1. A local arts council has 200 members. The council president wanted to estimate the percent of its members who have had experience in writing grants. The president randomly selected 30 members and surveyed the selected members on their grant-writing experience. Of the 30 selected members, 12 indicated that they did have the experience. Have the conditions for inference with a one-sample z-interval been met?

   (A) Yes, all conditions for inference have been met.

   (B) No, because the sample size is not large enough to satisfy the conditions for normality.

   (C) No, because the sample was not selected at random.

   (D) No, because the sample size is not less than 10 percent of the population size. ✓

   (E) No, because the sample is not representative of the population.

   Answer D

   Correct. The sample size of 30 is greater than 10 percent of the population of 200 and risks violating the independence condition.

2. A city planner wants to estimate the proportion of city residents who commute to work by subway each day. A random sample of 30 city residents was selected, and 28 of those selected indicated that they rode the subway to work. Is it appropriate to assume that the sampling distribution of the sample proportion is approximately normal?

   (A) No, because the size of the population is not known.

   (B) No, because the sample is not large enough to satisfy the normality conditions. ✓

   (C) Yes, because the sample is large enough to satisfy the normality conditions.

   (D) Yes, because the sample was selected at random.

   (E) Yes, because sampling distributions of proportions are modeled with a normal model.

   Answer B

   Correct. The number of successes (people who ride the subway) is greater than or equal to 10. However, because the number of failures, i.e., the number of people who did not ride the subway (2), is less than 10, the conditions for normality are not met.

3. The manager of a magazine wants to estimate the percent of magazine subscribers who approve of a new cover format. To gather data, the manager will select a random sample of subscribers.

   Which of the following is the most appropriate interval for the manager to use for such an estimate?

(A) A two-sample z-interval for a difference between sample proportions

(B) A two-sample z-interval for a difference between population proportions

(C) A one-sample z-interval for a sample proportion

(D) A one-sample z-interval for a population proportion ✓

(E) A one-sample z-interval for a difference between population proportions

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Answer D

Correct. A z-interval is used to estimate a population proportion for a categorical variable. In this case, the population proportion is the proportion of all subscribers who approve of the new format.

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4. The superintendent of a large school district wants to estimate the percent of district residents who support the building of a new middle school. To gather data, the superintendent will select a random sample of district residents.

Which of the following is the most appropriate method for creating such an estimate?

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

(B) A two-sample z-interval for a difference between population proportions

(C) A two-sample z-interval for a population proportion

(D) A one-sample z-interval for a difference between population proportions

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

Answer E

Correct. A z-interval is used to estimate a population proportion for a categorical variable. In this case, the population proportion is the proportion of all district residents who favor building a new school.

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5. A random sample of 80 people was selected, and 22 of the selected people indicated that it would be a good idea to eliminate the penny from circulation. What is the 99 percent confidence interval constructed from the sample proportion $\hat{p}$?

(A) $\quad 0.275 \pm 1.96\sqrt{\frac{(22)(58)}{80}}$

(B) $\quad 0.22 \pm 2.576\sqrt{\frac{(0.275)(0.725)}{80}}$

(C) $\quad 0.275 \pm 2.576\sqrt{\frac{(0.275)(0.725)}{80}}$ ✓

(D) $\quad 0.275 \pm 1.96\sqrt{\frac{(0.275)(0.725)}{80}}$

(E) $\quad 0.22 \pm 2.323\sqrt{\frac{(0.275)(0.725)}{80}}$

Answer C

Correct. The sample proportion is $\frac{22}{80} = 0.275$, and the z-value used to construct a 99 percent confidence interval is 2.576. The confidence interval is

$\hat{p} \pm z^*\sqrt{\frac{(\hat{p})(1-\hat{p})}{n}} = 0.275 \pm 2.576\sqrt{\frac{(0.275)(0.725)}{80}}$.

6. Paul will select a random sample of students to create a 95 percent confidence interval to estimate the proportion of students at his college who have a tattoo. Of the following, which is the smallest sample size that will result in a margin of error of no more than 5 percentage points?

(A) 73

(B) 97

(C) 271

(D) 385 ✓

(E) 1,537

Answer D

Correct. To find the least sample size, the formula for margin of error, $ME = z^*\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$, can be rearranged to solve for n. Because a proportion is not known, the value of 0.5 is used for the sample proportion. The z-value needed for 95% confidence is 1.96. For a 5% margin of error, $n = 0.25\left(\frac{1.96}{0.05}\right)^2 = 384.16$. The least value on the list not less than 384.16 is 385.

7. A school librarian wanted to estimate the proportion of students in the school who had read a certain book. The librarian sampled 50 students from the senior English classes, and 35 of the students in the sample had read the book. Have the conditions for creating a confidence interval for the population proportion been met?

   (A)   Yes, because the sample was selected at random.

   (B)   Yes, because sampling distributions of proportions are modeled with the normal model.

   (C)   Yes, because the sample is large enough to satisfy the normality conditions.

   (D)   No, because the sample is not large enough to satisfy the normality conditions.

   (E)   No, because the sample was not selected using a random method. ✓

Answer E

Correct. The sample should have been chosen randomly from all students at the school, not just from the senior English classes.

8.   Researchers investigating a new drug selected a random sample of 200 people who are taking the drug. Of those selected, 76 indicated they were experiencing side effects from the drug. If 5,000 people took the drug, which of the following is closest to the interval estimate of the number of people who would indicate they were experiencing side effects from the drug at a 90 percent level of confidence?

   (A) $(0.313, 0.447)$

   (B) $(0.324, 0.436)$

   (C) $(65, 87)$

   (D) $(1565, 2235)$

   (E) $(1620, 2180)$ ✓

Answer E

Correct. The 90 percent confidence interval for the proportion of people who would indicate they were experiencing side effects from the drug is $(0.324, 0.436)$. The interval estimate for the number of people who would indicate they were experiencing side effects from the drug is found by multiplying the endpoints of the interval for the proportions by 5,000.

9.   Environmentalists want to estimate the percent of trees in a large forest that are infested with a certain beetle. The environmentalists will select a random sample of trees to inspect.

   Which of the following is the most appropriate method for creating such an estimate?

(A)   A two-sample z-interval for a population proportion

(B)   A one-sample z-interval for a sample proportion

(C)   A one-sample z-interval for a population proportion ✓

(D)   A two-sample z-interval for a difference between sample proportions

(E)   A two-sample z-interval for a difference between population proportions

Answer C

Correct. A z-interval is used to estimate a population proportion for a categorical variable. In this case, the population proportion is the proportion of all trees in the forest that are infested with the beetle.