



Name: _____ Hour: _____ Date: _____



Lesson 11.2: Day 1: Does gummy bear brand matter?

Is the distribution of gummy bear color the same for Haribo gummy bears and Meijer gummy bears? We'll collect data as a class and determine if we have convincing evidence of a difference.

1. Add your data to the board and fill in the table below with the class totals.

Observed:	Color	Brand		
		Haribo	Meijer	Total
	Red			
	Green			
	Yellow			
	Orange			
	White			
	Total			

2. How many samples do we have? What population are they from? Explain.

2 samples \leftarrow 1 from Haribo population
 \leftarrow 1 from Meijer population

3. How many variables are we examining? Explain.

1 variable \rightarrow Color

4. As a class, write down hypotheses for a significance test.

H_0 : The color distribution is the same for Haribo and Meijer Gummy bears.

H_a : The color distribution is not the same for Haribo and Meijer gummy bears.

5. Now we will use a chi-square test to test if there is a difference between the two populations. We first need to find the expected values. Complete the table below.

Expected:	Color	Brand		
		Haribo	Meijer	Total
	Red			
	Green			
	Yellow			
	Orange			
	White			
	Total			

Fill in totals first

Think proportionately about what the expected amounts are if the distr. is the same (Null)

$$\text{Expected counts} = \frac{\text{Row total} \times \text{Column total}}{\text{Table total}}$$

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6. Use your work on the front page to complete a 4 step significance test.

STATE: Hypotheses:

Significance level: 5%

H_0 : The color distr. is the same for Haribo & Meijer gummy bears.
 H_a : The color distr. is not the same.

PLAN: Name of procedure: Chi-square test for homogeneity

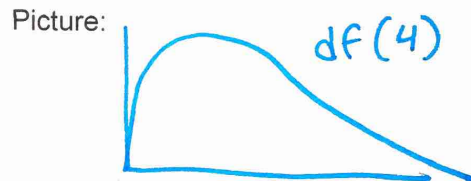
Check conditions: Random - We randomly selected gummies
-10%: $\frac{\text{Haribo Total}}{\text{sample}} < \frac{1}{10} \text{ Haribo Pop.}$ $\frac{\text{Meijer Total}}{\text{sample}} < \frac{1}{10} \text{ Meijer Pop.}$
-large counts: All expected counts ≥ 5 ✓

DO: Specific Formula: $\chi^2 = \sum \frac{(\text{Obs.} - \text{Exp.})^2}{\text{Exp.}}$

Work:

Haribo Red
 $(\quad)^2 + \dots$

$$df = (\text{rows} - 1)(\text{columns} - 1) \\ (5 - 1)(2 - 1) = 4$$



Meijer White
 $+ \dots (\quad)^2 = \chi^2$

Test statistic:

P-value:

CONCLUDE:

7. Explain how this test is different from a chi-square test for goodness of fit?

We have two samples from 2 populations.
 χ^2 GOF has one sample from 1 population.

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Lesson 11.2: Day 1: Chi-Square Test for Homogeneity

<p>Important ideas:</p> <p>LT#1 Hypotheses:</p> <p>H_0: There is no difference in the <u>cat variable</u> distribution for <u>population</u> and <u>population</u>.</p> <p>H_a: There is a difference in the _____ distribution for _____ and _____.</p>	<p>LT#2 Expected Counts & df</p> $\text{Expected Counts} = \frac{\text{Row Total} \times \text{Column Total}}{\text{Table Total}}$ $df = (\text{rows} - 1)(\text{columns} - 1)$ <p>LT#3</p> <p>χ^2 GOF \rightarrow 1 sample, 1 variable</p> <p>χ^2 Homogeneity \rightarrow 2 samples, 1 variable</p>
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Check Your Understanding

For a class project, Abby and Mia wanted to know if the gender of an interviewer could affect the responses to a survey question. The subjects in their experiment were 100 males from their school. Half of the males were randomly assigned to be asked, "Would you vote for a female president?" by a female interviewer. The other half of the males were asked the same question by a male interviewer. The table shows the results.

		Gender of interviewer		
		Male	Female	Total
Response to question	Yes	30	39	69
	No	8	3	11
	Maybe	12	8	20
	Total	50	50	100

(a) State the appropriate null and alternative hypotheses.

H_0 : There is no difference in the distributions of response to the question when asked by a male or female.

H_a : There is a difference in the distributions.

(b) Show the calculation for the expected count in the Male/Yes cell. Then provide a complete table of expected counts.

male/yes: $\frac{50 \times 69}{100} = 34.5$

	M	F
Y	34.5	34.5
N	5.5	5.5
M	10	10

(c) Calculate the value of the chi-square test statistic.

$$\chi^2 = \frac{(30 - 34.5)^2}{34.5} + \dots + \frac{(8 - 10)^2}{10} = 4.25$$