

AP Statistics - HTP: Hypothesis Tests for Proportions

AP Statistics Hypothesis Tests for Proportions (HTP) - 16 questions

16 Questions | 32 min

1. A truant officer believes that the percentage of students skipping school during the World Series is even greater than the previously claimed 7 percent. She conducts a hypothesis test on a random sample of 200 students and finds 23 guilty of truancy. Is this strong evidence against the 0.07 claim?

- (A) Yes, because the P-value is 0.0062
- (B) Yes, because the P-value is 2.5
- (C) No, because the P-value is only 0.0062
- (D) No, because the P-value is over 0.10
- (E) There is insufficient information to reach a conclusion.

2. New York State law limits the decibel level of truck horns. A major truck manufacturer claims that only 35 percent of trucks on the road are even capable of a horn decibel level at or over the legal limit. However, a congressional investigator believes the true percentage is greater and runs a hypothesis test at the 5% significance level. If 57 out of a simple random sample (SRS) of 150 trucks have horns capable of decibel blasts over the legal limit, what is the appropriate test statistic?

- (A) $z = \frac{0.38 - 0.35}{\sqrt{150(0.35)(1 - 0.35)}}$
- (B) $z = \frac{0.38 - 0.35}{\sqrt{150(0.38)(1 - 0.38)}}$
- (C) $z = \frac{0.38 - 0.35}{\sqrt{\frac{(0.35)(1-0.35)}{150}}}$
- (D) $z = \frac{0.38 - 0.35}{\sqrt{\frac{(0.38)(1-0.38)}{150}}}$
- (E) $z = 1.96 \frac{0.38 - 0.35}{\sqrt{150(0.35)(1 - 0.35)}}$

3. It is claimed that 54 percent of lost remote controls are stuck between sofa cushions. A reporter tests this claim by checking a simple random sample (SRS) of 500 people who lost remote controls, and 280 of them reported finding the remote controls between sofa cushions. With $H_0 : p = 0.54$ and $H_a : p \neq 0.54$, what is the P-value?

(A) $P\left(z > \frac{0.56 - 0.54}{\sqrt{500(0.54)(1 - 0.54)}}\right)$

(B) $2P\left(z > \frac{0.56 - 0.54}{\sqrt{500(0.54)(1 - 0.54)}}\right)$

(C) $P\left(z > \frac{0.56 - 0.54}{\sqrt{\frac{(0.54)(1-0.54)}{500}}}\right)$

(D) $2P\left(z > \frac{0.56 - 0.54}{\sqrt{\frac{(0.54)(1-0.54)}{500}}}\right)$

(E) $2P\left(z > \frac{0.56 - 0.54}{\sqrt{500(0.56)(1 - 0.56)}}\right)$

4. Two students using the same data perform different significance tests. The first student performs the test $H_0 : p = 0.76$ with $H_a : p \neq 0.76$, while the second student performs the test $H_0 : p = 0.76$ with $H_a : p < 0.76$. Although both use the $\alpha = 0.01$ level of significance, the first student claims there is not enough evidence to reject H_0 , while the second student says there is enough evidence to reject H_0 . Which of the following could have been the value for the test statistic?

- (A) $z = -2.6$ (B) $z = -2.4$ (C) $z = -0.01$ (D) $z = 0.76$ (E) $z = 2.6$

5. A hypothesis test is being run to see if there is significant evidence that fewer than 75 percent of elementary school children regularly eat cereal. In a random sample of 500 elementary school children, 66 percent say they regularly eat cereal. What is the test statistic for the appropriate test?

- (A) $\frac{0.66 - 0.75}{\sqrt{\frac{(0.66)(0.34)}{500}}}$
- (B) $\frac{0.66 - 0.75}{\sqrt{\frac{(0.75)(0.25)}{500}}}$
- (C) $\frac{0.66 - 0.75}{\sqrt{\frac{(0.5)(0.5)}{500}}}$
- (D) $\frac{0.75 - 0.66}{\sqrt{\frac{(0.66)(0.34)}{500}}}$
- (E) $\frac{0.75 - 0.66}{\sqrt{\frac{(0.75)(0.25)}{500}}}$

6. Five years ago, a claim stated, “22 percent of American adults are functionally illiterate.” For her dissertation, a graduate student tests the hypothesis that this percent has gone down, where $H_0 : p = 0.22$ and $H_a : p < 0.22$. An appropriate z-test gives a P-value of 0.18. Is there sufficient evidence at the 10% significance level to say that the proportion of American adults who are functionally illiterate is now less than 22 percent?

