheses for a suitable test to assess Sharma's belief. (1)

(b) For the test, calculate the expected frequency for

(i) those players aged under 20 who prefer game C

(ii) those players aged between 20 and 30 who prefer game A (2)

(c) State the degrees of freedom of the test statistic for this test. (1)

Sharma correctly calculates the test statistic for this test to be 11.542 (to 3 decimal places).

(d) Using a 5% significance level, and stating your critical value, comment on Sharma's belief.

(2)

(Total 6 marks)

2. Kelly throws a tetrahedral die n times and records the number on which it lands for each throw.

She calculates the expected frequency for each number to be 43 if the die was unbiased.

The table below shows three of the frequencies Kelly records but the fourth one is missing.

Number	1	2	3	4
Frequency	47	34	36	x

(a) Show that $x = 55$ (1)

Kelly wishes to test, at the 5% level of significance, whether or not there is evidence that the tetrahedral die is unbiased.

(b) Explain why there are 3 degrees of freedom for this test. (1)

(c) Stating your hypotheses clearly and the critical value used, carry out the test. (5)

(Total 7 marks)

3. Table 1 below shows the number of car breakdowns in the *Snoreap* district in each of 60 months.

Number of car breakdowns	0	1	2	3	4	5
Frequency	12	11	19	14	3	1

Table 1

Anja believes that the number of car breakdowns per month in *Snoreap* can be modelled by a Poisson distribution. Table 2 below shows the results of some of her calculations.

Number of car breakdowns	0	1	2	3	4	≥ 5
Observed frequency (O_i)	12	11	19	14	3	1
Expected frequency (E_i)	9.92			9.64	4.34	

Table 2

- (a) State suitable hypotheses for a test to investigate Anja's belief. (1)
- (b) Explain why Anja has changed the label of the final column to ≥ 5 (1)
- (c) Showing your working clearly, complete Table 2 (4)
- (d) Find the value of $\frac{(O_i - E_i)^2}{E_i}$ when the number of car breakdowns is
- (i) 1
- (ii) 3 (2)
- (e) Explain why Anja used 3 degrees of freedom for her test. (2)

The test statistic for Anja's test is 6.54 to 2 decimal places.

- (f) Stating the critical value and using a 5% level of significance, complete Anja's test. (2)

(Total 12 marks)