

3. The table below shows the population and the number of council employees for different towns and villages.

Town or village	Population	Number of council employees
<i>A</i>	211	10
<i>B</i>	356	2
<i>C</i>	1047	12
<i>D</i>	2463	21
<i>E</i>	4892	16
<i>F</i>	6479	25
<i>G</i>	6571	67
<i>H</i>	6573	45
<i>I</i>	9845	48
<i>J</i>	14 784	34

(a) Find, to 3 decimal places, Spearman's rank correlation coefficient between the population and the number of council employees. (5)

(b) Use your value of Spearman's rank correlation coefficient to test for evidence of a positive correlation between the population and the number of council employees. Use a 2.5% significance level. State your hypotheses clearly. (4)

It is suggested that a product moment correlation coefficient would be a more suitable calculation in this case. The product moment correlation coefficient for these data is 0.627 to 3 decimal places.

(c) Use the value of the product moment correlation coefficient to test for evidence of a positive correlation between the population and the number of council employees. Use a 2.5% significance level. (2)

(d) Interpret and comment on your results from part (b) and part (c). (2)



4. John thinks that a person's eye colour is related to their hair colour. He takes a random sample of 600 people and records their eye and hair colours. The results are shown in Table 1.

		Hair colour				Total
		Black	Brown	Red	Blonde	
Eye colour	Brown	45	125	15	58	243
	Blue	34	90	10	58	192
	Hazel	20	38	16	26	100
	Green	6	29	7	23	65
	Total	105	282	48	165	600

Table 1

John carries out a χ^2 test in order to test whether eye colour and hair colour are related. He calculates the expected frequencies shown in Table 2.

		Hair colour			
		Black	Brown	Red	Blonde
Eye colour	Brown	42.5	114.2	19.4	66.8
	Blue	33.6	90.2	15.4	52.8
	Hazel	17.5	47	8	27.5
	Green	11.4	30.6	5.2	17.9

Table 2

- (a) Show how the value 47 in Table 2 has been calculated. (1)

- (b) Write down the number of degrees of freedom John should use in this χ^2 test. (1)

Given that the value of the χ^2 statistic is 20.6, to 3 significant figures,

- (c) find the smallest value of α for which the null hypothesis will be rejected at the $\alpha\%$ level of significance. (1)

- (d) Use the data from Table 1 to test at the 5% level of significance whether or not the proportions of people in the population with black, brown, red and blonde hair are in the ratio 2:6:1:3
State your hypotheses clearly. (9)



