Carrying Out a Test for the Difference of Two Population Proportions Quiz

1. A factory manager selected a random sample of parts produced on an old assembly line and a random sample of parts produced on a new assembly line. The difference between the sample proportion of defective parts made on the old assembly line and the sample proportion of defective parts made on the new assembly line (old minus new) was 0.006. Under the assumption that all conditions for inference were met, a hypothesis test was conducted with the alternative hypothesis being the proportion of defective parts made on the old assembly line is greater than that of the new assembly line. The p-value of the test was 0.018.

Which of the following is the correct interpretation of the p-value?

(A) If there is a difference of 0.018 in the proportions of all defective parts made on the two assembly lines, the probability of observing that difference is 0.006.

(B) If there is a difference of 0.006 in the proportions of all defective parts made on the two assembly lines, the probability of observing that difference is 0.018.

(C) If there is no difference in the proportions of all defective parts made on the two assembly lines, the probability of observing a difference equal to 0.006 is 0.018.

(D) If there is no difference in the proportions of all defective parts made on the two assembly lines, the probability of observing a difference of at least 0.006 is 0.018.

(E) If there is no difference in the proportions of all defective parts made on the two assembly lines, the probability of observing a difference of at most 0.006 is 0.018.

2. Market researchers interviewed a random sample of 60 men and a random sample of 55 women about their preferences for different color designs for the packaging of a certain product. Of those interviewed, 23 men and 28 women preferred color design X.

Which of the following is the correct test statistic for a two-sample z-test for a difference in population proportions for men and women (men minus women) in their preference for color design X ?

(A) $z = \frac{0.51-0.38}{\sqrt{(0.44)(0.56)\left(\frac{1}{55}+\frac{1}{60}\right)}}$

(B) $z = \frac{23-28}{\sqrt{(0.38)(0.51)\left(\frac{1}{60+55}\right)}}$

(C) $z = \frac{23-28}{\sqrt{(0.44)(0.56)\left(\frac{1}{60}+\frac{1}{55}\right)}}$

(D) $z = \frac{0.38-0.51}{\sqrt{(0.44)(0.56)\left(\frac{1}{60+55}\right)}}$

(E) $z = \frac{0.38-0.51}{\sqrt{(0.44)(0.56)\left(\frac{1}{60}+\frac{1}{55}\right)}}$

3. To investigate whether there is a difference in opinion on a certain proposal between two voting districts, A and B, two independent random samples were taken. From district A, 35 of the 50 voters selected were in favor of the proposal, and from district B, 36 of the 60 voters selected were in favor of the proposal.

Which of the following is the test statistic for the appropriate test to investigate whether there is a difference in the proportion of voters who are in favor of the proposal between the two districts (district A minus district B)?

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(A) $\frac{35-36}{\sqrt{\frac{35}{50}+\frac{36}{60}}}$

(B) $\frac{35-36}{\sqrt{\frac{0.7}{50}+\frac{0.6}{60}}}$

(C) $\frac{0.7-0.6}{\sqrt{(0.65)(0.35)\left(\frac{1}{50}+\frac{1}{60}\right)}}$

(D) $\frac{0.7-0.6}{\sqrt{(0.7)(0.6)\left(\frac{1}{50+60}\right)}}$

(E) $\frac{0.7-0.6}{\left(0.7\right)\left(0.6\right)\sqrt{\frac{1}{50}+\frac{1}{60}}}$

4. A sociologist studying teen behavior took independent random samples of students from two high schools, F and G. Of the 80 students selected from High School F, 36 indicated they had seen a certain movie. Of the 72 students selected from High School G, 18 indicated they had seen the movie.

Which of the following is the test statistic for the appropriate test to investigate whether there is a difference in population proportions (High School F minus High School G) ?

