

#### Question 40

The thicknesses of twenty annual rings of a tree and the corresponding annual rainfall were found to be positively correlated, with a Pearson correlation coefficient of  $r = 0.54$ . The obtained significance probability if zero association between rainfall and ring thickness is assumed, is given by

$$r = 0.54 \quad n = 20$$

$$SP \text{ (obtained direction)} = 0.007.$$

On the basis of these results, comment on the strength of any relationship between annual rainfall and the thickness of annual rings in trees.

[3]

a Reasonably strong relation  
The SP is very small. There would seem to be a relationship between rainfall and ring thickness. On

#### Question 41

In house-to-house surveys of three geographical regions of rural India, data were collected on the incidence of rare oral lesions. Interest lay in seeing whether there was any link between geographical region and the nature of the lesions identified. Shown in the following table is a cross-classification of region against site of lesion, together with the frequencies observed and, in brackets, the expected frequencies if there was no association between the two variables.

		Site of lesion								
		LM	BM	C	G	HP	SP	T	FM	AR
Region	K	0 (0.37)	8 (6.3)	0 (0.37)	0 (0.37)	0 (0.37)	0 (0.37)	0 (0.37)	1 (0.74)	1 (0.74)
	G	1 (0.26)	1 (4.4)	1 (0.26)	1 (0.26)	1 (0.26)	1 (0.26)	1 (0.26)	0 (0.52)	0 (0.52)
	A	0 (0.37)	8 (6.3)	0 (0.37)	0 (0.37)	0 (0.37)	0 (0.37)	0 (0.37)	1 (0.74)	1 (0.74)

Site of lesion: LM = labial mucosa, BM = buccal mucosa, C = commissure, G = gingiva, HP = hard palate, SP = soft palate, T = tongue, FM = floor of mouth, AR = alveolar ridge  
Region: K = Kerala, G = Gujarat, A = Andhra

Summing over all  $3 \times 9 = 27$  cells, an observed  $\chi^2$  value of 22.1 was obtained, giving a significance probability of 0.14 against the chi-squared distribution with  $(3 - 1) \times (9 - 1) = 16$  degrees of freedom. Using a computer, an exact test for zero association resulted in a significance probability of 0.01.

Comment on these two analyses, and any conclusions that may be drawn from them.

[3]