AP® STATISTICS
2007 SCORING GUIDELINES (Form B)

Question 2

Intent of Question

The three primary goals of this question are to assess a student's ability to: (1) calculate a probability from a display of population frequencies; (2) calculate a binomial probability; and (3) describe a sampling distribution of a sample mean for a moderately large sample.

Solution

Part (a):

$P(X > 3) = 0.07 + 0.04 + 0.04 + 0.02 = 0.17.$

Part (b):

Y = number of households in violation.

Y has a binomial distribution with $n = 10$ and $p = 0.17$.

$$P(Y = 2) = \binom{10}{2}(0.17)^2(0.83)^8 = 0.2929.$$

Part (c):

The distribution of $\bar{X}$ will:

1. be approximately normal;
2. have mean $\mu_{\bar{X}} = \mu = 1.65$;
3. have standard deviation $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{1.851}{\sqrt{150}} = 0.1511.$

Scoring

This question is scored in four sections. Each section is scored as either essentially correct (E), partially correct (P), or incorrect (I).

Section 1 is part (a), section 2 is part (b), and sections 3 and 4 consist of elements of part (c). This scoring gives part (c) double weight relative to either part (a) or part (b).

Section 1 is essentially correct (E) if $P(X > 3)$ is correctly computed and work is shown in part (a).

Section 1 is partially correct (P) if:

$P(X \geq 3) = 0.26$ is computed;

OR

a correct numerical answer is given but no work is shown.

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Question 2 (continued)

Section 2 is essentially correct (E) if in part (b):

1. the probability from part (a) is correctly used to calculate the probability that exactly 2 households are in violation, either using the binomial pdf or using general probability rules, *AND*
2. work is shown.

Section 2 is partially correct (P) if in part (b):

the student computes $P(Y \geq 2) = 0.5270$ or $P(Y \leq 2) = 0.7659$ instead of $P(Y = 2)$;

OR

the correct probability is given but no work is shown;

OR

the binomial coefficient is omitted $\left[(0.83)^8 (0.17)^2 = 0.0065\right]$.

Section 3 is essentially correct (E) if the response to part (c):

recognizes that the distribution of $\bar{X}$ will be approximately normal;

OR

the response says that the distribution of $\bar{X}$ is more symmetric than the population distribution *AND* mentions that the population distribution is highly skewed.

Section 3 is partially correct (P) if the response to part (c) reports a normal distribution for $\bar{X}$ without indicating that the normal distribution is an approximation.

Section 4 is essentially correct (E) if the response to part (c) provides the appropriate mean $\mu_{\bar{X}} = \mu = 1.65$ and standard deviation $\sigma_{\bar{X}} = \dfrac{\sigma}{\sqrt{n}} = \dfrac{1.851}{\sqrt{150}} = 0.1511$ for $\bar{X}$.

Section 4 is partially correct (P) if the response to part (c):

provides either the correct mean or the correct standard deviation for $\bar{X}$, but not both;

OR

provides correct numerical values for both the mean and standard deviation but sample notation ($\bar{X}$ and s) is used instead of population notation (μ and $\sigma_{\bar{X}} = \sigma / \sqrt{n}$);

OR

says only that the $\bar{X}$ distribution is centered in the same place as the population and has a smaller standard deviation than the population (and does not give the values of 1.65 and 0.1511).

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Question 2 (continued)

4 **Complete Response**

All four sections essentially correct

3 **Substantial Response**

Three sections essentially correct and no section partially correct

OR

Two sections essentially correct and two sections partially correct

2 **Developing Response**

Two sections essentially correct and no sections partially correct

OR

One section essentially correct and two sections partially correct

OR

No sections essentially correct and four sections partially correct

1 **Minimal Response**

One section essentially correct and no sections partially correct

OR

No sections essentially correct and two sections partially correct

If a response is between two scores (for example, 2½ points) use a holistic approach to determine whether to score up or down depending on the strength of the response and communication. If the word "approximately" is missing in part (c), round down.

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