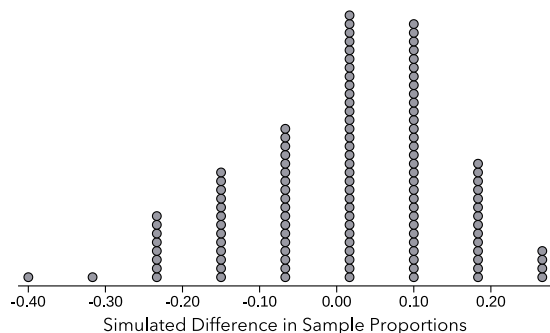


1. The AP Statistics students at a large high school conducted a survey among juniors and seniors to determine if a lower proportion of juniors have their own car than seniors. From a random sample of 20 juniors, 5 responded that they did have their own car. From a random sample of 30 seniors, 12 responded that they did have their own car.

- a. State appropriate hypotheses for performing a hypothesis test. Be sure to define your parameter of interest.

- b. The AP Statistics students used technology to carry out a simulation of 120 trials, each with 20 juniors and 30 seniors, assuming there is no difference in the proportions of students in each grade level who have their own car (juniors – seniors). The results of the simulation are displayed in the dotplot. What does the dot above -0.40 represent?



- c. Calculate the difference in proportions for the samples taken by the AP Statistics students. Based on the dotplot, what is the probability of getting this difference in proportions or less?
- d. Does the result in part (c) provide 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. According to Pew Research Center, adults under age 30 are more likely to use TikTok than adults between the ages of 31 and 49. Srihitha wants to investigate this claim for the people her large community. She randomly selects 100 adults under age 30 and finds that 45 use TikTok. From a separate random sample of 100 adults between the ages of 31 and 49, she finds that 32 use TikTok.
- State the null and alternative hypotheses.
 - Do the data collected from Srihitha's community provide some evidence for the alternative hypothesis? Explain.
 - Srihitha calculated a p -value of 0.0294. Interpret the p -value in the context of this problem.
 - Using a significance level of 0.05, what conclusion would Srihitha make?

3. In a recent Gallup poll, survey respondents were asked the following question:

"Do you think the number of hours of sleep you get at night is as much sleep as you need, or do you think you would feel better if you could get more sleep?"

According to the survey results, women were less likely to reply that they get as much sleep as they need than the men. An AP Statistics teacher wonders if this is true for the teachers in her school district, so she selected a random sample of 25 female teachers and 30 male teachers and asked the same question. Of the 25 female teachers, 10 reported that they get as much sleep as they need. Of the 30 male teachers, 15 reported that they get as much sleep as they need. For each part of the hypothesis test, identify and correct the error.

- a. $H_0 : p_f - p_m = 0$, $H_a : p_f - p_m < 0$, where $p_f - p_m$ is the true difference in proportions of all females and males who would report that they get as much sleep as they need.
- b. The p -value of the test is 0.229. This represents the probability of getting the observed difference in proportions or less, assuming female teachers in this school district are less likely to report that they get as much sleep as they need than male teachers in this school district.
- c. Because $0.229 > 0.05$, there is convincing evidence that the female and male teachers in this school district are equally likely to report that they get as much sleep as they need.

4. A math teacher has two forms of the same unit test. He wonders if there is a difference in the proportions of students who would pass the test for each form, so he uses a random method to assign half of his first period class to form A and the other half to form B. He performs a hypothesis test of $H_0 : p_A = p_B$ versus $H_a : p_A \neq p_B$, where p_A is the true proportion of students given form A who would pass the test and p_B is the true proportion of students given form B who would pass the test for students like the ones in his first period class.

The p -value for the test was 0.128.

- Interpret the p -value in context.
- Suppose the sample proportion of students who passed form A was less than the sample proportion of students who passed form B. The AP Statistics teacher considers an alternative hypothesis of $p_A < p_B$. Assuming that everything else stayed the same, what effect would the new alternative hypothesis have on the p -value?

5. According to a recent study, 27% of in-person employees would admit to napping during work hours, compared to 34% of fully remote employees. Assume this claim is true for a large tech company with a mix of in-person and remote employees. The company takes random samples of 40 in-person employees and 50 fully remote employees and give an anonymous survey about napping during work hours. Let $\hat{p}_1$ represent the sample proportion of all in-person employees who would admit to napping during work hours and $\hat{p}_2$ represent the sample proportion of all fully remote employees who would admit to napping during work hours.
- Describe the sampling distribution of $\hat{p}_1 - \hat{p}_2$. Be sure to determine the mean, standard deviation, and shape.
 - Find the probability that the proportion from the random sample of 40 in-person employees is greater than the proportion from the random sample of 50 fully remote employees.
 - Interpret the probability calculated in part (b).

6. A hospital in a large city is investigating whether the proportion of serious injuries is greater over the weekend than during the week. They select a random sample of hospital visits from Friday through Sunday and a separate random sample of hospital visits from Monday through Thursday. From both samples, they record the sample proportion of hospital visits that involved serious injuries. Let p_E represent the true proportion of all weekend hospital visits that involve serious injuries and p_D represent the true proportion of all weekday hospital visits. Which of the following hypotheses are correct for the appropriate hypothesis test?
- A) $H_0 : p_E = p_D, H_a : p_E \neq p_D$
- B) $H_0 : p_E > p_D, H_a : p_E = p_D$
- C) $H_0 : p_E = p_D, H_a : p_E > p_D$
- D) $H_0 : p_E = p_D, H_a : p_E < p_D$
7. A chain restaurant is hoping to increase appetizer sales, so they encourage their servers to promote different appetizers to each table when taking orders. A restaurant manager compared a random sample of orders from Server A to a random sample of orders from Server B and found the difference in sample proportions of orders with appetizer purchases (A – B) was 0.03. A hypothesis test of $H_0 : p_A = p_B$ versus $H_a : p_A > p_B$ was performed. The p -value of the test was 0.058. Which of the following is the correct interpretation of the p -value?
- A) If there is a difference of 0.03 in the proportions of all orders with appetizer purchases for the two servers, the probability of observing that difference is 0.058.
- B) If there is no difference in the proportions of all orders with appetizer purchases for the two servers, the probability of observing a difference of at most 0.03 is 0.058.
- C) If there is no difference in the proportions of all orders with appetizer purchases for the two servers, the probability of observing a difference equal to 0.03 is 0.058.
- D) If there is no difference in the proportions of all orders with appetizer purchases for the two servers, the probability of observing a difference of at least 0.03 is 0.058.