- (A) Yes, because $0.18 < 0.22$
- (B) Yes, because $0.18 > 0.10$
- (C) Yes, because $0.10 < 0.22$
- (D) No, because $0.18 < 0.22$
- (E) No, because $0.18 > 0.10$

7. A test of the hypotheses $H_0 : p = 0.4$ versus $H_a : p \neq 0.4$ was conducted using a sample of size $n = 175$. The test statistic was $z = 1.15$. What was the P-value of the test?

- (A) 0.125 (B) 0.25 (C) 0.4 (D) 0.5 (E) 0.75

8. A survey of 850 Europeans reveals that 725 believe that Atlantic bluefin tuna are an endangered animal and should have protections from the fishing industry. In Japan, bluefin tuna are considered a sushi delicacy. In a survey of 720 Japanese, only 216 believe that bluefin tuna are endangered and should be protected. To test at the 5% significance level whether or not the data are significant evidence that the proportion of Japanese who believe that tuna need protection is less than the proportion of Europeans with this belief, a student notes that $\frac{216}{720} = 0.3$ and sets up the following: $H_0 : p = 0.3$ and $H_a : p > 0.3$, where p is the proportion of Europeans who believe that bluefin tuna need protection. Which of the following is a true statement?

- (A) The student has set up a correct hypothesis test.
- (B) Given the large sample sizes, a 1% significance level would be more appropriate.
- (C) A two-sided test would be more appropriate.
- (D) Given that $\frac{725 + 216}{850 + 720} = 0.60$, $H_a : p > 0.60$ would be more appropriate.
- (E) A two-population difference in proportions hypothesis test would be more appropriate.

9. In a random survey of 500 college STEM majors, 315 said they were more interested in being challenged than in receiving high grades. In a random survey of 400 college business majors, 220 said they were more interested in being challenged than in receiving high grades. Is there sufficient evidence to show that the proportion of STEM majors who are more interested in being challenged than in receiving high grades is greater than the proportion of business majors who are more interested in being challenged than in receiving high grades?

- (A) Because $0.63 > 0.55$, there is strong evidence that the proportion of STEM majors who are more interested in being challenged is greater than that of business majors.
- (B) Because $0.0075 < 0.01$, there is very strong evidence that the proportion of STEM majors who are more interested in being challenged is greater than that of business majors.
- (C) Because $0.01 < 0.0329 < 0.05$, there is strong evidence that the proportion of STEM majors who are more interested in being challenged is greater than that of business majors.
- (D) There is insufficient evidence that the proportion of STEM majors who are more interested in being challenged is greater than that of business majors.
- (E) There is insufficient information to determine whether the proportion of STEM majors who are more interested in being challenged is greater than that of business majors.

10. In a well-known basketball study, it was reported that Larry Bird hit a second free throw in 48 out of 53 attempts after the first free throw was missed and hit a second free throw in 251 of 285 attempts after the first free throw was made. Suppose an appropriate test is performed to determine whether there is sufficient evidence to say that the probability that Bird will make a second free throw is different depending on whether or not he made the first free throw. What is the P-value of the appropriate test?

$$(A) P \left(z > \frac{\frac{48}{53} - \frac{251}{285}}{\sqrt{\frac{48+251}{53+285} \left(1 - \frac{48+251}{53+285}\right) \left(\frac{1}{53} + \frac{1}{285}\right)}} \right)$$

$$(B) 2P \left(z > \frac{\frac{48}{53} - \frac{251}{285}}{\sqrt{\frac{48+251}{53+285} \left(1 - \frac{48+251}{53+285}\right) \left(\frac{1}{53} + \frac{1}{285}\right)}} \right)$$

$$(C) P \left(z > \frac{\frac{48}{53} - \frac{251}{285}}{\sqrt{\frac{48}{53} \left(1 - \frac{48}{53}\right) + \frac{251}{285} \left(1 - \frac{251}{285}\right)}} \right)$$

$$(D) 2P \left(z > \frac{\frac{48}{53} - \frac{251}{285}}{\sqrt{\frac{48}{53} \left(1 - \frac{48}{53}\right) + \frac{251}{285} \left(1 - \frac{251}{285}\right)}} \right)$$

$$(E) P \left(z > \frac{\frac{48}{53} - \frac{251}{285}}{\sqrt{(0.5)(1 - 0.5) \left(\frac{1}{53} + \frac{1}{285}\right)}} \right)$$

11. A poll of 800 moviegoers showed 560 liked a new action film, while a poll of 600 moviegoers showed 450 liked the sequel. In a hypothesis test on whether a higher proportion of moviegoers like the sequel than like the original, what is the test statistic?

