AP® STATISTICS
2010 SCORING GUIDELINES

Question 3

Intent of Question

The primary goals of this question were to assess students' ability to (1) interpret the meaning of a confidence level; (2) use a confidence interval to test the plausibility of a claim about the value of a population parameter; (3) perform a sample size calculation related to a confidence interval.

Solution

Part (a):

The 95 percent confidence level means that if one were to repeatedly take random samples of the same size from the population and construct a 95 percent confidence interval from each sample, then in the long run 95 percent of those intervals would succeed in capturing the actual value of the population proportion of households in the county that own at least one dog.

Part (b):

No. The 95 percent confidence interval 0.417 ± 0.119 is the interval $(0.298, 0.536)$. This interval includes the value 0.39 as a plausible value for the population proportion of households in the county that own at least one dog. Therefore, the confidence interval does not provide evidence that the proportion of dog owners in this county is different from the claimed national proportion.

Part (c):

The sample proportion is 0.417, and the margin of error is 0.119. Determining the sample size requires solving the equation $0.119 = 1.96 \times \sqrt{\frac{0.417 \times (1-0.417)}{n}}$ for n.

Thus, $n = \frac{1.96^2 \times 0.417 \times (1-0.417)}{0.119^2} \approx 65.95$, so the humane society must have selected 66 households for its sample.

Scoring

Parts (a), (b) and (c) are scored as essentially correct (E), partially correct (P) or incorrect (I).

Part (a) is scored as follows:

Essentially correct (E) if the student provides a correct interpretation of the confidence level in the context of the study. A correct interpretation can take one of two approaches:

1. Based on the concept of repeated sampling, the response must fulfill the following three requirements:
   - Mentions repeated sampling or "in the long run" or "using this method"
   - Mentions that 95 percent of the intervals will capture the population proportion
   - Includes the context of the study

Question 3 (continued)

2. Based on probability, the response must state that there is a 0.95 probability that a random sample *selected in the future* will produce an interval that captures the actual value of the population proportion of households in the county that have at least one dog.

Partially correct (P) if the student provides an interpretation of the confidence level that includes two of the three components required for the repeated sampling interpretation *OR* provides a correct probability interpretation, but not in context.

Incorrect (I) if the student attempts to interpret a particular confidence *interval* rather than the confidence *level* (for example, by saying that we are 95 percent confident that an interval that has been obtained includes the population proportion of households in the county that have at least one dog) *OR* provides an interpretation of the confidence level that mentions at most one of the three components required for the repeated sampling interpretation.

Part (b) is scored as follows:

Essentially correct (E) if the student correctly states that because 0.39 (or "the claimed value") is in the computed interval, the interval does not provide evidence that the proportion of dog owners in the county is different from the claimed national proportion.

Partially correct (P) if the student indicates that the goal is to check whether the claimed value of 0.39 is in the computed interval but makes errors in implementation. Examples of errors include the following:

- The student notes that 0.39 is within the interval but does not draw a correct conclusion.
- The student makes an arithmetic error in computing the endpoints of the interval, but the conclusion is consistent with the computed interval.

OR

The student correctly notes that 0.39 is in the interval and then concludes that 0.39 *is* the population proportion for the county.

Incorrect (I) if the student does not recognize how to check whether the claim is consistent with the confidence interval.

Part (c) is scored as follows:

Essentially correct (E) if the student provides a correct equation with correct numerical values substituted, as well as a correct integer solution.

Partially correct (P) if the student provides a correct equation (and substitutions) but makes one or more of the following errors:

- Does not complete the calculation or completes the calculation incorrectly
- Uses 0.5 or 0.39 rather than 0.417 as the sample proportion
- Uses an incorrect but plausible z^* value
- Reports the answer as a non-integer value
- Gives the calculated value of n as a lower bound for the required sample size

Incorrect (I) otherwise.

Question 3 (continued)

Notes

- It is acceptable to use $z^* = 2$ instead of 1.96.
- It is acceptable for the response to round up or down to get an integer answer.

4 Complete Response

All three parts essentially correct

3 Substantial Response

Two parts essentially correct and one part partially correct

2 Developing Response

Two parts essentially correct and one part incorrect

OR

One part essentially correct and one or two parts partially correct

OR

Three parts partially correct

1 Minimal Response

One part essentially correct and two parts incorrect

OR

Two parts partially correct and one part incorrect