April 22 — Hypothesis Testing – M&M’s

1. Advertised distribution of M&M colors:

<table>
<thead>
<tr>
<th>Color</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>brown</td>
<td>13%</td>
</tr>
<tr>
<td>yellow</td>
<td>14%</td>
</tr>
<tr>
<td>red</td>
<td>13%</td>
</tr>
<tr>
<td>blue</td>
<td>24%</td>
</tr>
<tr>
<td>orange</td>
<td>20%</td>
</tr>
<tr>
<td>green</td>
<td>16%</td>
</tr>
</tbody>
</table>

2. The multinomial distribution. \( k + 1 \) parameters: \( n, \pi_1, \ldots, \pi_k \) such that \( \pi_1 + \cdots + \pi_k = 1 \). Interpretation: \( X_1, \ldots, X_k \) have a multinomial distribution if there are \( n \) independent trials of an experiment which can result in one of \( k \) distinct outcomes and \( X_i \) is the number of trials that result in the \( i^{th} \) outcome.

3. Want to test the hypothesis

\[
H_0: \quad \pi_1 = .13 \quad \pi_2 = .14 \quad \pi_3 = .13 \quad \pi_4 = .24 \quad \pi_5 = .20 \quad \pi_6 = .16
\]

or in general the hypothesis

\[
H_0: \quad \pi_1 = \pi_{1,0} \quad \ldots \quad \pi_k = \pi_{k,0}
\]

4. Development of a test statistic. Given the result of the experiment \( x_1, \ldots, x_k \) want a statistic \( T \) that measures deviation of the result from what would be expected if \( H_0 \) is true.

5. Candidate:

6. Decision: reject \( H_0 \) if \( T \) is too large.

7. If the null hypothesis is true then the distribution of \( T \) is approximately a distribution that is called the distribution. It has one parameter \( k - 1 \), called the degrees of freedom.

8. Decision: reject \( H_0 \) if

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Homework, Due Monday, May 2,

1. Read Devore and Farnum 8.3, pages 373-376.
2. Do problems 8.42–44.