

Question 40 (H11.2, 11.5; B11.2.1, 11.2.4)

A SP of less than 1% does suggest a 'significant' result. We can say that there is a positive association between the two variables, but without a scatter plot we do not know whether or not it is of linear form, so we cannot firmly say that there is high association, for instance. We *cannot* deduce (though it might be true) that high rainfall *causes* thicker annual rings.

[3]

Question 41 (H11.7; B11.4)

The chi-squared analysis is completely uninformative and unreliable. The majority of expected frequencies are less than 1, let alone 5, and so this asymptotic test has been utilized in inappropriate circumstances. Ignore its conclusions.

We can place much more reliance on the conclusions of the exact test. The SP is very low, so we reject the notion that type of lesion is independent of region. It is hard to tell quite what form the association takes, however.

[3]

Question 42 (H11.7; B11.4.2)

The expected frequency is $E = 1606 \times 2292/6188 = 594.9$ so $(O - E)^2/E = 0.0396$. (Your answer may differ slightly if you have rounded in a different place.)

The test statistic $\chi^2 = 0.0918$ should be compared with a chi-squared distribution on 2 degrees of freedom. This is not significant at the 5% level so we have no reason to suppose that the distributions of the two groups differ.

[3]

Question 43 (H12.4, 12.5; B12.3.2, 12.3.3)

(a) The mood transition probabilities from day to day are estimated by

$$\hat{M} = \begin{bmatrix} 27/38 & 11/38 \\ 11/25 & 14/25 \end{bmatrix} = \begin{bmatrix} 0.711 & 0.289 \\ 0.440 & 0.560 \end{bmatrix}.$$

[2]

(b) This result suggests that the Bernoulli model is inadequate: and with fewer runs than expected, this patient apparently tends to stay in the same mood for long periods.

[2]

Question 44 (H12.1, 12.2, 12.6; B4.1.1, 12.2, 12.3.1, 12.4)

All that is expected here are realistic scenarios.

(a) 'A Bernoulli model might be useful for where I work, where the cleaners are a mixture of men and women, and do not seem to have a rota or anything. Every evening it is a toss-up who might appear with $P(\text{woman}) = 0.85$ and $P(\text{man}) = 0.15$.'

[2]

(b) 'The Markov chain model would be good for my interactions with my wife measured every 3 hours. Sometimes we are in a good mood and sometimes rowing. We have long runs of being in the same state with each other. My estimate for M is

$$M = \begin{matrix} & \begin{matrix} \text{OK} \\ \text{Rowing} \end{matrix} \end{matrix} \begin{bmatrix} 0.7 & 0.3 \\ 0.2 & 0.8 \end{bmatrix}.$$

[2]

(c) 'Domestic incidents (bashed thumb, broken cup, light bulb goes) occur in my house completely unexpectedly, roughly once a week.'

[2]