(A) $\frac{0.45-0.25}{\sqrt{(0.36)(0.64)\left(\frac{1}{80}+\frac{1}{72}\right)}}$

(B) $\frac{0.45-0.25}{\sqrt{(0.36)(0.64)\left(\frac{1}{80+72}\right)}}$

(C) $\frac{0.45-0.25}{\left(0.45\right)\left(0.25\right)\sqrt{\frac{1}{80}+\frac{1}{72}}}$

(D) $\frac{36-18}{\sqrt{\frac{0.45}{80}+\frac{0.25}{72}}}$

(E) $\frac{36-18}{\sqrt{\frac{0.45+0.25}{80+72}}}$

5. Because library books are read many times, glue is often applied to the spine of a book to keep the pages tight. A glue is considered successful if a book lasts at least 6 months before needing to be reglued. Two brands of glue, G and K, were tested to determine whether there was a difference in the proportion of books lasting at least 6 months. Let p_{G} represent the proportion of books lasting at least 6 months when glued with G, and let p_{K} represent the proportion of books lasting at least 6 months when glued with K. The following hypothesis test was conducted at the significance level of $\alpha = 0.01$.

$\text{H}_0 : p_{\text{G}} = p_{\text{K}}$

$\text{H}_\text{a} : p_{\text{G}} \neq p_{\text{K}}$

All conditions for inference were met, and the resulting p-value was 0.006. Which of the following is the correct decision for the test?

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(A) The p-value is less than α, and the null hypothesis is rejected. There is not convincing evidence to support the claim that the proportion of books lasting at least 6 months when glued with G is different from the proportion of books lasting at least 6 months when glued with K.

(B) The p-value is less than α, and the null hypothesis is rejected. There is convincing evidence to support the claim that the proportion of books lasting at least 6 months when glued with G is different from the proportion of books lasting at least 6 months when glued with K.

(C) The p-value is less than α, and the null hypothesis is not rejected. There is not convincing evidence to support the claim that the proportion of books lasting at least 6 months when glued with G is different from the proportion of books lasting at least 6 months when glued with K.

(D) The p-value is greater than α, and the null hypothesis is rejected. There is convincing evidence to support the claim that the proportion of books lasting at least 6 months when glued with G is different from the proportion of books lasting at least 6 months when glued with K.

(E) The p-value is greater than α, and the null hypothesis is not rejected. There is not convincing evidence to support the claim that the proportion of books lasting at least 6 months when glued with G is different from the proportion of books lasting at least 6 months when glued with K.

6. Market researchers selected a random sample of people from region A and a random sample of people from region B. The researchers asked the people in the samples whether they had tried a new product. The difference between the sample proportions (B minus A) of people in the regions who indicated they had tried the new product was 0.15. Under the assumption that all conditions for inference were met, a hypothesis test was conducted with the alternative hypothesis being that the population proportion of B is greater than that of A. The p-value of the test was 0.34.

Which of the following is the correct interpretation of the p-value?

(A) If the difference in proportions of people who have tried the new product between the two populations is actually 0.15, the probability of observing that difference is 0.34.

(B) If the difference in proportions of people who have tried the new product between the two populations is actually 0.34, the probability of observing that difference is 0.15.

(C) If the proportions of all people who have tried the new product is the same for both regions, the probability of observing a difference of at least 0.15 is 0.34.

(D) If the proportions of all people who have tried the new product is the same for both regions, the probability of observing a difference of at most 0.15 is 0.34.

(E) If the proportions of all people who have tried the new product is the same for both regions, the probability of observing a difference equal to 0.15 is 0.34.

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7. Show all your work. Indicate clearly the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

A random sample of 100 people from region A and a random sample of 100 people from region B were surveyed about their grocery-shopping habits. From the region A sample, 16 percent of the people indicated that they shop for groceries online. From the region B sample, 24 percent of the people indicated that they shop for groceries online.

At the significance level of $\alpha = 0.05$, do the data provide convincing statistical evidence that there is a difference between the two regions for the population proportions of people who shop online for groceries? Complete the appropriate inference procedure to support your answer.

