Lesson #47 · Topic 3G · Practice

Answer Key

1. a. $H_0 : p_J - p_S = 0,\ H_a : p_J - p_S < 0$, where $p_J - p_S =$ the true difference in proportions of juniors and seniors who have their own car
   b. Random samples of 20 juniors and 30 seniors, where the difference in proportions who have their own car is -0.40. This means the proportion for juniors was 0.40 less than the proportion for seniors.
   c. $\hat{p}_J - \hat{p}_S = \frac{5}{20} - \frac{12}{30} = -0.15$. $\frac{23}{120} = 0.19$ of the simulations resulted in a difference in sample proportions of -0.15 or less.
   d. No. Because $0.19 > 0.05$, there is not convincing statistical evidence that the proportion of juniors who have their own car is less than the proportion of seniors who have their own car.

2. a. $H_0 : p_1 - p_2 = 0,\ H_a : p_1 - p_2 > 0$, where $p_1 - p_2$ is the true difference in proportions of adults under 30 and adults between the ages of 31 and 49 in Srihitha's community who use TikTok
   b. Yes. $\frac{45}{100} - \frac{32}{100} = 0.13$ and $0.13 > 0$.
   c. Assuming H_0 is true $(p_1 - p_2 = 0)$, there is a 0.0294 probability of getting a difference in sample proportions of 0.13 or greater purely by chance.
   d. $0.0294 < 0.05$, so she would reject H_0. She does have convincing evidence that the true proportion of adults under 30 in Srihitha's community who use TikTok is greater than the true proportion of adults between the ages of 31 and 49 in Srihitha's community who use TikTok.

3. a. The parameter is defined incorrectly. The AP Statistics teacher wonders if this is true for teachers in her school district, not all females and males. The correct parameter is: $p_f - p_m =$ true difference in proportions of all female and male teachers in this school district who would report that they get as much sleep as they need.
   b. The p -value is calculated assuming that the null hypothesis is true, not the alternative hypothesis. The correct interpretation should say, "...assuming there is no difference in the proportions of female and male teachers in this school district who would report that they get as much sleep as they need."
   c. When the p -value is large, we do not have convincing evidence for the alternative hypothesis. The statement should not make conclusions about the null hypothesis. The correct conclusion is: Because $0.229 > 0.05$, we fail to reject the null and there is not convincing evidence that the female teachers in this school district are less likely to report that they get as much sleep as they need than the male teachers in this school district.

4. a. Assuming H_0 is true $(H_0 : p_A = p_B)$, there is a 0.128 probability of getting the observed $\hat{p}_A - \hat{p}_B$ or more extreme in either direction purely by chance.
   b. The p -value would be half of the original since the test is now one-sided. The new p -value would be 0.064.

5. a. Mean = $0.27 - 0.34 = -0.07$

   SD = $\sqrt{\frac{0.27(0.73)}{40} + \frac{0.34(0.66)}{50}} = 0.097$

   Shape is approximately normal because 40(0.27) = 10.8, 40(0.73) = 29.2, 50(0.34) = 17, and 50(0.66) = 33 are all $\geq$ 10.

   b. $P(\hat{p}_1 - \hat{p}_2 > 0) = 0.2358$

   c. If the true difference in proportions of in-person and fully remote employees at this company who would admit to napping during work hours is -0.07 , there is a 0.2358 probability of getting a difference of $\hat{p}_1 - \hat{p}_2$ of 0 or greater purely by chance.

6. C

7. D