

p. 846

③ Grade	A	B	C	D/F	TOTAL
Counts	22	38	20	11	91

$$P(A) = \frac{22}{91} = 24.2\% \quad P(B) = \frac{38}{91} = 41.8\% \quad P(C) = \frac{20}{91} = 22\% \quad P(D/F) = \frac{11}{91} = 12.1\%$$

TA's: 32% 41% 20% 7%

a) Professor gave fewer A's and more D/F's than the TA.

b) Expected Counts	A	B	C	D/F
	$(.32)(91)$ 29.12	$(.41)(91)$ 37.31	$(.2)(91)$ 18.2	$(.07)(91)$ 6.37

c) Parameters:
 P_A = proportion of students receiving A's
 P_B = proportion of students receiving B's
 P_C = proportion of students receiving C's
 $P_{D/F}$ = proportion of students receiving D's or F's

Inference Test: χ^2 test for Goodness of Fit

Conditions: ① SRS - no reason to assume otherwise

② all expected counts ≥ 1 Condition met (see table)

80% of expected counts ≥ 5 Condition met (see table)

Hypotheses:
 $H_0: P_A = .32 \quad P_B = .41 \quad P_C = .20 \quad P_{D/F} = .07$

H_a : at least one of these proportions is different

③ cont'd

Test Statistic: $\chi^2 = \sum \frac{(\text{obs} - \text{exp})^2}{\text{exp}}$

$$\chi^2 = \frac{(22 - 29.12)^2}{29.12} + \frac{(38 - 37.31)^2}{37.31} + \frac{(20 - 18.2)^2}{18.2} + \frac{(11 - 6.37)^2}{6.37}$$

$$= 1.7409 + 0.01276 + 0.17802 + 3.3653 = 5.297$$

$$df = 3 \quad \alpha = .05$$

$$P(\chi^2 \geq 5.297) = .1513$$



Conclusion:

Since our p-value of .1513 is less than our significance level $\alpha = .05$, we have evidence to fail to reject the null. We have evidence to conclude that the professor's grade distribution does differ from the TA's grade distribution.

④

	Vertical	Tilt 20°	Tilt 40°	Total
obs	31	14	8	53
exp	$\frac{1}{3}(53) = 17.67$	$\frac{1}{3}(53) = 17.67$	$\frac{1}{3}(53) = 17.67$	

Parameters:

- p_v = proportion of bird strikes against a window with no tilt
- p_{20° = proportion of bird strikes against a window with a 20° tilt
- p_{40° = proportion of bird strikes against a window with a 40° tilt

Inference Test: χ^2 test for Goodness of Fit

Conditions: ① SRS - no reason to assume otherwise

② all expected counts ≥ 1 (see table)

80% of expected counts ≥ 5 (see table)

Conditions met

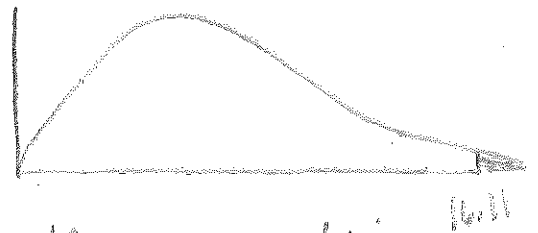
④ cont'd

Hypotheses: $H_0: p_v = p_{30} = p_{40} = \frac{1}{3}$

H_a : at least one of these proportions is different

Test Statistic: $\chi^2 = \sum \frac{(\text{obs} - \text{exp})^2}{\text{exp}} = \frac{(31 - 17.67)^2}{17.67} + \frac{(14 - 17.67)^2}{17.67} + \frac{(8 - 17.67)^2}{17.67}$
 $= 16.11 \quad df = 2 \quad \alpha = .05$

$P(\chi^2 \geq 16.11) = .000318$



Conclusion:

Since our p-value of 0.000318 is smaller than our significance level of .05, we have evidence to reject the null. We can conclude that the proportion of birds hitting windows of different tilt is not the same. Our data show more birds than expected strike the vertical window and fewer than expected strike the window tilted at 40°.