8. Maria has two routes, E and W, she can take when commuting to work. Both routes go through a railroad crossing, and sometimes she needs to stop at the crossing to allow trains to pass. She claims that the proportion of times she needs to stop when taking route E is different from the proportion of times she needs to stop when taking route W. She conducted the following hypothesis test at the significance level of $\alpha = 0.10$.

$H_0 : p_E = p_W$
$H_a : p_E \neq p_W$

In the hypotheses, p_E represents the proportion of times she needs to stop at the crossing when using route E, and p_W represents the proportion of times she needs to stop at the crossing when using route W.

All conditions for inference were met, and the resulting p-value was 0.37. Which of the following is the correct decision for the test?

(A) The p-value is less than α, and the null hypothesis is rejected. There is convincing evidence to support the claim that the proportion of times she needs to stop at the crossing is different for the different routes.

(B) The p-value is greater than α, and the null hypothesis is not rejected. There is convincing evidence to support the claim that the proportion of times she needs to stop at the crossing is the same for the different routes.

(C) The p-value is greater than α, and the null hypothesis is rejected. There is not convincing evidence to support the claim that the proportion of times she needs to stop at the crossing is different for the different routes.

(D) The p-value is greater than α, and the null hypothesis is not rejected. There is not convincing evidence to support the claim that the proportion of times she needs to stop at the crossing is different for the different routes.

(E) The p-value is greater than α, and the null hypothesis is rejected. There is convincing evidence to support the claim that the proportion of times she needs to stop at the crossing is different for the different routes.

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9. Biologists were studying the proportions of cats that had spotted markings on their fur in two populations of cats, C and F. An independent random sample of cats was taken from each population, and the difference between the sample proportions of cats with the spotted markings (C minus F) was 0.62. Under the assumption that all conditions for inference were met, a hypothesis test was conducted with the alternative hypothesis being that the population proportions are not equal. The p-value of the test was 0.01.

Which of the following is the correct interpretation of the p-value?

(A) If the proportions of all cats with spotted markings is the same for both populations, the probability of observing a sample difference of at least 0.62 or at most -0.62 is 0.01.

(B) If the proportions of all cats with spotted markings is the same for both populations, the probability of observing a sample difference of at least 0.62 is 0.01.

(C) If the proportions of all cats with spotted markings is the same for both populations, the probability of observing a sample difference of at most -0.62 is 0.01.

(D) If the difference in proportions of cats with spotted markings between the two populations is actually 0.62, the probability of observing that difference is 0.01.

(E) If the difference in proportions of cats with spotted markings between the two populations is actually 0.01, the probability of observing that difference is 0.62.

10. A political scientist claims that negative advertising on television affects younger voters more than it affects older voters. To test this claim, the scientist obtained data from two random samples of voters categorized into two age-groups, older and younger. The null hypothesis was that there was no difference in the proportions of voters in the two age-groups who would be affected by negative ads. The alternative hypothesis was that the proportion of younger voters affected would be greater than the proportion of older voters affected.

Assuming all conditions for inference were met, the scientist conducted the test at a significance level of $\alpha = 0.05$. The resulting p-value was 0.206. Which of the following is the correct decision for the test?

(A) The p-value is less than α, and the null hypothesis is rejected. There is convincing evidence to support the claim that younger voters are more affected by negative ads than are older voters.

(B) The p-value is less than α, and the null hypothesis is rejected. There is not convincing evidence to support the claim that younger voters are more affected by negative ads than are older voters.

(C) The p-value is greater than α, and the null hypothesis is not rejected. There is convincing evidence to support the claim that younger voters are more affected by negative ads than are older voters.

(D) The p-value is greater than α, and the null hypothesis is rejected. There is convincing evidence to support the claim that younger voters are more affected by negative ads than are older voters.

(E) The p-value is greater than α, and the null hypothesis is not rejected. There is not convincing evidence to support the claim that younger voters are more affected by negative ads than are older voters.