

You have been given an unknown number of M&Ms in three colors – white, pink and red. Choose your color for your sampling. Do NOT eat any of your candies until you have completed all steps and trials. Please read all of these instructions before you begin!

Procedure:

1. Take one random sample (without replacement) of 15 M&Ms. Record the number of M&Ms in the color you selected to estimate. Return the M&Ms to your cup and mix up the candies. Repeat this sample 9 more times.

Sample Or Trial #	# in your color	Proportion in your color	Sample or Trial #	# in your color	Proportion in your color
1			6		
2			7		
3			8		
4			9		
5			10		

Calculate the mean proportion and standard deviation of the proportion of your sample in the space above.

2. Take one random sample without replacement of 20 M&Ms. Record the number of M&Ms for your color. Return the M&Ms to your cup and mix up the candies. Repeat this sample 9 more times.

Sample or Trial #	# in your color	Proportion in your color	Sample or Trial #	# in your color	Proportion in your color
1			6		
2			7		
3			8		
4			9		
5			10		

Calculate the same sample statistics as you did for Step 1.

3. Take one random sample without replacement of 25 M&Ms. Record the number of M&Ms for your color. Return the M&Ms to your cup and mix up the candies. Repeat this sample 9 more times.

Sample or Trial #	# in your color	Proportion in your color	Sample or Trial #	# in your color	Proportion in your color
1			6		
2			7		
3			8		
4			9		
5			10		

Calculate the same sample statistics as you did for Step 1.

4. Create a frequency histogram of p 's that you calculated for each of the experiments. You should have 3 histograms, one for each of the 3 experiments.

5. Count your M&Ms – total number in your cup's "population" and the number of your chosen color. Determine the overall p of your population.

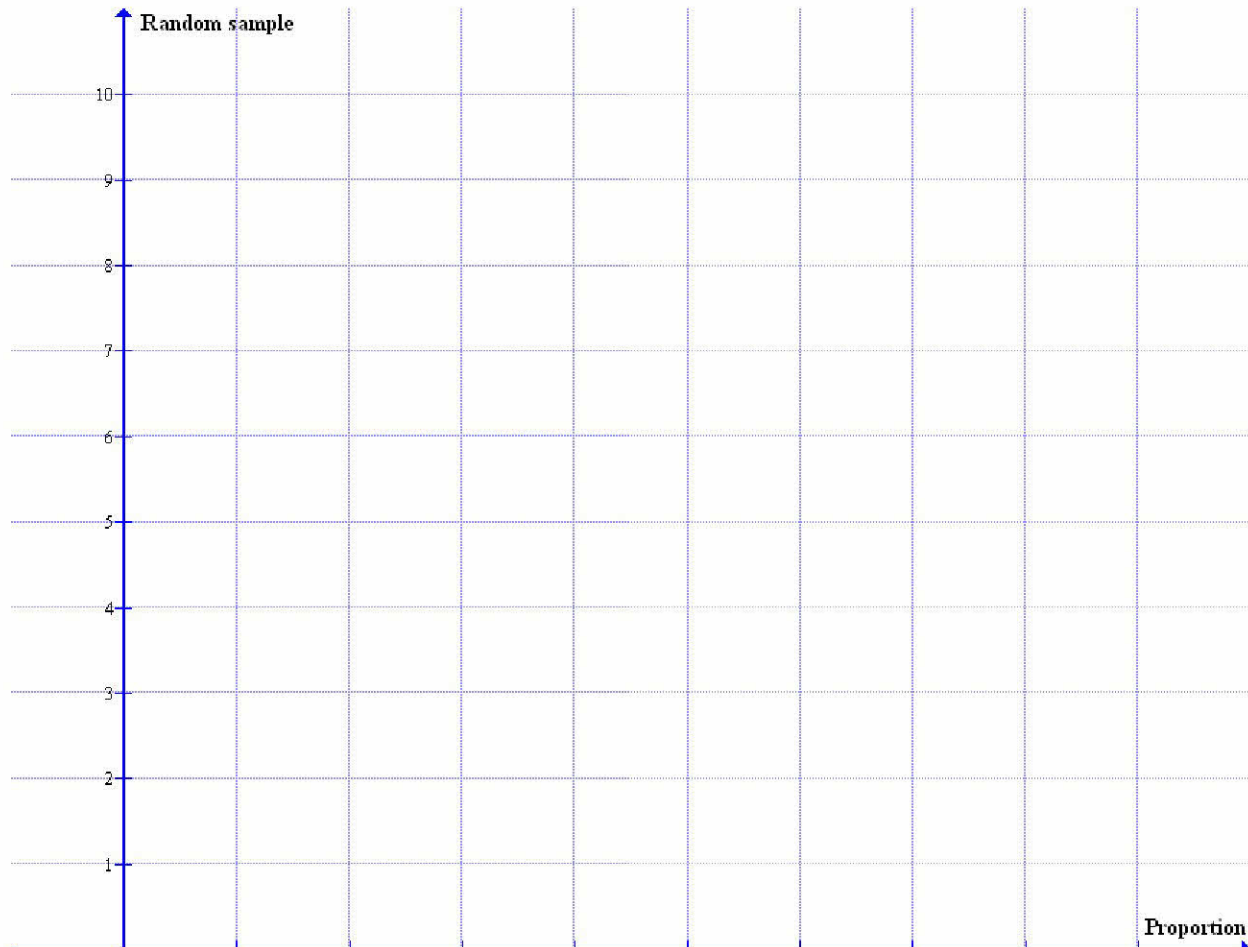
Part II of Estimating the Proportion of M&Ms of a Particular Color

