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2015 QUESTION 2: Confidence Intervals
tPlease view the questions here:
http://media.collegeboard.com/digitalServices/pdf/ap/ap15_frq_statistics.pdf

Question 2: INTENT OF THE QUESTION:

This is a question whose main intent was to assess a student's ability to use confidence intervals to test a question about a hypothesis and determine the relationship between sample size and margin of error.

SAMPLE SOLUTION:

a. The student had to indicate "No" and give an appropriate justification. Use of the word "plausible" made the answers more clear and showed a deeper understanding. They must discuss the alternative hypothesis—not the null.
   Grading for this question was in 2 parts:
   a- Part 1: Full credit required students to check that .20 was in the interval and draw a conclusion.

   a - Part 2 : Response concludes that there **is not** convincing statistical evidence that the computer program generates a discount with a probability of 0.20 **AND** justifies the conclusion by noting there are other values besides 0.20 in the interval

b.   The student had to relay a clear solution that indicated the relationship between the margin of error and sample size and what sample size will result in a margin of error that is half the given size.
   Grading for this question required the following for full credit:
   The response gives the correct value of 0.03 as the new margin of error by using the correct formula or by explaining that quadrupling the sample size divides the margin of error from the original sample by two. If the student used decimals, this was correct as long as the margin of error was rounded to 0.030. Note the last decimal place!

c. The students computed a new confidence interval and determined if the computer program was working correctly based on the new interval.
   Grading for this part of the question required the following for full credit:
   Response states that there is convincing evidence that the computer program is not working as intended based on the new margin of error and the interval not containing 0.20 **OR**   the conclusion states that 0.20 is greater than the upper bound of the new confidence interval – 0.18 **OR** the conclusion states the margin of error is smaller than the difference between the sample proportion and the long run probability of 0.20 **NOTE:** (Students that computed an incorrect margin of error in part (b) but correctly answered (c) based on the "wrong" margin of error scored a E. Also --- if a student gave no specific confidence interval or margin of error in b and c, but a correct generic conclusion that referred to a smaller margin of error and narrower interval was scored E).

SCORING: Each "E" was worth 1 point and each "P" was worth ½ point. Points were added to determine the score for the paper and holistic grading was used for scores that included a ½ .

COMMON MISTAKES/NOTES/TEACHER NOTES

1. Students often stated that 0.20 was a plausible value for the proportion of discounts, but gave no further explanation
2. Using the word "prove". Stating that having 0.20 in the interval does not "prove" that 0.20 is the true proportion. This was a very common mistake because it is incomplete reasoning. The reader fails to identify why 0.20 is not the true proportion.
3. Many students made references that were equivalent to accepting the null hypothesis and this was automatically an I.
4. Generic statements were made indicating one should never accept the null – no context and the students did not answer the question.
5. It is not acceptable to give a generic statement with no context.
6. Many students on part (d) got everything correct, but failed to make the connection that 0.20 was not in the interval. This received NO CREDIT!
7. Students failing to distinguish between a confidence level and a confidence interval. Although the level was ignored this year, often it is not!
8. Students based their conclusion in part (d) on a relative location of 0.20 (such as near the edge of the interval) failed to identify exactly where 0.20 was --- in or out of the interval.
9. In part a, many students failed to completely justify—students had to know that the confidence interval represented many possible values for the proportion and failure to acknowledge the "range of values" was quite common.
10. Some students did not understand the difference in a-I and a-ii. The second part required students to know that the confidence interval contained many values for the proportion.
11. The location argument was prevalent for a-ii and incorrect. Student must use more accurate statistical language and representation when answering questions.
12. Indicating that a value (including 0.20) was more likely happened often and is not true.
13. Students mixed up "convincing evidence that the program is not working correctly" or "not convincing evidence that the program is not working correctly".
14. Identifying "the program is working correctly" is equivalent to accepting the null and was not acceptable but happened quite often. Students had trouble with the double negative (the "not" in the problem).
15. Holistic grading notes: students who had "good statistics", great communication, and good strength of other parts not in question—it was possible to round up.
16. Overall this was a tough question for students. Communication and correct use of terms, as well as learning to give complete reasoning –not just state a quick answer were very important. Wording tricked students because that had to say "It does not provide convincing evidence that the computer program **is not working correctly.**