

Introductory Statistics Tutorial Answers

Chapter 11 – Tables of Counts

Section A: One-way Tables

1. (a) H_0 : Relative market shares are the same as they were prior to Channel A altering its programming, ie $p_A = 0.1, p_B = 0.4, p_C = 0.5$.
 H_1 : Relative market shares differ since Channel A altered its programming, ie the proportions are not $p_A = 0.1, p_B = 0.4, p_C = 0.5$.
- (b) Degrees of freedom = $3 - 1 = 2$
- (c) Expected count for Channel A = $0.1 \times 300 = 30$
 Expected count for Channel B = $0.4 \times 300 = 120$
 Expected count for Channel C = $0.5 \times 300 = 150$
- (d) Cell contribution = $\frac{(125 - 120)^2}{120} = 0.2083$
- (e) (i) $P\text{-value} = \text{pr}(\chi^2 \geq 5.0417) = 1 - 0.9196 = 0.0804$
 (ii) There is weak evidence that the altered programming for Channel A has affected relative market shares.
- (f) The results are valid because all of the expected counts are greater than 5.
2. (a) H_0 : The proportions of the types are $p_{BC} = \frac{9}{16}, p_{Bc} = \frac{3}{16}, p_{bC} = \frac{3}{16}, p_{bc} = \frac{1}{16}$.
 H_1 : The proportions of the types are not $p_{BC} = \frac{9}{16}, p_{Bc} = \frac{3}{16}, p_{bC} = \frac{3}{16}, p_{bc} = \frac{1}{16}$.
- (b) Degrees of freedom = $4 - 1 = 3$
- (c) Expected count for type BC = $\frac{9}{16} \times 160 = 90$
- (d) Cell contribution = $\frac{(16 - 30)^2}{30} = 6.5333$
- (e) (i) $P\text{-value} = \text{pr}(\chi^2 \geq 9.8667) = 1 - 0.9803 = 0.0197$
 (ii) There is strong evidence against the types occurring in the ratio 9:3:3:1.

Section B: Two-way Tables

1. (a) H_0 : A person's primary source of news is independent of their age.
 H_1 : There is a relationship between a person's primary source of news and their age.
- (b) Yes. We could consider the samples of people under 30, people in the 30-49 age group and the people in the 50 and over age group as three independent sub-samples and carry out a Chi-square test of homogeneity with the primary news source as the response factor.
- (c) Degrees of freedom = $(3 - 1)(3 - 1) = 2 \times 2 = 4$
- (d) Expected count for the (Under 30, Radio) cell = $\frac{225 \times 250}{1000} = 56.25$
- (e) Cell contribution = $\frac{(100 - 51.625)^2}{51.625} = 45.330$
- (f) The $P\text{-value} = 0.000$ to 3 decimal places.
 We have very strong evidence to suggest that there is a relationship between a person's age and their primary news source.
- (g) The results are valid because all of the expected counts are greater than 5.
2. (a) H_0 : The distribution of the opinions is the same for each group.
 H_1 : The distribution of the opinions is different for at least one group.
- (b) No. This data has been collected as three independent samples and a Chi-square test for independence requires that the data is collected as one random sample.
- (c) Degrees of freedom = $(4 - 1)(3 - 1) = 3 \times 2 = 6$
- (d) Expected count for the (Increase government expenditure, Economists) cell
 $= \frac{64 \times 100}{300} = 21.33$
- (e) (i) Cell contribution = 0.005
 (ii) (Increase government expenditure, Government officials) – more than expected
 (Increase government expenditure, Business executives) – fewer than expected
 (Other business incentives, Business executives) – more than expected
 (iii) The $P\text{-value} = 0.000$ to 3 decimal places.
 There is extremely strong evidence that the opinions of the three groups differ.