Chi-Squared Tests on Contingency Tables (From Edexcel 6691)

Q1, (Jun 2007, Q2)

The Director of Studies at a large college believed that students' grades in Mathematics were independent of their grades in English. She examined the results of a random group of candidates who had studied both subjects and she recorded the number of candidates in each of the 6 categories shown.

	Maths grade A or B	Maths grade C or D	Maths grade E or U
English grade A or B	25	25	10
English grade C to U	15	30	15

(a) Stating your hypotheses clearly, test the Director's belief using a 10% level of significance. You must show each step of your working.

(9)

The Head of English suggested that the Director was losing accuracy by combining the English grades C to U in one row. He suggested that the Director should split the English grades into two rows, grades C or D and grades E or U as for Mathematics.

(b) State why this might lead to problems in performing the test.

(1)

Q2, (Jun 2010, Q5)

A random sample of 100 people were asked if their finances were worse, the same or better than this time last year. The sample was split according to their annual income and the results are shown in the table below.

Finances / Annual income	Worse	Same	Better
Under £15 000	14	11	9
£15 000 and above	17	20	29

Test, at the 5% level of significance, whether or not the relative state of their finances is independent of their income range. State your hypotheses and show your working clearly.

(10)

Q3, (Jun 2012, Q4)

Two breeds of chicken are surveyed to measure their egg yield. The results are shown in the table below.

Egg yield / Breed	Low	Medium	High
Leghorn	22	52	26
Cornish	14	32	4

Showing each stage of your working clearly, test, at the 5% significance level, whether or not there is an association between egg yield and breed of chicken. State your hypotheses clearly.

(10)

Q4, (Jun 2013, Q1)

A doctor takes a random sample of 100 patients and measures their intake of saturated fats in their food and the level of cholesterol in their blood. The results are summarised in the table below.

Cholesterol level / Intake of saturated fats	High	Low
High	12	8
Low	26	54

Using a 5% level of significance, test whether or not there is an association between cholesterol level and intake of saturated fats. State your hypotheses and show your working clearly.

(10)

Q5, (Jun 2014, Q3)

A number of males and females were asked to rate their happiness under the headings "not happy", "fairly happy" and "very happy".

The results are shown in the table below

		Happiness			Total
		Not happy	Fairly happy	Very happy	
Gender	Female	9	43	34	86
	Male	13	25	16	54
Total		22	68	50	140

Stating your hypotheses, test at the 5% level of significance, whether or not there is evidence of an association between happiness and gender. Show your working clearly.

(10)

Q6, (Jun 2016, Q2)

A new drug to vaccinate against influenza was given to 110 randomly chosen volunteers. The volunteers were given the drug in one of 3 different concentrations, A, B and C, and then were monitored to see if they caught influenza. The results are shown in the table below.

	A	B	C
Influenza	12	29	9
No influenza	15	23	22

Test, at the 10% level of significance, whether or not there is an association between catching influenza and the concentration of the new drug. State your hypotheses and show your working clearly. You should state your expected frequencies to 2 decimal places.

(10)

Q7, (Jun 2017, Q4)

A psychologist carries out a survey of the perceived body weight of 150 randomly chosen people. He asks them if they think they are underweight, about right or overweight. His results are summarised in the table below.

	Underweight	About right	Overweight
Male	20	22	30
Female	16	28	34

The psychologist calculates two of the expected frequencies, to 2 decimal places, for a test of independence between perceived body weight and gender. These results are shown in the table below.

	Underweight	About right	Overweight
Male	17.28		
Female	18.72		

(a) Complete the table of expected frequencies shown above.

(2)

(b) Test, at the 10% level of significance, whether or not perceived body weight is independent of gender. State your hypotheses clearly.

(7)

The psychologist now combines the male and female data to test whether or not body weight types are chosen equally.

(c) Find the smallest significance level, from the tables in the formula booklet, for which there is evidence of a preference.

(5)