Contingency tables

AS Further Statistics 1 | Edexcel 8FM0 | 12 questions, 93 marks

Further Maths topic practice

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Name: _____ **Date:** _____ **Score:** _____ **/ 93**

1 A survey of 200 pupils recorded how they travel to school and their key stage.

	KS3	KS4	Total
Walk	45	35	80
Car	55	65	120
Total	100	100	200

A test is to be carried out to see whether there is an association between how a pupil travels and their key stage.

a. Find the expected frequency for each cell if there is no association.

b. State the number of degrees of freedom for the test.

(3 marks)

Answer _____

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2 Pupils at a school were asked to choose their favourite sport from four options.

	Football	Netball	Swimming	Tennis	Total
Year 7	22	15	18	10	65
Year 8	25	12	20	13	70
Year 9	18	20	14	13	65
Total	65	47	52	36	200

The PE department wants to test whether favourite sport is independent of year group.

a. Write down suitable hypotheses.

b. Find the expected frequency for Year 8 pupils who choose swimming.

c. State the degrees of freedom and the critical value for a test at the 5% level of significance.

(4 marks)

Answer

3 A random sample of 150 households in a district was asked whether they own a pet. Each household was also classified by whether it is in a town or a village.

	Town	Village	Total
Has a pet	38	22	60
No pet	42	48	90
Total	80	70	150

Test, at the 5% level of significance, whether there is an association between owning a pet and living in a town or a village. State your hypotheses and show your working clearly.

(7 marks)

Answer

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4 A travel agent asked 240 customers where they went on their main holiday last year.

Age group	UK	Europe	Further afield	Total
Under 40	30	52	38	120
40 and over	50	38	32	120
Total	80	90	70	240

Some of the expected frequencies for a test of independence are shown below.

Expected	UK	Europe	Further afield
Under 40	40	45	
40 and over		45	

a. Complete the table of expected frequencies.

b. Test, at the 5% level of significance, whether there is an association between age group and holiday destination. State your hypotheses and the critical value clearly.

(8 marks)

Answer

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5 A school nurse asks pupils how long they usually sleep on a school night.

	Less than 7 h	7 to 8 h	More than 8 h	Total
Year 9	12	30	28	70
Year 11	20	34	16	70
Year 13	25	22	8	55
Total	57	86	52	195

She wants to test whether sleep time is independent of year group.

a. Without calculating every expected frequency, identify the cell with the smallest expected frequency, giving a reason, and calculate it.

b. Explain what this tells the nurse about combining classes.

c. The test statistic is 17.09. Test, at the 1% level of significance, whether sleep time is independent of year group. State your hypotheses and critical value.

(6 marks)

Answer

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6 Pupils at three secondary schools in a city were asked how they usually travel to school.

	Walk	Bus	Car	Cycle	Total
School P	40	25	30	5	100
School Q	28	40	22	2	92
School R	32	35	38	3	108
Total	100	100	90	10	300

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(10 marks)

Answer _____

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7 A café owner records whether each of a random sample of 250 customers bought a hot drink or a cold drink, and the time of day.

	Morning	**Afternoon**	**Evening**	**Total**
Hot drink	64	40	26	130
Cold drink	36	50	34	120
Total	100	90	60	250

The contributions $(O - E)^2/E$ to the test statistic are shown below, correct to 3 decimal places.

	Morning	**Afternoon**	**Evening**
Hot drink	2.769	0.988	0.867
Cold drink	c	1.070	0.939

a. Show that the expected frequency for cold drinks in the morning is 48 and find the value of c.

b. Test, at the 5% level of significance, whether type of drink is independent of time of day. State your hypotheses and the critical value.

c. Use the contributions to describe the association.

(8 marks)

Answer

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8 After a local council election, a researcher asked a random sample of 390 adults whether they had voted.

Age group	18 to 29	30 to 44	45 to 64	65 and over	Total
Voted	30	48	70	62	210
Did not vote	50	52	50	28	180
Total	80	100	120	90	390

Test, at the 1% level of significance, whether there is an association between age group and voting. State your hypotheses and the critical value clearly, and show your working. (9 marks)

Answer

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9 A sixth form college runs a pilot survey asking 40 students whether they prefer online or face to face revision sessions.

Pilot	Year 12	Year 13	Total
Online	14	6	20
Face to face	10	10	20
Total	24	16	40

a. Test, at the 5% level of significance, whether preference is independent of year group.

The college then surveys 120 students and, by chance, every frequency is exactly three times the pilot frequency.

b. Show that the test statistic for the larger survey is three times the test statistic for the pilot, and complete the test at the 5% level.

c. Explain why the test should not be carried out on the percentages of students in each cell.

(10 marks)

Answer

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10 A library service asked a random sample of 270 adults and children how often they visit a library.

Age	Weekly	Monthly	Rarely	Total
Under 18	4	3	5	12
18 to 34	20	26	34	80
35 to 59	30	32	28	90
60 and over	46	24	18	88
Total	100	85	85	270

a. Explain why the Under 18 row must be combined with another row before a test can be carried out, and why combining it with the 18 to 34 row is sensible.

b. Test, at the 5% level of significance, whether frequency of library visits is independent of age. State your hypotheses, the degrees of freedom and the critical value.

c. Describe the association, using the cells that contribute most.

(10 marks)

Answer

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11 A survey of 200 pupils recorded whether they usually have a school dinner or a packed lunch.

	KS3	KS4	Total
School dinner	x	50	
Packed lunch	$90 - x$	60	
Total	90	110	200

For a test of independence, the expected frequency for KS3 pupils having a school dinner is 45.

a. Find the value of x.

b. Test, at the 5% level of significance, whether type of lunch is independent of key stage. State your hypotheses and the critical value.

(8 marks)

Answer _____

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12 A head of maths records, for 190 Year 11 pupils, whether they used practice papers in their revision and the grade they achieved in GCSE Mathematics.

	Grade 4 or below	**Grade 5 or 6**	**Grade 7 or above**	**Total**
Used practice papers	18	42	40	100
Did not	32	38	20	90
Total	50	80	60	190

a. Test, at the 5% level of significance, whether grade achieved is independent of using practice papers. State your hypotheses and the critical value clearly.

b. Identify the two cells with the largest contributions and say what they show.

c. The head of maths says this proves that using practice papers causes higher grades. Comment on this claim.

(10 marks)

Answer _____

End of questions | Total 93 marks

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