**Contingency tables**

**QUESTION 2.**  **2011**

Some people notice a distinctive smell from their urine after eating asparagus, while others never notice the smell. These differences could arise from variation among people in the chemical profile of the urine (i.e., how compounds from asparagus are metabolised), or from variation in the ability of different people to detect the smell.

A recent paper (Pelchat *et al.* 2010 *Chemical Senses*) reviewed these studies and presented the following data that described variation among four study populations:

|  |  |  |
| --- | --- | --- |
| **Population** | **Number of people that can detect odour** | **Number of people that cannot detect odour** |
| Israel  (Lison *et al*. 1980) | 328 | 0 |
| China  (Hoffenberg 1983) | 96 | 2 |
| USA  (Sugarman and Neelon 1985) | 10 | 5 |
| USA  (Lison *et al*. 1980) | 11 | 10 |

Answer all parts 2A to 2D.

**2A)** What statistical test could you use to detect differences among populations in the perception of the odour? (2 marks)

**2B)** What numbers of people would be expected to smell the odour in each population if all study populations had the same proportion of people able to detect the odour? (4 marks)

**2C)** Conduct the test, and give the value of the test statistic. (4 marks)

**2D)** Is your null hypothesis rejected or retained? (2 marks)

**2E)** In Pelchat *et al.*’s own experiments, only three of the 37 participants could not smell the asparagus odour in urine. Did this differ from the average proportion of people in the above studies that could not detect the odour? (8 marks)

**QUESTION 3.**  **2012**

A fisheries officer was checking whether recreational fishers were aware of the regulations that governed where fishing is allowed around a marine park at Jervis Bay. Boats were approached on a busy holiday weekend at Easter and asked whether they had a map of the marine park and were aware of the location of the sanctuary zones where fishing was prohibited. They were also asked whether they were locals or tourists to the area. The officer collected the following data (number of boats).

|  |  |  |
| --- | --- | --- |
|  | Aware of sanctuary zones | Not aware of sanctuary zones |
| Locals | 28 | 5 |
| Tourists | 12 | 10 |

Answer all parts 3A to 3D.

**3A)** What statistical test could you use to test the hypothesis that tourists and locals differed in their awareness of where they are allowed to fish in the marine park? (2 marks)

**3B)** Conduct the test, and give the value of the test statistic. (8 marks)

**3C)** Is your null hypothesis rejected or retained? (2 marks)

**3D)** Write a paragraph that the fisheries officer could use to explain the results of their test to their manager, with recommendations on what group of people should be targeted for programs aimed at further educated people about the marine park zoning regulations. (8 marks)

**QUESTION 4: 2006**

An ecologist wishes to know if there are differences in habitat preference between four species of lizard. He constructs a series of arenas 1m by 1m and places three habitat types over an equal area: sand, leaf litter, and rock. He then returns 24 hours later and notes which habitat the lizard is in. He uses one lizard in an arena at a time, and conducts trials on 45 different individuals from each species. The number of individuals found in each habitat is as follows:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Sand | Leaf litter | Rock |
| House gecko | 8 | 19 | 18 |
| Barking gecko | 7 | 16 | 22 |
| Snow skink | 18 | 15 | 12 |
| Water skink | 24 | 15 | 6 |

(a) How would you test the null hypothesis “the choice of habitat type is independent of species”. Give reasons for your answer. 5 marks

(b) Based on your answer above, test the null hypothesis and show your full working.

12 marks

(c) Do you reject or accept the null hypothesis? In plain language explain your interpretation of your results.

**QUESTION 4.**  **2014**

A study by CSIRO demonstrated the soil in termite mounds could be used as an indicator of gold in local landscapes. Testing this approach, a geochemist counted the number of soil samples from termite mounds that contained trace amounts of gold and the number lacking any evidence of gold. She obtained the following data from her collection of samples from both Western Australia and the Northern Territory.

|  |  |  |
| --- | --- | --- |
| Gold in sample | Western Australia | Northern Territory |
| Contains gold | 15 | 14 |
| None | 39 | 32 |

Answer all parts 4A to 4D.

**4A)** What statistical test could you use to test the hypothesis that the proportion of samples containing gold differed between Western Australia and Northern Territory? (2 marks)

**4B)** Conduct the test, and give the value of the test statistic. (8 marks)

**4C)** Is your null hypothesis rejected or retained? (2 marks)

**4D)** A researcher in the Northern Territory was convinced that the species of termites in his area were more likely to have gold in their mounds than those found in other areas. With reasons, discuss whether your test supports this conclusion, and whether your test could be used to argue that gold deposits are more frequent in the Northern Territory (8 marks)

**QUESTION 4: 2006**

Gouldian finches (*Erythrura gouldiae*) are endangered, brightly coloured grassfinches living in the area around Katherine, NT. They are polymorphic, having either red, yellow or black faces. Their bills are also either red, yellow or black, but bill colour is not always the same as face colour. You have been commissioned to analyse data on face and bill colouration. From 134 wild-caught birds, you are provided with the following face- and bill-colour data. Is there a significant association between face and bill colour? 20 marks

|  |  |  |  |
| --- | --- | --- | --- |
| **Bill** | **Face** | | |
|  | Black | Red | Yellow |
| Black | 16 | 5 | 6 |
| Red | 19 | 20 | 6 |
| Yellow | 18 | 22 | 22 |