2016 #5

Purpose: assess whether the students can perform the arithmetic to construct a confidence interval, if they can interpret the interval properly in context, whether they can give the reason for one of the conditions of the process, and if they can explain why a suggested alternate approach would be unacceptable (even impossible!).

(a) The procedure must be identified by name or formula and the interval constructed. The procedure used is a one-sample z-interval for a population proportion (also accepted would be 1 prop Z interval), or the formula $\hat{p} \pm 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$. Inserting the values into the formula for the symbols, computing the form of the interval in estimator ± margin of error form, or computing the lower bound and upper bound of the interval will satisfy the construction component. These forms are $.37 \pm 1.96\sqrt{\frac{.37(1-.37)}{1048}}$ or .37 ± .03 or (.34, .40).

The interpretation is scored separately, and contains 4 parts: the proportions that make up the interval, the confidence level, the inference about the population, and context. Two examples would be

We are 95% confident that the interval .37± .03 captures the population proportion of all U.S. adults who would have selected the economy statement.

We are 95% confident that the population proportion of all U.S. adults who would have selected the economy statement falls within the interval (.34, .40).

An otherwise complete statement without context or an otherwise complete statement that leaves out the 95% was scored as partially complete. A complete explanation of the confidence LEVEL in context without the INTERVAL interpretation was scored as a partial at best. If both level and interval are provided, the interval interpretation was scored and the level was ignored for this problem.

Missing or preposterous proportions for the interval bump the score down a level.

Any interpretation that refers to the sample explicitly or through language like “adults who selected the economy statement” is scored an Incomplete because it is not inference!

(b) And (c) were scored together.

For (b): The condition must be met so that the sampling distribution of $\hat{p}$ would be approximately Normally distributed.

Other acceptable responses would include
The condition must be met so that the Normal approximation to the binomial could be used.

The condition must be met so that the sampling distribution (of the sample proportions is optional) would be approximately Normal.

Without a reference of some sort to the sampling distribution or the binomial, this criterion is not met.

For part (c):
To construct a two sample z-interval you need proportions from two independent samples. We have only one sample, making the proportions dependent. Therefore, a two sample z interval is impossible in this setting.

Simply stating that "We need two samples to do a two sample test and we only have one" would be scored as acceptable, but just "We need two samples to do a two sample test" was not adequate.

Students are performing better on inference problems, but need to refine their language for the interpretation. Also, the formulas on College Board's formula sheets give the ideal-world versions of the formulas for standard deviations. Students often copy those formulas, including parameters, then insert statistics in place of the parameters. This costs the students points for incorrectly naming the test AND for performing the arithmetic for that stated test incorrectly.

Part (b) was another example of AP asking students not to verify a condition, but to explain WHY the condition is necessary. Extra emphasis should be placed on linking each of the conditions to the part of the process it supports:

Randomness: the point estimator is unbiased

Independence: the standard deviation formula we use (for both one and two sample processes) is reasonable

Normality: The sampling distribution of sample measures or differences of sample measures will be Normal enough that we can use Z or t procedures to compute the tail probabilities.

The format for constructing answers for part (c) was (1) what do you need? (2) what do you have? (3) what does it mean? This format has been seen elsewhere on this test and in other FRQs that require a choice between two options. Incomplete responses did not earn credit.