STAT 110: Homework 5 (20 points) Name(s): _____
Fall 2017

Researchers hypothesized that the use of the word "forbid" versus "allow" might affect people's responses to survey questions. To investigate, a random sample of 117 adults was obtained, and the subjects were randomly assigned to answer one of the following survey questions:

Version 1	Do you think the United States should *forbid* public speeches against democracy?
Version 2	Do you think the United States should *allow* public speeches against democracy?

Even though the questions were worded differently, they are essentially measuring the same opinion. The responses to both questions were used to classify subjects as being either "in favor" or "not in favor" of public speeches against democracy. The following summaries were obtained from the study:

- Total number randomly assigned to the "forbid" version: 58
- Total number randomly assigned to the "allow" version: 59
- Total number who indicated they were "in favor" of public speeches: 78
- Total number who indicated they were "not in favor" of public speeches: 39

1. Write the above row and column totals in the following table. The researchers suspected that people would be more likely to answer that they were "in favor" of public speeches when the word "forbid" was used. Write in the counts in the table that would provide the *most convincing* evidence to support their theory (assume that the row and column totals are fixed). (1 pt)

	In favor of speeches	Not in favor of speeches	Total
Forbid version			
Allow version			
Total			

2. Again, write the above row and column totals in the following table. What counts in the table would we expect to see if the wording of the question had absolutely *no effect* on how people responded? Write these expected values in the following table. (2 pts)

	In favor of speeches	Not in favor of speeches	Total
Forbid version			
Allow version			
Total			

The table of counts obtained in the actual study is given below.

	In favor of speeches	Not in favor of speeches	Total
Forbid version	46	12	58
Allow version	32	27	59
Total	78	39	117

3. Identify both the response variable and the explanatory/predictor variable in this study. (2 pts)

   Response Variable:

   Explanatory/Predictor Variable:

4. Find the proportion of the sample that indicated they were "in favor" of the speeches for each version of the question. (2 pts)

   $\hat{\pi}_{\text{in favor} \mid \text{forbid}} =$

   $\hat{\pi}_{\text{in favor} \mid \text{allow}} =$

5. Sketch the mosaic plot based on your answers to Question 4. (1 pt)

6. Suppose the research question is as follows: *Are people more likely to say they are in favor of public speeches against democracy when the word "forbid" is used in the question than when the word "allow" is used?* Convert this research question into a null and alternative hypothesis. (2 pts)

   H_o:

   H_a:

7. Use JMP to carry out Fisher's exact test to obtain an exact p-value for investigating the research hypothesis from Question 6. What is this p-value? (2 pts)

   p-value: _____

8. Do the researchers' results provide convincing evidence that people are more likely to say they are in favor of public speeches against democracy when the word "forbid" is used in the question? Explain your reasoning. (2 pts)

9. Can the results of this study be used to indicate that the wording of the question truly *influences* people's responses? In other words, does this study provide evidence that there is a *cause-and-effect* relationship between the explanatory and predictor variables in this study? Explain why or why not. (1 pt)

10. In Question 7, you used JMP to find the p-value using Fisher's exact test. Now, use JMP to obtain the necessary output to carry out the chi-square test, instead (note that this is now testing for a difference in the proportion who are "in favor" of the speeches between the two versions). Find both the chi-square test statistic and the associated p-value from this output. (2 pts)

    chi-square test statistic: _____

    p-value from chi-square test: _____

11. Attach the JMP output showing the results of both Fisher's exact test and the chi-square test to your solutions. (1 pt)

12. Verify the value of the chi-square test statistic "by hand." You must show all your work to obtain credit. (2 pts)