

Alternative Solution for Question 96.3, 97.4, 99.1 and 99.2 With Expected Values Lower Limit 5 Considered

Exercise 96

3. (a) H_0 : The number of emails received on each day follows the assigned distribution. A1 N1 [1]
- (b) $a = 4, b = 5$ A2 N2 [2]

Group the first two columns together and the last two columns together:

Number of emails	0 - 1	2	3 - 5
Expected frequency	12	8	11
Observed frequency	8	6	17

- (c) 2 A1 N1 [1]
- (d) p -value = 0.077845413 (A1) for correct value
 p -value = 0.0778 A1 N2 [2]
- (e) The null hypothesis is not rejected. A1
 As p -value > 0.05. R1 N2 [2]

Exercise 97

4. (a) H_0 : The age of staffs and their number of investment bank accounts are independent. A1 N1 [1]
- (b) $x = 5, y = 4$ A2 N2 [2]

Group the last four columns together:

		Number of investment bank accounts		
		Zero	One to Four	Total
Age	18 to 37	5	13	18
	38 to 57	4	12	16
	58 to 77	11	5	16
	Total	20	30	50

- (c) 2 A1 N1 [1]
- (d) p -value = 0.0171562366 (A1) for correct value
 p -value = 0.0172 A1 N2 [2]
- (e) The null hypothesis is rejected. A1
 As p -value < 0.05. R1 N2 [2]

Exercise 99

1. (a) (i) H_0 : The punctuality of buses and the locations of bus stops are independent. A1 N1
- (ii) H_1 : The punctuality of buses and the locations of bus stops are not independent. A1 N1

[2]

Group the first two columns together and the last two columns together:

		Bus stations	
		A and B	C and D
Arrivals	On time	36	49
	Late	4	11

- (b) 1 A1 N1 [1]

- (c) $\chi^2_{calc} = 1.307189542$ (A1) for correct value

- $\chi^2_{calc} = 1.31$ A1 N2 [2]

- (d) The null hypothesis is not rejected. A1
As $\chi^2_{calc} < 2.706$, the updated critical value. R1 N2 [2]

- (e) (i) The required probability
 $= \frac{20}{100}$ (A1) for correct formula
 $= \frac{1}{5}$ A1 N2

- (ii) The required probability
 $= \frac{1+3+8+3}{100}$ (A1) for correct formula
 $= \frac{3}{20}$ A1 N2

- (iii) The required probability
 $= \frac{19}{19+17+20+29}$ (A1) for correct formula
 $= \frac{19}{85}$ A1 N2

[6]

(f) The required probability

$$= \left(\frac{85}{100} \right) \left(\frac{85-1}{100-1} \right)$$

$$= \frac{119}{165}$$

(A2) for correct formula

A1 N3

[3]

2. (a) (i) H_0 : The number of free lunches offered and the positions of staffs are independent. A1 N1
- (ii) H_1 : The number of free lunches offered and the positions of staffs are not independent. A1 N1
- [2]

Group the first two columns together and the last two columns together:

		Positions	
		Administration and Customer Service	Human Resources and Others
Number of free lunches	0	8	26
	1	9	25
	2	12	4
	3 or more	11	5

- (b) 3 A1 N1 [1]
- (c) p -value = 0.0001608033962 (A1) for correct value
 p -value = 0.000161 A1 N2 [2]
- (d) 20.1 A1 N1 [1]
- (e) The null hypothesis is rejected. A1
 As p -value < 0.05. R1 N2 [2]

- (f) (i) The required probability

$$= \frac{4}{100}$$

$$= \frac{1}{25}$$
(A1) for correct formula
A1 N2
- (ii) The required probability

$$= \frac{2+10+2+2+1+10+3+2}{100}$$

$$= \frac{8}{25}$$
(A1) for correct formula
A1 N2
- (iii) The required probability

$$= \frac{2}{2+10+2+2}$$

$$= \frac{1}{8}$$
(A1) for correct formula
A1 N2
[6]
- (g) The required probability

$$= \binom{68}{100} \binom{68-1}{100-1}$$

$$= \frac{1139}{2475}$$
(A2) for correct formula
A1 N3
[3]