



1. During a village show, two judges,  $P$  and  $Q$ , had to award a mark out of 30 to some flower displays. The marks they awarded to a random sample of 8 displays were as follows:

Display	$A$	$B$	$C$	$D$	$E$	$F$	$G$	$H$
Judge $P$	25	19	21	23	28	17	16	20
Judge $Q$	20	9	21	13	17	14	11	15

(a) Calculate Spearman's rank correlation coefficient for the marks awarded by the two judges. (6)

After the show, one competitor complained about the judges. She claimed that there was no positive correlation between their marks.

(b) Stating your hypotheses clearly, test whether or not this sample provides support for the competitor's claim. Use a 5% level of significance. (4)

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2. 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)**

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Question 2 continued

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**Question 2 continued**

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4. A quality control manager regularly samples 20 items from a production line and records the number of defective items  $x$ . The results of 100 such samples are given in Table 1 below.

$x$	0	1	2	3	4	5	6	7 or more
Frequency	17	31	19	14	9	7	3	0

**Table 1**

- (a) Estimate the proportion of defective items from the production line. (2)

The manager claimed that the number of defective items in a sample of 20 can be modelled by a binomial distribution. He used the answer in part (a) to calculate the expected frequencies given in Table 2.

$x$	0	1	2	3	4	5	6	7 or more
Expected frequency	12.2	27.0	$r$	19.0	$s$	3.2	0.9	0.2

**Table 2**

- (b) Find the value of  $r$  and the value of  $s$  giving your answers to 1 decimal place. (3)

- (c) Stating your hypotheses clearly, use a 5% level of significance to test the manager's claim. (7)

- (d) Explain what the analysis in part (c) tells the manager about the occurrence of defective items from this production line. (1)

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**Question 7 continued**

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