$$(A) z = \frac{0.7 - 0.75}{\sqrt{(0.7) \frac{1-0.7}{800} + (0.75) \frac{1-0.75}{600}}}$$

$$(B) z = \frac{0.7 - 0.75}{\sqrt{(0.7214)(1 - 0.7214) \left(\frac{1}{800} + \frac{1}{600}\right)}}$$

$$(C) z = \frac{0.7 - 0.75}{\sqrt{800(0.7)(1 - 0.7) + 600(0.75)(1 - 0.75)}}$$

$$(D) z = \frac{0.7 - 0.75}{\sqrt{\frac{(0.725)(1-0.725)}{700}}}$$

$$(E) z = \frac{0.7 - 0.75}{\sqrt{700(0.725)(1 - 0.725)}}$$

12. In independent random samples of 600 men and 500 women, 80 percent of the men and 76 percent of the women say they are satisfied with their physical attractiveness. Is there sufficient evidence to say that the proportion of men who are satisfied with their physical attractiveness is greater than the proportion of women who are satisfied with their physical attractiveness?

- (A) Yes, because the difference in sample proportions, 0.04, is less than 0.05
- (B) Yes, because the probability of observing a difference at least as large as the sample difference, if the two population proportions are the same, is less than 0.05
- (C) Yes, because the probability of observing a difference at least as large as the sample difference, if the two population proportions are the same, is greater than 0.05
- (D) No, because the probability of observing a difference at least as large as the sample difference, if the two population proportions are the same, is less than 0.05
- (E) No, because the probability of observing a difference at least as large as the sample difference, if the two population proportions are the same, is greater than 0.05

13. Are more immigrants coming to America or to Canada? In random surveys of 3,500 Americans and 2,800 Canadians, 525 of the Americans and 474 of the Canadians say they were born in a different country. A test is conducted with $H_0 : p_1 = p_2$ versus $H_a : p_1 \neq p_2$. What is the conclusion at the 5% significance level?

- (A) There is not sufficient evidence that the proportion of all Americans who say they were born in another country is different from the proportion of all Canadians who say they were born in another country because $\hat{p} = \frac{525 + 474}{3500 + 2800} = 0.159 > 0.05$
- (B) There is not sufficient evidence that the proportion of all Americans who say they were born in another country is different from the proportion of all Canadians who say they were born in another country because the P-value is greater than 0.05.
- (C) There is sufficient evidence that the proportion of all Americans who say they were born in another country is different from the proportion of all Canadians who say they were born in another country because the P-value is positive.
- (D) There is sufficient evidence that the proportion of all Americans who say they were born in another country is different from the proportion of all Canadians who say they were born in another country because the P-value is less than 0.05.
- (E) There is sufficient evidence that the proportion of all Americans who say they were born in another country is different from the proportion of all Canadians who say they were born in another country because the P-value is greater than 0.05.

14. In a well-known study, two booths were set up, one on each side of a college campus. One booth sold fine Swiss chocolates for 5 cents each and Hershey chocolate kisses for a penny each. The second booth sold the fine Swiss chocolates for 4 cents each and gave away the Hershey chocolate kisses for free. Both booths limited each student to picking one piece of chocolate. A higher proportion of students bought the Swiss chocolates at the first booth, while a higher proportion of students took the free Hershey chocolate kisses at the second booth. Which of the following test procedures should be used to test for statistical significance?

- (A) A one-sample z-test of proportions because the student body is a single population
- (B) A two-sample z-test for a difference of proportions
- (C) A one-sample t-test of the mean difference of proportions
- (D) A matched pair t-test comparing one booth to the other
- (E) A t-test for the slope of a regression line of proportions sold at one booth versus proportions sold at the other booth

15. A random sample of 120 AP students was asked if they would prefer to have review sessions after school rather than on Saturdays. 67 students expressed a preference for after-school sessions, while 53 expressed a preference for Saturday sessions. A two-sample z-test for the difference of proportions using $\hat{p}_1 = \frac{67}{120}$ and $\hat{p}_2 = \frac{53}{120}$ results in a P-value of 0.035. What was the error in this analysis?

- (A) A two-sided test should have been performed rather than the one-sided test that was performed.
- (B) A one-sample z-test should have been performed rather than the two-sample test.
- (C) A chi-square test of independence would have been the proper test.
- (D) It is not clear whether or not the 10% rule was violated.
- (E) There was no error.

16. A hypothesis test comparing two population proportions results in a P-value of 0.028. Which of the following is a proper conclusion?

- (A) The probability that the null hypothesis is true is 0.028.
- (B) The probability that the alternative hypothesis is true is 0.028.
- (C) The difference in sample proportions is 0.028.
- (D) The difference in population proportions is 0.028.
- (E) None of the above are proper conclusions.