Lesson #43 · Topic 3F · Practice

Name _____

1. In a nutrition intervention trial , 382 volunteer nondiabetic subjects aged 55-80 years were randomly assigned to either a Mediterranean diet (experimental group, $n = 248$) or a low-fat diet (control group, $n = 134$). After four years, 10.6% of participants on the Mediterranean diet and 17.9% of participants on the low-fat diet had been diagnosed with diabetes. Let p_1 be the true proportion of adults like those in the study who would be diagnosed with diabetes when following a Mediterranean diet and p_2 be the true proportion of adults like those in the study who would be diagnosed with diabetes when following a low-fat diet.

   a. Define the parameter of interest, $p_1 - p_2$.

   b. Check if the conditions for constructing a confidence interval for $p_1 - p_2$ are met.

2. The Pew Research Center randomly selected 5,733 U.S. adults for a survey about their social media usage. Among the respondents, the proportion who used TikTok was 0.35 for those with a high school diploma and 0.226 for those who were college graduates. A 99% confidence interval for the difference in proportions of U.S. adults who use TikTok (high school diploma $-$ college graduate) is (0.084, 0.164).

   a. Interpret the confidence interval.

   b. Is there convincing statistical evidence that the true proportion of all adults with a high school diploma who use TikTok is greater than the true proportion of all adults with a college degree who use TikTok? Explain.

3. The Center for Disease Control (CDC) conducted a survey of randomly selected U.S. adults about physical activity. Among the respondents, 22.0% of the 1,183 adults living in the South met the recommended daily amounts of physical activity, while 28.5% of the 1,023 adults living in the West met the recommended daily amounts.

   a. Construct and interpret a 95% confidence interval to estimate the true difference in proportions of U.S. adults who meet the recommended amounts of physical activity (South − West).

   b. Does the interval provide convincing statistical evidence that the true proportion of U.S. adults meeting the recommended physical activity guidelines is lower in the South than in the West? Explain.

4. Suppose that a 95% confidence interval is constructed for the true difference in proportions between two independent groups $(p_1 - p_2)$. The sample proportions show that $\hat{p}_1 - \hat{p}_2 = -0.14$. Assume that all conditions have been met. Give a margin of error that would make each conclusion valid. If the conclusion is not valid for any margin of error, explain why.

a. It is plausible that $p_1 - p_2 = 0.05$.

b. There is convincing evidence that $p_1 - p_2 > 0$.

c. There is convincing evidence that $p_1 = p_2$.

d. There is $\underline{\text{not}}$ convincing evidence that $p_1 - p_2 < 0$.

5. A large company selects a simple random sample of 250 employees and asks them whether they prefer first shift, second shift, or third shift. In the sample, 54% of employees prefer first shift, 38% prefer second shift, and 6% prefer third shift. The company wants to construct a 90% confidence interval to estimate the true difference in the proportions between employees who prefer first shift and those who prefer second shift. Which of the following reasons best explains why this procedure is not appropriate?

A) Not each employee was equally likely to be selected.

B) There are more than two categories for preferred shift.

C) The responses were not collected from two independent samples.

D) The company should have averaged the two proportions and constructed a confidence interval for a single proportion instead.

6. A 16-oz candle is expected to burn for at least 60 hours, but Franzi has observed that the brand of candle may influence the burn time. To investigate, she randomly selected 80 16-oz WonderWicks candles and 80 16-oz FlickerFusion candles and burned them continuously. Of the WonderWicks candles, 52 burned for at least 60 hours. Of the FlickerFusion candles, 66 burned for at least 60 hours. Which of the following gives a 95% confidence interval for the difference in the population proportions of 16-oz WonderWicks candles and 16-oz FlickerFusion candles that burn for at least 60 hours? Assume all conditions have been met.

A) $(0.65 - 0.825) \pm 1.96\sqrt{\frac{(0.65)(0.35)}{80} + \frac{(0.825)(0.175)}{80}}$

B) $(0.65 - 0.825) \pm 1.96\sqrt{(0.74)(0.26)\left(\frac{1}{80} + \frac{1}{80}\right)}$

C) $(0.65 - 0.825) \pm 1.96\sqrt{\frac{(0.65)(0.35) + (0.825)(0.175)}{160}}$

D) $(0.65 - 0.825) \pm 1.645\sqrt{\frac{(0.65)(0.35)}{80} + \frac{(0.825)(0.175)}{80}}$