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8. $f_{i1} = x_i$ $\qquad f_{i2} = n_i - x_i$

$e_{i1} = n_i\hat{\theta}$ $\qquad e_{i2} = n_i(1-\hat{\theta})$

$$\frac{(f_{i1}-e_{i1})^2}{e_{i1}} + \frac{(f_{i2}-e_{i2})^2}{e_{i2}} = \frac{(x_i - n_i\hat{\theta})^2}{n_i\hat{\theta}} + \frac{(n_i - x_i - n_i(1-\hat{\theta}))^2}{n_i(1-\hat{\theta})}$$

$$= \frac{(x_i - n_i\hat{\theta})^2(1-\hat{\theta}) + (-x_i + n_i\hat{\theta})^2\hat{\theta}}{n_i\hat{\theta}(1-\hat{\theta})}$$

$$= \frac{(x_i - n_i\hat{\theta})^2}{n_i\hat{\theta}(1-\hat{\theta})}$$

Therefore $\displaystyle\sum_{i=1}^{k} \frac{(x_i - n_i\hat{\theta})^2}{n_i\hat{\theta}(1-\hat{\theta})} = \sum_{i=1}^{k}\sum_{j=1}^{2} \frac{(f_{ij}-e_{ij})^2}{e_{ij}}$.

19. Solution in the book

20. P-value .0316

a) Fail to reject H_0 at $\alpha = .01$

b) Reject H_0 at $\alpha = .05$

c) reject H_0 at $\alpha = .1$

33. Solution in the book

34. Probability of at least one type I error: $1-(1-.01)^{48} \approx .3827$
The probability of one (or more) factor being incorrectly associated with cancer is 0.3827. The probability of exactly one factor being incorrectly associated with cancer is $\binom{48}{1}(.01)(.99)^{47} \approx .2993$.