Warm Up:
What symbol do you use for sample proportions?

\[ \hat{p} \]

Learning Goals:
I will be able to determine whether the conditions are met for doing inference about a difference between two proportions. I will be able to construct and interpret a confidence interval for a difference between two proportions. I will be able to calculate the standardized test statistic and P-Value for a test about a difference between two proportions. I will be able to perform a significance test about a difference between two proportions.

10.1 Comparing Two Proportions Day 2

Which gender uses Twitter more?

A recent random sample of 200 U.S. females revealed 110 use Twitter regularly. A separate random sample of 150 males revealed that 60 use Twitter regularly. Construct a 95% confidence interval for the true difference in proportions who use Twitter regularly (females - males).

State: State the parameter you want to estimate and the confidence level.
Parameter: \( \pi_1 - \pi_2 \rightarrow \text{true difference in prop.} \)
Statistic: \( \hat{p}_1 = \frac{110}{200} = 0.55 \quad \hat{p}_2 = \frac{60}{150} = 0.40 \)
Confidence Level: 95%

Plan: Identify the appropriate inference method and check conditions.
Name of procedure: 2-Sample Z interval for \( \pi_1 - \pi_2 \)
Check Conditions:
Random
SRS-Females
SRS-Males
Large counts:
\( 200(0.55) > 10 \) \( 200(0.45) > 10 \)
\( 150(0.40) > 10 \) \( 150(0.60) > 10 \)
DO: If the conditions are met, perform the calculations.

General Formula: \[ \text{point estimate} \pm M \text{OE} \]

Specific Formula: \[ (\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}} \]

Work: \[ .15 \pm 1.96 \sqrt{\frac{.05(1-.05)}{200} + \frac{.40(1-.40)}{150}} \]

Answer: \[ (.046, .254) \]

CONCLUDE: Interpret your interval in the context of the problem.

Interpret:
We are 95% confident that the interval from .046 to .254 contains the true difference in proportions of females who use Twitter. We estimate that females use Twitter 4.6% to 25.4% more than males.

Are some groups underrepresented?

According to phys.org, Black and Hispanic females are underrepresented in STEM programs compared to non-STEM programs. A certain university would like to see if this is true for their student population. They took a random sample of 300 STEM students and found that 12 were Black or Hispanic females. A separate random sample of 500 non-STEM students had 75 Black or Hispanic females.

Do the data provide convincing evidence that Black and Hispanic females are underrepresented in STEM programs? Use a 5% significance level.
STATE: Parameter: P_1 - P_2, true diff. of proportion of Black-Asian females.
Hypotheses:
H_0: P_1 - P_2 = 0
H_a: P_1 - P_2 < 0
Significance Level: \( \alpha = 0.05 \)

PLAN: Name of procedure: 2-sample Z-test for P_1 - P_2.

Check Conditions:
- Random
- SRS of 300
- SRS of 500

Sample sizes:
- 300 (.04) > 10
- 500 (.15) > 10

Large counts:
- 300 (.04) > 10
- 500 (.15) > 10

You have 10 minutes to check your understanding. Work with a partner!

H_0: P_1 - P_2 = 0
H_a: P_1 - P_2 < 0

Pooled Proportions:
- p = both proportions combined
- \( \bar{p} = \frac{\hat{p}_1 n_1 + \hat{p}_2 n_2}{n_1 + n_2} \)

Mean:
- \( M_{\bar{p}} = \bar{p} \)

Standard Deviation:
- \( S_{\bar{p}} = \sqrt{\frac{\hat{p}_1 (1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2 (1-\hat{p}_2)}{n_2}} \)

Test Statistic:
- \( Z = \frac{(\bar{p}_1 - \bar{p}_2) - (0 - 0)}{S_{\bar{p}} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \)
- \( Z = -4.973 \)

P-Value:
- Normal CDF(-1.644, 9.533, 0.1)

You have 10 minutes to complete the check your understanding. Work with a partner!!!
Coursework:
pg 622 # 12, 14, 16, 18, 24, 26, 29-32
***Quiz next class over 10.1***