

Quick Questions 20 Nonparametric Hypothesis Testing of Nominal Data

I. Place the number of the formula or expression next to the concept it defines.

- A. $\chi^2 =$ 5
- B. Expected frequency f_e must be 3
- C. f_e for a contingency table equals 2
- D. Chi-square is the ratio of 1
- E. df for use with a contingency table 6
- F. df for a goodness of fit problem 4

| | |
|-------------------------------|--|
| 1. $(n - 1)s$ to σ^2 | 4. $k - 1$ |
| 2. $\frac{f_r \times f_k}{n}$ | 5. $\sum \left[\frac{(f_o - f_e)^2}{f_e} \right]$ |
| 3. ≥ 5 | 6. $(r - 1)(c - 1)$ |

II. Last year, 40% of Linda's customers rented 1 tape, 30% rented 2 tapes, 20% rented 3 tapes, and 10% rented 4 or more tapes. Below is last week's tape rental distribution for Linda's stores. Using the 5-step approach to hypothesis testing, test at the .05 level of significance whether there has been a change in the distribution of tape rentals. Each expected frequency will be the total of 1,000 observations multiplied by last year's appropriate percentage.

| Tape Rental Analysis | | | | | |
|-----------------------------|------------------------------|------------------------------|-----------------|------------------------------|---|
| | Observed Frequency (f_o) | Expected Frequency (f_e) | ($f_o - f_e$) | ($f_o - f_e$) ² | ($f_o - f_e$) ² / f_e |
| 1 tape | 300 | .4 x 1,000 = 400 | -100 | 10,000 | 25.00 |
| 2 tapes | 250 | .3 x 1,000 = 300 | -50 | 2,500 | 8.33 |
| 3 tapes | 250 | .2 x 1,000 = 200 | 50 | 2,500 | 12.50 |
| 4+ tapes | <u>200</u> | .1 x 1,000 = <u>100</u> | 100 | 10,000 | <u>100.00</u> |
| Totals | 1,000 | 1,000 | | | $\chi^2 = 145.83$ |

1. H_0 : defects follow Linda's distribution.
 H_1 : defects do not follow Linda's distribution.
2. The significance level is .05.
3. Chi-square is the test statistic.
4. The decision rule:

 If χ^2 from the test statistic is beyond the critical value, the difference is significant, reject the null hypothesis.
5. Apply the decision rule.

df = k - 1 = 4 - 1 = 3 → $\chi^2 = 7.81$

Reject H_0 because 145.83 > 7.81.
 Last week's distribution does not follow last year's distribution.

III. Is Linda happy with these test results? Why?

Yes. Customers are renting tapes for a longer period than last year. Other things being equal, this means more sales revenue and more profit.