AP® STATISTICS
2007 SCORING GUIDELINES

Question 6

Intent of Question

This question was designed to evaluate a student's ability to make inferences for simple linear regression models. Interpreting model parameters and comparing and contrasting different models are important skills that are also being assessed. Finally, a multiple regression model with a special variable, an indicator variable, is introduced to investigate whether the relationship between the predictor and response variable differs for two different groups of people. Students are asked to sketch the estimated line for both groups and interpret the estimated parameters in the multiple regression model.

Solution

Part (a):

The value 1.080 estimates the *average* increase (in feet) in the perceived distance for each additional foot in actual distance between the two objects.

Part (b):

The model with zero intercept makes more intuitive sense in this particular situation. If the two objects are placed side by side (so the actual distance is zero), then we would expect the subjects to say that the distance between the objects is zero.

Part (c):

Let β denote the true slope between the perceived distances and the actual distances. The researcher's hypothesis is equivalent to $\beta > 1$. Thus, we want to conduct a hypothesis test for the slope parameter.

Step 1: States a correct pair of hypotheses:

$H_0 : \beta = 1$
$H_a : \beta > 1$

Step 2: Correct mechanics, including the value of the test statistic and *p*-value (or rejection region).

This is a *t*-test of a slope.

$$t = \frac{b - \beta}{s_b} = \frac{1.102 - 1}{0.393} = 0.260$$

$\text{df} = 40 - 1 = 39$

p-value = $P(t > .260) = 0.398$

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Question 6 (continued)

Step 3: States a correct conclusion in the context of the problem, using the result of the statistical test.

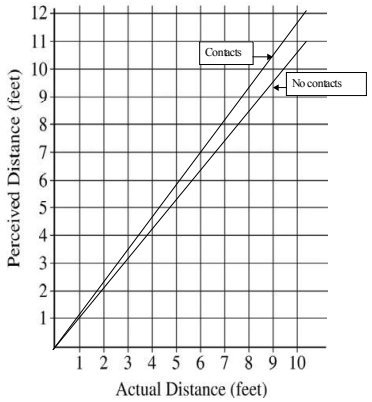
Since the *p*-value 0.398 is greater than 0.05, we cannot reject H_0. That is, we do not have statistically significant evidence to conclude that the subjects overestimate the distance with the magnitude of the overestimation increasing as the actual distance increases.

Part (d):

According to Model 3, the estimated models for the two groups are:

Contact wearers (*contact* = 1):
perceived distance = 1.05 (*actual distance*) + 0.12 (*actual distance*)
= 1.17 (*actual distance*)

Noncontact wearers (*contact* = 0):
perceived distance = 1.05 (*actual distance*)



Part (e):

Model 3 allows prediction of perceived distance separately for contact wearers and for noncontact wearers. The value of 1.05 estimates the average increase (in feet) in the perceived distance for each one-foot increase in actual distance for the population of noncontact wearers. The value of 0.12 estimates the *additional* increase (in feet) in the average perceived distance for each one-foot increase in actual distance for the contact wearers.

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