Use the M&M Candies data set from the Data Hoard found at http://stat.pugetsound.edu/hoard/datasetDetails.aspx?id=1 for this assignment. As always, be sure to read the description of the data set. For this particular assignment, make sure that you use only the peanutplain M&Ms, not the entire data set.

It isn’t clear what population the bags of M&Ms in the data set might be considered to be drawn approximately at random from, so we will just refer to them as the “peanut M&Ms population” and the “plain M&Ms population” in this problem.

Let $\lambda_1$ be the true, unknown proportion of orange M&Ms in the peanut M&Ms population. This is the same as the probability of drawing a orange M&M when you draw at random from the peanut M&Ms population. Let $\lambda_2$ be the true, unknown proportion of orange M&Ms in the plain M&Ms population. This is the same as the probability of drawing a orange M&M when you draw at random from the plain M&Ms population. Let $\Delta \lambda = \lambda_2 - \lambda_1$.

Let $L_1$ be the random variable whose value is the proportion of orange M&Ms in a simple random sample of size 153 drawn from the peanut M&Ms population. As usual, we use $L_1$ as an estimator of $\lambda_1$.

Let $L_2$ be the random variable whose value is the proportion of orange M&Ms in a simple random sample of size 462 drawn from the plain M&Ms population. As usual, we use $L_2$ as an estimator of $\lambda_2$.

Let $\Delta L = L_2 - L_1$. We use $\Delta L$ as an estimator of $\Delta \lambda$.

1. What is the value of the point estimate of $\Delta \lambda$ obtained from $\Delta L$ with this sample?
2. What is the standard error of $\Delta L$ used in computing a 95% confidence interval for $\lambda$?
3. What is the central 0.95 quantile for a standard normal distribution?
4. What is a 95% confidence interval for $\lambda$?
5. You are wondering whether the proportion of orange in the population of peanut M&Ms was the same as the proportion of orange in the population of plain M&Ms in the summer of 2008.

You will now conduct a hypothesis test with

$$H_0 : \Delta \lambda = 0 \quad \text{and} \quad H_a : \Delta \lambda \neq 0.$$ 

As usual, use a significance level of 0.05.

What is the standard error of $\Delta L$ used in this hypothesis test?

6. What approximation of the distribution of $\Delta L$ under the null hypothesis should we use for this hypothesis test?

7. What is $Z$, the standardized value of $L$, for this particular sample?

8. What is the $p$-value of this hypothesis test for this sample? 

9. Did you find statistically significant evidence against the null hypothesis?

10. How should this be interpreted in terms of what it tells you about M&Ms?