Chi-Square Hypothesis Test

Info about the chi-square hypothesis test

1. First check the following assumptions:
   a. We have two categorical variables.
   b. Observed counts come from a random sample.
   c. Each expected count is at least 5.

2. The null and alternative hypotheses take the form:
   a. \( H_0 \): There is not an association between the variables.
   b. \( H_A \): There is an association between the variables.

3. Make a contingency table that summarizes the two variables. Then find the expected count of each entry in the table using the formula:
   \[
   \text{Expected} = \frac{\text{row total} \times \text{column total}}{\text{table total}}.
   \]
   Before continuing, make sure each expected count is at least 5.

4. Compute the test statistic \( X^2 \) in the following way: for each entry calculate
   \[
   \frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}
   \]
   and then sum these up to get \( X^2 \).

5. We find the P-value of \( X^2 \) using the calculator function \( X^2cdf(a,10^{\infty},df) \), where \( a \) is the test statistic and
   \[
   df = (# \text{ rows} - 1)(# \text{ columns} - 1).
   \]
   For this test, we always compute a right tail.

6. Compare the P-value and the significance level \( \alpha \). If \( P < \alpha \), then we reject the null hypothesis. Otherwise, we fail to reject it.

Performing a chi-square hypothesis test on the TI-83/84

1. Begin by entering the observed counts into a matrix as follows.
   a. Press 2nd \( x^{-1} \) (MATRIX) on newer models, or MATRIX on older models.
   b. Right arrow over to EDIT and hit enter.
   c. Next to MATRIX[A], enter the number of rows followed by the number of columns in the table. Hit Enter. Do not include the “total” row or column!
   d. Input the observed counts into the matrix exactly as they appear in the table.
   e. Use 2nd quit to exit.

2. Run the test as follows.
   a. Go to STAT and right arrow over to TESTS.
   b. Scroll down to \( \chi^2 \)-Test and hit enter.
   c. Down arrow to CALCULATE and hit enter. The calculator displays the \( \chi^2 \) test statistic value, the \( P \)-value, and the degrees of freedom.

3. The expected counts are calculated for you and stored in matrix B. To see the expected counts go again to MATRIX, right arrow over to EDIT, scroll down to [B] and hit enter. Remember, each expected count should at least be 5.