CH 12: Testing the Equality of Population Proportions for Three or more Population Proportions

(A) The pair of hypothesis:

H_0: $p_1 = p_2 = p_3 = ... = p_k$.

H_1: Not all population proportions are equal.

(B) Test Statistic (χ^2-test):

eq12.5: The test stat: $\chi^2 = \sum_i \sum_j \frac{(f_{ij} - e_{ij})^2}{e_{ij}}$

(where f_{ij} is the observed frequency for the cell in row i and column$j$, e_{ij} expected frequency for the cell in row i and column j under the assumption H_0 is true.)

Note1: Select a random sample from each of the populations and recored the observed frequencies, f_{ij} in a table with 2 rows and k columns.

Note2: The expected frequencies $e_{ij} = \frac{(Row\ i\ Total)(Column\ j\ Total)}{Total\ sample\ size}$

Note 3: We set up a table to compute the test statistic

(C) How to use the χ^2 table:

(1) The test statistic has chi-square distribution with $k - 1$ degrees of freedom.

(2) α is the level of significance (upper tail).

(D) We can use either the p-value approach or the critical value approach to make a decision.

EX Suppose that in a particular study we want to compare the customer loyalty for three automobiles. Chevrolet Impala, Ford Fusion, and Honda Accord. The Hypotheses are stated as follows:

H_0: $p_1 = p_2 = p_3$

H_1: Not all population proportions are equal

Sample results of likely to repurchase for three populations of automobile owners are given from the following table:

Find the test statistic and use $\alpha = 0.01$ to make a decision.

(1) Set up a table to find the test statistic: eq12.5: $\chi^2 = \sum_i \sum_j \frac{(f_{ij}-e_{ij})^2}{e_{ij}}$

(2) Use the p-value approach to make a decision.

(3) Use the critical value approach to make a decision.