

## TASTE TEST OF GLUTEN FREE CAKE MIXES

### RELEVANT JMP PLATFORMS AND STATISTICAL TECHNIQUES

Graph Builder :	Mosaic Plot
Categorical :	Contingency table Chi-Square analysis, Multiple comparisons, Confidence intervals for proportions
Text Explorer :	Analysis of unstructured text

### PROBLEM STATEMENT

A food product company is interested in offering a gluten-free cake mix to enhance their offerings in that important market. They've developed three test mixes, each a blend of several alternative flours (e.g., almond, rice, sorghum, millet). Ideally, a cake made from these alternatives would very closely match the taste and texture of their traditional wheat flour cake mix. They will move forward with development of one of these mixes if their research shows that at least 80% of consumers would find it as good, or better than, their traditional mix.



They conducted an experiment in which 50 tasters compared cakes made with these three alternative flours to cake made with the standard wheat mix. Across three separate sessions, each taster tasted a cake made with the standard wheat mix and then one made with one of the alternative flour mixes. For each session, the taster indicated whether they thought the alternative mix tasted 'Not as Good', 'Same', or 'Better' than the standard mix. The assignment of the alternative mixes to the sessions was chosen randomly for each taster.

If the taster thought the alternative mix was 'Not as Good' or 'Better Than' than the standard mix, they were asked to describe why.


## DATA SET

Taste\_Test\_of\_Gluten\_Free\_Cake\_Mixes.jmp

Taster	ID of the taster (1, 2, ... , 50)
Formulation	Formulation of the gluten-free mix (F1, F2, F3)
Order	Random assignment of the alternative mixes to the three tasting sessions
Rating	Comparison to standard wheat flour mix ('Not as Good', 'Same', 'Better Than')
Comments	Taster's description of why they rated the alternative gluten-free mix 'Not as Good' or 'Better Than' the standard wheat flour mix

## EXERCISES

1. Create a mosaic plot displaying the percentage of each rating for each formulation. Briefly describe the results.

*Instructions: Launch Graph > Graph Builder. Place 'Rating' on the Y axis, 'Formulation' on the X, and choose the mosaic plot icon. *

*Add the percent values by selecting Label by Percent in the Cell Labeling drop down menu on the left. Set Label Format to Percent with 0 decimal places.*

2. Perform a statistical test to determine if these data provide statistically significant evidence that the distribution of the ratings is not equal across the three formulations. Summarize the conclusion that can be reached from this analysis using non-statistical terminology.  
*Hint: Here and in the other exercises, be careful with your wording so as to state only what can be concluded from the result of the specific statistical test conducted.*

*Instructions: Launch Analyze > Consumer Research > Categorical. Choose 'Rating' for the Response role in the Simple tab. Choose 'Formulation' for the X, Grouping Category. Click OK.*

*In the Categorical report window created, select Test Response Homogeneity under the top red triangle. Examine the p-value for the test. Note: Two test results are shown (Likelihood ratio Chi-Square and Pearsons Chi-Square). For this and the other analyses, use results from Pearson's test.*

*Note: The Fit Y by X platform can also be used to conduct this statistical test. We're using the Categorical platform instead as it provides the opportunity to perform additional analyses in later exercises.*


3. Perform a set of statistical tests to determine if there are significant differences in the distribution of the ratings between each possible pair of formulations. Summarize the results using non-statistical terminology.

*Instructions: In the top red triangle menu, select Compare Each Sample. Examine the p-values for the tests. Note: There are 3 statistical tests being done in this analysis.*

4. Perform a set of statistical tests to determine if there are significant differences between each pair of the formulations in their proportions for each of the three rating levels. Summarize the results using non-statistical terminology.

*Instructions: In the top red triangle menu, select More Cell Options > Compare Each Cell. Examine the p-values for the tests. Note: There are 9 statistical tests being done in this analysis.*

5. Evaluate if the order in which the tasters evaluated each mix had an unwanted impact on their rating. Do you have any concerns? Explain why randomizing the order that the formulations are evaluated is a good strategy in this kind of an experiment.

*Instructions: Launch Graph > Graph Builder. Place 'Rating' on the Y axis, 'Order' on the X, and 'Formulation' on the Group X. Choose the mosaic plot icon. *

*Choose to display the percent labels and conduct a Chi-Square test for each formulation.*

*A test statistic and p-value for each formulation will be displayed testing for a statistical difference in the distribution of the ratings across the order.*

6. Calculate confidence intervals estimating the proportion of a population of consumers who would conclude each of the three ratings for each of the three formulations. Interpret these confidence intervals.

*Instructions: Back in the Categorical platform report, select More Cell Options > Share Confidence Interval under the top red triangle menu. Note: There are 9 confidence intervals that have been added to the table to interpret.*

7. Is there enough statistical evidence at the 95% confidence level to conclude for any of these formulations that over 80% of consumers would find it as good or better than the wheat mix? If not, which mix at least appears to be the most promising for further development?

*Instructions: Hint: Examine the CIs for the 'Not as Good' category and translate that in terms of 'Same or Better Than'.*

8. Examine the comments the testers provided when they thought the mix was either 'Not as Good' or 'Better Than' the standard mix. Identify a few of the common themes for each of the mixes.

*Instructions: Launch Analyze > Text Explorer. Place 'Comments' as the Text Columns and click OK. In the report created, select Local Data Filter under the top red triangle. Select 'Formulation' and 'Rating'. Click the + symbol. Now you can select a specific 'Formulation' and a specific 'Rating' and the data will be filtered to only those rows. Right-click on any of the words and/or phrases in the list and choose Show Text to see the full comments that use the selected word/phrase.*

9. Returning to the 9 confidence intervals created in Exercise 6. How do you feel about the precision in these estimates captured by the interval width? What would be needed in this kind of experiment for them to be more precise?
10. Determine the number of tasters that would be needed to produce confidence intervals that would have a margin of error of  $\pm .05$ .

*Instructions: Launch DOE > Sample Size Explorers > Confidence Intervals > Margin of Error for One Sample Proportion. Set the Proportion in the graph in the lower right to 0.50. Note: This will produce the most conservative answer as this is the proportion where the confidence interval would be widest. Type in the value 0.10 for the Interval Size. Set the Target Variable to Sample Size. Click Go.*

11. Provide any ideas you have for other types of experiments or data that would be valuable to collect.