CHI-SQUARE GOODNESS OF FIT TEST

This test is used to determine if observed counts are equal to a hypothesized distribution.

A researcher believes the Mars Company is misleading the public on its color distribution of M&Ms. He wants to compare the color distribution from a random sample of M&Ms to the Mars Company’s expected values:

<table>
<thead>
<tr>
<th></th>
<th>Brown</th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
<th>Orange</th>
<th>Blue</th>
<th>Purple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>10</td>
<td>8</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Expected</td>
<td>.10 (5)</td>
<td>.20 (10)</td>
<td>.20 (10)</td>
<td>.10 (5)</td>
<td>.10 (5)</td>
<td>.10 (5)</td>
<td>.20 (10)</td>
</tr>
</tbody>
</table>

H  STATE NULL AND ALTERNATIVE HYPOTHESES:

H₀: Color distribution of M&Ms is the same as the company claims

Hₐ: Color distribution of M&Ms is different than the company claims

A  DETERMINE THAT CONDITIONS FOR TEST ARE ACCEPTABLE:

- SRS- unknown although the sample was random
- Counts (not percents)- yes
- Every expected count ≥ 1 and 80% ≥ 5- yes

T  PERFORM TEST:

a) Calculate Chi-Square statistic:

\[ X^2 = \sum \frac{(O_i - E_i)^2}{E_i} = \frac{(4 - 5)^2}{5} + \ldots + \frac{(4 - 10)^2}{10} = 18.0 \]

b) Determine Degrees of Freedom = Number of Categories – 1 = 7 – 1 = 6

c) Determine P-Value

i) Using Table E:

P-value < .01 for \( X^2 \) of 18 and degrees of freedom 6

ii) Using calculator:

\[ \text{DISTR} \Rightarrow 7: X^2 \text{ cdf (18, 100, 6)} \Rightarrow p = .006 \]

S  STATE CONCLUSION IN CONTEXT

There is very good evidence to reject H₀ (p = .006) and conclude that the color distribution of M&Ms is not what the company claims it should be.