CHI SQUARE TEST OF ASSOCIATION

In Stat Tool open: HW_Chi-Square.dat

A bird watcher thinks that different kinds of birds eat at different times of the day. So one fine day in early spring he fills his back yard feeder with birdseed and begins watching and counting. Table 1 gives the results of his count. He thinks he can tell one individual bird from another and so he never counts a bird twice.

TABLE 1

	MORNING	AFTERNOON	EVENING
Cardinals	4	6	15
Blue Jays	10	14	1
Chickadees	14	5	3
Other	12	10	11

On the basis of the data pattern in Table 1 he concludes that different species of bird have a particular time of day when they do most of their eating.

1. What is the scientific hypothesis? 2. What are the variables, abstractly and operationally?

STATISTICAL CONCLUSION VALIDITY

4. Describe verbally the data pattern. 5. Does this data pattern fit with the scientific hypothesis? 6. Check the statistical conclusion validity at alpha = .05. (Choose and name an appropriate test, state the null and alternative statistical hypotheses, draw a line with appropriate critical value(s) and rejection region(s), calculate the test statistic, and, finally, reject or do not reject the null hypothesis).

Key HW χ^2 Association

1) Scientific Hypothesis is that there is an association between kind of bird and feeding time.

2) Variables are

Abstractly		Operationally
Kind of Bird	—	Cardinals, Blue Jays, Chickadees, other
TIME OF DAY	—	MORNING, AFTERNOON, Evening

3) & 4) ≃ "Different Birds appear to have different feeding times

5) Data Pattern Fits Sci. Hyp.

6) observed Z

4	6	15	25
10	14	1	25
14	5	3	22
12	10	11	33
40	35	30	105

MAKE Expected → table

$$\left(\text{each expected frequency} = \frac{(\text{row total})\cdot(\text{column total})}{\text{total } N}\right)$$

$\frac{25\cdot 40}{105}$	$\frac{25\cdot 35}{105}$	$\frac{25\cdot 30}{105}$
$\frac{25\cdot 40}{105}$	$\frac{25\cdot 35}{105}$	$\frac{25\cdot 30}{105}$
$\frac{22\cdot 40}{105}$	$\frac{22\cdot 35}{105}$	$\frac{22\cdot 30}{105}$
$\frac{33\cdot 40}{105}$	$\frac{33\cdot 35}{105}$	$\frac{33\cdot 30}{105}$

=

[expected]

9.5238	$8.\bar{3}$	7.1429
9.5238	$8.\bar{3}$	7.1429
8.381	$7.\bar{3}$	6.2857
12.571	11	9.429

$$\chi^2 = \sum_j \sum_k \frac{(fo_{jk} - fe_{jk})^2}{fe_{jk}} = \frac{(4-9.5238)^2}{9.5238} + \frac{(6-8.3333)^2}{8.3333} + \frac{(15-7.1429)^2}{7.1429} +$$

$$\frac{(10-9.5238)^2}{9.5238} + \frac{(14-8.3333)^2}{8.3333} + \frac{(1-7.1429)^2}{7.1429} +$$

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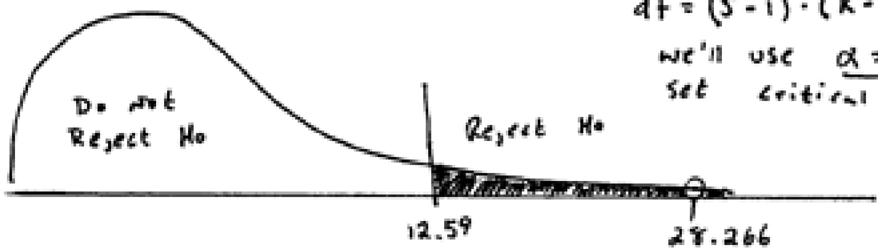
$$+ \frac{(14 - 8.381)^2}{8.381} + \frac{(5 - 7.3333)^2}{7.3333} + \frac{(3 - 6.2857)^2}{6.2857} +$$

$$\frac{(12 - 12.571)^2}{12.571} + \frac{(10 - 11)^2}{11} + \frac{(11 - 9.429)^2}{9.429} = \boxed{28.266}$$

$\underline{\chi^2 = 28.266}$

$dF = (J - 1) \cdot (k - 1) = 6$

we'll use $\underline{\alpha = .05}$ & $dF = 6$ to set critical value.



H_0 : E(observed - expected) = 0

H_a : E (observed - expected) ≠ 0

__Reject__ null hypothesis.