

1. A study was recently conducted in several countries about the importance of social media to democracy. Of 150 people interviewed in the United States, 51 said social media has been a good thing for democracy. Of 100 people interviewed in Spain, 61 said social media has been a good thing for democracy. Stefan will perform a hypothesis test of $H_0 : p_1 - p_2 = 0$ versus $H_a : p_1 - p_2 \neq 0$ where $p_1 - p_2 =$ the true difference in proportions of people who would say that social media has been a good thing for democracy (United States – Spain).
 - a. If H_0 is true, what is true about p_1 and p_2 ?
 - b. Calculate $\hat{p}_c$. What does this proportion represent?
 - c. Use $\hat{p}_c$ to check the Large Counts condition.
 - d. Calculate the standard error of the test statistic for a two-sample z -test for the difference in population proportions.
 - e. Why do we use $\hat{p}_c$ instead of the separate sample proportions?

2. Pew Research Center conducted two separate surveys (in 2022 and in 2023) about concerns over using artificial intelligence (AI) in daily life. In the 2022 survey, 38 percent of a random sample of 1,000 adults were more concerned than excited about using AI in daily life. In the 2023 survey, 52 percent of a random sample of 2,000 adults were more concerned than excited about using AI in daily life. We want to determine if there is a statistically significant difference between the true proportions of all adults who were more concerned than excited about using AI in daily life in these two years.
 - a. Is the Random condition satisfied? Why is this important?
 - b. Is the 10% condition satisfied? Why is this important?
 - c. Check the Large Counts condition. Why is this important?

3. Educational researchers compared two teaching methods for mathematics. Students were randomly assigned to either lectures or collaborative small groups, both taught by the same teacher. In the lecture group, 33 of 75 students received a grade of C or higher on the post-test. In the small-group setting, 47 of 72 students received a C or higher on the post-test. Using $\alpha = 0.05$, is there convincing statistical evidence that these teaching methods differ in the proportion of students who would receive a C or higher on the post-test (lecture – small group)?
- Classify the type of variables and type of study.
 - Identify the correct procedure and state the appropriate hypotheses.
 - Check the conditions for inference.
 - Calculate the test statistic and p -value.
 - State your conclusion in context.
 - Would a 95% confidence interval for the difference in proportions (lecture – small group) contain 0? Explain.

4. The head chef at a large high school believes that the proportion of freshmen who purchase school lunch is greater than the proportion of sophomores. From two separate random samples, 45 of 60 freshmen and 50 of 70 sophomores purchase school lunch. Using a significance level of $\alpha = 0.05$, is there convincing statistical evidence that the proportion of freshmen who purchase lunch at this school is greater than the proportion of sophomores?
5. A local gym wants to determine if daily text reminders increase member attendance. Of 50 members who volunteered to receive reminders, 40 went to the gym at least three days a week for one month. Of 125 members who did not volunteer, 75 went at least three days a week for one month. The local gym wishes to perform a two-sample z -test for a difference in population proportions. Have the conditions for inference been met?
- A) Yes. All conditions for inference have been met.
 - B) No, because there was no random sampling or random assignment.
 - C) No, because the expected number of successes and failures for the text reminder group are too small.
 - D) No, because the expected number of successes and failures for no text reminder group are too small.

6. The Student Government Association (SGA) interviewed separate random samples of 40 juniors and 50 seniors about their preferences for the location of prom. From the samples, 14 juniors and 10 seniors preferred the school gym. Which of the following is the correct test statistic for a two-sample z -test for a difference in population proportions who prefer prom to be in the school gym (juniors – seniors).

A) $z = \frac{14 - 10}{\sqrt{(0.35)(0.20) \left(\frac{1}{40} + \frac{1}{50} \right)}}$

B) $z = \frac{14 - 10}{\sqrt{(0.27)(0.73) \left(\frac{1}{40} + \frac{1}{50} \right)}}$

C) $z = \frac{0.35 - 0.20}{\sqrt{(0.27)(0.73) \left(\frac{1}{40} + \frac{1}{50} \right)}}$

D) $z = \frac{0.35 - 0.20}{\sqrt{(0.50)(0.50) \left(\frac{1}{40} + \frac{1}{50} \right)}}$