M and m's

GOODNESS OF FIT WORKSHEET The following is a quote from the Mars Company, maker of M&M candies: We can assure you that the colors are blended mechanically according to the formula. Our present means of color dispensing should place a fairly uniform blend of colors in every package: however, occasionally an unusual assortment of colors may appear.

The theoretical percentages of each color (as given by the M&M company) are:

Red

Yellow

Green

Orange

Blue

Brown

Plain

20

20

10

10

10

30

Peanut

20

20

20

10

0

30

1. Each person will need to buy a package of regular colors, Milk Chocolate M&M's that is at least 4 oz. (colors of red, yellow, green orange, blue, brown) to be used for this project. Exchange your counts with the members of your group to get the total for the group.

Red

Yellow

Green

Orange

Blue

Brown

Total

Yours

18

19

8

13

12

36

106

Group

78

79

38

36

38

123

392

Expected value

2. Group Leader will total the group values, will sum their color and post those totals on the bulletin board. After consulting with the rest of the group on the answers to these questions the leader will need to post these results on the bulletin board and email this completed form to the instructor.

Red

Yellow

Green

Orange

Blue

Brown

Total

Group

78

79

38

36

38

123

392

Expected value

3. Is this frequency data? How can you tell?

Yes, this is frequency data. This is because the data represents the counts for each color (colors of red, yellow, green orange, blue, and brown) for the regular colors (Plain), Milk Chocolate M&M's candies.

4. Write the null and alternative hypotheses. Remember these two statements must include all of the possible outcomes.

H0:

Ha: At least one of the proportions is not equal to the given claimed value.

5. Determine the expected values for all of the M&Ms. Use the number of M&Ms from the whole group.

The expected frequency for each color is calculated using formula: $E = np$

Red

Yellow

Green

Orange

Blue

Brown

Total

Observed value, O

78

79

38

36

38

123

392

Proportion, p

0. 20

0. 20

0. 10

0. 10

0. 10

0. 30

1. 00

Expected value, E

0. 20*392 = 78. 4

78. 4

39. 2

39. 2

39. 2

117. 6

392

6. Compute the Chi-square critical value

There are 6 colors for the Milk Chocolate M&M's candies. Therefore, the

degrees of freedom are

$df = k – 1 = 6 – 1 = 5$

The Chi-square critical value for $\alpha = .05$ with degrees of freedom of 5 is =

11. 07. Therefore, decision rule will be

Reject H0 if $\chi^2 > 11. 07$. Otherwise, do not reject H0.

7. Compute the test statistic value

Table 1 shows the calculation for the χ2 Test Statistic value.

The value of test statistic is

= 0. 5893

Table 1: Calculating the χ2 Test Statistic for the colors of Milk Chocolate

M&M's candies

Color

Observed Frequency O

Expected Frequency E

Red

78

78. 4

-0. 40

0. 16

0. 0020

Yellow

79

78. 4

0. 60

0. 36

0. 0046

Green

38

39. 2

-1. 20

1. 44

0. 0367

Orange

36

39. 2

-3. 20

10. 24

0. 2612

Blue

38

39. 2

-1. 20

1. 44

0. 0367

Brown

123

117. 6

5. 40

29. 16

0. 2480

Total

392

392

= 0. 5893

8. Write a decision about null hypothesis:

Decision: Fail to reject H0.

This is because the test statistic χ2 = 0. 589 is less than the critical value = 11. 07.

9. Write a conclusion about the colors of the M&Ms:

There is not enough evidence to reject the claim about the theoretical percentages of each color given by the M&M Company for the regular colors (Plain), Milk Chocolate M&M's candies.

In conclusion, M&M Company's claim about the proportion for the regular colors (Plain), Milk Chocolate M&M's candies is correct.

10. Put the group names on this handout, post your results (number in each category, hypothesis test steps and conclusion) to the BB and email a copy of the handout to the instructor.

Please write group names

Triola, Mario F. (2011). Elementary statistics using the TI-83/84 plus calculator. (3rd

edition).