**Warm Up:**

What is the sentence for Confidence Intervals?

We are _______ confident that an interval from ______ to ______ captures true (mean/proportion) of ______ (context).

What are the 2 formulas for Confidence Intervals?

Proportions:

\[ \hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \]

Means:

\[ \bar{x} \pm t^* \left( \frac{s}{\sqrt{n}} \right) \]

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**Learning Goals:**

- State appropriate hypotheses for a significance test about a population parameter.
- Interpret a P-Value in context.
- Make an appropriate conclusion for a significance test.
- Interpret a Type I and Type II error in context.
- Give a consequence of each error in a given setting.

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**Is this gender discrimination?**

A local engineering firm had to conduct a series of layoffs recently. They will lay off 10 people. The company has 180 employees that could be laid off. All are equally qualified so the company decides to use a lottery system to be carried out by the manager to decide who will be laid off. The manager posts a list of the employees to be laid off. Five employees are women and 5 are men. One of the women claims this is gender discrimination and starts a lawsuit against the company.

1.) The manager responds, "How could there be gender discrimination when half of the employees laid off were female and half were male?" What additional information do you need to evaluate this statement?

2.) How can you investigate the gender discrimination claim? Detail a process that could be used.
3.) Complete your investigation below:

4.) What percentage of the dots represent half or more females being laid off?

\[ \frac{4}{100} = 0.067 \]

5.) Interpret this percentage in context.

Assuming the lottery was carried out fairly, there is a 0.067 probability of getting a sample proportion of 0.4 or higher.

6.) Do you have convincing evidence of gender discrimination? Explain.

Yes, it did not happen very often.

Conclusions:
- We do not have convincing evidence against the null.
- \( \alpha \): Significance level
- \( p \)-Value < \( \alpha \): Significant

Hypotheses:

<table>
<thead>
<tr>
<th>Null</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>( H_0: \mu = \text{null} )</td>
<td>( H_a: \mu &lt; \text{null} )</td>
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</tbody>
</table>

P-Value: The probability of getting the results or more extreme purely by chance if the null is true.

You have 10 minutes to complete the Check your Understanding then we will go over it! Work with a partner!!

1.) \( H_0: \mu = 1300 \) \( \rightarrow \) true mean daily intake

\( H_a: \mu < 1300 \)

4.) \( 1.404 > \alpha = 0.05 \), we fail to reject \( H_0 \), we don't have convincing evidence against \( H_0 \)
The Wolverine Worldwide (a shoe company in Omaha) improperly disposed of chemicals (PFAS), which have leaked into the ground water. The state’s drinking water limit of 70 parts per trillion (ppt) is considered safe, while anything above 70 ppt is considered dangerous. Officials believe the water in Omaha may be unsafe. They take a random sample of 200 households in Omaha. They find the average lead level of the sample is 70.5 ppt.

1.) State appropriate hypotheses for performing a significance test using words and symbols.
   \[ H_0 : \mu = 70 \text{ ppt}, \text{ the water is safe} \]
   \[ H_a : \mu > 70 \text{ ppt}, \text{ the water is unsafe} \]

2.) After conducting a significance test, a P-value of 0.045 is found. Interpret this value.
   Assuming the water is safe, there is a 4.5% probability of getting a sample mean of 70.5 ppt or more purely by chance.

3.) Based on the P-value, should Omaha keep the current water or switch to bottled water? Explain.
   They should switch since we have \[ 0.045 < 0.05 \]
   convincing evidence for the \[ H_a \].

4.) Let’s suppose this decision is wrong. What would be a consequence of this error?
   They would waste money.

5.) Given the water is safe, how often will this error occur?
   5% of the time

6.) Now suppose the P-value was 0.14. Should the town keep the current water or switch to bottled water?
   Keep current water, we don’t have convincing evidence.
   \[ 0.14 > 0.05 \]

7.) Let’s suppose this decision is wrong. What would be a consequence of this error?
   People could die/get sick.

8.) Are the consequences in question #4 or question #7 more serious. Explain.
   #7, people could die

Errors:

<table>
<thead>
<tr>
<th>Type I Error</th>
<th>Type II Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reject ( H_0 )</td>
<td>Fail to Reject ( H_0 )</td>
</tr>
</tbody>
</table>

Type I Error: The null is true but.....we make the decision. (Occurs by chance \( \alpha \ % \ ))

Type II Error: The alternative hypothesis is true but....we make the wrong decision.
You have 10 minutes to complete the Check your Understanding then we will go over it! Work with a partner!!

Coursework:
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