Chapter 12 FRAPPY!
Scoring Guidelines

Intent of the question The primary goals of this question are to assess a student's ability to: (1) Recognize when a condition for inference is not met; (2) Make a prediction using regression output for transformed data; and (3) Construct and interpret a confidence interval for the slope of a least-squares regression line.

Model Solution

(a) It would not be appropriate to calculate a confidence interval for the slope because the Linear condition is not met. The association shown in the scatterplot is clearly curved.

(b) $\widehat{\ln(\text{Money})} = 77.537 - 0.90470(70) = 14.208.$ Thus, $\widehat{\text{Money}} = e^{14.208} = \$1,480,662.$

(c) State: We want to estimate the slope β of the population regression line relating ln y = natural logarithm of money earned to x = scoring average at the 95% confidence level.

Plan: We were told the conditions were met, so we will use a t interval for the slope to estimate β.

Do: Using df = 14 – 2 = 12, the t critical value is $t^* = 2.179$. Thus, the 95% confidence interval is $-0.90470 \pm 2.179(0.09679) = -0.90470 \pm 0.21091 = (-1.11561, -0.69379)$.

Conclude: We are 95% confident that the interval from –1.11561 to –0.69379 captures the slope of the population regression line relating ln(money) to scoring average.

Scoring
Parts (a) and (b) are scored essentially correct (E), partially correct (P), or incorrect (I). Part (c) is divided into two steps and each step is scored essentially correct (E), partially correct (P), or incorrect (I).

Part (a) is scored as follows

Essentially correct (E) if the response states that it would not be appropriate because the association between scoring average and money is nonlinear.

Partially correct (P) if the response correctly discusses the nonlinear association but also includes other incorrect reasons (e.g., the sample size is too small).

Incorrect (I) if the response doesn't correctly address the nonlinear association.

Note: Correct verification that other conditions are satisfied (e.g., random sample) should be considered extraneous and ignored.

Part (b) is scored as follows

Essentially correct (E) if the response includes the correct predicted value and shows work.

Partially correct (P) if the response includes the correct predicted value but doesn't show work OR if the response states that the predicted value is 14.208 and shows work.

Incorrect (I) otherwise.

Part (c), Step 1 is scored as follows

Essentially correct (E) if the response identifies the correct procedure (by name or formula) and correctly calculates the interval.

Partially correct (P) if the response correctly calculates the interval but doesn't identify the procedure OR the response calculates the interval using the formula but uses the wrong critical value or wrong standard error, but not both.

Incorrect (I) otherwise.

Note: If a response provides additional incorrect work, such as a wrong formula, reduce the score in this step by one level (i.e., E to P, or P to I).

Part (c), Step 2 is scored as follows

Essentially correct (E) if the response gives a reasonable interpretation of the interval that includes the following three components:

1. Inference about the slope of a population regression line
2. 95% confidence
3. Context

Partially correct (P) if the response gives a reasonable interpretation of the interval that includes two of the three components

Incorrect (I) if the response does not meet the criteria for an E or a P.

Note: If the response attempts to interpret the confidence level and makes a mistake, reduce the score in this step by one level (i.e., E to P, or P to I).

Each essentially correct (E) part counts as 1 point. Each partially correct (P) part counts as ½ point. If a response is between two scores (for example, 2½ points), use a holistic approach to decide whether to score up or down, depending on the overall strength of the response and communication.

4 Complete Response

3 Substantial Response

2 Developing Response

1 Minimal Response