



## Free-Response W.S. Topics 16,17,18

2. To increase business, the owner of a restaurant is running a promotion in which a customer's bill can be randomly selected to receive a discount. When a customer's bill is printed, a program in the cash register randomly determines whether the customer will receive a discount on the bill. The program was written to generate a discount with a probability of 0.2, that is, giving 20 percent of the bills a discount in the long run. However, the owner is concerned that the program has a mistake that results in the program not generating the intended long-run proportion of 0.2.

The owner selected a random sample of bills and found that only 15 percent of them received discounts. A confidence interval for  $p$ , the proportion of bills that will receive a discount in the long run, is  $0.15 \pm 0.06$ . All conditions for inference were met.

- a) Consider the confidence interval  $0.15 \pm 0.06$ .
- Does the confidence interval provide convincing statistical evidence that the program is not working as intended? Justify your answer.
  - Does the confidence interval provide convincing statistical evidence that the program generates the discount with a probability of 0.2? Justify your answer.

A second random sample of bills was taken that was four times the size of the original sample. In the second sample 15 percent of the bills received the discount.

- b) Determine the value of the margin of error based on the second sample of bills that would be used to compute an interval for  $p$  with the same confidence level as that of the original interval.
- c) Based on the margin of error in part (b) that was obtained from the second sample, what do you conclude about whether the program is working as intended? Justify your answer.

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d) The original sample size where only 15 percent of the bills received a discount was 170. Perform the significance test to see if the program does not generate the intended long-run proportion of 0.2. Use the 0.05 significance level.

e) Explain how the results using the confidence interval in part (a) are consistent with the results of the significance test in part (d). What confidence level would have to have been used in part (a) to be sure that it is consistent with the conclusion in part (d)?