Setting Up a Test for a Population Proportion Quiz

1. In order to make statistical inferences when testing a population proportion p, which of the following conditions verify that inference procedures are appropriate?

I. The data are collected using a random sample or random assignment.
II. The sample size is less than 10 percent of the population size.
III. $np_0 \geq 10$ and $n(1-p_0) \geq 10$ for sample size n and hypothesized proportion p_0.

(A) I only
(B) II only
(C) III only
(D) II and III only
(E) I, II, and III ✓

Answer E

Correct. All three conditions (randomization, independence, and normality) need to be met to make statistical inferences when testing a population proportion.

2. The germination rate is the rate at which plants begin to grow after the seed is planted. A seed company claims that the germination rate for their seeds is 90 percent. Concerned that the germination rate is actually less than 90 percent, a botanist obtained a random sample of seeds, of which only 80 percent germinated. What are the correct hypotheses for a one-sample z-test for a population proportion p ?

(A) $H_0 : p = 0.80$, $H_a : p < 0.80$
(B) $H_0 : p = 0.80$, $H_a : p > 0.80$
(C) $H_0 : p = 0.90$, $H_a : p < 0.90$ ✓
(D) $H_0 : p = 0.90$, $H_a : p > 0.90$
(E) $H_0 : p = 0.90$, $H_a : p \neq 0.90$

Answer C

Correct. The null hypothesis is a statement about the population proportion, which in this case is 0.90. The alternative hypothesis is the botanist's concern that the population proportion is less than 0.90.

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3. A one-sample z-test for a population proportion will be conducted using a simple random sample selected without replacement from a population. Which of the following is a check for independence?

(A) $np_0 \geq 10$ and $n(1 - p_0) \geq 10$ for sample size n and population proportion p_0.

(B) Each sample proportion value is less than or equal to 0.5.

(C) The sample size is more than 10 times the population size.

(D) The population size is more than 10 times the sample size. ✓

(E) The population distribution is approximately normal.

Answer D

Correct. When sampling without replacement, the lack of independence can be ignored if the sample size is small relative to the population size (less than 10%)–that is, if the population size is more than 10 times the sample size.

4. After a tropical storm in a certain state, news reports indicated that 19 percent of households in the state lost power during the storm. A state engineer believes that estimate is too low. The engineer will collect data to perform a hypothesis test on the proportion of all households without power. Which of the following are the appropriate hypotheses for such a test?

(A) $\mathrm{H}_0 : \hat{p} = 0.19$
$\mathrm{H}_\mathrm{a} : \hat{p} < 0.19$

(B) $\mathrm{H}_0 : \hat{p} = 0.19$
$\mathrm{H}_\mathrm{a} : \hat{p} > 0.19$

(C) $\mathrm{H}_0 : p = 0.19$
$\mathrm{H}_\mathrm{a} : p < 0.19$

(D) $\mathrm{H}_0 : p = 0.19$
$\mathrm{H}_\mathrm{a} : p \neq 0.19$

(E) $\mathrm{H}_0 : p = 0.19$
$\mathrm{H}_\mathrm{a} : p > 0.19$ ✓

Answer E

Correct. The engineer believes the actual proportion is higher, so the alternative hypothesis is greater than the population proportion.

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5. Approximately 38 percent of people living in Region W have the blood type O positive. A random sample of 100 people from Region X revealed that 35 people in the sample had the blood type O positive. Consider a hypothesis test to investigate whether the percent of people in Region X with O positive blood is different from that of in Region W. Which of the following is the appropriate null hypothesis for the investigation?

(A) $\mathrm{H}_0 : \hat{p} = 0.35$

(B) $\mathrm{H}_0 : \hat{p} = 0.38$

(C) $\mathrm{H}_0 : p = 0.35$

(D) $\mathrm{H}_0 : p = 0.38$ ✓

(E) $\mathrm{H}_0 : p \neq 0.38$

Answer D

Correct. The null hypothesis is a statement of the population proportion, which in this case is 0.38.

6. Consider a population with population proportion p, and a sample from the population with sample proportion $\hat{p}$. Which of the following describes the purpose of the one-sample z-test?

(A) To estimate the value of $\hat{p}$

(B) To estimate the value of p

(C) To estimate a margin of error for $\hat{p}$

(D) To estimate the probability of observing a value as extreme as $\hat{p}$ given p ✓

(E) To estimate the probability of observing a value as extreme as p given $\hat{p}$

Answer D

Correct. The test statistic for a one-sample z-test is the distance, in units of standard deviations, between the statistic and the given parameter. From that distance, probabilities (a p-value) can be calculated and a claim can be assessed.

7. Studies indicate that about 10 percent of polar bears weigh more than 1,000 pounds. A biologist studying the bears thinks that percent might be too high. From a random sample of polar bears, the biologist found only 8 percent of the sample weighing over 1,000 pounds. Which of the following is the most appropriate method for the biologist's study?

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(A) A one-sample z-test for a sample proportion

(B) A one-sample z-test for a population proportion ✓

(C) A one-sample z-test for a difference in population proportions

(D) A two-sample z-test for a difference in sample proportions

(E) A two-sample z-test for a difference in population proportions

Answer B

Correct. A one-sample z-test for a population proportion is appropriate to investigate how likely 0.08 is just by chance, assuming the population proportion is 0.10.

8. A recent study indicated that 17 percent of adults in the country actively seek out science news sites to keep current on topics in science. A university researcher believes that percent is too low. From a random sample of adults in the country, the researcher found that 22 percent of the sample actively seek out science news sites. Which of the following is the most appropriate method for the researcher's study?

(A) A two-sample z-test for a difference in population proportions

(B) A two-sample z-test for a difference in sample proportions

(C) A one-sample z-test for a difference in population proportions

(D) A one-sample z-test for a sample proportion

(E) A one-sample z-test for a population proportion ✓

Answer E

Correct. A one-sample z-test for a population proportion is appropriate to investigate whether the sample proportion 0.22 provides sufficient evidence that the population proportion is greater than 0.17.

9. For a one-sample test for a population proportion p and sample size n, why is it necessary that np_0 and $n(1-p_0)$ are both at least 10 ?

(A) The sample size must be large enough to support an assumption that the distribution of the population is approximately normal.

(B) The sample size must be large enough to support an assumption that the distribution of the sample is approximately normal.

(C) The sample size must be large enough to support an assumption that the sampling distribution of the sample proportion is approximately normal. ✓

(D) The sample size must be large enough to support an assumption that the observations are independent.

(E) The sample size must be large enough to support an assumption that the sample proportion is an unbiased estimator of the population proportion.

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Answer C

Correct. The condition justifies the assumption that the sampling distribution of $\hat{p}$ is approximately normal.