Chosen color is _____

Name _____

Since most of you received between 225 and 250 M&Ms in your packet of candies, we will use the $n = 20$ sample size. For each p value you calculated for your ten random samples, calculate a 95% confidence interval. (You may do your work on the back of this page.)

On the grid paper below, graph each of your ten confidence intervals.



Questions:

- 1) Is there a common value or set of values that falls into each confidence interval?
- 2) Compare your confidence intervals to those of your classmates who choose the same color you selected. Are your results similar?

AP Statistics

**Part III of Estimating the Proportion of M&Ms of a Particular Color:
Hypothesis Testing on M&Ms**

You conducted 10 random samples of size $n = 20$ for your particular color of M&Ms. Based on those 10 samples, you calculated a sample proportion and standard deviation for your sampling distribution. Does this random sample meet the requirements for a normality assumption?

All students who selected the same color for the first two rounds of activity will share their 20-sample outcomes and complete the following table. Record the number of M&Ms in the color (red, pink or white) that you obtained in each of your 10 samples.

Student	# candies in sample	Sample # -- Give the proportion of representative color in each sample.									
		1	2	3	4	5	6	7	8	9	10
Total											

What is the overall proportion for all students with the same color choice of the proportion of candies in that color?

Mars Candy Company, the manufacturer of M&M candies does not publish a color distribution for the holiday-themed candies. Therefore, the reasonable assumption is that the three colors (red, white, pink) are equally distributed, $\pi = 0.333$. Use the statistic you calculated from the large sample to determine a two-tailed hypothesis at the $\alpha = 0.05$ level of significance. What conclusion can you draw from this test?

Teacher notes:

Do this activity in class before you talk about sampling distributions for proportions or means.

This activity works best if you do not use one of the usual types of M&M candies available, but something like the special holiday-themed candies that have fewer colors in a packet. I use the Sweetheart candies because my students do this activity in late January, hence I mention the colors ‘white, pink and red’. If you are doing this in the fall because you are at a block-schedule school, try getting the Halloween theme candies and change the handout as appropriate. Also, the big idea behind this activity is to NOT know the true distribution of the colors in these holiday-themed packages. In general, I have found that the holiday-themed candies are evenly distributed across the colors, but that is what you are to tease out with your students. You can use the regular candies when you study the chi-square distribution.

I also learned last year that giving $\frac{1}{2}$ cup of candies gives between 110 and 125 candies to each student (buy the 14-oz bags of these candies). Since the sample size should be less than 10% of the ‘population’ and you have $np \geq 5$ and $n(1-p) \geq 5$ sampling requirements to meet in order to use an approximately normal distribution, you really need to give a cup of candies to each team of students (2 or 3 students/team, depending upon the size of your classes). I usually end up spending about \$30 on M&Ms for this series of activities, but you’ll find the students get a LOT out of these endeavors.

I did this activity over the period of 2 or 3 weeks (we’re a non-block school). We do the first activity during one class period and discuss it the next day, leading into a discussion of the normal distribution of sample means and proportions. Once students have learned how to construct a confidence interval for proportions, we re-visit this activity and complete Part II. After you have covered the fundamentals in writing hypotheses and conducting hypotheses tests, give the class Part III and ask them to complete it.

Email me if you have any questions: crowland@wcpss.net or msmathwhiz@gmail.com.

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