Exploration Supplement for Section 3.2

Work through questions 1 – 5 from Exploration 3.2 on p. 177.

1. Although we expect π to be close to 0.80, we realize there may be other plausible values for the population parameter as well.
   a. Consider the value 0.5. Is this a plausible value for π? Use the **One Proportion** applet to simulate random samples of 1,019 people from such a population to answer this question. (*Hint:* keep in mind that 0.50 is what we are assuming for the population proportion and 0.80 is the observed sample proportion).

   b. Also check the **Summary Stats** box and report the mean and standard deviation of this null distribution.

   c. How many standard deviations is 0.80 from 0.5? (*Hint:* Standardize the value by looking at the difference between 0.8 and 0.5 and divide by the standard deviation you found in part (b).)

2. Determine a 95% confidence interval using the 2SD method:
   a. First find the margin of error: 2 x (standard deviation of your null distribution of sample proportions) using 0.5 in the simulation to estimate the SD.

   b. Use this SD to calculate a 95% confidence interval for π. $\hat{p} \pm 2xSD$

One limitation to this method is that it only applies for a 95% confidence interval. To find a confidence interval using a theory-based approach we will need to estimate the standard deviation of the sample proportion.

$$SE(\hat{p}) = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

3. Calculate the standard error of the sample proportion. How does it compare to the value found in 1b?

4. Using the **Theory-Based Inference applet**, specify the sample size (n) of 1019 and the sample proportion of 0.8 and press **Calculate**. (The applet will fill in the count). Check the box **for Confidence Interval,** confirm the confidence level is 95% and press **Calculate CI** to generate a theory-based confidence interval. Report the 95% theory-based confidence interval.

   The **standard <u>deviation</u> of the sample proportion** is: $SD(\hat{p}) = \sqrt{\frac{\pi(1-\pi)}{n}}$

   The **standard <u>error</u> of the sample proportion** is: $SE(\hat{p}) = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

5. What do each of the symbols in the two quantities above represent in context of this study?

   π

   n

   $\hat{p}$

6. Which quantity ($SD(\hat{p})$ or $SE(\hat{p})$) do we use when calculating the margin of error for a confidence interval for π? when calculating a standardized statistic for testing $H_0: \pi = \pi_0$?

   To estimate a population proportion using a theory-based approach use:

   $$\hat{p} \pm multiplier x SE(\hat{p})$$

   Multipliers used for common confidence levels for categorical variables: (pg. 176)
   - 90% CI = 1.645
   - 95% CI = 1.96
   - 99% CI = 2.576

7. Calculate a 95% confidence interval by hand using your calculated standard error from #3 and a multiplier of 1.96. Compare this interval found with the applet.

8. Calculate a 99% confidence interval by hand using your calculated standard error from #3 and a multiplier of 2.576.

9. Write a sentence interpreting your 99% confidence interval you calculated above in context of the problem.