Warm Up:
What is the shape, mean and standard deviation of one sample proportions?

Shape: Approx Normal nptaly ≥ 10
Mean: \( \mu = p \)
SD: \( \sigma_p = \sqrt{\frac{p(1-p)}{n}} \)

Learning Goal: I will be able to describe the shape, center, and variability of the sampling distributions for a difference of proportions.

Is Yawning Contagious?

Mythbusters investigated this question. Here's a brief recap. Each subject was placed in a booth for an extended period of time and monitored by hidden cameras. 34 subjects were given a "yawn seed" by one of the experimenters: that is, the experimenter yawned in the subject's presence before leaving the room. The remaining 16 subjects were given no yawn seed.

1.) Draw an outline of Mythbuster's experiment.

50 subjects

2.) Here are the Mythbuster's results:

\[ \begin{array}{c|c|c|c}
 & \text{Yes} & \text{No} & \text{Total} \\
\hline
\text{Yawn seed} & 20 & 24 & 34 \\
\text{No} & 4 & 36 & 40 \\
\text{Total} & 24 & 60 & 84 \\
\hline
\end{array} \]

Call \( p_1 \): the true proportion of people who given the yawn seed will yawn.
Call \( p_2 \): the true proportion of people who given no yawn seed will yawn.

What is the difference in proportions: \( p_1 - p_2 \)?

3.) Do the data provide some evidence that yawning is contagious? Why?

Yes, people given the yawn seed yawned more often than those that were not given seed.

4.) Adam Savage and Jamie Hyneman, the cohosts of Mythbusters used these data to conclude that yawning is contagious. Do you agree?

No, it could happen that people yawn more often by chance.
In this Activity, your class will investigate whether the results of the experiment are statistically significant or if they could have occurred purely by chance due to random assignment.

4.) What is the null hypothesis?

\[ H_0: \hat{p}_1 - \hat{p}_2 = 0 \]

The treatment doesn’t affect whether or not the person yawns.

The 50 people in the experiment are represented by the cards. A person is either a yawner or a non-yawner, no matter which treatment they are randomly assigned.

5.) Shuffle the 50 cards and put them into two piles, one group of 34 that gets the yawn seed and one group of 16 that does not get the yawn seed. Record the proportion of people who yawned in each group. You will do this three times.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Proportion who yawned in yawn seed group, ( \hat{p}_1 )</th>
<th>Proportion who yawned in no yawn seed group, ( \hat{p}_2 )</th>
<th>Difference in proportions, ( \hat{p}_1 - \hat{p}_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td></td>
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<tr>
<td>2</td>
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<td>3</td>
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6.) Make a class dotplot of the difference in proportions. Sketch below:

7.) In what percent of the class’s trials did the difference in proportions equal or exceed 29% - 25% = 4% (what Mythbuster’s got in their experiment)?

\[ \frac{2}{3} \times 0.583 = 0.583 \text{ p-value} \]

8.) What conclusion can you draw about whether yawning is contagious?

Since \( p = 0.583 > 0.05 \), we fail to reject \( H_0 \). We don’t have enough evidence to say yawning contagious.

Shape, Center and spread of the sampling distribution of \( \hat{p}_1 - \hat{p}_2 \)

<table>
<thead>
<tr>
<th>Shape:</th>
<th>Center:</th>
<th>Spread:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximately Normal:</td>
<td>( \hat{\mu}_{\hat{p}_1 - \hat{p}_2} = \hat{p}_1 - \hat{p}_2 )</td>
<td>( \hat{\sigma}_{\hat{p}_1 - \hat{p}_2} = \sqrt{\frac{\hat{p}_1 q_1}{n_1} + \frac{\hat{p}_2 q_2}{n_2}} )</td>
</tr>
</tbody>
</table>
Coursework:
pg 621 # 1-4 and 7-8