**Unit 12, Module 31: Chi-Square Test for 1 Way Tables**

Do M&M’s in our sample suggest that the color distribution is different than the one advertised? According to your textbook, M&M’s claim that there are 13% Brown, 13% Red, 14% Yellow, 24% Blue, 20% Orange and 16% Green. I took the samples we got from earlier in the semester and lumped them ALL together (from everyone in class who participated in the collection of the M&M data) and here is what we got:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Blue** | **Orange** | **Red** | **Brown** | **Green** | **Yellow** | **Total** |
| **Observed** | 245 | 354 | 226 | 250 | 208 | 280 | 1563 |
| **Expected** |   |   |   |   |   |   |   |

If we want to see if our results are out of the ordinary, we compare them to the results we would expect to get. Fill in the Expected Value of each of the colors.

One way of seeing if our results are very different from what the company claims would be to just subtract the values: observed – expected. Try doing that for each of the different colors. What happens when you add them up?

Just like with the standard deviation and the correlation coefficient, we square those results so that we don’t get negative values (and have everything sum to 0!), but we also take them as a fraction out of **what we expect**. We do this so that we can tell if a large difference is really large.

To calculate , we use the formula: 

 is a measure of how different our results are from what is expected in the population. We can use this to measure how likely it would be to get the results we got (our observed values) IF the claim made by the company were true (sound familiar? What does this sound like?).

Can you tell what  would be if our observed values matched the expected values?

Calculate  for our data here:

Now, for us to see if the differences we observed were rare or not, we need to know what the model for  looks like. It turns out that it is skewed to the right (we can talk about why this should make some sense) and depends on degrees of freedom. This time, the degrees of freedom will be one less than the **NUMBER OF CATEGORIES**. They call this “r-1”, where r represents the number of categories. What would that be in our case?

Once we know the degrees of freedom and the value of , we can use a table (or in our case technology) to find the “p-value” and determine whether we think our observed results are so odd that the claim of the company is off.

Let’s use technology and find that p-value!

What should we conclude?

**When are we meant to use** ?

If we are trying to test a claim about a population where the variable of interest is categorical (with many categories) and the following 2 assumptions/conditions are verified:

1. **Random** sample
2. Each of the expected values is greater than or equal to 5

**\*\*Notice!** This test is VERY similar to a Hypothesis Test! Where the Null Hypothesis is the claim that the M&M company makes about the distribution of colors in its candies and the Alternative is that their claim is WRONG! When we look up the value on the chart, it is essentially giving us a p-value and the rules for what we conclude are the same as for Hypothesis Testing.